Goodrive350 Series High-Performance Multifunction VFD

User Manual

SHENZHEN INVT ELECTRIC CO., LTD.

Preface

Overview

Thank you for purchasing INVT Goodrive350 series variable-frequency drive (VFD). If not otherwise specified, the VFD mentioned in this manual refers to Goodrive350 series VFD. The product is widely used to drive high-speed fans, high-speed electric spindles and automation production equipment in the textile, lifting, paper making, petroleum, plastics, metal processing, printing and packaging industries.

This manual mainly describes the methods of mechanical installation, electrical installation, operation methods, commissioning, maintenance and troubleshooting of the VFD. Read the manual carefully before installing and using the VFD.

Readers

Personnel with electrical professional knowledge (such as qualified electrical engineers or personnel with equivalent knowledge).

Change history

The manual is subject to change irregularly without prior notice due to product version upgrades or other reasons.

No.	Change description	Version	Release date
1	● Updated the document structure.	V2.0	April 2025

Contents

1 Safety precautions

1.1 Safety declaration

Read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the product. Otherwise, equipment damage or physical injury or death may be caused.

We shall not be liable or responsible for any equipment damage or physical injury or death caused due to failure to follow the safety precautions.

1.2 Safety level definition

To ensure personal safety and avoid property damage, you must pay attention to the symbols and warnings in the manual.

Warning symbols	Name	Description
	Danger	Severe personal injury or even death can result if related requirements are not followed.
	Electric shock	Severe personal injury or even death can result if related requirements are not followed. As high voltage still presents in the bus capacitor after power off, wait for at least 5 minutes (or 15 minutes, 25 minutes, depending on the warning symbols on the machine) after power off to prevent electric shock.
	Warning	Personal injury or equipment damage can result if related requirements are not followed.
	Electrostatic discharge	The PCBA may be damaged if related requirements are not followed.
	Hot sides	You may get burnt if related requirements are not followed.
Note	Note	Slight personal injury or equipment damage can result if related requirements are not followed.

1.3 Personnel requirements

Trained and qualified professionals: People operating the VFD must have received professional electrical and safety training and obtained the certificates, and must be familiar with all steps and requirements of VFD installing, commissioning, running and maintaining and capable to prevent any emergencies according to experiences.

1.4 Safety guidelines

General principles

- Only trained and qualified professionals are allowed to carry out related operations.
- Do not perform wiring, inspection or component replacement when power supply is applied. Before performing these operations, ensure all the input power supplies have been disconnected, and wait for at least the time designated on the VFD or until the DC bus voltage is less than 36V. The minimum waiting time is listed in the following.

Model	Minimum waiting time
380V 1.5–110kW; 660V 22–132kW	5 minutes
380V 132–315kW; 660V 160–355kW	15 minutes
380V ≥355kW; 660V 400–630kW	25 minutes

- Do not modify the VFD unless authorized; otherwise fire, electric shock or other injury may result.
- The VFD cannot be used as an "Emergency-stop device".
- The VFD cannot act as an emergency brake for the motor; it is a must to install a mechanical braking device.
- Prevent the screws, cables and other conductive parts from falling into the VFD.

- The base may become hot when the VFD is running. Do not touch. Otherwise, you may get burnt.

- The electrical parts and components inside the VFD are electrostatic sensitive. Take measurements to prevent electrostatic discharge when performing related operations.

Delivery

- Select appropriate tools for VFD delivery to avoid damage to the VFD, and take protective measures like wearing safety shoes and working uniforms to avoid physical injury or death.
- Protect the VFD against physical shock or vibration.
- Do not carry the VFD only by its front cover as the cover may fall off.

Installation

- Do not install the VFD on inflammables. In addition, prevent the VFD from contacting or adhering to inflammables.
- Do not install the damaged or incomplete VFD.
- Do not contact the VFD with damp objects or body parts. Otherwise, electric shock may result.

Installation	
	● The installation site must be away from children and other public places. For details, see section 3.2.1 Installation environment and site. ● Connect the optional braking parts (such as braking resistors, braking units or feedback units) according to the wiring diagrams. ● As VFD leakage current caused during running may exceed 3.5mA, apply reliable grounding and ensure the ground resistance is less than 10Ω. The PE ground conductor and phase conductor have equal conductivity capability. For the models of 30kW and higher, the cross sectional area of the PE ground conductor can be slightly less than the recommended area. ● R, S, and T are the power input terminals, while U, V, and W are the output motor-connection terminals. Connect the input power cables and motor cables properly; otherwise, the VFD may be damaged. ● When the VFD is installed in a confined space (such as cabinet), it is necessary to provide protective devices (such as fireproof housing, electrical protective housing, mechanical protective housing, etc.) that meet the IP rating, and the IP rating shall comply with the relevant IEC standards and local regulations.

Commissioning	
	● The VFD may start up by itself when power-off restart is enabled (P01.21=1). Do not get close to the VFD and motor.
	● Do not switch on or switch off the input power supplies of the VFD frequently. ● If the VFD has been stored without use for a long time, perform capacitor reforming (described in section 9.3 Reforming), inspection and pilot run for the VFD before the reuse.

Run	
	● Close the VFD front cover before running; otherwise, electric shock may occur. ● High voltage presents inside the VFD during running. Do not carry out any operation on the VFD during running except for keypad setup. The control terminals of the 380V or 660V VFD form extra-low voltage (ELV) circuits. Therefore, you need to prevent the control terminals from connecting to accessible terminals of other devices. ● During driving a synchronous motor, besides above-mentioned items, the following work must be done: ✓ All input power supplies have been disconnected, including the main power and control power.

Run	
	✓ The synchronous motor has been stopped, and the voltage on output end of the VFD is lower than 36V. ✓ After the synchronous motor has stopped, wait for at least the time designated on the VFD, and ensure the voltage between (+) and (-) is lower than 36V. ✓ During operation, it is a must to ensure the synchronous motor cannot run again by the action of external load; it is recommended to install an effective external braking device or cut off the direct electrical connection between the synchronous motor and the VFD.

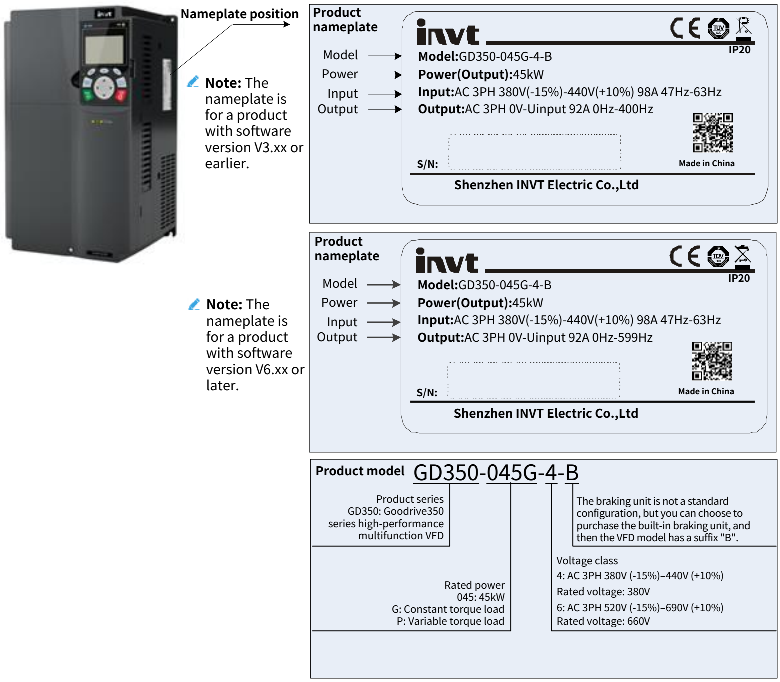
Maintenance	
	● Do not perform VFD maintenance or component replacement when the power is on. Otherwise, electric shock may result. ● Keep the VFD and its parts and components away from combustible materials and ensure they have no combustible materials adhered.
	● During maintenance and component replacement, take proper anti-static measures on the VFD and its internal parts.
	● Do not carry out insulation voltage-endurance test on the VFD, or measure the control circuits of the VFD with a megohmmeter.
Note	● Use proper torque to tighten screws.

Disposal	
	● The VFD contains heavy metals. Dispose of a scrap VFD as industrial waste.

2 Product overview

2.1 Product nameplate and model

Each VFD is affixed with a nameplate containing the basic product information and, depending on the actual certification, certification marks such as the CE mark.



2.2 Product specifications

Item		Specification
Input	Input voltage (V)	AC 3PH 380V (-15%) – 440V (+10%); rated voltage: 380V AC 3PH 520V (-15%) – 690V (+10%); rated voltage: 660V
	Input current (A)	See section 2.3 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–63Hz, with a maximum change rate of 20%/s
	Short-circuit	According to the definition in IEC 61439-1, the maximum

Item		Specification
	capacity	allowable short-circuit current at the incoming end is 100 kA. Therefore, the VFD is applicable to scenarios where the transmitted current in the circuit is no larger than 100kA when the VFD runs at the maximum rated voltage.
Output	Output voltage (V)	0–Input voltage (V)
	Output current (A)	See section 2.3 Product ratings.
	Output power (kW)	See section 2.3 Product ratings.
	Output frequency (Hz)	0–400Hz **Note:** Supported by software of version V3.xx or earlier.
		0–599Hz **Note:** Supported by software of version V6.xx or later.
Control performance	Control mode	Space voltage vector control, sensorless vector control (SVC), and feedback vector control (FVC) mode
	Motor	Motor type: Asynchronous motor (AM) and synchronous motor (SM) Voltage: 0–U1 (motor rated voltage), 3PH symmetrical, Umax (VFD rated voltage) at the field-weakening point Circuit protection: The motor output short-circuit protection meets the requirements of IEC 61800-5-1. Frequency: 0–400Hz, frequency resolution: 0.01Hz **Note:** Supported by software of version V3.xx or earlier. Frequency: 0–599Hz, frequency resolution: 0.01Hz **Note:** Supported by software of version V6.xx or later. Carrier frequency: 1kHz–15kHz. Please refer to the function code P00.14 for the default carrier frequency. Maximum motor cable length: 50m
	Speed ratio	For AMs: 1: 200 (SVC) For SMs: 1: 20 (SVC); 1: 1000 (FVC)
	Speed control accuracy	±0.2% (SVC); ±0.02% (FVC)
	Speed fluctuation	±0.3% (SVC)
	Torque response	<20ms (SVC); <10ms (FVC)
	Torque control accuracy	10% (SVC); 5% (FVC)
	Starting torque	For AMs: 0.25Hz/150% (SVC) For SMs: 2.5 Hz/150% (SVC); 0Hz/200% (FVC)
	Overload capacity	150% of the rated current for 60s

Item		Specification
		180% of the rated current for 10s 200% of the rated current for 1s
Peripheral interface	Terminal analog input resolution	No more than 20mV
	Terminal digital input resolution	No more than 2ms
	Analog input	Two inputs. AI1: 10–10V/0–20mA; AI2: -10–10V
	Analog output	One output. AO1: 0–10V/0–20mA
	Digital input	Four regular inputs. Max. frequency: 1kHz; internal impedance: 3.3kΩ Two high-speed inputs. Max. frequency: 50kHz; supporting quadrature encoder input; with speed measurement function
	Digital output	One high-speed pulse output; max. frequency: 50kHz One Y terminal open collector output
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V
	Expansion interfaces	Three extended interfaces: SLOT1, SLOT2, and SLOT3; Supporting PG cards, programmable cards, communication cards, and I/O cards. You should not insert two cards of the same type simultaneously. **Note:** Only 7.5kW and higher VFDs can be installed with three expansion cards simultaneously.
Environment requirements and standards	Mounting method	Three methods: Wall mounting, floor mounting, and flange mounting.
	Temperature of running environment	-10–+50°C **Note:** Derating is required when the ambient temperature exceeds 40°C.
	IP rating	IP20
	Pollution degree	Degree 2
	Cooling method	Forced air cooling
	Certification	CE

2.3 Product ratings

Product model	Output power (kW)	Input current (A)	Output current (A)
AC 3PH 380V (-15%) – 440V (+10%) of a single VFD			
GD350-1R5G-4	1.5	5.0	3.7
GD350-2R2G-4	2.2	5.8	5
GD350-004G-4	4	13.5	9.5
GD350-5R5G-4	5.5	19.5	14
GD350-7R5G-4	7.5	25	18.5
GD350-011G-4	11	32	25
GD350-015G-4	15	40	32
GD350-018G-4	18.5	47	38
GD350-022G-4	22	51	45
GD350-030G-4	30	70	60
GD350-037G-4	37	80	75
GD350-045G-4	45	98	92
GD350-055G-4	55	128	115
GD350-075G-4	75	139	150
GD350-090G-4	90	168	180
GD350-110G-4	110	201	215
GD350-132G-4	132	265	260
GD350-160G-4	160	310	305
GD350-185G-4	185	345	340
GD350-200G-4	200	385	380
GD350-220G-4	220	430	425
GD350-250G-4	250	460	480
GD350-280G-4	280	500	530
GD350-315G-4	315	580	600
GD350-355G-4	355	625	650
GD350-400G-4	400	715	720
GD350-450G-4	450	840	820
GD350-500G-4	500	890	860
AC 3PH 380V (-15%) – 440V (+10%) of parallel VFDs			
GD350-560G-4	560	1090	1060
GD350-630G-4	630	1220	1200
GD350-710G-4	710	1250	1300
GD350-800G-4	800	1430	1440

Product model	Output power (kW)	Input current (A)	Output current (A)
GD350-1000G-4	1000	1780	1720
GD350-1200G-4	1200	2145	2160
GD350-1500G-4	1500	2670	2580
GD350-2000G-4	2000	3560	3440
GD350-2500G-4	2500	4450	4300
GD350-3000G-4	3000	5340	5160
AC 3PH 520V (-15%) – 690V (+10%) of a single VFD			
GD350-022G-6	22	35	27
GD350-030G-6	30	40	35
GD350-037G-6	37	47	45
GD350-045G-6	45	52	52
GD350-055G-6	55	65	62
GD350-075G-6	75	85	86
GD350-090G-6	90	95	98
GD350-110G-6	110	118	120
GD350-132G-6	132	145	150
GD350-160G-6	160	165	175
GD350-185G-6	185	190	200
GD350-200G-6	200	210	220
GD350-220G-6	220	230	240
GD350-250G-6	250	255	270
GD350-280G-6	280	286	300
GD350-315G-6	315	334	350
GD350-355G-6	355	360	380
GD350-400G-6	400	411	430
GD350-450G-6	450	445	465
GD350-500G-6	500	518	540
GD350-560G-6	560	578	600
GD350-630G-6	630	655	680
AC 3PH 520V (-15%) – 690V (+10%) of parallel VFDs			
GD350-710G-6	710	720	760
GD350-800G-6	800	822	860
GD350-1000G-6	1000	1036	1080
GD350-1200G-6	1200	1310	1360
GD350-1500G-6	1500	1554	1620
GD350-2000G-6	2000	2072	2160

Product model	Output power (kW)	Input current (A)	Output current (A)
GD350-2500G-6	2500	2620	2720
GD350-3000G-6	3000	3275	3400

2.4 Parallel VFD model

Power (kW)	380V parallel VFD		660V parallel VFD	
	Power (kW)	Qty	Power (kW)	Qty
560	280	2	-	-
630	315	2	-	-
710	355	2	355	2
800	400	2	400	2
1000	500	2	500	2
1200	400	3	630	2
1500	500	3	500	3
2000	500	4	500	4
2500	500	5	630	4
3000	500	6	630	5

2.5 Product dimensions and weights

Product model	Outline dimensions L×W×H (mm)	Package dimensions L×W×H (mm)	Weight (kg)
Single VFD of AC 3PH 380V(-15%)–440V(+10%)			
GD350-1R5G-4	126×186×185	290×210×265	2
GD350-2R2G-4			
GD350-004G-4	126×186×201		2.5
GD350-5R5G-4			
GD350-7R5G-4	146×256×192	343×230×270	3
GD350-011G-4	170×320×220	430×275×325	6
GD350-015G-4			
GD350-018G-4	200×340.6×208	490×315×315	8.5
GD350-022G-4			
GD350-030G-4	250×400×223	580×395×360	16
GD350-037G-4			
GD350-045G-4	282×560×258	680×425×380	25

Product model	Outline dimensions L×W×H (mm)	Package dimensions L×W×H (mm)	Weight (kg)
GD350-055G-4			
GD350-075G-4			
GD350-090G-4	338×554×330	675×470×575	41
GD350-110G-4			
GD350-132G-4	500×872×360	971×631×565	85
GD350-160G-4			
GD350-185G-4			
GD350-200G-4			
GD350-220G-4	680×960×380	1086×826×595	135
GD350-250G-4			
GD350-280G-4			
GD350-315G-4			
GD350-355G-4	620×1700×560	1850×840×820	350
GD350-400G-4			
GD350-450G-4			
GD350-500G-4			
Parallel VFDs of AC 3PH 380V(-15%)–440V(+10%)			
GD350-560G-4	1447×1419.9×442.5	2 * (845×605×1625)	432
GD350-630G-4			462
GD350-710G-4	1323×1900×636.3	2 * (855×795×2130)	814
GD350-800G-4			
GD350-1000G-4			820
GD350-1200G-4	1956×1900×636.3	3 * (855×795×2130)	1221
GD350-1500G-4			1230
GD350-2000G-4	2589×1900×636.3	4 * (855×795×2130)	1640
GD350-2500G-4	3222×1900×636.3	5 * (855×795×2130)	2050
GD350-3000G-4	3855×1900×636.3	6 * (855×795×2130)	2460
Single VFD of AC 3PH 520V(-15%)–690V(+10%)			
GD350-022G-6	270×557×325	659×378×423	30
GD350-030G-6			
GD350-037G-6			
GD350-045G-6			

Product model	Outline dimensions L×W×H (mm)	Package dimensions L×W×H (mm)	Weight (kg)
GD350-055G-6	325×682×365	784×433×468	47
GD350-075G-6			
GD350-090G-6			
GD350-110G-6			
GD350-132G-6			
GD350-160G-6	500×872×360	970×630×565	85
GD350-185G-6			
GD350-200G-6			
GD350-220G-6			
GD350-250G-6	680×960×380	1086×826×595	135
GD350-280G-6			
GD350-315G-6			
GD350-355G-6			
GD350-400G-6	620×1700×560	1850×840×820	350
GD350-450G-6			
GD350-500G-6			
GD350-560G-6			
GD350-630G-6			
Parallel VFDs of AC 3PH 520V(-15%)–690V(+10%)			
GD350-710G-6	1447×1419.9×442.5	2 * (845×605×1625)	450
GD350-800G-6	1323×1900×636.3	2 * (855×795×2130)	820
GD350-1000G-6			
GD350-1200G-6			
GD350-1500G-6	1956×1900×636.3	3 * (855×795×2130)	1230
GD350-2000G-6	2589×1900×636.3	4 * (855×795×2130)	1640
GD350-2500G-6			
GD350-3000G-6	3222×1900×636.3	5 * (855×795×2130)	2050

2.6 Product heat dissipation

Product model	Entire machine full load power dissipation (W)	Entire machine standby power dissipation (W)	Heat dissipation (BTU/hr)	Air rate (m^3/h)	Air rate (CFM) (ft^3/min)
Single VFD of AC 3PH 380V(-15%)–440V(+10%)					
GD350-1R5G-4	77	12	263	10.75	6.33
GD350-2R2G-4	95	12	324		
GD350-004G-4	162	12	553	53.26	31.35
GD350-5R5G-4	240	12	819		
GD350-7R5G-4	345	12	1177	90.2	53.09
GD350-011G-4	390	14	1331	100.8	59.33
GD350-015G-4	436	14	1488	105.46	62.07
GD350-018G-4	525	14	1791	131.5	77.40
GD350-022G-4	544	14	1856	176.2	103.71
GD350-030G-4	848	14	2893		
GD350-037G-4	968	25	3303	251	147.73
GD350-045G-4	919	25	3136		
GD350-055G-4	1276	30	4354		
GD350-075G-4	1518	30	5179	383.5	225.72
GD350-090G-4	1866	48	6367		
GD350-110G-4	2181	48	7442		
GD350-132G-4	2465	68	8411	606.3	356.85
GD350-160G-4	2681	73	9148		
GD350-185G-4	2884	100	9840		
GD350-200G-4	3371	115	11502		
GD350-220G-4	4171	140	14232	662.47	389.92
GD350-250G-4	4591	139	15665		
GD350-280G-4	4385	173	14962		
GD350-315G-4	5201	203	17746		
GD350-355G-4	6298	224	21489	1180	694.5
GD350-400G-4	6679	257	22789		
GD350-450G-4	7453	254	25430		
GD350-500G-4	7914	264	27003		
Parallel VFDs of AC 3PH 380V(-15%)–440V(+10%)					

Product model	Entire machine full load power dissipation (W)	Entire machine standby power dissipation (W)	Heat dissipation (BTU/hr)	Air rate (m^3/h)	Air rate (CFM) (ft^3/min)
GD350-560G-4	10665	346	36390	1325	779
GD350-630G-4	12281	406	41903	1325	779
GD350-710G-4	14734	448	50272	2360	1388
GD350-800G-4	15456	514	52735	2360	1388
GD350-1000G-4	18589	528	63426	2360	1388
GD350-1200G-4	23183	771	79102	3540	2082
GD350-1500G-4	27884	792	95139	3540	2082
GD350-2000G-4	37178	1056	126852	4720	2776
GD350-2500G-4	46473	1320	158565	5900	3471
GD350-3000G-4	55767	1584	190278	7080	4165
Single VFD of AC 3PH 520V(-15%)–690V(+10%)					
GD350-022G-6	609	61	2078	251	147.73
GD350-030G-6	737	61	2515		
GD350-037G-6	916	61	3125		
GD350-045G-6	1022	61	3487		
GD350-055G-6	1056	62	3603	383.5	225.72
GD350-075G-6	1213	63	4139		
GD350-090G-6	1373	69	4685		
GD350-110G-6	1668	76	5691		
GD350-132G-6	2154	83	7350		
GD350-160G-6	2345	110	8001	606.3	356.85
GD350-185G-6	2647	113	9032		
GD350-200G-6	2952	135	10072		
GD350-220G-6	3246	141	11075		
GD350-250G-6	3668	147	12515	662.47	389.92
GD350-280G-6	3984	186	13594		
GD350-315G-6	4787	219	16333		
GD350-355G-6	5067	213	17289		
GD350-400G-6	6449	233	22004	1180	694.5
GD350-450G-6	6785	227	23151		
GD350-500G-6	8080	274	27569		
GD350-560G-6	9037	299	30835		

Product model	Entire machine full load power dissipation (W)	Entire machine standby power dissipation (W)	Heat dissipation (BTU/hr)	Air rate (m^3/h)	Air rate (CFM) (ft^3/min)
GD350-630G-6	8960	309	30572		
Parallel VFDs of AC 3PH 520V(-15%)–690V(+10%)					
GD350-710G-6	11329	426	38654	1325	779
GD350-800G-6	13923	466	47504	2360	1388
GD350-1000G-6	17352	548	59205	2360	1388
GD350-1200G-6	20230	618	69026	2360	1388
GD350-1500G-6	26021	822	88782	3540	2082
GD350-2000G-6	34688	1096	118354	4720	2776
GD350-2500G-6	40336	1236	137627	4720	2776
GD350-3000G-6	50823	1545	173407	5900	3471

2.7 Product structure

Figure 2-1 Product component diagram (taking the 380V 30kW VFD as an example)

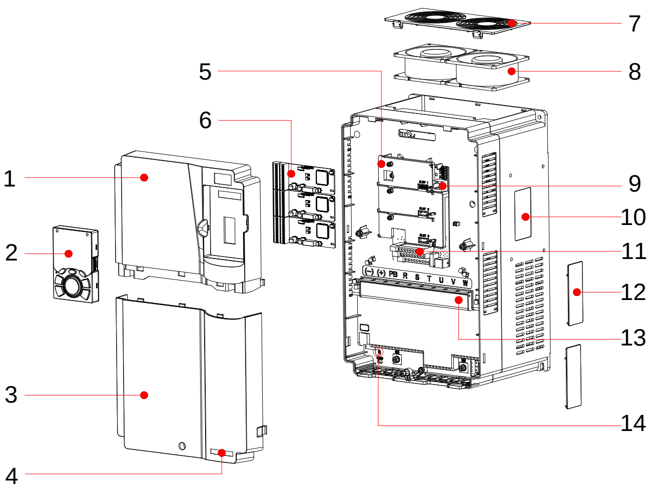


Table 2-1 Product component description

No.	Component	Description
1	Upper cover	Protects internal components and parts.

No.	Component	Description
2	Keypad	See section 5.3 Operation procedure.
3	Lower cover	Protects internal components and parts.
4	Product label	See section 2.1 Product nameplate and model.
5	Baffle of control board	Protects the control board and install extension card.
6	Expansion card	Optional. See Appendix E Expansion card.
7	Fan cover	See section 9.2.1 Cooling fan.
8	Cooling fan	See section 9.2.1 Cooling fan.
9	Keypad interface	Connects the keypad.
10	Nameplate	See section 2.1 Product nameplate and model.
11	Control terminals	See section 4.4.2 Control circuit terminals.
12	Cover plate of heat emission hole	Optional. Cover plate can upgrade protection level, however, as it will also increase internal temperature, derated use is required.
13	Main circuit terminals	See section 4.3.2 Main circuit terminals.
14	POWER indicator	Power supply indicator.

2.8 System configuration

When using the VFD to drive a motor to form a control system, various electrical devices need to be installed on the input and output sides of the VFD to ensure stable system running.

Figure 2-2 System configuration

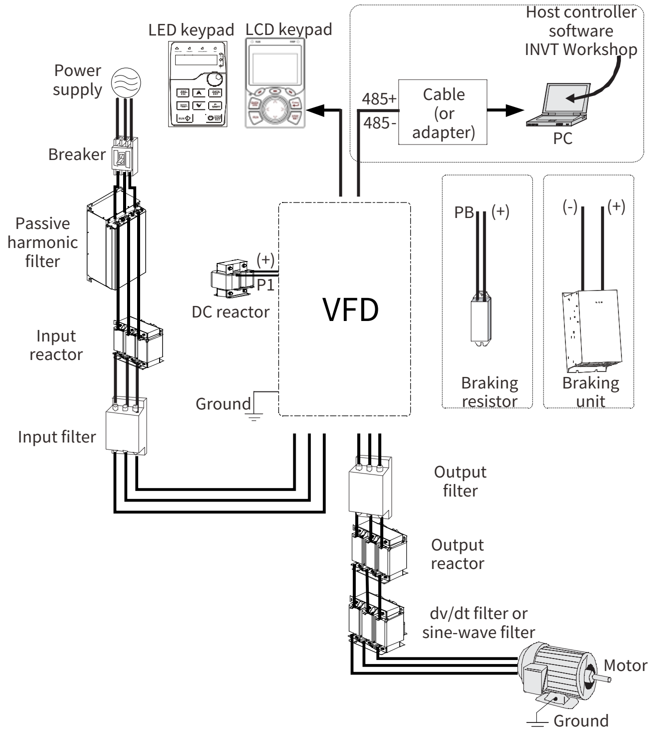
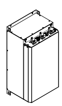
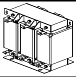
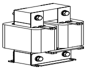
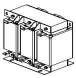
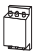
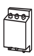
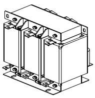
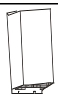
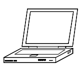


Table 2-2 System configuration

Component		Position value	Description
	Breaker	Between the power supply and the VFD input side	Accessory for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30mA.
	Passive harmonic filter	On the VFD input side	Accessory used to reduce the current distortion rate and harmonic content, thereby improving the power factor.

Component		Position value	Description
	Input reactor	On the VFD input side	Accessories used to improve the power factor on the input side of the VFD, and thus suppress high-order harmonic currents. ● DC reactor: Embedded in the 380V 18.5kW–110kW (inclusive) models; externally connection option for 380V⩾132kW and 660V models. ● AC input reactor: Embedded in the 380V⩾355kW and 660V ⩾400kW models.
	DC reactor	Between VFD terminals P1 and (+)	
	Output reactor	Between the VFD output side and the motor, and installed near the VFD.	(Optional) Accessory used to lengthen the valid transmission distance of the VFD, which effectively restricts the transient high voltage generated during the switch-on and switch-off of the IGBT module of the VFD.
	Input filter	On the VFD input side	(Optional) Input filter: Accessory that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Try to install the input filter near the input terminal side of the VFD. (Optional) Output filter: Accessory used to restrict interference generated in the wiring area on the output side of the VFD. All 380V models can meet the conductivity and transmission requirements of IEC/EN 61800-3 C3 electrical drive systems. Optional external filters can be used to meet the conductivity and transmission requirements of IEC/EN 61800-3 C2 electrical drive systems. **Note:** For details about the motor, motor cable, and filter assembly, observe the technical requirements specified in the appendix.
	Output filter	Try to install the output filter near the output terminal side of the VFD.	

<table>
<tr><th colspan="2">Component</th><th>Position value</th><th>Description</th></tr>
<tr><td rowspan="2"></td><td>dv/dt filter</td><td>Between the VFD output side and the motor, adjacent to the motor</td><td>Accessory used to suppress voltage spikes, reduce traveling waves in long cables, and reflect dv/dt transient voltages, thereby reducing motor eddy current losses and noise, and providing motor insulation protection.</td></tr>
<tr><td>Sine-wave filter</td><td>Between the VFD output side and the motor, adjacent to the motor</td><td>Accessory used to suppress and absorb high-order harmonic currents derived from switching frequency ripple currents, correcting the waveform to approximate a sine wave, significantly extending the length of the output cable, reducing motor eddy current losses and noise, and protecting motor insulation.</td></tr>
<tr><td></td><td>Braking unit</td><td>Between the VFD main circuit terminals (+) and (-)</td><td rowspan="2">Accessories used to consume the regenerative energy of the motor to reduce the DEC time.
● Braking unit: Embedded in the 380V ≤37kW models (only external braking resistor required); built-in option for 380V 45–110kW (inclusive) models; externally-connected option for the 380V ≥132kW and 660V models
● Braking resistor: Externally-connected option for all models</td></tr>
<tr><td></td><td>Braking resistor</td><td>Between the VFD main circuit terminals (+) and PB</td></tr>
<tr><td></td><td>Host controller software</td><td>Installed in the host controller which controls the VFD</td><td>INVT Workshop software is used to configure and monitor the VFD. Its main functions include:
● Monitor multiple VFDs.
● Set and monitor function parameters; upload and download function parameters in batches.
● View modified function codes, compare default values, and follow up and query for function codes.
● Query for and follow up status parameters.
● View real-time and historic faults.</td></tr>
</table>

Component		Position value	Description
			● Display function codes in configuration mode. ● Control device startup, stop, forward running, reverse running, and other operations. ● View oscillographic curves, save and replay waveform data, operate waveforms through cursor, and simulate waveform data. Please visit www.invt.com to obtain it for free.

For details about option model selection, see Appendix D Peripheral accessories and options.

2.9 Quick startup

Task	Reference
1. Unpacking inspection	See section 3.1 Unpacking inspection
2. Check whether the VFD connected load and power supply match.	See section 2.1 Product nameplate and model
3. Check the installation environment.	See section 3.2 Preparing
4. Install the VFD on the wall/in the cabinet.	See section 3.3 Installation method
5. Wiring	See chapter 4 Electrical installation
6. Commission the VFD.	See chapter 6 Commissioning

3 Mechanical installation

3.1 Unpacking inspection

After receiving the product, perform the following steps to ensure the product use safety.

- **Check the package**

  Before unpacking, check whether the product package is intact–whether the package is damaged, dampened, soaked, or deformed. After unpacking, check whether the interior surface of the packing box is abnormal, for example, in wet condition.

- **Check the machine and parts**

  After unpacking, check whether the equipment enclosure is damaged or cracked, whether the parts (including the VFD, keypad, and manual) inside the packing box are complete, and whether the nameplate and label on the product body are consistent with the model ordered.

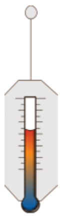
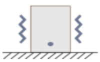
3.2 Preparing

Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Read the following installation preparation carefully before installation to ensure smooth installation and avoid personal injury or equipment damage.

Warning	
	● Carry out operations according to instructions presented in section 1.4 Safety guidelines. Ensure the VFD power has been disconnected before installation. If the VFD has been powered on, disconnect the VFD and wait for at least the time designated on the VFD, and ensure the POWER indicator is off. You are recommended to use a multimeter to check and ensure the VFD DC bus voltage is below 36V. ● The VFD installation must be designed and done according to applicable local laws and regulations. INVT does not assume any liability whatsoever for any VFD installation which breaches local laws or regulations.

3.2.1 Installation environment and site

- **Environment requirements**

Environment		Requirement
Temperature		● -10–+50°C ● Do not use the VFD when the ambient temperature exceeds 50°C. When the ambient temperature exceeds 40°C, derate 1% for every increase of 1°C. ● The temperature does not change rapidly. ● When the VFD is installed in a closed space, such as control cabinet, use a cooling fan or air conditioner for temperature adjustment if necessary. ● When the temperature is too low, if you want to use the VFD that has been idled for a long time, install an external heating device before the use to eliminate the freeze inside the VFD. Otherwise, the VFD may be damaged.
Relative humidity (RH)		● RH: less than 90%, no condensation ● The max. RH cannot exceed 60% in the environment with corrosive gases.
Altitude		● Lower than 1000m ● When the altitude exceeds 1000m, derate by 1% for every increase of 100m. ● When the altitude exceeds 3000m, consult our local dealer or office for details.
Vibration		Max. vibration ACC: $5.8m/s^2$ (0.6g)

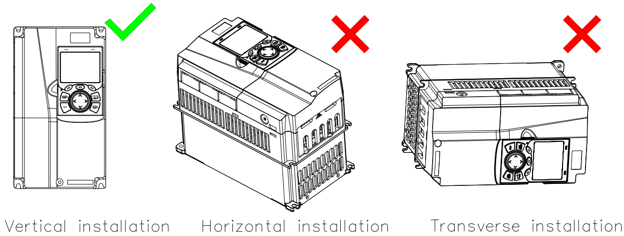
■ **Site requirement**

Site		Requirement
Indoor		Without electromagnetic radiation sources and direct sunlight. **Note:** The VFD must be installed in a clean and well-ventilated environment based on the housing IP rating.
		Without foreign objects such as oil mist, metal powder, conductive dust, and water.
		Without radioactive, corrosive, hazard, and combustible and explosive substances. **Note:** Do not install the VFD onto combustible objects.
		With low salt content.

3.2.2 Installation direction

The VFD can be installed on the wall or in a cabinet. Vertical installation is a must. Do not install the VFD in other directions such as horizontal, transverse or upside-down.

Figure 3-1 Mounting direction



3.2.3 Installation space

3.2.3.1 Single VFD

Figure 3-2 Installation space of a single VFD

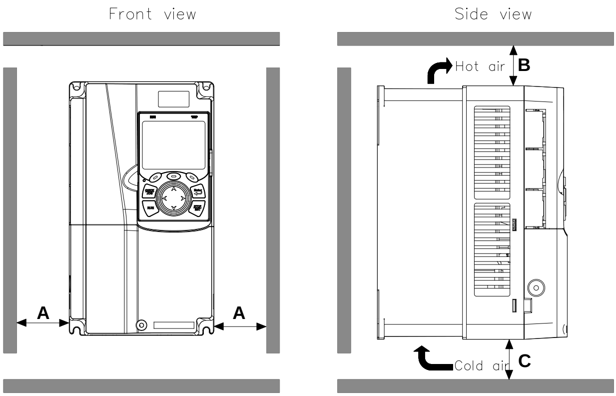


Table 3-1 Installation space dimensions of a single VFD

Power (kW)	Dimensions (mm)		
	A	B	C
1.5–200kW	⩾100	⩾100	⩾100
220–630kW	⩾100	⩾100	0

3.2.3.2 Multiple VFDs

- **Parallel installation**

When installing multiple VFDs, it is recommended to install them in parallel. When you install VFDs in different sizes, align the top of each VFD before installation for the convenience of future maintenance.

Figure 3-3 Installation space of multiple VFDs

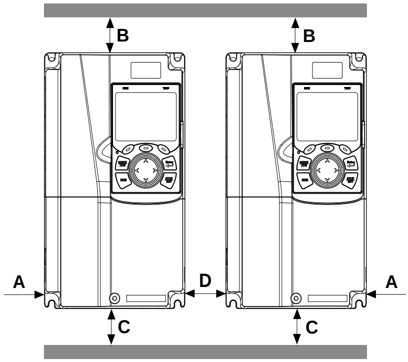
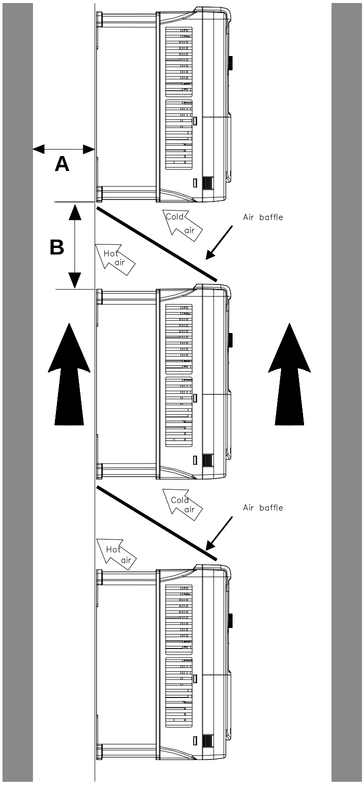


Table 3-2 Installation space dimensions of multiple VFDs

Power (kW)	Dimensions (mm)			
	A	B	C	D
1.5–200kW	⩾100	⩾100	⩾100	⩾100
220–630kW	⩾100	⩾100	0	⩾100

■ Vertical installation

Figure 3-4 Vertical installation space

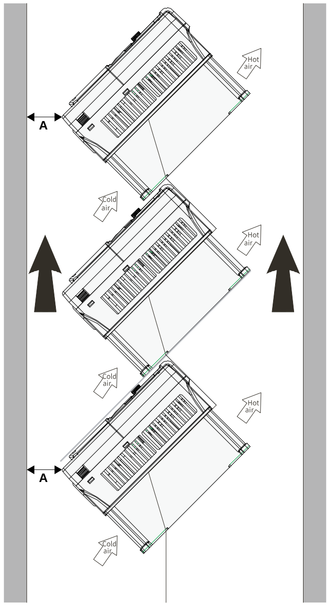


Note:

- During vertical installation, you must install windshield, otherwise, the VFD will experience mutual interference, and the heat dissipation effect will be degraded.
- The minimum spaces of A and B are ⩾50*n*. n is the number of machines, and n must be greater than 1.
- Vertical installation is applicable to 1.5–355kW VFD models.

■ **Tilted installation**

Figure 3-5 Tilted installation space



Note:

- During tilted installation, it is a must to ensure the air inlet duct and air outlet duct are separated from each other to avoid mutual interference.
- The minimum space of A is ⩾50*n*. n is the number of machines, and n must be greater than 1.
- Tilted installation is applicable to 1.5–355kW VFD models.

3.3 Installation method

The installation method of the VFD varies with the outline dimensions. Based on the specific model and application environment, select the appropriate installation method according to the following table. (✓ means you can choose this installation method.)

Table 3-3 Installation method selection

Rated voltage (V)	Power (kW)	Mounting method		
		Wall mounting	Flange mounting	Floor mounting
380V	1.5–75kW	✓	✓	-
	90–110kW	✓	✓	-

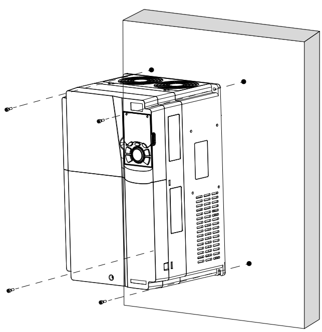
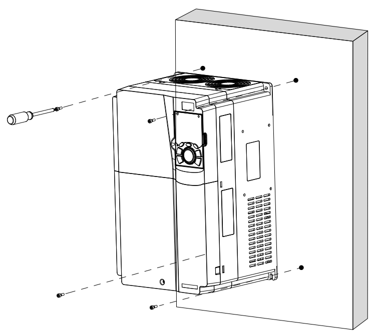
Rated voltage (V)	Power (kW)	Mounting method		
		Wall mounting	Flange mounting	Floor mounting
	132–200kW	√	√	-
	220–315kW	√	-	√
	355–500kW	-	-	√
660V	22–132kW	√	√	-
	160–220kW	√	√	-
	250–355kW	√	-	√
	400–630kW	-	-	√

Note:

- A flange-mounting plate must be selected for the flange mounting of 380V 1.5–110kW VFD models; while no flange-mounting plate is not needed for the the flange mounting of 380V 132–200kW and 660V 22–220kW models.
- Optional installation base is available for the 380V 220–315kW and 660V 250–355kW VFD models. The base can hold an input AC reactor (or DC reactor) and an output AC reactor.

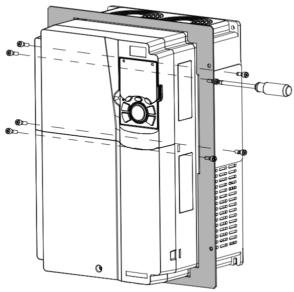
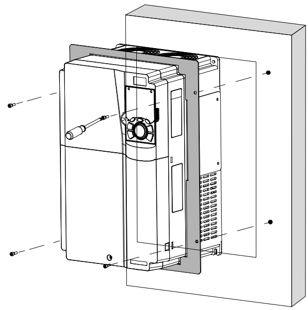
3.3.1 Wall mounting

The mounting procedures are as follows:

Step 1 Mark the installation hole positions. Mount the screws or bolts onto the designated positions. For details about the installation hole positions, see C.2 VFD overall dimensions. 	Step 2 Fix the VFD on the wall or mounting plate, and tighten the screws on the wall or mounting plate. 

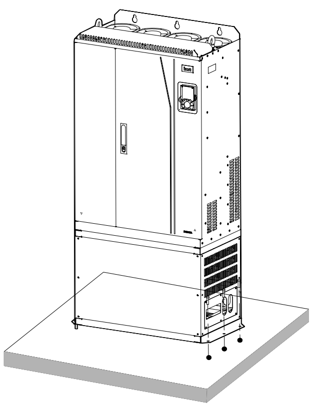
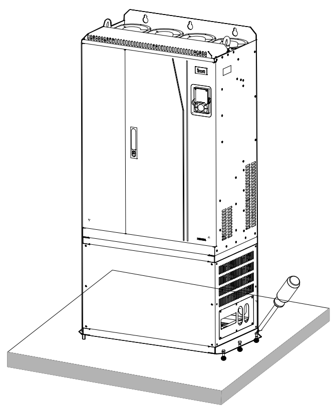
3.3.2 Flange mounting

The mounting procedures are as follows:

Step 1 Fix the bracket on both sides of the VFD body, and tighten the screws on both sides of the bracket. 	Step 2 Fix the VFD with bracket on the control cabinet, and tighten the screws on the front of the bracket. 

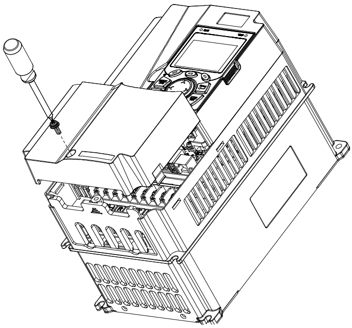
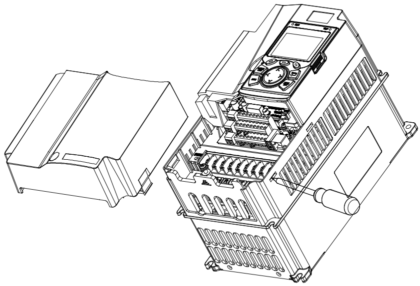
3.3.3 Floor mounting

The mounting procedures are as follows:

Step 1 Mark the installation hole positions. Mount the screws or bolts onto the designated positions. For details about the installation hole positions, see C.2 VFD overall dimensions. 	Step 2 Fix the VFD on the ground or mounting plate, and tighten the screws on the ground or mounting plate. 

3.4 Removing the lower cover

Remove the lower cover of the VFD to perform the wiring of main circuit and control circuit. The removal steps are as follows.

Step 1 Use a tool to loosen the screw on the lower cover and take it out. 	Step 2 Use a tool to pry up the snaps on both sides of the lower cover. Lift up the bottom of the lower cover gently and take out the lower cover. 

4 Electrical installation

4.1 Insulation inspection

Do not perform any voltage endurance or insulation resistance tests, such as high-voltage insulation tests or using a megohmmeter to measure the insulation resistance, on the VFD or its components. Insulation and voltage endurance tests have been performed between the main circuit and housing of each VFD before delivery. In addition, voltage limiting circuits that can automatically cut off the test voltage are configured inside the VFDs. If you need to conduct insulation resistance testing on the VFD, please contact us.

Note: Before conducting insulation resistance testing on input and output power cables, remove the cable connection terminals from the VFD.

■ **Input power cable**

Check the insulation conditions of the input power cable of a VFD according to the local regulations before connecting it.

■ **Motor cable**

Ensure that the motor cable is connected to the motor, and then remove the motor cable from the U, V, and W output terminals of the VFD. Use a megohmmeter of 500V DC to measure the insulation resistance between each phase conductor and the protection grounding conductor. For details about the insulation resistance of the motor, see the description provided by the manufacturer.

Note: If the motor inside is damp, the insulation resistance is reduced. If you suspect the inside of motor is moist, dry and re-measure the motor.

4.2 Cable selection and routing

4.2.1 Cable selection

■ **Power cable**

Power cables mainly include input power cables and motor cables. To meet the EMC requirements stipulated in the CE standards, it is recommended to use symmetrical shielded cables as motor cables and input power cables. See section D.1.1 Power cable.

Note: If the electrical conductivity of the motor cable shield layer does not meet the requirements, a separate PE conductor must be used.

■ **Control cable**

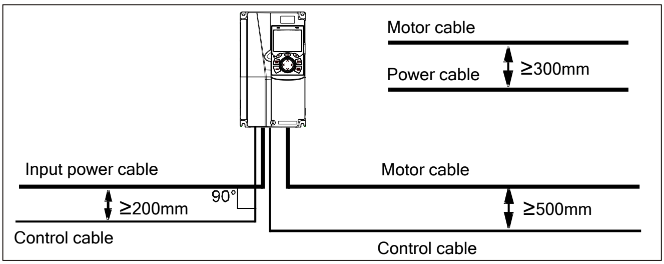
Control cables mainly include analog signal control cables and digital signal control cables. Analog signal control cables use twisted double shielded cables with a separate shielded twisted pair for each signal and different ground wires for different analog signals. For digital signal control cables, a double-shielded cable is preferred, but single-shielded or unshielded twisted pairs can also be used. See section D.1.2 Control cable.

4.2.2 Cable arrangement

Motor cables must be arranged away from other cables. The dU/dt of the VFD output may increase electromagnetic interference on other cables. The motor cables of several VFDs can be arranged in parallel. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays.

If a control cable and power cable must cross each other, ensure that the angle between them is 90°. The cable trays must be connected properly and well grounded. Figure 4-1 shows the cable routing and wiring distance.

Figure 4-1 Cable routing distance



4.3 Main circuit wiring

4.3.1 Main circuit wiring diagrams

Figure 4-2 Main circuit wiring

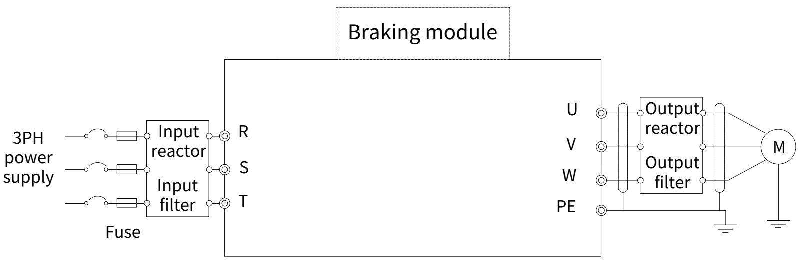
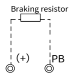
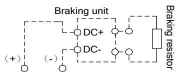
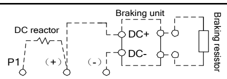


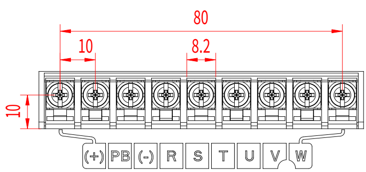
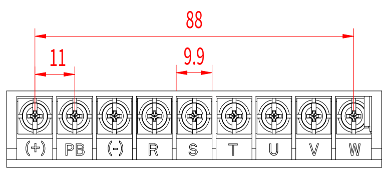
Table 4-1 Braking module power range

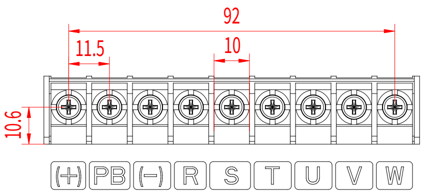
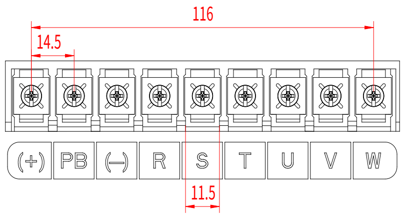
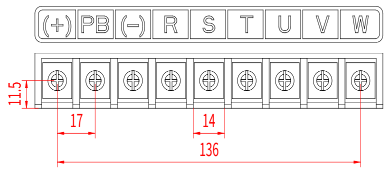
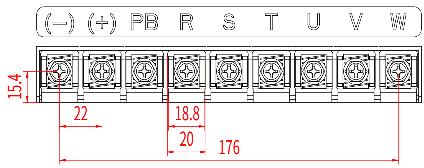
Braking module	Applicable power range
	380V 37kW and lower
	380V 45–110kW (inclusive)
	380V 132kW and higher or 660V 22kW and higher

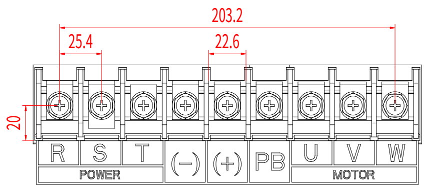
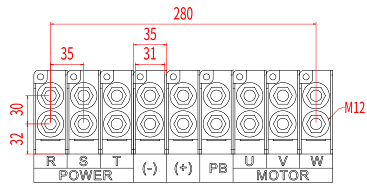
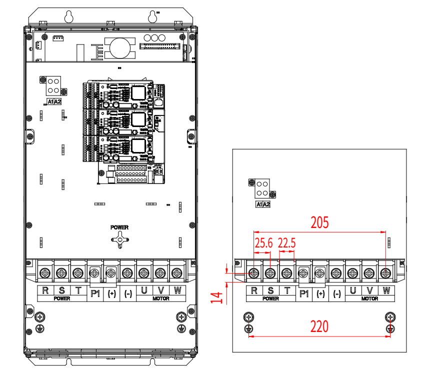
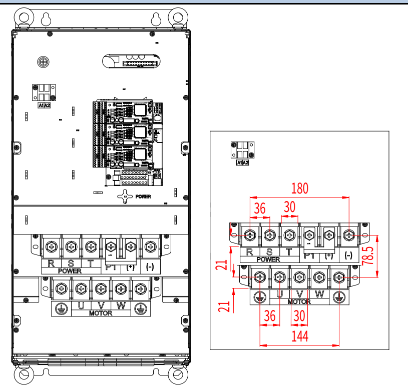
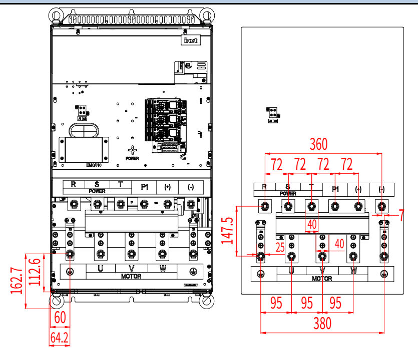
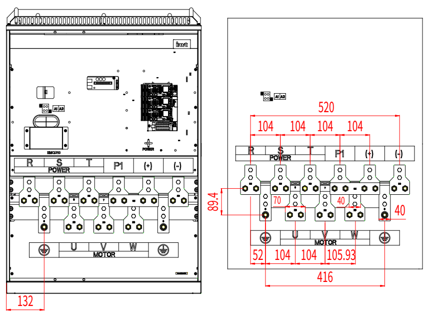
Note:

- The fuse, DC reactor, braking unit, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. For details, see Appendix D Peripheral accessories.
- P1 and (+) have been short connected by default for the 380V 132kW or higher and 660V 22kW or higher VFD models. If you need to connect to an external DC reactor, remove the jumper between P1 and (+).
- Before connecting the braking resistor, remove the yellow warning labels marked with PB, (+), or (-) from the terminal block; otherwise, poor contact may occur.
- Built-in braking unit is optional for the 380V 45–110kW VFD models.
- For details about the main circuit wiring diagram of parallel VFDs, see the manual for Goodrive series parallel VFDs.

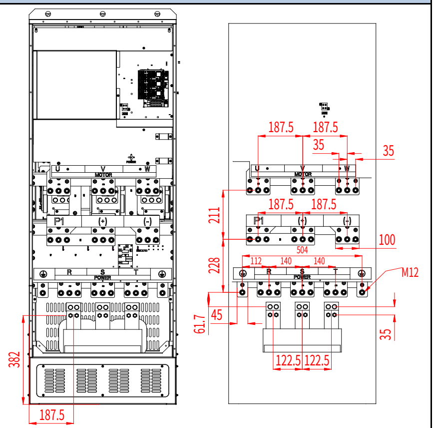
4.3.2 Main circuit terminals

Main circuit terminal diagram for 380V 1.5–2.2kW VFD models	Main circuit terminal diagram for 380V 4–4.5kW VFD models
	

Main circuit terminal diagram for 380V 7.5kW VFD models	Main circuit terminal diagram for 380V 11–15kW VFD models
	
Main circuit terminal diagram for 380V 18.5–22kW VFD models	**Main circuit terminal diagram for 380V 30–37kW VFD models**
	

Main circuit terminal diagram for 380V 45–75kW VFD models (PB is valid when a braking unit is embedded)	Main circuit terminal diagram for 380V 90–110kW VFD models (PB is valid when a braking unit is embedded)
	
Main circuit terminal diagram for 660V 22–45kW VFD models	**Main circuit terminal diagram for 660V 55–132kW VFD models**
	
Main circuit terminal diagram for 380V 132–200kW VFD models (without A1 or A2) Main circuit terminal diagram for 660V 160–220kW VFD models	**Main circuit terminal diagram for 380V 220–315kW VFD models (without A1 or A2) Main circuit terminal diagram for 660V 250–355kW VFD models**
	

Main circuit terminal diagram for 380V 355–500kW VFD models (without A1 or A2)
Main circuit terminal diagram for 660V 400–630kW VFD models



<table>
<tr><th rowspan="3">Terminal symbol</th><th colspan="3">Terminal name</th><th rowspan="3">Function</th></tr>
<tr><th rowspan="2">380V⩽37kW</th><th rowspan="2">380V 45–110kW (inclusive)</th><th>380V⩾132kW</th></tr>
<tr><th>All 660V models</th></tr>
<tr><td>R, S, T</td><td colspan="3">Main circuit power input</td><td>3PH AC input terminals, connected to the grid</td></tr>
<tr><td>U, V, W</td><td colspan="3">VFD output</td><td>3PH AC output terminals, connected to the motor usually</td></tr>
<tr><td>P1</td><td>Not available</td><td>Not available</td><td>DC reactor terminal 1</td><td rowspan="4">P1 and (+) connect to external DC reactors.
(+) and (-) connect to the external braking unit.
PB and (+) connect to external braking resistor terminal</td></tr>
<tr><td>(+)</td><td>Braking resistor terminal 1</td><td>Braking unit terminal 1</td><td>DC reactor terminal 2, Braking unit terminal 1</td></tr>
<tr><td>(-)</td><td>Not available</td><td colspan="2">Braking unit terminal 2</td></tr>
<tr><td>PB</td><td>Braking resistor terminal 2</td><td colspan="2">Not available</td></tr>
<tr><td>PE</td><td colspan="3">Grounding terminal for safe protection</td><td>Grounding terminal for safe protection; each machine must carry two PE terminals</td></tr>
</table>

<table>
<tr><th rowspan="3">Terminal symbol</th><th colspan="3">Terminal name</th><th rowspan="3">Function</th></tr>
<tr><th rowspan="2">380V≤37kW</th><th rowspan="2">380V 45–110kW (inclusive)</th><th>380V≥132kW</th></tr>
<tr><th>All 660V models</th></tr>
<tr><td></td><td colspan="3"></td><td>and proper grounding is required</td></tr>
<tr><td>A1, A2</td><td colspan="2">Not available</td><td>660V: 220V control power terminals</td><td>External 220V control power terminals</td></tr>
</table>

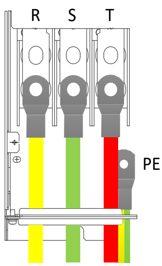
Note:

- It is not recommended to use asymmetrical motor cables. If there is a symmetrical grounding conductor in the motor cable besides the conductive shielded layer, ground the grounding conductor on the VFD end and motor end.
- Braking resistor, braking unit and DC reactor are optional parts.
- "Not available" means this terminal is not for external connection.
- GD series VFDs cannot share the DC bus with other series VFDs.
- When sharing the DC bus, the VFDs must be the same in power and must be simultaneously powered on or off.
- In shared DC bus running mode, current balance on the VFD input side must be considered during wiring, and equalizing reactors are recommended to be configured.

4.3.3 Wiring procedure

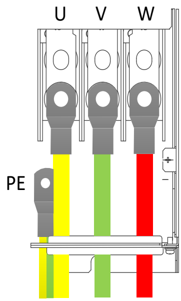
Step 1 Connect the grounding line of the input power cable to the grounding terminal (PE) of the VFD, and connect the 3PH input cable to R, S and T terminals and tighten up.

Figure 4-3 Input power cable connection



Step 2 Connect the ground wire of the motor cable to the PE terminal of the VFD, connect the motor 3PH cable to the U, V and W terminals, and tighten up.

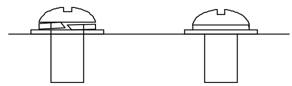
Figure 4-4 Motor cable connection



Step 3 Connect optional parts such as the braking resistor that carries cables to designated positions. For details, see 4.3.1 Main circuit wiring diagrams.

Step 4 Fasten all the cables outside the VFD mechanically if allowed.

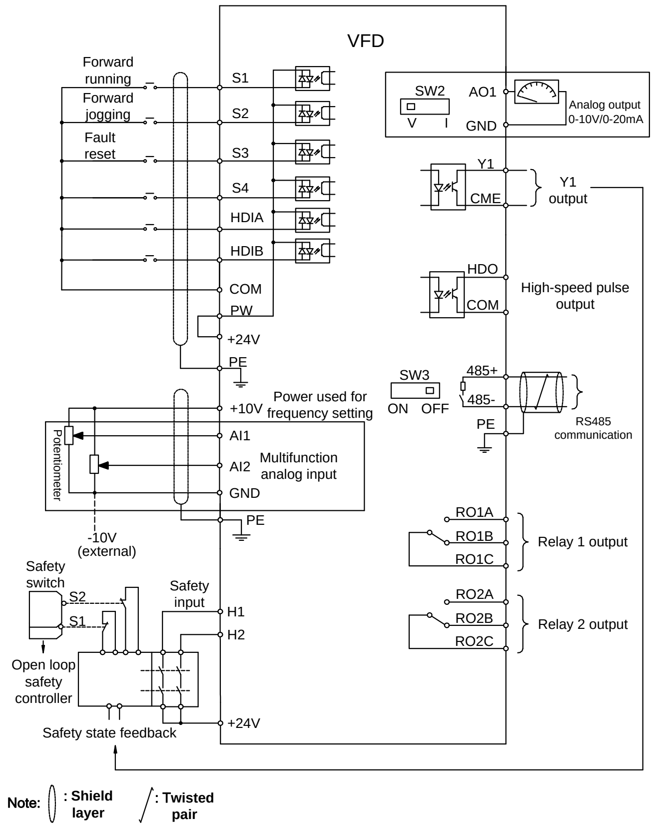
Figure 4-5 Correct screw installation



4.4 Control circuit wiring

4.4.1 Control circuit wiring

Figure 4-6 Control circuit wiring



Note:

- The sampling line of the potentiometer (the wire in the middle of the resistor) must not be connected to 10V or GND. It must be wired exactly as shown in Figure 4-6. Otherwise, adjusting the potentiometer may cause a short circuit to 10V, and a long time of short circuit could damage the control board.
- If wire-passing board outlet space is insufficient when all terminals on the control board are wired, cut the knock-out hole on the lower cover for wire outlet. If a

dangerous situation occurs when the knock-out hole is cut for a purpose but not wire outlet, we will not bear any responsibility.

- For details about the control circuit wiring diagram of parallel VFDs, see the manual for Goodrive series parallel VFDs.

4.4.2 Control circuit terminals

Figure 4-7 Terminal diagram of the 5.5kW and lower control circuit

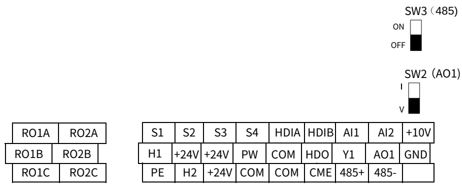
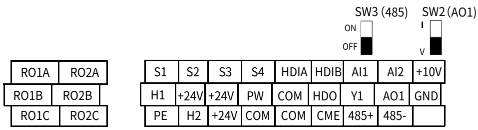


Figure 4-8 Terminal diagram of the 7.5kW and higher control circuit



Terminal name	Specifications
+10V	Locally provided +10V power supply
AI1 AI2	Input range: AI1: 0–10V/0–20mA; AI2: -10V–+10V Whether voltage or current is used for input of AI1 is set through P05.50. Input impedance: 20kΩ for voltage input or 250Ω for current input Resolution: 5mV when 10V corresponds to 50Hz Deviation: ±0.5% at 25°C, when input is above 5V/10mA
GND	+10V reference ground
AO1	Output range: 0–10V, 0–20mA Whether voltage or current is used for output is set through the DIP switch SW2 Deviation: ±0.5% when output exceeds 5V or 10mA at 25°C
RO1A RO1B RO1C	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V, 1A/DC30V
RO2A RO2B RO2C	RO2 output; RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC 250V, 1A/DC 30V
HDO	Switch capacity: 50mA/30V

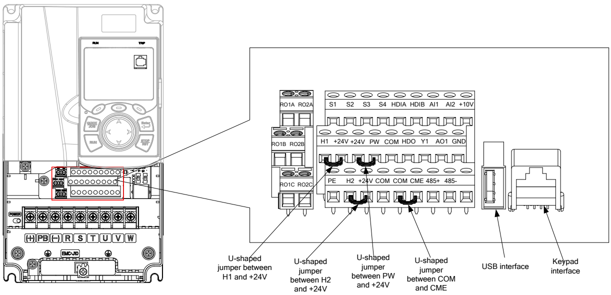
<table>
<tr><th>Terminal name</th><th colspan="2">Specifications</th></tr>
<tr><td></td><td colspan="2">Output frequency range: 0–50kHz
Duty ratio: 50%</td></tr>
<tr><td>COM</td><td colspan="2">+24V reference ground</td></tr>
<tr><td>CME</td><td colspan="2">Common terminal of open collector output; short connected to COM by default</td></tr>
<tr><td>Y1</td><td colspan="2">Switch capacity: 50mA/30V
Output frequency range: 0–1kHz</td></tr>
<tr><td>485+</td><td colspan="2" rowspan="2">RS485 differential signal communication port. The standard 485 communication interface should use shielded twisted pair; 120Ω terminal matching resistor of RS485 communication is connected by the switch SW3.</td></tr>
<tr><td>485-</td></tr>
<tr><td>PE</td><td colspan="2">Grounding terminal</td></tr>
<tr><td>PW</td><td colspan="2">External input terminal for digital input circuits
Voltage range: 12–30V</td></tr>
<tr><td>+24V</td><td colspan="2">User power supply provided by the VFD. Max. output current: 200mA</td></tr>
<tr><td>S1</td><td colspan="2" rowspan="4">● Digital input terminals 1–4
● Internal impedance: 3.3kΩ
● 12–30V voltage input is acceptable
● Bi-direction input terminals, supporting both NPN and PNP
● Max. input frequency: 1kHz
● All are programmable digital input terminals, the functions of which can be set through function codes</td></tr>
<tr><td>S2</td></tr>
<tr><td>S3</td></tr>
<tr><td>S4</td></tr>
<tr><td>HDIA</td><td colspan="2" rowspan="2">In addition to S1–S4 functions, the terminals can also act as high frequency pulse input channels.
Max. input frequency: 50kHz
Duty ratio: 30%–70%
Supports the input of a quadrature encoder with 24V power supply; equipped with speed-measurement function</td></tr>
<tr><td>HDIB</td></tr>
<tr><td>+24V—H1</td><td>STO input 1</td><td rowspan="2">Safe torque off (STO) redundant input, connected to the external NC contact. When the contact opens, STO acts and the VFD stops output.
● Safety input signal wires use shielded wires whose length is within 25m.
● The H1 and H2 terminals are short connected to +24V by default. Remove the jumper from the terminals before using the STO function.</td></tr>
<tr><td>+24V—H2</td><td>STO input 2</td></tr>
</table>

4.4.3 Input/output signal connection diagram

4.4.3.1 Input signal connection diagram

You can select the NPN/PNP mode and the internal/external power through the U-shaped jumper. The NPN internal mode is adopted by default. There are two ways to set the U-shaped jumper based on the input signal:

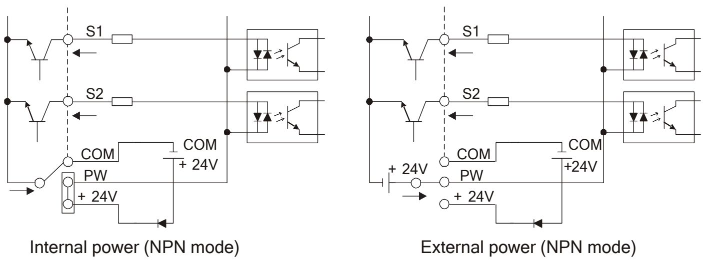
Figure 4-9 U-shaped jumper position



Note: As shown in the figure above, the USB port can be used to upgrade the software, and the keypad port can be used to connect an external keypad. The external keypad cannot be used when the local VFD keypad is used.

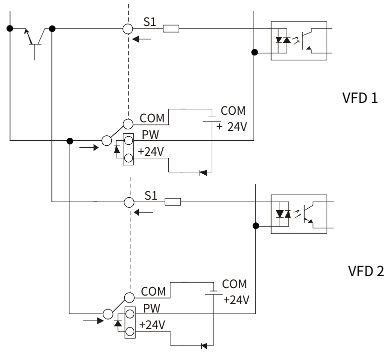
Method 1: If the input signal comes from the NPN transistor, set the U-shaped jumper between +24V and PW based on the power used according to the following figure.

Figure 4-10 NPN mode



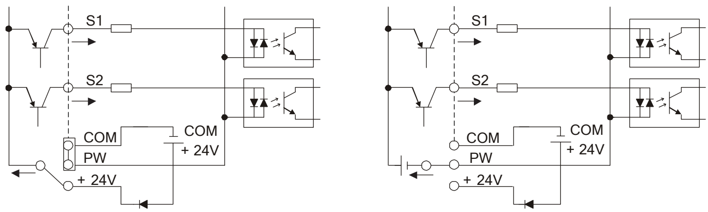
Note: When the internal power is used in wiring mode 1, the S terminals of different VFDs cannot be connected in parallel, as this may cause malfunction of the S terminals. If the S terminals need to be connected in parallel (between different VFDs), a diode must be connected in series between 24V and PW (with the anode connected to 24V). The diode must meet the requirements: IF > 40mA, VR > 40V, as shown in Figure 4-11.

Figure 4-11 Parallel connection of S terminals between multiple VFDs (in internal power NPN mode)



Method 2: If the input signal comes from the PNP transistor, set the U-shaped jumper between COM and PW based on the power used according to the following figure.

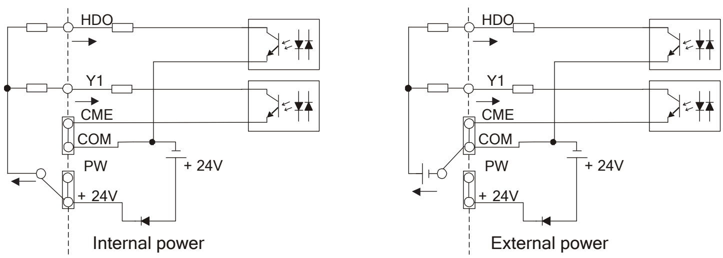
Figure 4-12 PNP mode



Internal power (PNP mode) External power (PNP mode)

4.4.3.2 Output signal connection diagram

Figure 4-13 Y1 and HDO terminal wiring



Internal power External power

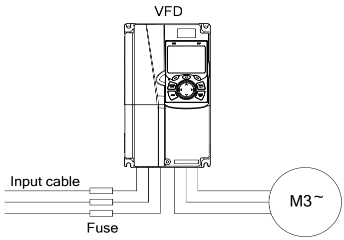
4.5 Power distribution protection

	Do not connect any power source to the VFD output terminals U, V and W. The voltage applied to the motor cable may cause permanent damage to the VFD.

■ **Power cable and inverter protection**

In case of short circuit, the fuse protects input power cables to avoid damage to the VFD; if internal short circuit occurs to the VFD, it can protect neighboring equipment from being damaged. The wiring diagram is as follows.

Figure 4-14 Fuse configuration



Note: Select the fuse according to D.2 Breaker and electromagnetic contactor.

■ **Motor and motor cable short-circuit protection**

If the motor cable is selected based on VFD rated current, the VFD is able to protect the motor cable and motor without other protective devices during short circuit.

Note: If the VFD is connected to multiple motors, use a separated thermal overload switch or breaker to protect the cable and motor, which may require the fuse to cut off the short circuit current.

■ **Motor thermal overload protection**

Once overload is detected, the power supply must be cut off. The VFD is equipped with the motor thermal overload protection function, which can block output and cut off the current (if necessary) to protect the motor.

■ **Bypass connection protection**

In some critical scenarios, the power/variable frequency conversion circuit needs to be configured to ensure proper operation of the system when a fault occurs to the VFD.

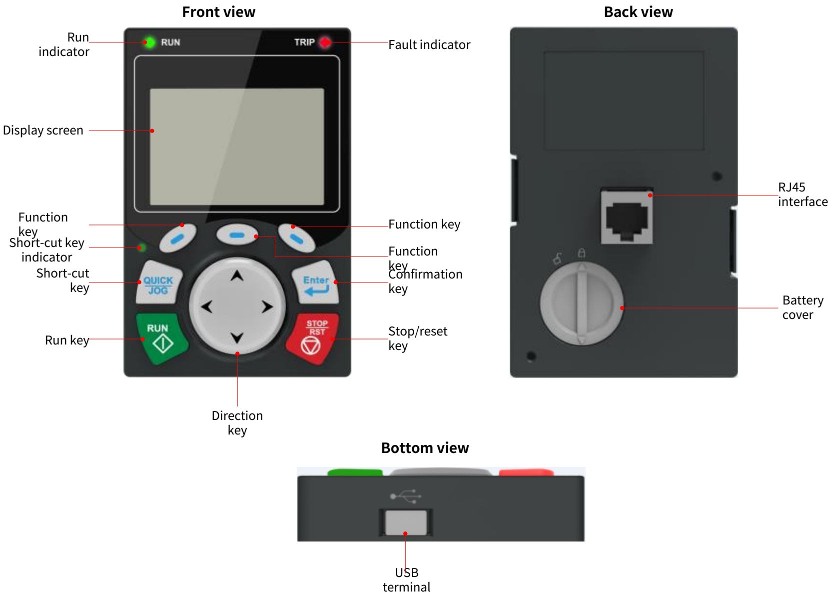
In some special scenarios, such as in soft startup, power-frequency running is directly performed after the startup, which requires bypass connection.

If VFD status needs to be switched frequently, you can use the switch which carries mechanical interlock or a contactor to ensure motor terminals are not connected to input power cables and VFD output ends simultaneously.

5 Keypad operation guidelines

5.1 Keypad panel display

The VFD has been equipped with a LCD keypad as a standard configuration part, through which various functions can be realized, such as: controlling the start and stop, reading status data, setting parameters, and copying parameters of the VFD.



Note:

- The keypad is equipped with a real-time clock, which can run properly after being installed with batteries even if the power line is disconnected. The clock battery (model number: CR2032) is user purchased.
- If the keypad needs to be extended, use a standard RJ45 crystal head network cable as the keypad extension cable, and mount the keypad on the front door panel of the cabinet using M3 screws or the optional keypad bracket.

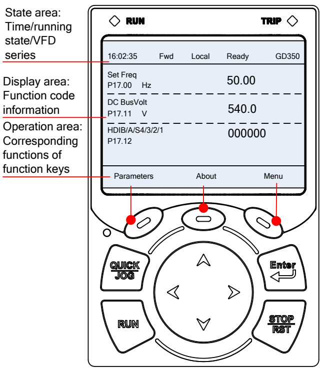
5.1.1 Indicator

Indicator	Status	Description
RUN	◆ Steady on	The VFD is running.

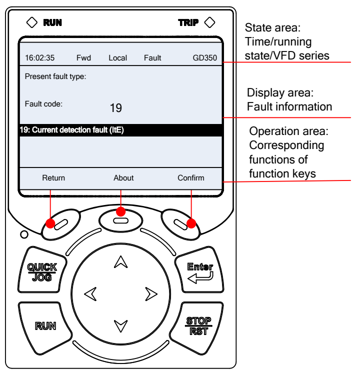
Indicator	Status	Description
	Blinking	The VFD is in parameter autotuning.
	Steady off	The VFD has stopped.
TRIP	Steady on	The VFD is in fault state.
	Blinking	The VFD is in pre-alarm state.
	Steady off	The VFD is in normal state.
QUICK/JOG	Steady on	The displayed state varies depending on the short-cut key function. For details, see the definition of QUICK/JOG.
	Blinking	
	Steady off	

5.1.2 Display screen

The display shows different content depending on the operating scenario.

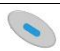


Example of parameters displayed in stopped state



Example of parameters displayed in fault state

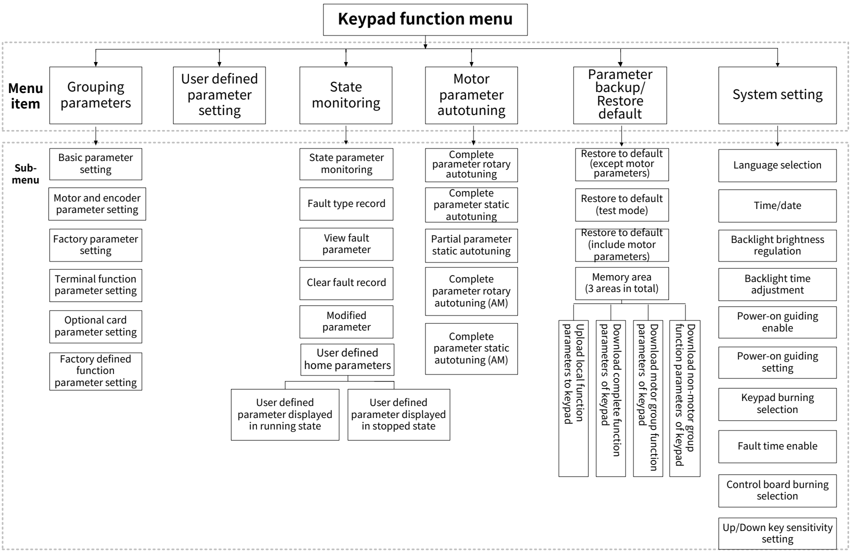
5.1.3 Key

Key		Function
	Function key	Press it to display the function on the corresponding page position.
		
		

Key		Function
	Short-cut key	The ones place of P07.02 defines the key function, which is jogging by default and can be redefined. For details, see the description of P07.02.
	Confirmation key	The function of this key varies depending on the menu, such as confirming parameter settings, selecting parameters, or entering a sub-menu.
	Run key	Press it to run or perform autotuning under keypad operation mode.
	Stop/Reset key	The function code P07.04 specifies the validity of the key function. Press it to stop running or autotuning in running state. Press it to reset in fault alarm state.
	Direction key	The function of the direction key varies with interfaces. Up key : Press it to move the item up or increase the value. Down key : Press it to move the item down or decrease the value. Left key : Press it to switch the page, move the cursor to the left, or return to the previous menu. Right key : Press it to switch the page, move the cursor to the right, or enter the next menu.

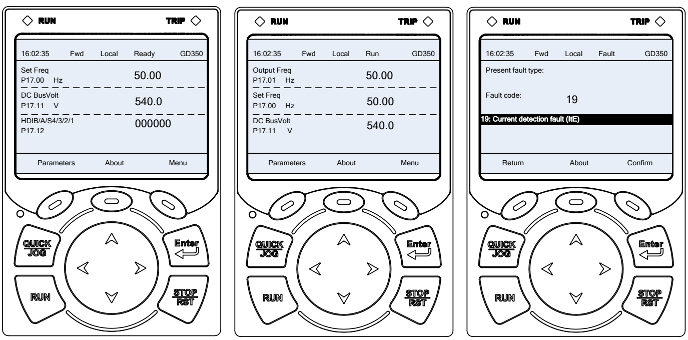
Note: Generally, you can press or or to enter the current cursor-lighted menu, or you can press or to return to the previous menu. In the following, take or as an example to enter the current menu or return to the previous menu.

5.2 Keypad functions



5.3 Operation procedure

You can operate the VFD through the keypad homepage **Menu** regardless of whether the VFD is stopped or running.



Stopped state homepage Running state homepage Fault state homepage

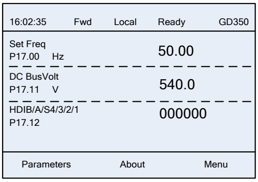
Once a fault is detected, the keypad displays the fault code and fault information with the indicator on the keypad turning on. You can perform fault reset by using the STOP/RST key, control terminals, or communication commands.

5.3.1 Entering/Exiting menus

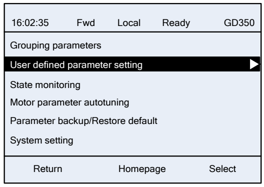
The following figures show how to enter/exit menu in the stopped state.

Note: The content may be displayed on multi-pages due to a limited display size. You can press to display full items.

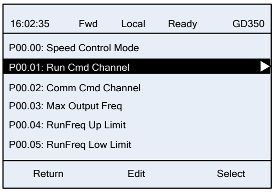
Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.



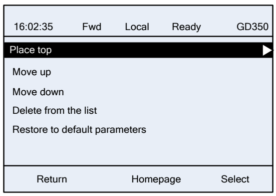
Step 2 Press the down key to select **User defined parameter setting** and press to confirm.



Step 3 Press the key or to select the function code.

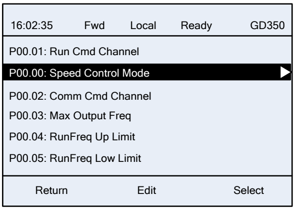


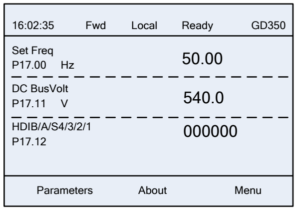
Step 4 After pressing the key corresponding to **Edit**, press the key corresponding to **Place top** to confirm.



Step 5 Press the key corresponding to **Return** to return to the previous menu.

Step 6 Press the key corresponding to **Return** or press the key corresponding to **Homepage** to return to the homepage.

<table>
<tr>
<td>


</td>
<td>


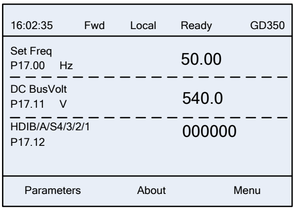
</td>
</tr>
</table>

5.3.2 Editing the parameter list

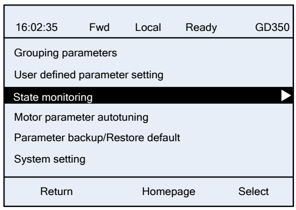
You can edit the user-defined parameter list (in the stopped state or running state), and the editing operations include **Place top**, **Move up**, **Move down**, **Delete from the list**, and **Restore to default parameters**.

The operation example is as follows:

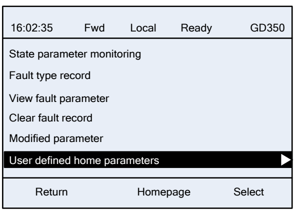
<table>
<tr>
<td>
Step 1 In the stopped state homepage, press the key corresponding to Menu to select the menu item.



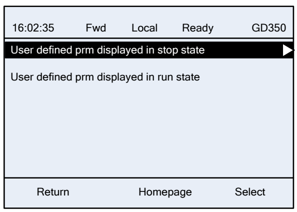
</td>
<td>
Step 2 Press to select State monitoring and press to confirm.



</td>
</tr>
<tr>
<td>
Step 3 Press to select User defined home parameters and press to confirm.

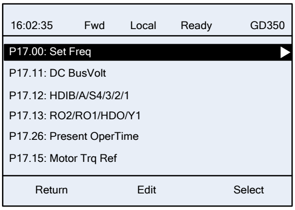


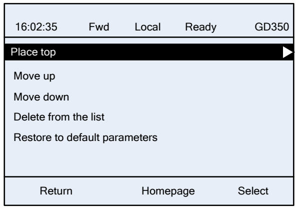
</td>
<td>
Step 4 Press to select User defined prm displayed in stop state.



</td>
</tr>
<tr>
<td>Step 5 Press to select the function</td>
<td>Step 6 Press to select Place top.</td>
</tr>
</table>

code P17.00.



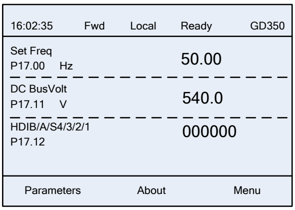


5.3.3 Adding parameters

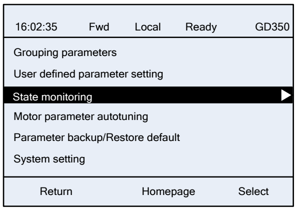
Parameter list displayed in the stopped/running state

The operation example is as follows:

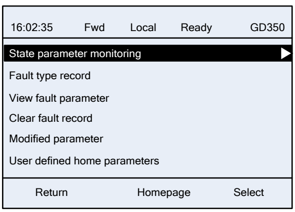
Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.



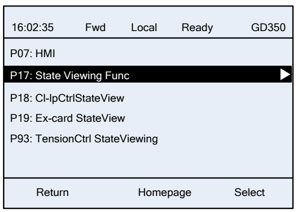
Step 2 Press to select **State monitoring** and press to confirm.



Step 3 Select **State parameter monitoring** and press to confirm.

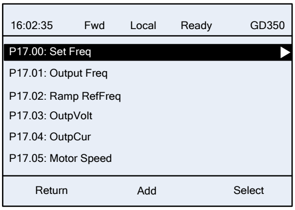


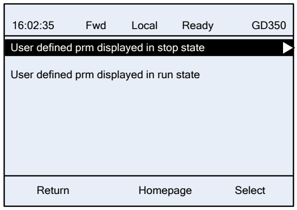
Step 4 Press to select function code group P17 and press to confirm.



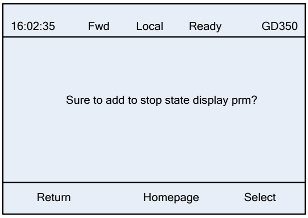
Step 5 Press the key corresponding to **Add**.

Step 6 Press to select **User defined prm displayed in stop state**.

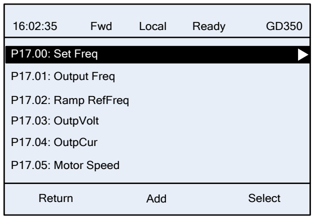




Step 7 Press the key corresponding to "Confirm".



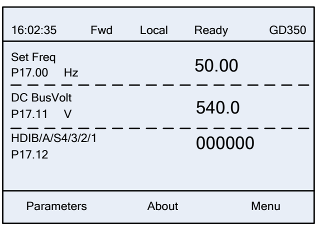
Step 8 After the page returns to the current function code group, continue adding function codes or return to the previous menu.



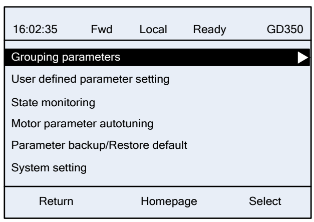
User defined parameter list

The operation example is as follows:

Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.

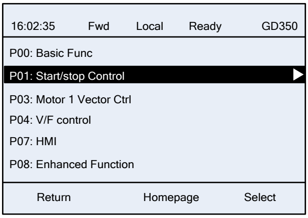
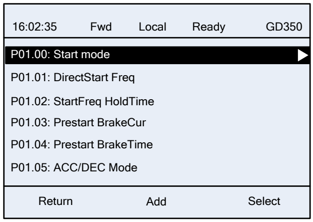
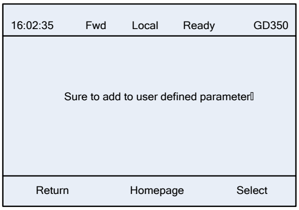
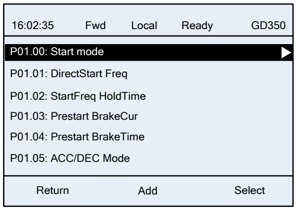


Step 2 Select **Grouping parameters** and press to confirm.



Step 3 Press to select P01, and press to confirm.

Step 4 Press the key corresponding to **Add**.

<table>
<tr>
<td>
</td>
<td>
</td>
</tr>
<tr>
<td>Step 5 Press the key  for confirmation.

</td>
<td>Step 6 After the page returns to the current function code group, continue adding function codes or return to the previous menu.

</td>
</tr>
</table>

5.3.4 Modifying parameters

You can quickly modify the parameter value through **Parameters** on the homepage in the stopped/running state, or through **Menu** > **Grouping Parameters** or **User defined parameter setting**.

In parameter value modification interface, **Authority** on the top right indicates whether the parameter can be modified.

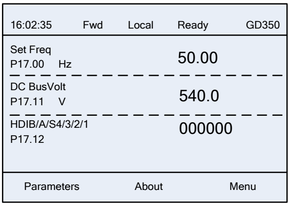
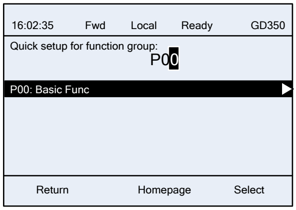
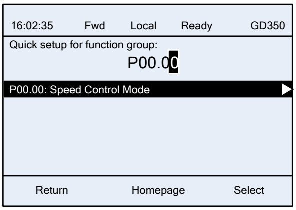
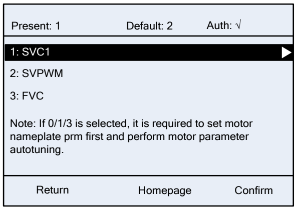
"✓": It indicates that the value of the parameter can be modified under current VFD state.

"×": It indicates that the value of the parameter cannot be modified under current VFD state.

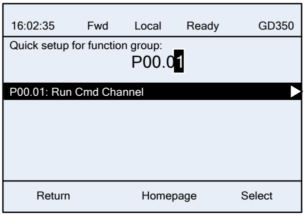
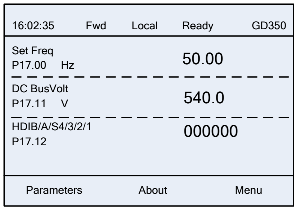
Quick parameter modification

The operation example is as follows:

<table>
<tr>
<td>Step 1 In the stopped state homepage, press the key  corresponding to Parameters to select the menu</td>
<td>Step 2 Press  or  to select a function code group; press the key  corresponding to Select to</td>
</tr>
</table>

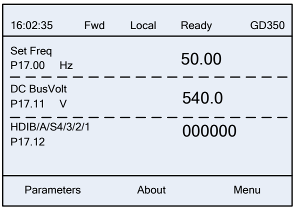
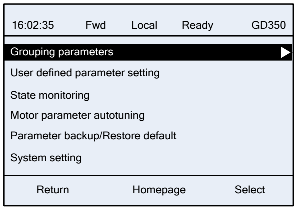
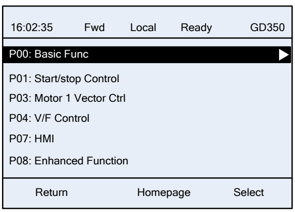
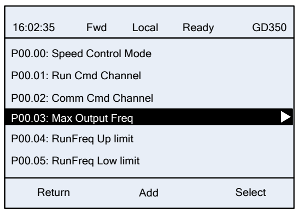
<table>
<tr>
<td>item.

</td>
<td>keep the current selection.

</td>
</tr>
<tr>
<td>Step 3 Press or to select a function code; press the key corresponding to Select to keep the current selection.

</td>
<td>Step 4 Press or to change the value.


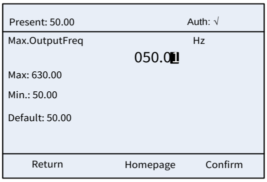
Press the key corresponding to Confirm. The page returns to the current group function code list. You can continue with the modification or to return to the previous menu.</td>
</tr>
<tr>
<td>Step 5 Press the key to confirm. The page goes to the next function code.</td>
<td>Step 6 Repeating the preceding steps to modify other parameters, or press the key corresponding to Return to return to previous menu, or press the key corresponding to Homepage to go to the homepage.</td>
</tr>
</table>

<table>
<tr>
<td>
</td>
<td>
</td>
</tr>
</table>

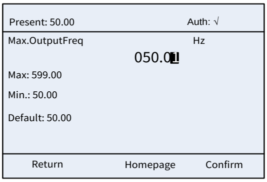
Grouping parameters

The operation example is as follows:

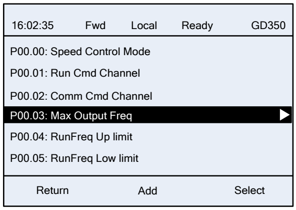
<table>
<tr>
<td>Step 1 In the stopped state homepage, press the key corresponding to Menu to select the menu item.

</td>
<td>Step 2 Select Grouping parameters and press to confirm.

</td>
</tr>
<tr>
<td>Step 3 Select Basic Func, and press to select function code group P00.

</td>
<td>Step 4 Press to select a function code, and press to confirm.

</td>
</tr>
<tr>
<td>Step 5 Press or to increase or decrease the value.</td>
<td>Step 6 Press the key corresponding to Confirm. The page returns to the current group function code list. You can continue with the modification or to return to the previous menu.</td>
</tr>
</table>



Note: Supported by software of version V3.xx or earlier.

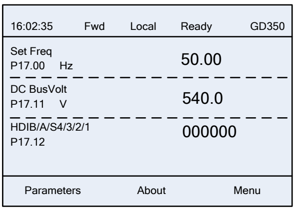


Note: Supported by software of version V6.xx or later.

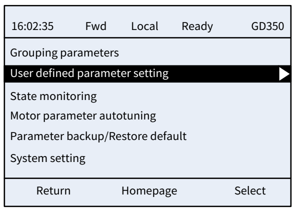


User defined parameter setting

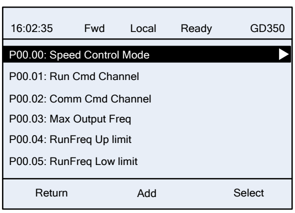
Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.



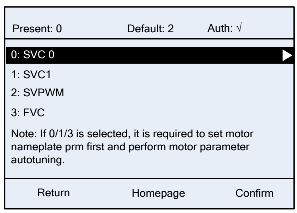
Step 2 Press to select **User defined parameter setting**, and press to confirm.



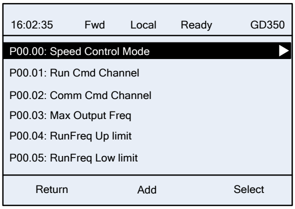
Step 3 Press the key corresponding to **Select**.



Step 4 Press or to change the value.



Step 5 Press the key corresponding to **Confirm**. The page returns to the user defined parameter list, and you can continue to modify parameters or return to the previous menu.

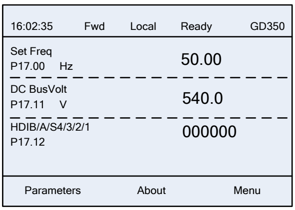


5.3.5 Viewing parameters

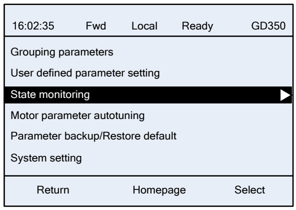
Users can know the VFD state through viewing related parameters.

The operation example is as follows:

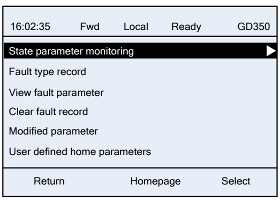
Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.



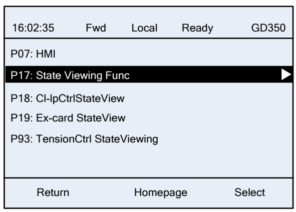
Step 2 Press to select **State monitoring** and press to confirm.



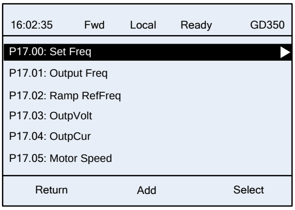
Step 3 Press to select **State parameter monitoring**, and press to confirm.



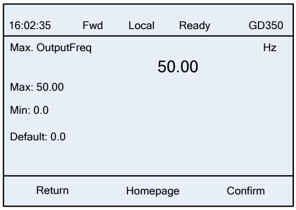
Step 4 Press to select function code group P17, and press to confirm.



Step 5 Press the key corresponding to **Select**.



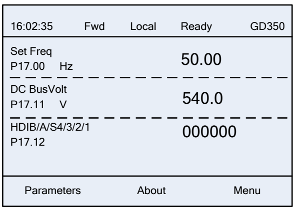
Step 6 Press the key corresponding to **Confirm** to display the next function code, or press the key corresponding to **Return** to return to the current function code group.



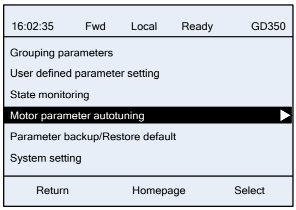
5.3.6 Motor parameter autotuning

The operation example is as follows:

Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.

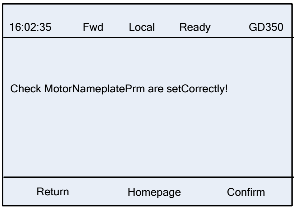


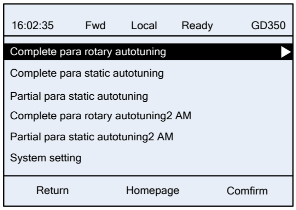
Step 2 Press to select **Motor parameter autotuning**, and press to confirm.



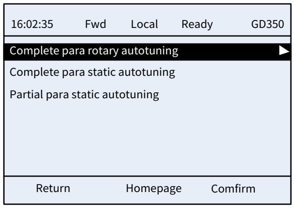
Step 3 (Assume that the motor nameplate parameters have been set.) Press the key corresponding to **Confirm**.

Step 4 Press to select **Complete para rotary autotuning**.



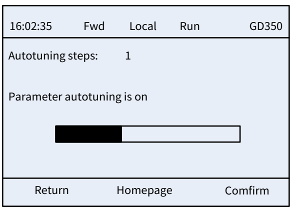


Note: Supported by software of version V3.xx or earlier.

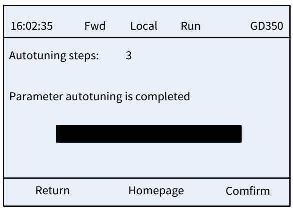


Note: Supported by software of version V6.xx or later.

Step 5 The page shows the autotuning progress, and you can press the key corresponding to **Stop** to end the autotuning.



Step 6 Press the key corresponding to **Confirm**.

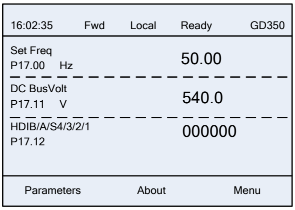


5.3.7 Backing up parameters

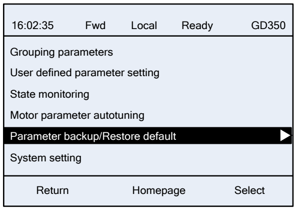
The keypad provides three different storage areas for parameter backup, and each storage area can save the parameters of one VFD, namely it can save parameters of three VFDs in total.

The operation example is as follows:

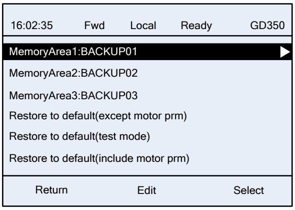
Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.



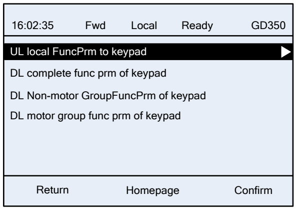
Step 2 Press to select **Parameter backup/Restore default**, and press to confirm.



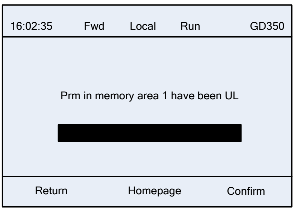
Step 3 Press to select **MemoryArea1: BACKUP01**.



Step 4 Press to select **UL local FuncPrm to keypad**.



Step 5 After parameter uploading is completed, press **Confirm** or **Return** to return to the previous menu.



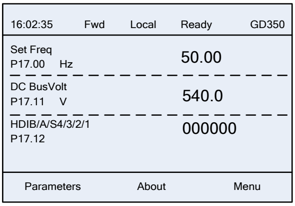
5.3.8 System setup

You can set keypad language, time/date, backlight brightness, backlight time and restore parameters.

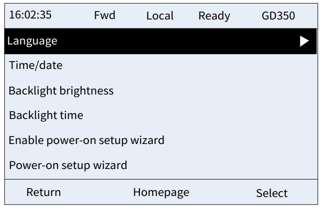
Note: The keypad time/date needs to be reset after power down.

The operation example is as follows:

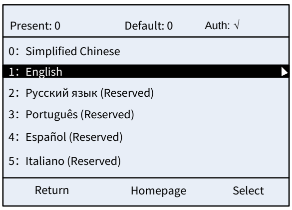
Step 1 In the stopped state homepage, press the key corresponding to **Menu** to select the menu item.



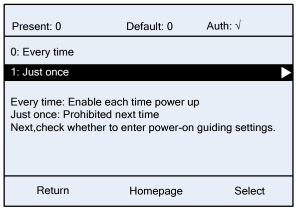
Step 2 Press to select **Language**.



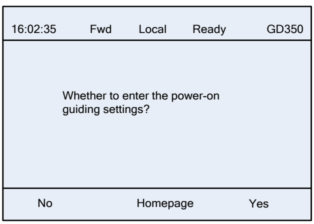
Step 3 Press to select **1: English**.



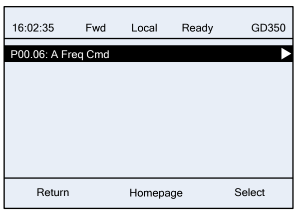
Step 4 Press to select **1: Just once**, and press the key corresponding to **Confirm**.



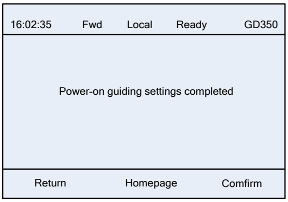
Step 5 Press the key corresponding to **Yes**.



Step 6 Complete all parameter settings according to the on-screen instructions.



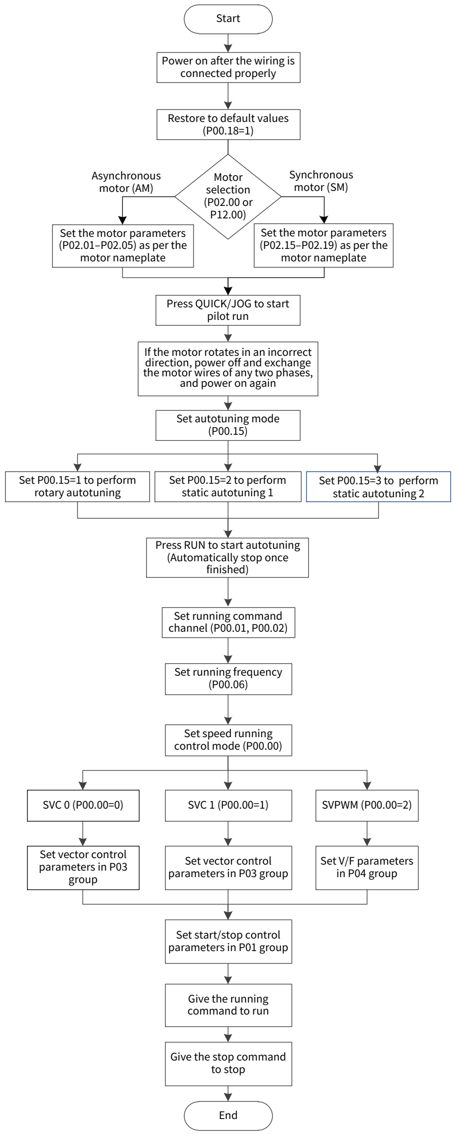
Step 7 When finished, press the key corresponding to **Confirm** to go to the home page.



If you want to change the guiding settings, you can select **Menu** > **System-setting** > **Power-on guiding enable** or **Power-on guiding settings** to modify.

6 Commissioning

The simplified VFD commissioning flowchart is as follows:



6.1 Motor parameter setting

The product supports the control of three-phase AC asynchronous motors and permanent magnet synchronous motors. The VFD supports the setting of two groups of motor parameters. Motor 1 corresponds to parameters in group P02 and motor 2 corresponds to parameters in group P12. Switching between the two sets of motor parameters can be achieved through multifunctional digital input terminals or communication methods.

6.1.1 Motor type selection

You can select the motor type by setting P02.00 or P12.00.

Function code	Name	Default	Setting range	Description
P02.00	Type of motor 1	0	0–1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)
P12.00	Type of motor 2	0	0–1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)

Note: The types of motors that are driven at the same time must be the same.

6.1.2 Rated motor parameter setting

■ **Set the rated parameters of three-phase AC asynchronous motors according to the motor nameplate.**

P02.01–P02.05 are used to set parameters of AM 1, and P12.01–P12.05 are used to set parameters of AM 2.

Function code	Name	Default	Setting range	Description
P02.01	Rated power of AM 1	Model depended	0.1–3000.0kW	-
P02.02	Rated frequency of AM 1	50.00Hz	0.01Hz–P00.03	P00.03 specifies the max. output frequency.
P02.03	Rated speed of AM 1	Model depended	1–60000RPM	-
P02.04	Rated voltage of AM 1	Model depended	0–1200V	-
P02.05	Rated current of SM 1	Model depended	0.8–6000.0A	-
P12.01	Rated power of AM 2	Model depended	0.1–3000.0kW	-

Function code	Name	Default	Setting range	Description
P12.02	Rated frequency of AM 2	50.00Hz	0.01Hz–P00.03	P00.03 specifies the max. output frequency.
P12.03	Rated speed of AM 2	Model depended	1–60000 RPM	-
P12.04	Rated voltage of AM 2	Model depended	0–1200V	-
P12.05	Rated current of SM 2	Model depended	0.8–6000.0A	-

■ **Set the rated parameters of three-phase permanent magnetic synchronous motors according to the motor nameplate.**

P02.15–P02.19 are used to set parameters of SM 1, and P12.15–P12.19 are used to set parameters of SM 2.

Function code	Name	Default	Setting range	Description
P02.15	Rated power of SM 1	Model depended	0.1–3000.0kW	-
P02.16	Rated frequency of SM 1	50.00Hz	0.01Hz–P00.03	P00.03 specifies the max. output frequency.
P02.17	Number of pole pairs of SM 1	2	1–128	-
P02.18	Rated voltage of SM 1	Model depended	0–1200V	-
P02.19	Rated current of SM 1	Model depended	0.8–6000.0A	-
P12.15	Rated power of SM 2	Model depended	0.1–3000.0kW	-
P12.16	Rated frequency of SM 2	50.00Hz	0.01Hz–P00.03	P00.03 specifies the max. output frequency.
P12.17	Number of pole pairs of SM 2	2	1–128	-
P12.18	Rated voltage of SM 2	Model depended	0–1200V	-
P12.19	Rated current of SM 2	Model depended	0.8–6000.0A	-

6.1.3 Motor switchover

P05.01–P05.06 or P08.31 is used to switch between two sets of motor parameters. There are two switching methods.

Method 1 Switching through multifunction digital input terminal function setting

Set any one terminal function of P05.01–P05.06 to 35.

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	35: Switch from motor 1 to motor 2

Note: The two groups of motor parameters cannot be switched directly during running. You can switch motors only after the VFD has stopped.

Method 2 Switching through communication mode setting

Set the ones place of P08.31 to select any channel for motor switching.

Function code	Name	Default	Setting range	Description
P08.31	Channel for switching between motor 1 and motor 2	0x00	0x00–0x14	Ones place: Switchover channel 0: Switch over through terminals 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable

6.2 Parameter autotuning setting

To improve motor control effect, you are recommended to set motor rated parameters according to the motor nameplate after the first power on, and then conduct parameter autotuning. The VFD supports three parameter autotuning modes, which are motor parameter autotuning, motor inertia autotuning, and SM initial magnetic pole angle autotuning. You can select an autotuning mode based on actual conditions.

6.2.1 Motor parameter autotuning

Motor parameters have a significant impact on the calculation of the control model, especially in the case of vector control, which requires motor parameter autotuning first.

After setting the motor parameters, set P00.15 to select the autotuning mode to perform motor parameter autotuning. The setting procedure is as follows.

Step 1 Set P00.01 to 0 to select the keypad as the command running channel.

Step 2 Set P00.15 to select one motor parameter autotuning method.

Step 3 Press RUN to give the start command to perform motor parameter autotuning.

Function code	Name	Default	Setting range	Description
P00.15	Motor parameter autotuning	0	0–5	0: No operation 1: Dynamic autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning 4: Dynamic autotuning 2 (valid only for AMs) 5: Partial parameter static autotuning 2 (valid only for AMs) **Note:** Supported by software of version V3.xx or earlier.
		0x000	0x000–0x133	Ones place: Motor basic parameter autotuning 0: No operation 1: Complete parameter rotary autotuning 2: Complete parameter static autotuning 3: Partial parameter static

Function code	Name	Default	Setting range	Description
				autotuning Tens place: Initial pole angle autotuning 0: No operation 1: Rotary autotuning 2: Static autotuning 1: Rotary autotuning 2 Hundreds place: Inertia autotuning 0: Disable 1: Enable **Note:** Supported by software of version V6.xx or later.

Note:

- For software versions V3.xx and earlier, when parameter P00.15 is set to 1 or 4, or for software versions V6.xx and later, when parameter P00.15 is set to 0x001, the motor must be disconnected from the load, ensuring the motor is in a stationary, no-load state.
- For software versions V3.xx and earlier, when parameter P00.15 is set to 2, 3, or 5, or for software versions V6.xx and later, when parameter P00.15 is set to 0x002 or 0x003, the motor does not need to be disconnected from the load.
- Motor autotuning can be carried out on the present motor only. If you need to perform autotuning on the other motor, switch the motor first.

Table 6-1 Motor parameters autotuned in different autotuning methods

<table>
<tr><th colspan="2">Setting of P00.15</th><th colspan="4">Autotuning parameters</th></tr>
<tr><th>Software of version V3.xx or earlier</th><th>Software of version V6.xx or later</th><th>AM 1</th><th>AM 2</th><th>SM 1</th><th>SM 2</th></tr>
<tr><td>1</td><td>0x001</td><td>P02.06–P02.14</td><td>P12.06–P12.14</td><td>P02.20–P02.23</td><td>P12.20–P12.23</td></tr>
<tr><td>2</td><td>0x002</td><td>P02.06–P02.10</td><td>P12.06–P12.10</td><td rowspan="2">P02.20–P02.22</td><td rowspan="2">P12.20–P12.22</td></tr>
<tr><td>3</td><td>0x003</td><td>P02.06–P02.08</td><td>P12.06–P12.08</td></tr>
<tr><td>4</td><td>-</td><td>P02.06–P02.14</td><td>P12.06–P12.14</td><td>-</td><td>-</td></tr>
<tr><td>5</td><td>-</td><td>P02.06–P02.08</td><td>P12.06–P12.08</td><td>-</td><td>-</td></tr>
</table>

Note: If the autotuned parameters have deviation, SM back-EMF constants P02.23 and P12.23 can be calculated.

Back-EMF constants can also be calculated based on the parameters on the motor nameplate, and there are three calculation methods.

Method 1: If the back-EMF coefficient K_e is marked on the nameplate, the calculation is as follows:

$E=(K_e*n_N*2\pi)/60$

Method 2: If the back-EMF E' (V/1000r/min) is marked on the nameplate, the calculation is as follows:

$E=E'*n_N/1000$

Method 3: If none of the two preceding parameters is marked on the nameplate, the calculation is as follows:

$E=P/(\sqrt{3}*I)$

In the preceding formulas, n_N indicates the rated rotation speed, P indicates the rated power, and I indicates the rated current.

6.2.2 Motor inertia autotuning

Inertia autotuning is applicable to the scenarios where large inertia exists and speed dynamic response follows up well in the closed-loop vector control mode. Inertia autotuning is required before inertia compensation enabling. During the autotuning process, the VFD controls the automatic start and stop of the motor and prompts for autotuning completion. Set P03.44 to perform the motor inertia autotuning. The setting procedure is as follows:

Step 1 Set P00.01 to 0 to select the keypad as the command running channel.

Step 2 Set P03.44 to 1 for enabling.

Step 3 After the RUN key is pressed to give the VFD start command, the VFD starts inertia identifying and automatically controls the motor start and stop.

Function code	Name	Default	Setting range	Description
P03.43	Inertia identification torque	10.0%	0.0–100.0% (of the motor rated torque)	Due to friction force, it is required to set certain identification torque for the inertia identification to be performed properly.
P03.44	Enabling motor inertia identification	0	0–1	0: No operation 1: Enable

Note: If the motor is running at low speed for a long time, which indicates that P03.43 (Inertia identification torque) is set too low, perform manual stop, increase the value of

P03.43, and execute inertia identification again.

6.2.3 SM initial pole angle autotuning

SM initial pole angle autotuning is applicable to the scenarios where an absolute position encoder is installed in the closed-loop vector control mode. Set P20.11 to perform the SM initial pole angle autotuning. The procedure is as follows:

Step 1 Set P00.01 to 0 to select the keypad as the command running channel.

Step 2 Set P02.00 or P12.00 to 1 to select the synchronous motor.

Step 3 Set P20.11 to select an autotuning method.

Step 4 Press RUN to give VFD the start command. The VFD enters parameter autotuning.

Function code	Name	Default	Setting range	Description
P20.11	Initial pole position autotuning	0	0–3	0: No operation 1: Rotary autotuning (DC braking first, applicable to encoders with Z signals) 2: Static autotuning (applicable to resolver-type encoders or sin/cos encoders with CD signal feedback) 3: Rotary autotuning (initial angle static autotuning first, applicable to encoders with Z signals) **Note:** The pole initial angle obtained through option "1: Rotary autotuning" is accurate. Option "1: Rotary autotuning" is recommended in most cases, in which the motor needs to be decoupled from the load or the motor load is light.

6.3 Running command selection

The running commands are used to control the start, stop, forward running, reverse running, and jogging of the VFD. The channels of running commands include keypad, terminal, and communication. Set P00.01 to select a channel of running commands.

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

Keypad

When P00.01 is set to 0, you can control the VFD run or stop through the keypad key  or . Press the  key, the VFD starts running and the RUN indicator is on. When the VFD is running, press the  key, the VFD stops running and the RUN indicator is off. For details about the keypad, see chapter 5 Keypad operation guidelines.

Terminal

When P00.01 is set to 1, you can control the VFD start or stop by setting commands through external terminals. The setting procedure is as follows:

Step 1 Set any terminal function of P05.01–P05.09 to any of 1–6.

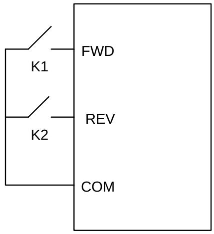
Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	0: No function 1: Run forward (FWD) 2: Run reversely (REV) 3: Three-wire running control (S_{in}) 4: Jog forward 5: Jog reversely 6: Coast to stop

Step 2 Set P05.11 to select the terminal control mode.

Function code	Name	Default	Setting range	Description
P05.11	Terminal control mode	0	0–3	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2

Two-wire control mode 1: P05.11= 0

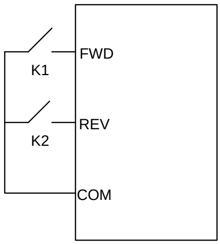
The enabling is combined with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction.



FWD	REV	Running command
OFF	OFF	Stop
ON	OFF	Forward running
OFF	ON	Reverse running
ON	ON	Hold

Two-wire control mode 2: P05.11=1

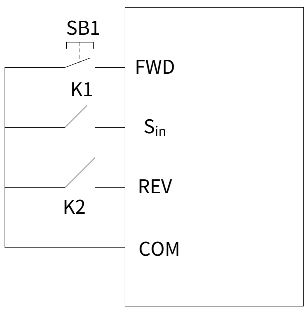
The enabling separated from the direction. In this mode, FWD is the enabling terminal. The direction depends on the defined REV state.



FWD	REV	Running command
OFF	OFF	Stop
ON	OFF	Forward running
OFF	ON	Stop
ON	ON	Reverse running

Three-wire control mode 1: P05.11=2

This mode defines S_{in} as the enabling terminal, and the running command is generated by FWD, while the direction is controlled by REV. During running, the S_{in} terminal needs to be closed, and when terminal FWD generates a rising edge signal, the VFD starts to run in the direction set by the state of terminal REV; the VFD needs to be stopped by disconnecting terminal S_{in}.



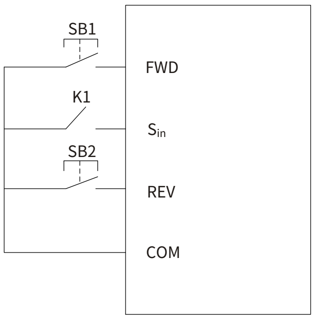
The direction control is as follows during running:

S_{in}	REV	Previous direction	Present direction
ON	OFF→ON	FWD run	REW run
		REW run	FWD run

S_{in}	REV	Previous direction	Present direction
ON	ON→OFF	REW run	FWD run
		FWD run	REW run
ON→OFF	ON	Decelerate to stop	
	OFF		

Three-wire control mode 2: P05.11= 3

This mode defines S_{in} as the enabling terminal, and the running command is generated by FWD or REV, but the direction is controlled by both FWD and REV. During running, the S_{in} terminal needs to be closed, and terminal FWD or REV generates a rising edge signal to control the running and direction of the VFD; the VFD needs to be stopped by disconnecting terminal S_{in}.



The direction control is as follows during running:

S_{in}	FWD	REV	Running direction
ON	OFF→ON	ON	FWD run
		OFF	FWD run
ON	ON	OFF→ON	REW run
	OFF		REW run
ON→OFF	-	-	Decelerate to stop

Note: For two-wire controlled running mode, when the FWD/REV terminal is valid, if the VFD stops due to a stop command given by another source, the VFD does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the VFD run, you need to trigger FWD/REV again, for example, PLC single-cycle stop, fixed-length stop, and valid STOP/RST stop during terminal control. (See P07.04.)

Communication

When P00.01 is set to 2, you can control the VFD run or stop by giving commands through communication. For details, see chapter 7 Communication.

Function code	Name	Default	Setting range	Description
P00.02	Communication mode of running commands	0	0–6	0: Modbus/Modbus TCP communication 1: PROFIBUS/CANopen/DeviceNet communication 2: Ethernet communication 3: EtherCAT/PROFINET/EtherNet IP communication 4: Programmable card 5: Wireless communication card 6: Reserved **Note:** The Modbus TCP communication mode of option 0, and options 1, 2, 3, 4 and 5 are extended functions which are applicable with corresponding cards.

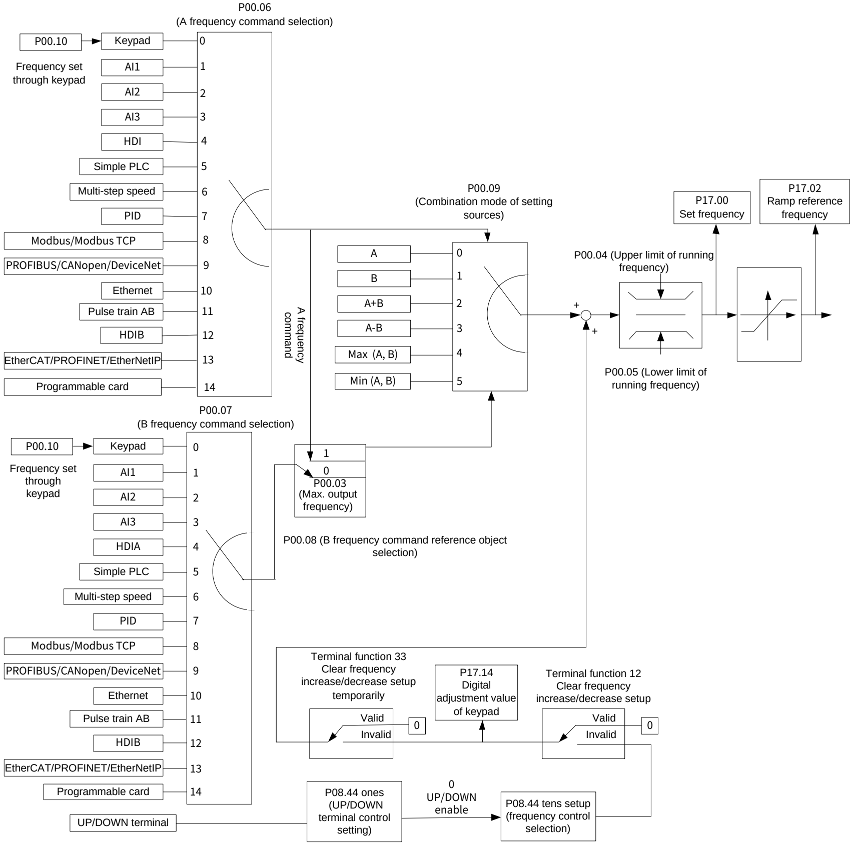
6.4 Frequency setting

The VFD supports multiple kinds of frequency reference modes, which can be categorized into two types: main reference channel and auxiliary reference channel.

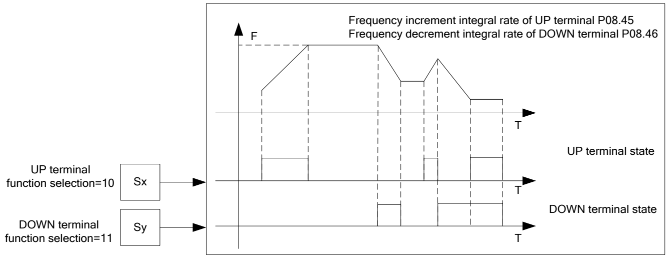
There are two main reference channels, namely frequency reference channel A and frequency reference channel B. These two channels support simple arithmetical operation between each other, and they can be switched dynamically.

There is one auxiliary reference channel, namely terminal UP/DOWN switch input, equivalent to the VFD internal auxiliary reference frequency. By setting P08.44, you can enable the corresponding reference mode and the impact made on the VFD frequency reference by this reference mode.

The actual VFD reference is comprised of the main reference channel and auxiliary reference channel. See the following figure.



When setting the auxiliary frequency inside the VFD by selecting function 10 or 11 for one function codes from P05.01–P05.06, you can increase or decrease the frequency quickly by setting P08.45 (Up terminal frequency incremental change rate) or P08.46 (Down terminal frequency decremental change rate), as shown in the following figure.



6.4.1 Combination of frequency setting source

6.4.1.1 Combination mode of setting source

Set P00.09 to select the combination mode of setting source.

Function code	Name	Default	Setting range	Description
P00.09	Combination mode of setting source	0	0–5	0: A 1: B 2: (A+B) 3: (A- B) 4: Max(A, B) 5: Min. (A, B)

6.4.1.2 Frequency channel switchover

The functions 13–15 of P05.01–P05.06 (any one of them) can be used to switch the frequency channel. The setting procedure is as follows:

Step 1 Select any one of multifunction digital input terminals S1–S4, HDIA, and HDIB as an external input terminal.

Step 2 Set P05.01–P05.06 to any one of functions 13–15.

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th>Description</th></tr>
<tr><td rowspan="6">P05.01–P05.06</td><td rowspan="6">Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)</td><td>1</td><td rowspan="6">0–95</td><td rowspan="6">13: Switch between A setting and B setting
14: Switch between combination setting and A setting
15: Switch between combination setting and B setting</td></tr>
<tr><td>4</td></tr>
<tr><td>7</td></tr>
<tr><td>0</td></tr>
<tr><td>0</td></tr>
<tr><td>0</td></tr>
</table>

The combinations are described in the following table:

Present reference channel P00.09	Multifunction digital input terminal function 13 (Switch from channel A to channel B)	Multifunction digital input terminal function 14 (Switch from combined setting to channel A)	Multifunction digital input terminal function 15 (Switch from combined setting to channel B)
A	B	-	-
B	A	-	-
A+B	-	A	B
A-B	-	A	B
Max(A, B)	-	A	B
Min(A, B)	-	A	B

6.4.2 Frequency setting method

The VFD supports multiple frequency setting methods. Set P00.06 to select A frequency command reference and P00.07 to select B frequency command reference.

Function code	Name	Default	Setting range	Description
P00.06	Setting channel of A frequency command	0	0–15	0: Keypad digital 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus/Modbus TCP communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High-speed pulse HDIB 12: Pulse train AB 13: EtherCAT/PROFINET/EtherNet IP communication 14: Programmable card 15: Reserved
P00.07	Setting channel of B frequency command	15		

6.4.2.1 Setting frequency through keypad

Set P00.06 or P00.07 to 0 to select keypad for setting, and P00.10 is the initial value of the VFD frequency digital setting.

Function code	Name	Default	Setting range	Description
P00.10	Setting frequency through keypad	50.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency. When the setting channel of A and B frequency commands is keypad, P00.10 specifies the original value of the digital setting based VFD frequency.

6.4.2.2 Setting frequency through analog

Set P00.06 or P00.07 to any one of 1–3 to select analog for setting. For details, see section 6.10.2 Analog input and output terminal functions.

6.4.2.3 Setting frequency through high-speed pulse

Set P00.06 or P00.07 to 4 or 11, which implements frequency setting through high-speed pulse). For details, see section 6.10.3 High-speed pulse input and output terminal functions.

6.4.2.4 Setting frequency through pulse train

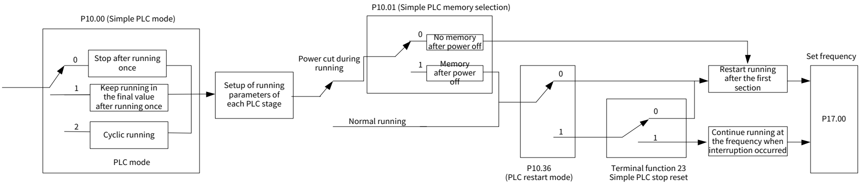
Set P00.06 or P00.07 to 12 to select pulse train AB command for frequency setting. It is applicable to the scenarios where PG cards with pulse reference signals are installed.

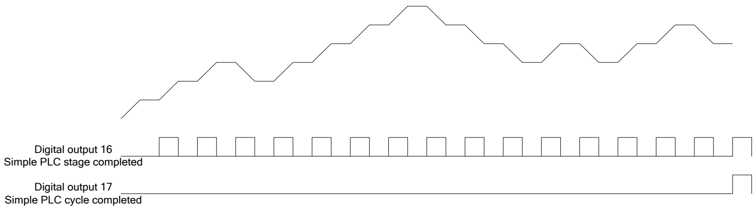
Function code	Name	Default	Setting range	Description
P20.20	Pulse reference F-channel pulse count	1024	0–16000	-

6.4.2.5 Setting frequency through simple PLC

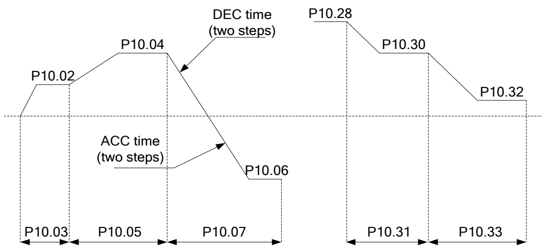
Set P00.06 or P00.07 to 5, which implements frequency setting through simple PLC commands.

Simple PLC is a multi-step speed generator, and the VFD can change the running frequency and direction automatically based on the running time to fulfill process requirements. The VFD can realize 16-step speed control, and provide four groups of acceleration/deceleration time for selection. After the set PLC completes one cycle (or one step), an ON signal can be output by the multifunction relay. See the following figure.





When simple PLC is selected for frequency giving, you need to set P10.02–P10.33 to determine the running frequency and running time of each step. The schematic diagram is as follows.



Note: The symbol of multi-step speed determines the running direction of simple PLC, and the negative value means reverse running. ACC time indicates the time needed for the VFD to accelerate from 0Hz to the max. output frequency (P00.03). DEC time means the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. Select corresponding ACC/DEC time, and then convert 16-bit binary number into hexadecimal number, finally, and then set corresponding function codes.

Function code	Name	Default	Setting range	Description
P00.11	ACC time 1	Model depended	0.0–3600.0s	The VFD has four groups of ACC/DEC time, which can be selected by multifunction digital
P00.12	DEC time 1	Model		

Function code	Name	Default	Setting range	Description
		depended		input terminal functions 21 and 22 (specified by P05). The factory default ACC/DEC time of the VFD is the first group.
P08.00	ACC time 2	Model depended		
P08.01	DEC time 2	Model depended		
P08.02	ACC time 3	Model depended		
P08.03	DEC time 3	Model depended		
P08.04	ACC time 4	Model depended		
P08.05	DEC time 4	Model depended		
P10.34	ACC/DEC time of steps 0–7 of simple PLC	0x0000	0x0000–0xFFFF	Select corresponding acceleration/deceleration time, convert a 16-bit binary number into a hexadecimal number, and then set corresponding function codes. For details, see the following table.
P10.35	ACC/DEC time of steps 8–15 of simple PLC	0x0000		

The description is as follows:

Function code	Binary		Step	ACC/DEC time 1	ACC/DEC time 2	ACC/DEC time 3	ACC/DEC time 4
P10.34	Bit1	Bit0	0	00	01	10	11
	Bit3	Bit2	1	00	01	10	11
	Bit5	Bit4	2	00	01	10	11
	Bit7	Bit6	3	00	01	10	11
	Bit9	Bit8	4	00	01	10	11
	Bit11	Bit10	5	00	01	10	11
	Bit13	Bit12	6	00	01	10	11
	Bit15	Bit14	7	00	01	10	11
P10.35	Bit1	Bit0	8	00	01	10	11
	Bit3	Bit2	9	00	01	10	11
	Bit5	Bit4	10	00	01	10	11
	Bit7	Bit6	11	00	01	10	11

Function code	Binary		Step	ACC/DEC time 1	ACC/DEC time 2	ACC/DEC time 3	ACC/DEC time 4
	Bit9	Bit8	12	00	01	10	11
	Bit11	Bit10	13	00	01	10	11
	Bit13	Bit12	14	00	01	10	11
	Bit15	Bit14	15	00	01	10	11

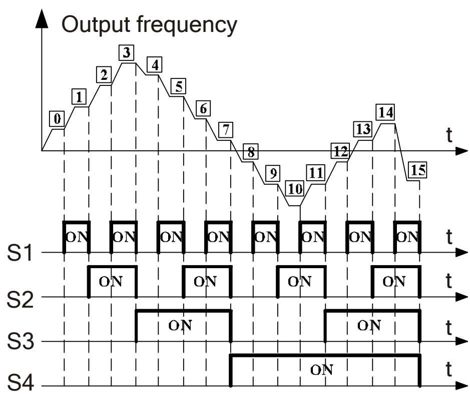
6.4.2.6 Setting frequency through multi-step speed commands

You can set P00.06 or P00.07 to 6 (setting frequency through multi-step speed commands). It is applicable to scenarios where the VFD running frequency does not need to be adjusted continuously and only a number of frequency values are needed.

The VFD supports the setting of 16-step speed, which are set by combined codes of multi-step terminals 1–4 set by S terminals, corresponding to function code P05.01–P05.06) and correspond to multi-step speed 0 to multi-step speed 15.

When terminal 1, terminal 2, terminal 3, and terminal 4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminal 1, terminal 2, terminal 3 and terminal 4 are not all OFF, the frequency set by multi-step speed will prevail, and the priority of multi-step setting is higher than that of the keypad, analog, high-speed pulse, PID, and communication settings.

Note: The sign of multi-step speed determines the running direction of simple PLC, and a negative value means reverse running. For details, see section 6.4.2.5 Setting frequency through simple PLC.



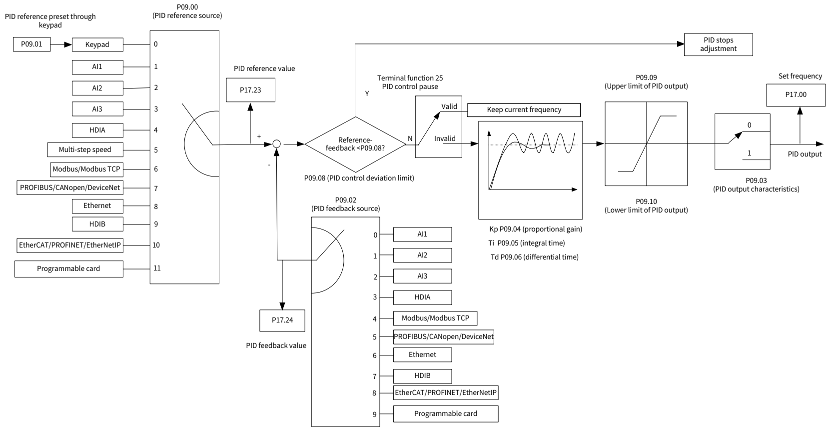
Terminal 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Terminal 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Terminal 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Terminal 4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Step	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Terminal 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Terminal 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Terminal 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Terminal 4	ON	ON	ON	ON	ON	ON	ON	ON
Step	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	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
P10.02–P10.32	Multi-step speeds 0–15 and running time	0.0%	Frequency: -300.0–300.0%	The setting 100.0% corresponds to the max. output frequency P00.03.
		0.0s(min)	Time: 0.0–6553.5s (min)	The time unit is specified by P10.37.

6.4.2.7 Setting frequency through PID control

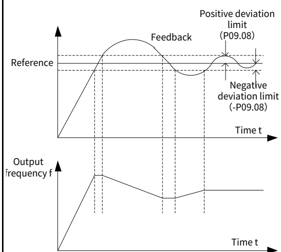
Set P00.06 or P00.07 to 7, which implements frequency setting through PID commands.

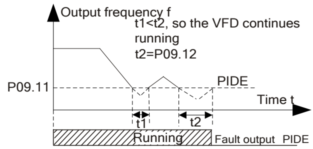
PID control, a common mode for process control, is mainly used to adjust the VFD output frequency or output voltage, thus forming a negative feedback system to keep the controlled variables above the target. It is applicable to flow control, pressure control, temperature control, and so on. The following is the basic schematic block diagram for output frequency regulation.



Function code	Name	Default	Setting range	Description
P09.00	PID reference source selection	0	0–12	When P00.06 or P00.07 (Setting channel of A/B frequency command) is 7 or P04.27 (Voltage setting channel) is 6, the VFD is process PID controlled. The function code determines the target given channel during the PID process. 0: Setting through P09.01 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step running 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/EtherNet

Function code	Name	Default	Setting range	Description
				IP communication 11: Programmable card 12: Reserved The set target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system always performs calculation by using a relative value (0–100.0%).
P09.01	PID digital setting	0.0%	-100.0%–100.0%	The function code is mandatory when P09.00=0. The base value of P09.01 is the feedback of the system.
P09.02	PID feedback source selection	0	0–10	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/EtherNet IP communication 9: Programmable card 10: Reserved **Note:** The reference channel and feedback channel cannot be duplicate. Otherwise, effective PID control cannot be achieved.
P09.03	PID output characteristics selection	0	0–1	0: PID output is positive. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will decrease to balance the PID.

Function code	Name	Default	Setting range	Description
				Example: PID control on strain during unwinding. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will increase to balance the PID. Example: PID control on tension during unwinding
P09.07	Sampling period (T)	0.001s	0.000–1.000s	Used to indicate the sampling cycle of feedback. The regulator calculates in each sampling cycle. A longer sampling cycle indicates slower response.
P09.08	PID control deviation limit	0.0%	0.0–100.0%	Used to adjust the accuracy and stability of the PID system. The output value 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. 
P09.09	PID output upper limit	100.0%	P09.10–100.0% (of max. frequency or voltage)	Used to set the upper limit of PID regulator output values.
P09.10	PID output lower limit	0.0%	-100.0%–P09.09 (max. frequency or	Used to set the lower limit of PID regulator output values.

Function code	Name	Default	Setting range	Description
			voltage)	
P09.11	Feedback offline detection value	0.0%	0.0–100.0%	When the feedback value is smaller than or equal to the feedback offline detection value, and the duration exceeds the value specified by P09.12, the VFD reports "PID feedback offline fault" the keypad displays "PIDE".
P09.12	Feedback offline detection time	1.0s	0.0–3600.0s	
P09.13	PID control selection	0x0001	0x0000–0x1111	Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens place: 0: Same as the main reference direction 1: Contrary to the main reference direction Hundreds place: 0: Limit as per the max. frequency 1: Limit as per A frequency Thousands place: 0: A+B frequency. ACC/DEC of main reference A frequency source buffering is invalid. 1: A+B frequency, acceleration/ deceleration of main reference A frequency source buffering is valid, acceleration/deceleration is determined by P08.04 (acceleration time 4).

Function code	Name	Default	Setting range	Description
P09.14	Low frequency proportional gain (Kp)	1.00	0.00–100.00	Low-frequency switching point: 5.00Hz, high-frequency switching point: 10.00Hz (P09.04 corresponds to high-frequency parameter), and the middle is the linear interpolation between these two points.
P09.15	ACC/DEC time of PID command	0.0s	0.0–1000.0s	-
P09.16	PID output filter time	0.000s	0.000–10.000s	-
P09.18	Low frequency integral time (Ti)	0.90s	0.00–10.00s	-
P09.19	Low frequency differential time (Td)	0.00s	0.00–10.00s	-
P09.20	Low frequency point for PID parameter switching	5.00Hz	0.00Hz–P09.21	-
P09.21	High frequency point for PID parameter switching	10.00Hz	P09.20–P00.03	-
P17.00	Set frequency	0.00Hz	0.00Hz–P00.03 (Max. output frequency)	-
P17.23	PID reference value	0.0%	-100.0–100.0%	-
P17.24	PID feedback value	0.0%	-100.0–100.0%	-

■ Introduction to the working principles and control methods for PID control

Proportional regulation (Kp)

Proportional control can respond to feedback changes rapidly, however, it cannot eliminate the static 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 to run the system, 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.

Function code	Name	Default	Setting range	Description
P09.04	Proportional gain (Kp)	1.80	0.00–100.00	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID regulator. The larger the value of P, the stronger the adjustment intensity. The value 100 indicates that when the difference between the PID feedback value and given value is 100%, the range within which the PID regulator can regulate the output frequency command is the max. frequency (ignoring integral function and differential function).

Integral time (Ti)

The integral adjuster can be used to eliminate static difference. Too large regulation may lead to system oscillation. The integral time parameter is generally regulated gradually from large to small until the stabilized system speed fulfills the requirement.

Function code	Name	Default	Setting range	Description
P09.05	Integral time (Ti)	0.90s	0.01–10.00s	Used to determine the speed of the integral adjustment on the deviation of PID feedback and

Function code	Name	Default	Setting range	Description
				reference from the PID regulator. When the deviation between PID feedback and reference is 100%, the integral regulator works continuously during the time to achieve the max. output frequency (P00.03) or the max. voltage (P04.31). Shorter integral time indicates stronger adjustment.

Differential time (Td)

Differential control is used to control the feedback signal variation based on the change trend. Exercise caution before using the differential regulator since it may enlarge the system interferences, especially those with high change frequency.

When P00.06 or P00.07 (Setting channel of A/B frequency command) is 7 or P04.27 (Voltage setting channel) is 6, the VFD is process PID controlled.

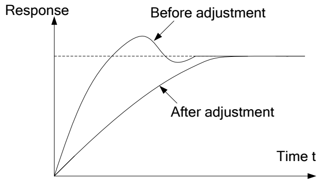
Function code	Name	Default	Setting range	Description
P09.06	Differential time (Td)	0.00s	0.00–10.00s	Used to determine the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. If the PID feedback changes 100% during the time, the adjustment of the differential regulator is the max. output frequency (P00.03) or the max. voltage (P04.31). Longer differential time indicates stronger adjustment.

- **How to fine-tune PID**

After setting the parameters controlled by PID, you can adjust these parameters by the following means.

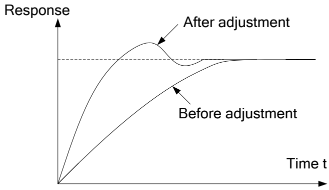
Control overshoot

When overshoot occurred, shorten the derivative time (Td) and prolong integral time (Ti).



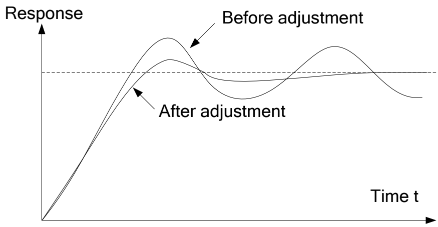
Stabilize the feedback value as fast as possible

When overshoot occurred, shorten integral time (Ti) and prolong derivative time (Td) to stabilize control as fast as possible.



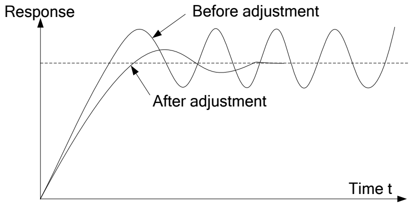
Control long-term oscillation

If the cycle of periodic oscillation is longer than the set value of integral time (Ti), it indicates the integral action is too strong, prolong the integral time (Ti) to control oscillation.



Control short-term oscillation

If the oscillation cycle is as short almost the same as the set value of differential time (Td), it indicates the differential action is too strong. Shorten the differential time (Td) to control oscillation. When the differential time (Td) is set to 0.00 (namely no differential control), and there is no way to control oscillation, decrease the proportional gain.



6.4.2.8 Frequency set through communication

Set P00.06 or P00.07 to 8, 9, 10, 13, or 14, which implements frequency setting through communication. For details, see chapter 7 Communication.

6.4.3 Frequency fine-tuning

The VFD supports frequency fine-tuning based on the set frequency. In some special scenarios, the set frequency can be set to 0, and the frequency fine-tuning function can be used for frequency setting during the whole process.

Step 1 Select any one of multifunction terminals S1–S4, HDIA, and HDIB as an external input terminal.

Step 2 Set P05.01–P05.09 to 10 or 11.

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN)
P08.44	UP/DOWN terminal control setting	0x000	0x000–0x221	Ones place: Whether the setting made through UP/DOWN is valid. 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">1: Valid for all frequency setting methods
2: Invalid for multi-step speed running when multi-step speed running has the priority
Hundreds place: Action selection for stop
0: Setting is valid.
1: Valid during running, cleared after stop
2: Valid during running, cleared after a stop command is received</td></tr>
<tr><td rowspan="2">P08.45</td><td rowspan="2">UP terminal frequency incremental change rate</td><td rowspan="2">0.50Hz/s</td><td>0.01–50.00Hz/s</td><td rowspan="4">Note: The value is also used as the frequency increment or decrement that is made by pressing the UP/DOWN key on the LCD keypad.</td><td>Note:
Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.01Hz/s–P00.03/s</td><td>Note:
Supported by software of version V6.xx or later.</td></tr>
<tr><td rowspan="2">P08.46</td><td rowspan="2">DOWN terminal frequency incremental change rate</td><td rowspan="2">0.50Hz/s</td><td>0.01–50.00Hz/s</td><td>Note:
Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.01Hz/s–P00.03/s</td><td>Note:
Supported by software of version V6.xx or later.</td></tr>
</table>

6.5 Speed control mode selection

The VFD supports four speed control modes. You can set P00.00 to select the speed control mode based on actual conditions. Before using a vector control mode (0, 1, or 3), set the motor nameplate parameters and perform motor parameter autotuning first. For details, see sections 6.1.2 Rated motor parameter setting and 6.2.1 Motor parameter autotuning.

Function code	Name	Default	Setting range	Description
P00.00	Speed control mode	2	0–3	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Closed-loop vector control mode

SVC mode 0: P00.00=0

In this case, there is no need to install encoders. It is applicable to scenarios with requirements for low frequency, great torque, and high speed control accuracy. It implements precise control of speed and torque. Relative to SVC mode 1, this mode is more applicable to the scenarios requiring small power. For details, see Group P03—Vector control of motor 1.

Note: The SM in this mode is applicable to large-power low frequency running rather than ultra-high speed running.

SVC mode 1: P00.00=1

In this case, there is no need to install encoders. It is applicable to scenarios that require high speed control accuracy. It can be used across all power ranges, enabling precise control of speed and torque. For details, see Group P03—Vector control of motor 1.

Space voltage vector control mode: P00.00=2

In this case, there is no need to install encoders. It can improve the control accuracy with the advantages of stable operation, valid low-frequency torque boost and current vibration suppression and the functions of slip compensation and voltage adjustment. For details, see

Group P04—V/F control.

Closed-loop vector control mode: P00.00=3

In this case, encoders need to be installed. It is applicable to scenarios with high demands on speed control and current control accuracy. For details, see Group P20—Encoder of motor 1.

Note: The mode requires that the motor must be equipped with an encoder whose type is the same as the type of PG expansion card supported by the VFD.

6.6 Torque setting method selection

The VFD supports torque control and speed control. Speed control aims to stabilize the speed to keep the set speed consistent with the actual running speed, meanwhile, the max. load-carrying capacity is restricted by the torque limit. Torque control aims to stabilize the torque to keep the set torque consistent with the actual output torque, meanwhile, the output frequency is restricted by the upper and lower limits.

6.6.1 Torque setting method selection

Set P03.11 to select a torque setting method. The torque setting adopts a relative value, 100% corresponds to the motor rated current, and the setting range is -300.0%–300.0%. After giving the start command to the VFD, the VFD runs in the forward direction when the torque reference value is positive and in the reverse direction when the torque reference value is negative.

Function code	Name	Default	Setting range	Description
P03.11	Torque setting method selection	0	0–12	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step torque 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card **Note:** 100% corresponds to the motor rated current.
P03.12	Torque set through keypad	20.0%	-300.0%–300.0%	The torque setting adopts a relative value, 100% corresponds to the motor rated current.
P03.13	Torque reference filter time	0.010s	0.000–10.000s	-

6.6.2 Switching between speed control and torque control

There are two switching methods for speed control and torque control.

Method 1 Enable control switching

Set P03.32 to 0 for speed control or 1 for torque control.

Method 2 Switch through multifunction digital input terminal signal function selection

The multifunction digital input terminal signal switching procedure is as follows:

Step 1 Select any one of multifunction terminals S1–S4, HDIA, and HDIB as an external input.

Step 2 Set P05.01–P05.06 to 29.

When function 29 is valid, set P03.32 to 0 for torque control or 1 for speed control.

Note: When the terminal for switching speed control and torque control is valid, the control enabling selection is the opposite of that selected in P03.32.

Function code	Name	Default	Setting range	Description
P03.32	Enabling torque control	0	0–1	0: Disable 1: Enable
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	29: Switch between speed control and torque control

6.7 Start/stop settings

6.7.1 Start settings

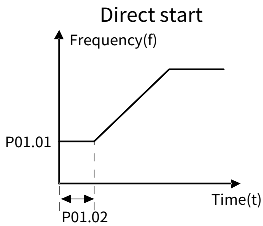
For a specific motor type and application scenario, you can select a starting mode by setting P01.00.

Function code	Name	Default	Setting range	Description
P01.00	Running mode of start	0	0–4	0: Direct start 1: Start after DC braking 2: Start after speed tracking (with

Function code	Name	Default	Setting range	Description
				exciting) 3: Start after speed tracking (without exciting) 4: Start after speed tracking (software, supported only by version V6.xx or later)

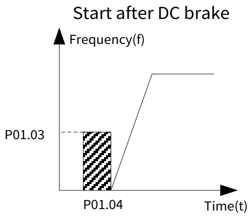
Direct start: P01.00=0

If the braking time before start is 0, the VFD runs at the starting frequency of direct start (P01.01). This is often applicable to start from a still state. See the following figure.



Start after DC braking: P01.00=1

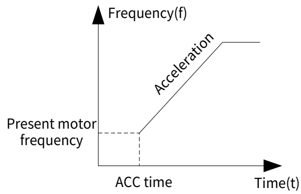
If the DC braking time is not 0, enable the motor to keep at a position by means of DC braking, and then perform ACC start. This is applicable to the scenarios with the motor in slight rotation before start. See the following figure.



Start after speed tracking: P01.00=2, 3, or 4

The VFD searches for the current running frequency and direction of the motor and then controls the motor to run from the current frequency to the set frequency, implementing smooth running without impact. This is applicable to the scenarios with the motor in high-speed rotation or with transient grid voltage drop. See the following figure.

Start after speed tracking



<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">P01.01</td><td rowspan="2">Starting frequency of direct start</td><td rowspan="2">0.50Hz</td><td>0.00–50.00Hz</td><td rowspan="2">The function code indicates the initial frequency during VFD start. See P01.02 (Starting frequency hold time) for detailed information.</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.00Hz–P00.03</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P01.02</td><td>Starting frequency hold time</td><td>0.0s</td><td>0.0–50.0s</td><td colspan="2">Setting a proper starting frequency can increase the torque during VFD start. During the hold time of the starting frequency, the output frequency of the VFD is the starting frequency. And then, the VFD runs from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the VFD stops running and keeps in the standby state. The starting frequency is not limited in the lower limit frequency.</td></tr>
<tr><td>P01.03</td><td>Braking current before start</td><td>0.0%</td><td>0.0–100.0%</td><td colspan="2">The VFD performs DC braking with the braking current before start and it speeds up after the DC</td></tr>
</table>

Function code	Name	Default	Setting range	Description
P01.04	Braking time before start	0.00s	0.00–50.00s	braking time. If the set DC braking time is 0, DC braking is invalid. Stronger braking current indicates larger braking power. The DC braking current before start is a percentage of the VFD rated output current.
P01.23	Start delay time	0.0s	0.0–600.0s	After a VFD running command is given, the VFD is in standby state and restarts with the start delay to implement brake release.
P01.30	Hold time of short-circuit braking for start	0.00s	0.00–50.00s	When the VFD starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to enter short-circuit braking.

6.7.2 Stop settings

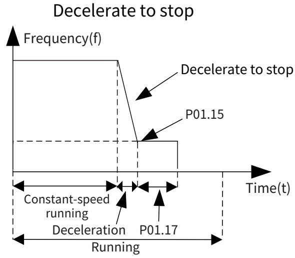
You can select a stop mode by setting P01.08.

Function code	Name	Default	Setting range	Description
P01.08	Stop mode	0	0: Decelerate to stop 1: Coast to stop	-

Decelerate to stop: P01.08=0

After a stop command takes effect, the VFD lowers output frequency based on the DEC mode and the defined DEC time; after the frequency drops to the stop speed (P01.15), the VFD stops.

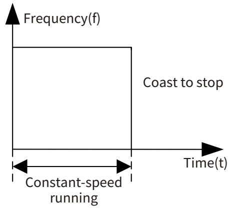
Decelerate to stop



Coast to stop: P01.08=1

After a stop command takes effect, the VFD stops output immediately. And the load coasts to stop according to mechanical inertia.

Coast to stop



Note: If the set frequency is changed from higher than the frequency lower limit to lower than the frequency lower limit, the VFD takes the action specified by P01.19.

Function code	Name	Default	Setting range	Description
P01.19	Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	0x00	0x00–0x12	Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop

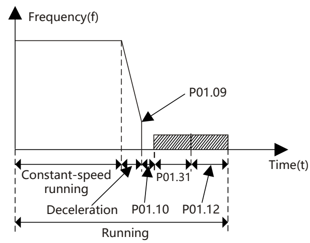
If you need to achieve a fast and stable stop of the motor, the motor can be stopped by short circuit braking or DC braking after reaching the low speed frequency specified by P01.09.

Function code	Name	Default	Setting range	Description
P01.09	Starting frequency of braking for stop	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency. During the deceleration to stop, the VFD starts DC braking for stop when the running frequency reaches the frequency specified by P01.09.

P01.09 = Non-zero value

Short-circuit braking for stop and DC braking can be valid only with this setting. During decelerating to stop, if the running frequency of VFD is lower than the starting frequency of brake for stop (P01.09), the VFD waits for the demagnetization time P01.10 and checks the value of P01.31. If the value is a non-zero value, the VFD enters short-circuit braking for stop. Then the VFD checks the value of P01.12. If the value is a non-zero value, the VFD performs DC braking with the time specified by P01.12. When the DC braking time is reached, the VFD coasts to stop. If the value of P01.31 is zero, short-circuit braking for stop is invalid. Similarly, if the value of P01.12 is zero, DC braking for stop is invalid.

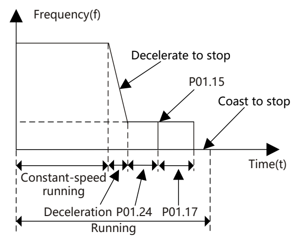
P01.09 = Non-zero value



P01.09 = Zero

The VFD decelerates to stop according to the normal process. When the ramp frequency is less than P01.15, the VFD performs stop determination with a delay specified by P01.24 according to the mode specified by P01.16. If P01.16=0, the VFD coasts to stop. If P01.16=1, the VFD needs to check whether the motor output frequency is less than P01.15. If yes, the VFD coasts to stop. If no, the VFD coasts to stop with a delay specified by P01.17.

P01.19 = 0



The methods for fast decelerating to stop are as follows:

Method 1 Increase the VFD power to improve the VFD max. braking capability.

Method 2 Decelerate to the lower speed specified by P01.09 to enable short-circuit braking or DC braking.

Method 3 Set P08.50 to enable magnetic flux braking to accelerate the motor's deceleration tracking process.

Method 4 Add braking resistors.

Method 5 Set the S-curve deceleration method.

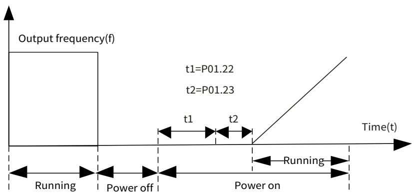
<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td>P01.10</td><td>Demagnetization time</td><td>0.00s</td><td>0.00–30.00s</td><td colspan="2">The VFD blocks the output before starting DC braking for stop. The VFD starts DC braking after this time so as to prevent overcurrent caused by DC braking at high speed.</td></tr>
<tr><td>P01.11</td><td>DC braking current for stop</td><td>0.0%</td><td>0.0–100.0%</td><td colspan="2">Percentage of the VFD rated output current.
Stronger current indicates greater DC braking effect.</td></tr>
<tr><td>P01.12</td><td>DC braking time for stop</td><td>0.00s</td><td>0.0–50.0s</td><td colspan="2">DC braking duration. If the time is 0, DC braking is invalid, and the VFD decelerates to stop within the specified time.</td></tr>
<tr><td rowspan="2">P01.15</td><td rowspan="2">Stop speed</td><td rowspan="2">0.50Hz</td><td>0.00–100.00Hz</td><td rowspan="2">Specifies the stop speed (frequency).</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.00Hz–P00.03</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P01.16</td><td>Stop speed detection mode</td><td>0</td><td>0–1</td><td colspan="2">0: Detect by the set speed (unique in space voltage vector control mode)
1: Detect according to speed feedback</td></tr>
<tr><td>P01.17</td><td>Stop speed detection time</td><td>0.50s</td><td>0.00–100.00s</td><td colspan="2">-</td></tr>
<tr><td>P01.24</td><td>Stop speed delay</td><td>0.0s</td><td>0.0–600.0s</td><td colspan="2">-</td></tr>
</table>

Function code	Name	Default	Setting range	Description
P01.29	Short-circuit braking current	0.0%	0.0–150.0%	of the VFD rated current
P01.31	Hold time of short-circuit braking for stop	0.00s	0.00–50.00s	-

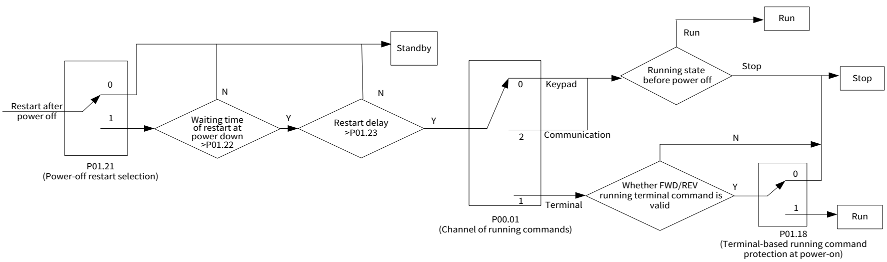
6.7.3 Power-off restart

For all command running channels, if P01.21=1, the VFD memorizes the running status at power off. If the VFD is running before power-off, the VFD automatically runs with a wait time specified by P01.22 at the next power-on when start conditions are met.

When terminals are uses as the command running channel, you need to set P01.18 to 1. The following figure shows the wait time for restart after power-off.



The following figure shows the logic diagram for restart after power-off:



Function code	Name	Default	Setting range	Description
P01.21	Power-off restart selection	0	0–1	0: Disable 1: Enable
P01.22	Wait time for power-on	1.0s	0.0–3600.0s	Valid when P01.21 is 1. The function code indicates the

Function code	Name	Default	Setting range	Description
	restart			wait time before the automatic running of the VFD that is re-powered on.
P01.23	Start delay time	0.0s	0.0–600.0s	After a VFD running command is given, the VFD restarts running output with the delay defined by P01.23 from the standby state, to implement brake release.
P01.18	Terminal-based running command protection at power-on	0	0–1	0: Invalid at power-on 1: Valid at power-on **Note:** ● Valid only when P01.21 is set to 0. ● Exercise caution before using this function. Otherwise, serious result may follow.

Terminal-based running command is invalid at power-on: P01.18 = 0

Though the command running terminal is considered as valid during power-on, the VFD does not run and it keeps the protection state until the terminal is disabled and then enabled.

Terminal-based running command is valid at power-on: P01.18=1

If the command running terminal is considered as valid during power-on, the VFD is started automatically after the initialization.

6.8 Position settings

You can select a positioning mode by setting P21.00. The ones place of P21.00 specifies the control mode (1: position control), while the tens place specifies the position setting source. Different position setting sources correspond to different position giving methods, as listed in the following table.

Function code	Name	Default	Setting range	Description
P21.00	Positioning mode	0x0000	0x0000–0x7121	Ones place: Control mode selection (only for closed-loop vector control) 0: Speed control

Function code	Name	Default	Setting range	Description
				1: Position control Tens place: Position command source 0: Pulse train. The pulse giving signals from PG card terminals A2 and B2 are used for position control. 1: Digital position. The setting of P21.17 is used for positioning, while the positioning mode can be set through P21.16. 2: Positioning of photoelectric switch during stop. When a terminal receives a photoelectric switch signal (terminal function 43 selected), the VFD starts positioning for stop, and the stop distance can be set through P21.17. Hundred place: Position feedback source 0: PG1 1: PG2 Thousands place: Servo mode (Reserved) 0: Disable servo, without position deviation 1: Disable servo, with position deviation 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved **Note:** In the pulse train or spindle positioning mode, the VFD enters the servo operation mode if there is a valid servo

Function code	Name	Default	Setting range	Description
				enabling signal. If there is no servo enabling signal, the VFD enter the servo operation mode only after it receives a forward running or reverse running command.

Pulse train position giving: P21.00=0x0001

Before using the pulse train to give the position, you need to set P21.01 to adjust the AB pulse form and direction.

Digital position giving: P21.00=0x0011

Before selecting digital position giving, you need to set P21.16 and P21.17 to set the position.

Function code	Name	Default	Setting range	Description
P21.01	Pulse command mode	0x0000	0x0000–0x3133	Ones place: Pulse mode 0: A/B quadrature pulse; A leads B 1: A is PULSE and B is SIGN If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A is positive pulse Channel A is positive pulse; channel B needs no wiring 3: A/B dual-channel pulse; channel A pulse edge counts up, channel B pulse edge counts down Tens place: Pulse direction 0: Pulse direction setting: forward 1: Pulse direction setting: reverse 2: Pulse direction set by running direction 3: Pulse direction set by running direction Hundreds place: Frequency

Function code	Name	Default	Setting range	Description
				multiplication selection for pulse +direction (reserved) 0: No frequency multiplication 1: Frequency multiplication Thousands place: Pulse control selection 0: Inertia filter, without overspeed control 1: Average moving filter, without overspeed control 2: Inertia filter, with overspeed control 3: Average moving filter, with overspeed control **Note:** The numerator and denominator of the position command ratio are used to adjust the position relationship between the spindle and the motor shaft. When the spindle is not the motor shaft, set P21.11 (or P21.30) and P21.12 to match the position setting of the spindle. In position control mode, you can view P18.03, P18.04, P18.24, and P18.25 in P18 to check whether the position setting is correct.
P21.11	Numerator of position command ratio	1000	1–65535	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement.
P21.12	Denominator of position command ratio	1000	1–65535	-
P21.16	Digital positioning mode	0	0x0000–0xFFFF	Bit 0: Positioning mode 0: Relative position 1: Absolute position (Origin mode. This function is reserved.)

Function code	Name	Default	Setting range	Description
				Bit 1: Cyclic positioning setting. You can enable positioning through a terminal (function 55) or choose automatic cyclic positioning. Terminals support only the enabling of continuous positioning, and automatic cyclic positioning can be set to cyclic positioning or reciprocating positioning through bit 2 of P21.16. 0: Terminal-based cyclic positioning 1: Automatic cyclic positioning Bit 2: Cyclic mode 0: Continuous 1: Reciprocating (support the automatic cyclic positioning) Bit 3: P21.17 based digital setting mode. You can select incremental or position type. The incremental type indicates that P21.17 positioning distance needs to be conducted again after each positioning is enabled. The position type indicates that the displacement is set through P21.17, and the new position is located automatically if P21.17 is changed. 0: Incremental 1: Position type (do not support the continuous mode) Bit 4: Origin searching mode. This function is reserved. 0: Search for the origin only for once 1: Search for the origin in every time of running Bit 5: Origin calibration mode.

Function code	Name	Default	Setting range	Description
				This function is reserved. 0: Calibration in real time 1: One-time calibration Bit 6: Positioning completion signal setting. You can set the positioning completion signal in the pulse or electrical level form. The positioning completion signal is valid in the positioning completion signal holding time set in P21.25. 0: Valid in the positioning completion signal holding time (P21.25) 1: Always valid Bit 7: First positioning setting. You can set whether the first positioning is performed when a running command is received. If no, the first positioning is performed only after the positioning enabling terminal or automatic cyclic positioning is enabled. 0: Invalid 1: Enable Bit 8: Positioning enabling signal setting (for terminal-based cyclic positioning). In the pulse form, after positioning is completed or in the first positioning, the jump edge of the positioning enabling terminal needs to be detected for performing positioning. In the electrical level mode, after positioning is completed or in the first positioning, positioning is performed after it is detected that the positioning enabling terminal is switched on.

Function code	Name	Default	Setting range	Description
				0: Pulse signal 1: Electrical level signal Bit 9: Position source 0: P21.17 1: PROFIBUS/CANopen setting Bit 10: Indicates whether to save encoder pulse count value at power-off 0: No 1: Yes Bit 11: Reserved Bit 12: Positioning curve setting (reserved) 0: Straight line 1: S curve
P21.17	Position set in digital mode	0	0–65535	Used for digital positioning. Actual position = P21.17×P21.11/P21.12
P21.30	Numerator of the 2nd command ratio	1000	1–65535	-
P18.03	High bit of position reference value	0	0–30000	It is cleared after stop.
P18.04	Low bit of position reference value	0	0–65535	It is cleared after stop.
P18.24	High-order bit of count value of pulse reference	0	0–65535	Indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on.
P18.25	Low-order bit of count value of pulse reference	0	0–65535	Indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on.

6.9 Control performance regulation

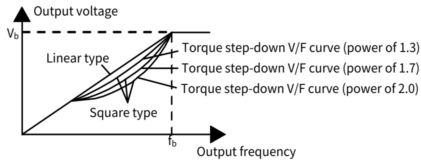
6.9.1 Space vector control performance optimization

6.9.1.1 V/F curve setting

The VFD provides multiple V/F curve modes to meet different requirements. You can select V/F curves or set V/F curves as required.

For the load featuring constant torque, such as conveyor belt which runs in straight line, as the whole running process requires constant torque, it is recommended to adopt the straight line V/F curve.

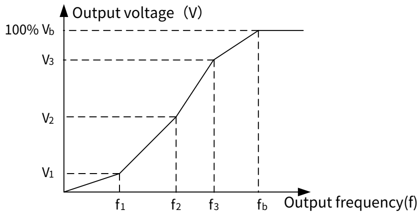
For the load featuring decreasing torque, such as fan and water pumps, as there is a power (square or cube) relationship between its actual torque and speed, it is recommended to adopt the V/F curve corresponding to the power of 1.3, 1.7 or 2.0.



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

Function code	Name	Default	Setting range	Description
P04.00	V/F curve setting of motor 1	0	0–5	0: Straight-line V/F curve, applicable to constant torque loads 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); in this mode, V can be separated from F and F can be adjusted through the frequency setting channel set by P00.06 or the voltage setting channel set by P04.27 to change the characteristics of the curve.

The VFD also provides multi-point V/F curves. You can change the VFD output V/F curves by setting the voltage and frequency of the three points in the middle. The complete curve consists of five points starting from (0Hz, 0V) and ending at (motor fundamental frequency, motor rated voltage). During setting, follow the rule: 0 ≤ f1 ≤ f2 ≤ f3 ≤ Motor fundamental frequency, and 0 ≤ V1 ≤ V2 ≤ V3 ≤ Motor rated voltage Too high voltage for low frequency will cause motor overheat or damage and cause VFD overcurrent stall or overcurrent protection. When P04.00 is set to 1 (multi-dot V/F curve), you can set the V/F curve through P04.03–P04.08.



Function code	Name	Default	Setting range	Description
P04.03	V/F frequency point 1 of motor 1	0.00Hz	0.00Hz–P04.05	-
P04.04	V/F voltage point 1 of motor 1	0.0%	0.0%–110.0%	Rated voltage of motor 1
P04.05	V/F frequency point 2 of motor 1	0.00Hz	P04.03–P04.07	-
P04.06	V/F voltage point 2 of motor 1	0.0%	0.0%–110.0%	Rated voltage of motor 1
P04.07	V/F frequency point 3 of motor 1	0.00Hz	P04.05–P02.02 (Rated frequency of AM 1) or P04.05–P02.16 (Rated frequency of SM 1)	-

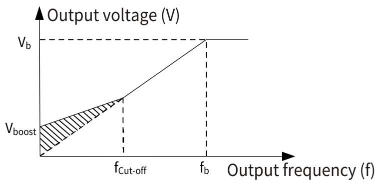
Function code	Name	Default	Setting range	Description
P04.08	V/F voltage point 3 of motor 1	0.0%	0.0%–110.0%	Rated voltage of motor 1

6.9.1.2 Torque boost

Boost compensation to output voltage can effectively improve the low-speed torque performance in the V/F control. The cut-off frequency of manual torque boost is a percentage of the rated motor frequency f_b. Torque boost can improve the low-frequency torque characteristics in the V/F control.

You need to select torque boost based on the load. The load is proportional to the boost, but the boost cannot be too large. 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. The default torque boost is 0.0%, which indicates automatic torque boost so that the VFD can regulate the torque boost based on the actual load.

Set P04.01 to determine the torque boost of motor 1. Set P04.02 to determine the torque boost cut-off frequency of motor 1. Below this frequency threshold, torque boost is valid; exceeding this threshold will invalidate torque boost. See the following figure.



Function code	Name	Default	Setting range	Description
P04.01	Torque boost of motor 1	0.0%	0.0%–10.0%	0.0% (automatic torque boost); 0.1%–10.0% (manual torque boost) **Note:** V_b indicates the max. output voltage.
P04.02	Torque boost cut-off of motor 1	20.0%	0.0%–50.0%	The cut-off frequency of manual torque boost is a percentage of the rated motor frequency f_b. Torque boost can improve the low-frequency torque characteristics in the V/F control.

6.9.1.3 Energy-saving run

During actual running, the VFD can search for the max. efficiency point to keep running in the most efficient state to save energy. This function is generally used in light load or no-load cases. Set P04.26 to specify whether to act in energy-saving run.

Function code	Name	Default	Setting range	Description
P04.26	Energy-saving run	0	0: Disable 1: Automatic energy-saving run	In light-load state, the motor can adjust the output voltage automatically to achieve energy saving. This function is no applicable to the cases where sudden load changes often occur.

6.9.1.4 V/F slip compensation gain

The V/F control is an open-loop mode, while a sudden motor load change will cause motor rotation speed fluctuation. In cases where strict speed requirements must be met, you can set the slip compensation gain through P04.09 to change the VFD internal output adjustment method and therefore compensate for the speed change caused by load fluctuation, improving the motor mechanical rigidity.

The formula used to calculate the motor rated slip frequency is as follows: $\triangle f=f_b-n*p/60$

Of which, f_b indicates the rated frequency of motor 1, corresponding to function code P02.02; n indicates the rated rotation speed of motor 1, corresponding to function code P02.03; p indicates the number of motor pole pairs. 100.0% corresponds to the rated slip frequency $\triangle f$ of motor 1.

Function code	Name	Default	Setting range	Description
P04.09	V/F slip compensation gain of motor 1	100.0%	0.0–200.0%	100% corresponds to the rated slip frequency.

Note: Rated slip frequency = (Rated synchronous rotation speed of motor – Rated rotation speed of motor) x (Number of motor pole pairs)/60

6.9.1.5 Oscillation control

In large-power driving scenarios, using the space voltage vector control mode will cause motor oscillation, which can be eliminated by setting P04.10 and P04.11, while the oscillation control threshold of motor 1 is specified by P04.12.

Function code	Name	Default	Setting range	Description
P04.10	Low-frequency oscillation control factor of motor 1	10	0–100	Setting a greater value indicates better control effect. However, if the value is too large, the VFD output current may be too large.
P04.11	High-frequency oscillation control factor of motor 1	10	0–100	
P04.12	Oscillation control threshold of motor 1	30.00Hz	0.00Hz–P00.03	

6.9.1.6 AM IF control

The following uses AM 1 for example, which is similar to AM 2.

Generally, the IF control mode is valid for AMs. It can be used for SMs only when the frequency is extremely low. IF control is implemented by performing closed-loop control on the total output current of the VFD. The output voltage adapts to the current reference, and open-loop control is separately performed over the frequency of the voltage and current. Set P04.40 to 1 to enable the IF mode for AM 1. You can set related parameters when the IF mode is enabled.

Function code	Name	Default	Setting range	Description
P04.40	Enabling IF mode for AM 1	0	0–1	0: Invalid 1: Enable
P04.41	Current setting in IF mode for AM 1	120.0%	0.0–200.0%	When IF control is adopted for AM 1, the parameter is used to set the output current. The value is a percentage of the motor rated current.
P04.42	Proportional coefficient in IF mode for AM 1	350	0–5000	When IF control is adopted for AM 1, the parameter is used to set the proportional coefficient of the output current closed-loop control.

Function code	Name	Default	Setting range	Description
P04.43	Integral coefficient in IF mode for AM 1	150	0–5000	When IF control is adopted for AM 1, the parameter is used to set the integral coefficient of the output current closed-loop control.
P04.44	Frequency threshold for switching off IF mode for AM 1	10.00Hz	0.00–P04.50	-
P04.50	End frequency point for switching off IF mode for motor 1	25.00Hz	P04.44–P00.03	-

6.9.1.7 Reactive current regulation in SM V/F control

When the SM V/F control mode is enabled, you can set P04.34 to specify the frequency threshold for the switching between pull-in current 1 and pull-in current 2. When the output frequency is less than P04.36, the motor reactive current is specified by P04.34; when the output frequency is greater than P04.36, the motor reactive current is specified by P04.35.

Function code	Name	Default	Setting range	Description
P04.34	Pull-in current 1 in SM 1 V/F control	20.0%	100.0%–100.0%	**Note:** Supported by software of version V3.xx or earlier.
		30.0%		**Note:** Supported by software of version V6.xx or later.
P04.35	Pull-in current 2 in SM 1 V/F control	10.0%	100.0%–100.0%	-
P04.36	V/F control pull-in current frequency switching point for SM 1	20.0%	0.0%–200.0%	-

Function code	Name	Default	Setting range	Description	
P04.37	V/F control reactive closed-loop proportional coefficient for SM 1	50	0–3000	When the SM V/F control mode is enabled, the parameter is used to set the proportional coefficient of reactive current closed-loop control.	**Note:** Supported by software of version V3.xx or earlier.
			0–500		**Note:** Supported by software of version V6.xx or later.
P04.38	V/F control reactive closed-loop integral time for SM 1	30	0–3000	When the SM V/F control mode is enabled, the parameter is used to set the integral coefficient of reactive current closed-loop control.	**Note:** Supported by software of version V3.xx or earlier.
			0–300		**Note:** Supported by software of version V6.xx or later.
P04.39	V/F control reactive closed-loop output limit for SM 1	8000	0–16000	When the SM V/F control mode is enabled, the parameter is used to set the output limit of the reactive current closed-loop control. A greater value indicates a higher reactive closed-loop compensation voltage and higher output power of the motor. In general, you do not need to modify the function code.	

6.9.1.8 V/F flux weakening performance optimization

When the AM needs to run with flux weakened, set P04.33 in the V/F control mode to increase the output voltage and maximize the bus voltage utilization, improving the motor acceleration time.

Function code	Name	Default	Setting range	Description
P04.33	Weakening coefficient in constant power zone (V/F)	1.00	1.00–1.30	-

6.9.2 Vector control performance optimization

6.9.2.1 Torque upper limit

Speed control and torque control in the vector control mode are restricted by torque upper limits. When you set P03.18 (Setting source of electromotive torque upper limit) to keypad, the torque upper limit is specified by P03.20. When you set P03.19 (Setting source of braking torque upper limit) to keypad, the torque upper limit is specified by P03.21.

Function code	Name	Default	Setting range	Description
P03.18	Setting source of electromotive torque upper limit	0	0–11	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11: Reserved **Note:** 100% corresponds to the motor rated current.

Function code	Name	Default	Setting range	Description
P03.19	Setting source of braking torque upper limit	0	0–11	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11: Reserved **Note:** 100% corresponds to the motor rated current.
P03.20	Electromotive torque upper limit set through keypad	180.0%	0.0–300.0% (of the motor rated current)	Used to set torque limits.
P03.21	Braking torque upper limit set through keypad	180.0%	0.0–300.0% (of the motor rated current)	

6.9.2.2 Frequency upper limit settings in torque control

In torque control, the VFD outputs torque according to the set torque command. When the set torque is greater than the load torque, the VFD output frequency increases to the frequency upper limit; when the set torque is less than the load torque, the VFD output frequency decreases to the frequency lower limit; when the VFD output frequency is restricted, the output torque will no longer be the same as the set torque. When you set P03.14 to set the setting source of forward rotation upper-limit frequency in torque control, the torque limit is specified by P03.16. When you set P03.15 to set the setting source of reverse rotation upper-limit frequency in torque control, the torque limit is specified by P03.17.

Function code	Name	Default	Setting range	Description
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0	0–12	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12: Reserved **Note:** For setting sources 1–11, 100% corresponds to the max. frequency.
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0	0–12	0: Keypad (P03.17) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12: Reserved **Note:** For setting sources 1–11, 100% corresponds to the max. frequency.

Function code	Name	Default	Setting range	Description
P03.16	Forward rotation frequency upper limit set through keypad in torque control	50.00Hz	0.00Hz–P00.03 (Max. output frequency)	Used to set frequency upper limits. 100% corresponds to the max. frequency. P03.16 specifies the value when P03.14 = 1; while P03.17 specifies the value when P03.15 = 1.
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control			

6.9.2.3 Speed loop

The following uses motor 1 for example, which is similar to motor 2.

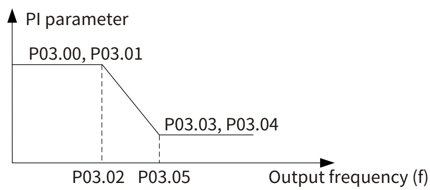
The speed loop dynamic response characteristics in vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator.

The dynamic response of speed regulator can be accelerated by increasing the proportional gain or decreasing the integral time. However, too quick dynamic response of speed regulator can cause oscillations.

Recommended adjustment method: If the default settings cannot meet the requirements, adjust the settings slightly. First, increase the proportional gain to ensure that the system does not oscillate; and then reduce the integration time, so that the system responds fast with small overshoot.

Improper PI parameter settings will cause large speed overshoot.

The switchover between the low-point frequency for switching and the high-point frequency for switching indicates the linear switchover between two groups of PI parameters. See the following figure.

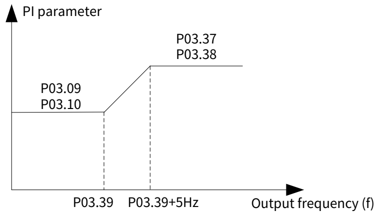


Function code	Name	Default	Setting range	Description
P03.00	Speed-loop proportional gain 1 of motor 1	20.0	0.0–200.0	Speed loop PI parameters are divided into the low-speed group and high-speed group. When the running frequency is less than P03.02 (Low-point frequency for speed-loop switching of motor 1), the speed loop PI parameters are P03.00 and P03.01. When the output frequency P17.01 is greater than P03.05 (High-point frequency for speed-loop switching of motor 1), the speed loop PI parameters are P03.03 and P03.04.
P03.01	Speed-loop integral time 1 of motor 1	0.200s	0.000–10.000s	
P03.02	Low-point frequency for speed-loop switching of motor 1	5.00Hz	0.00Hz–P03.05	
P03.03	Speed-loop proportional gain 2 of motor 1	20.0	0.0–200.0	
P03.04	Speed-loop integral time 2 of motor 1	0.200s	0.000–10.000s	-
P03.05	High-point frequency for speed-loop switching of motor 1	10.00Hz	P03.02–P00.03	-
P03.06	Speed-loop output filter of motor 1	0	0–8	-
P03.36	Speed-loop differential gain of motor 1	0.00s	0.00–10.00s	-

6.9.2.4 Current loop

The following uses motor 1 for example, which is similar to motor 2.

In vector control mode, the current regulator PI parameters are divided into low-speed group and high-speed group. The following figure shows the switchover between the two groups of PI parameter.



Function code	Name	Default	Setting range	Description
P03.09	Current-loop proportional coefficient P of motor 1	1000	0–65535	The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3). **Note:** Supported by software of version V3.xx or earlier.
P03.10	Current-loop integral coefficient I of motor 1	1000	0–65535	
P03.37	High-frequency current-loop proportional coefficient of motor 1	1000	0.00Hz–P03.05	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching point (P03.39), the current-loop PI parameters are P03.09 and P03.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P03.37 and P03.38. **Note:** Supported by software of version V3.xx or earlier.
P03.38	High-frequency current-loop integral coefficient of motor 1	1000	0.0–200.0	
P03.39	Current-loop high-frequency switching threshold of motor 1	100.0%	0.0–100.0%	
P03.45	Current-loop proportional coefficient after autotuning	0	0–65535	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for synchronous motors, you

Function code	Name	Default	Setting range	Description
				can set the value of the function code to that of P03.09. If motor parameter autotuning is not performed, the value of the function code is 0. **Note:** Supported by software of version V3.xx or earlier.
P03.46	Current-loop integral coefficient after autotuning	0	0–65535	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for synchronous motors, you can set the value of the function code to that of P03.10. If motor parameter autotuning is not performed, the value of the function code is 0. **Note:** Supported by software of version V3.xx or earlier.
P03.54	Current-loop band width of motor 1	400	0–2000	Smaller current-loop band width indicates slower response but better current waveform. **Note:** Supported by software of version V6.xx or later.

Note:

- A great current-loop proportional coefficient P indicates strong regulator effect. A great current-loop proportional coefficient I indicates strong regulator effect. This is reverse to the speed-loop integral coefficient time effect.
- When P03.39 is set to 100.0%, only P03.09 and P03.10 take effect.
- For asynchronous motor control, using the default values of current-loop parameters can meet the requirements of most applications.
- For asynchronous motor control, the current-loop parameters have a great impact on the speed control response and instantaneous current convergence, and therefore you need to increase the current-loop parameter values in scenarios such as with current divergence and motor stalling.
- If the SM sounds abnormally during running, in addition to decreasing the speed-loop parameters, decrease current-loop PI parameters. Generally, small

motor straight axis and cross axis inductance requires great current-loop PI parameter values.

6.9.2.5 Position loop

Set P21.04 to select the mode for switching between position-loop gains.

Function code	Name	Default	Setting range	Description
P21.04	Position-loop gain switchover mode	0	0: No switchover 1: Torque command 2: Speed command 3–5: Reserved	-

No switchover: P21.04=0

Position-loop gain 1 is used by default.

Torque command: P21.04=1

When the output torque is greater than P21.05, the VFD automatically switches to position-loop gain 2; when the output torque is equal to or less than P21.05, the VFD automatically switches to position-loop gain 1.

Speed command: P21.04=2

When the running rotation speed is greater than P21.06, the VFD automatically switches to position-loop gain 2; when the running rotation speed is equal to or less than P21.06, the VFD automatically switches to position-loop gain 1.

Function code	Name	Default	Setting range	Description
P21.02	Position-loop gain 1	20.0	0.0–400.0	The two position-loop gains are switched based on the switching mode set through P21.04. When the spindle accurate stop function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state.
P21.03	Position-loop gain 2	30.0		

Function code	Name	Default	Setting range	Description
P21.05	Position gain switchover threshold in torque command	10.0%	0.0–100.0% (of the motor rated torque)	-
P21.06	Position gain switchover threshold in speed command	10.0%	0.0–100.0% (of the motor rated speed)	-
P21.07	Smooth filter coefficient for gain switchover	5	0–15	Smooth filter coefficient for APR gain switchover.

Note: Increasing the position-loop gain can improve the response, but too great position-loop gain will lead to system oscillation. Reasonable switchover between the two position-loop gains can improve the stability in high-low frequency or heavy-light load running.

6.9.2.6 Position control performance optimization

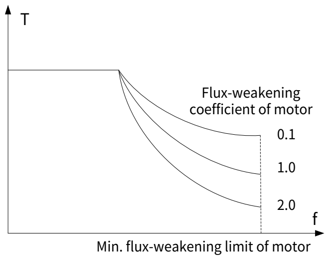
When P21.00=0x0001 (pulse train giving the position), you can set P21.02–P21.07 and P21.13 to increase the position feedforward gain to increase the response.

Function code	Name	Default	Setting range	Description
P21.13	Position feedforward gain	100.00	0.00–120.00%	For pulse train giving only (in position control); the position feedforward gain cannot be too great.
P21.14	Position feedforward filter time constant	3.0ms	0.0–3200.0ms	For pulse train giving only (in position control)
P21.15	Position command filter time constant	0.0ms	0.0–3200.0ms	Position feedforward filter time constant during the pulse string positioning.

6.9.2.7 Vector control flux weakening performance optimization

When running at a speed higher than the rated speed, the AM enters the flux weakening state. You can set P03.22 to change the flux-weakening curvature. A great flux-weakening control coefficient indicates a steep curve. The weakening coefficient in constant power zone is used in AM flux-weakening control, while the flux-weakening proportional gain and flux-weakening integral gain are specified by P03.26 and P03.33. The max. VFD output voltage is specified by P03.24.

If pre-exciting is performed for the motor when the VFD starts up, a magnetic field is built up inside the motor to improve the torque performance during the start process. The pre-exciting time is specified by P03.25.



<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">P03.22</td><td rowspan="2">Weakening coefficient in constant power zone</td><td>0.3</td><td>0.1–2.0</td><td rowspan="4">Used when the AM is in flux-weakening control;
the lowest weakening point in constant power zone is specified by P03.23.</td><td>Note:
Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>1.0</td><td>0.1–2.0</td><td>Note:
Supported by software of version V6.xx or later.</td></tr>
<tr><td rowspan="2">P03.23</td><td>Lowest weakening point in constant power zone</td><td>20%</td><td>10%–100.0%</td><td>Note:
Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>AM lowest weakening point in</td><td>10%</td><td>5%–100.0%</td><td>Note:
Supported by software of</td></tr>
</table>

Function code	Name	Default	Setting range	Description
	constant power zone			version V6.xx or later.
P03.24	Max. voltage limit	100.0%	0.0–120.0%	Used to set the max. VFD output voltage, which is a percentage of the motor rated voltage. Set the value according to onsite conditions.
P03.25	Pre-exciting time	0.300s	0.000–10.000s	Pre-exciting is performed for the motor when the VFD starts up. A magnetic field is built up inside the motor to improve the torque performance during the start process.
P03.26	Flux-weakening proportional gain	1000	0–8000	-
P03.33	Flux-weakening integral gain	1200	0–8000	**Note:** Supported by software of version V3.xx or earlier.
		100.0%	0.0–300.0%	**Note:** Supported by software of version V6.xx or later.

6.9.2.8 SM start control optimization

In closed-loop vector control mode, the autotuned initial magnetic pole angle is saved to P20.10, which can be directly used on the next startup without repeated autotuning. In a scenario with an incremental encoder stalled, each time after power-on, the static autotuning of initial magnetic pole angle is performed for the first startup, but the autotuned angle can be directly used for the next startup.

Function code	Name	Default	Setting range	Description
P20.10	Pole initial angle	0.00	0.00–359.99	Relative electric angle between the encoder position and the motor pole position.

In the open-loop control mode, you can select a start control method by setting P13.01.

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th>Description</th></tr>
<tr><td rowspan="2">P13.01</td><td rowspan="2">Initial pole detection method</td><td>0</td><td rowspan="2">0: No detection
1: High frequency superposition
2: Pulse superposition</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>2</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
</table>

No detection: P13.01=0

The VFD startup command given is a direct startup command. In this mode, set P13.02 to a great value to increase the starting torque, which causes a start reversal phenomenon with an average load carrying capacity.

High frequency superimposition: P13.01=1

If a VFD startup command is given, the VFD autotunes the initial pole angle by means of high-frequency current injection and then automatically starts up after the autotuning. When P13.02 is valid and the initial pole angle based direction setting is accurate, the reverse rotation problem can be weakened or eliminated, but also the load carrying capacity can be improved. This time you can adjust the high-frequency injection current by setting P13.13.

Pulse superimposition: P13.01=2

This method is similar to that when P13.01=1. The difference is that the initial pole angle autotuning method is different. This method has higher identification accuracy with shorter time but sharper noise, but you can adjust the pulse current value by setting P13.06.

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">P13.02</td><td rowspan="2">Pull-in current 1</td><td>20.0%</td><td rowspan="2">-100.0%–100.0% (of the motor rated current)</td><td rowspan="2">Pull-in current is the pole position orientation current; pull-in current 1 is valid within the lower limit of pull-in current switch-over</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>30.0%</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td></td><td></td><td></td><td></td><td>frequency threshold. If you need to increase the start torque, increase the value of this function parameter properly.</td><td></td></tr>
<tr><td rowspan="2">P13.06</td><td rowspan="2">Pulse current setting</td><td>100.0%</td><td rowspan="2">0.0–300.0% (of the motor rated voltage)</td><td rowspan="2">Used to set the pulse current threshold when the initial magnetic pole position is detected in the pulse mode.</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>80.0%</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P13.13</td><td>High-frequency injection current</td><td>20.0%</td><td>0.0–300.0% (of the VFD rated current)</td><td colspan="2">Used to set the pulse current threshold when the initial magnetic pole position is detected in the high-frequency current injection mode.</td></tr>
</table>

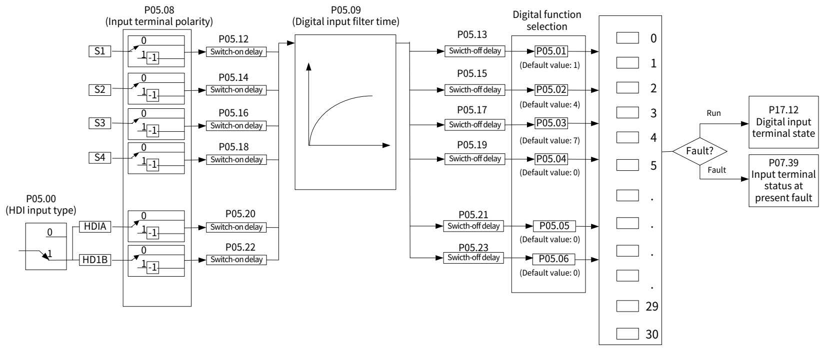
6.10 Input and output

6.10.1 Digital input and output

6.10.1.1 Digital input

The VFD carries four programmable digital input terminals and two HDI input terminals. The functions of all the digital input terminals can be programmed through function codes. HDI input terminal can be set to act as high-speed pulse input terminal or common digital input terminal; if it is set to act as high-speed pulse input terminal, you can also set HDIA or HDIB high-speed pulse input to serve as the frequency reference and encoder signal input.

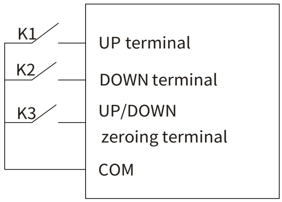
Note: For the wiring method, see section 4.4.3.1 Input signal connection diagram.



Note: Two different multifunction input terminals cannot be configured with a same function.

P05.01–P05.06 are used to set the functions of multifunction digital input terminals. Terminal functions are set as follows.

Setting	Function	Description
0	No function	The VFD does not act even if there is signal input. Set unused terminals to "no function" to avoid misaction.
1	Run forward (FWD)	External terminals are used to control the forward/reverse running of the VFD.
2	Run reversely (REV)	
3	Three-wire running control (S_{in})	The terminal is used to determine the three-wire running control of the VFD. For details, see the description for P05.13.
4	Jog forward	For details about frequency of jogging running and ACC/DEC time of jogging running, see the description for P08.06, P08.07, and P08.08.
5	Jog reversely	
6	Coast to stop	The VFD blocks output, and the stop process of motor is uncontrolled by the VFD. This mode is applied in the scenarios with large-inertia loads and without stop time requirements. Its definition is the same as P01.08, and it is mainly used in remote control.
7	Fault reset	External fault reset function, same as the reset function of the STOP/RST key on the keypad. You can use this function to reset faults remotely.
8	Pause running	The VFD decelerates to stop, however, all the run parameters are in memory state, such as PLC parameter,

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td></td><td></td><td>wobbling frequency, and PID parameter. After this signal disappears, the VFD will revert to the state before stop.</td></tr>
<tr><td>9</td><td>External fault input</td><td>When external fault signal is transmitted to the VFD, the VFD releases fault alarm and stops.</td></tr>
<tr><td>10</td><td>Increase frequency setting (UP)</td><td rowspan="3">Used to change the frequency increase/decrease command when the frequency is given by external terminals.


The terminal used to clear frequency-increase/decrease setting can clear the frequency value of auxiliary channel set by UP/DOWN, thus restoring the reference frequency to the frequency given by main reference frequency command channel.</td></tr>
<tr><td>12</td><td>Decrease frequency setting (DOWN)</td></tr>
<tr><td>12</td><td>Clear the frequency increase/decrease setting</td></tr>
<tr><td>13</td><td>Switch between A setting and B setting</td><td rowspan="3">The function is used to switch between the frequency setting channels.
Function 13 can implement the switchover between A frequency reference channel and B frequency reference channel; function 14 can implement the switchover between the combination channel set by P00.09 and the A frequency reference channel; function 15 can implement the switchover between the combination channel set by P00.09 and the B frequency reference channel.</td></tr>
<tr><td>14</td><td>Switch between combination setting and A setting</td></tr>
<tr><td>15</td><td>Switch between combination setting and B setting</td></tr>
<tr><td>16</td><td>Multi-step speed terminal 1</td><td rowspan="4">A total of 16-step speeds can be set by combining digital states of these four terminals.
Note: Multi-step speed 1 is the LSB, and multi-step speed 4 is the MSB.
<table><tr><th>Multi-step speed 4</th><th>Multi-step speed 3</th><th>Multi-ste p speed 2</th><th>Multi-step speed 1</th></tr><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr></table></td></tr>
<tr><td>17</td><td>Multi-step speed terminal 2</td></tr>
<tr><td>18</td><td>Multi-step speed terminal 3</td></tr>
<tr><td>19</td><td>Multi-step speed terminal 4</td></tr>
<tr><td>20</td><td>Pause multi-step speed running</td><td>The multi-step speed selection function can be screened to keep the set value in the present state.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td>21</td><td>ACC/DEC time selection 1</td><td rowspan="2">The status of the two terminals can be combined to select four groups of ACC/DEC time.
<table><tr><th>Terminal 1</th><th>Terminal 2</th><th>ACC/DEC time</th><th>Parameter</th></tr><tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td><td>P00.11/P00.12</td></tr><tr><td>ON</td><td>OFF</td><td>ACC/DEC time 2</td><td>P08.00/P08.01</td></tr><tr><td>OFF</td><td>ON</td><td>ACC/DEC time 3</td><td>P08.02/P08.03</td></tr><tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td><td>P08.04/P08.05</td></tr></table></td></tr>
<tr><td>22</td><td>ACC/DEC time selection 2</td></tr>
<tr><td>23</td><td>Simple PLC stop reset</td><td>Used to clear the previous PLC state memory information and restart the simple PLC process.</td></tr>
<tr><td>24</td><td>Pause simple PLC</td><td>Used to pause the simple PLC. When the function is revoked, the simple PLC resumes the running.</td></tr>
<tr><td>25</td><td>Pause PID control</td><td>PID is ineffective temporarily, and the VFD maintains current frequency output.</td></tr>
<tr><td>26</td><td>Pause wobbling frequency (stop at current frequency)</td><td>The VFD pauses at current output. After this function is canceled, it continues wobbling-frequency operation at current frequency.</td></tr>
<tr><td>27</td><td>Reset wobbling frequency (back to center frequency)</td><td>The set frequency of VFD reverts to center frequency.</td></tr>
<tr><td>28</td><td>Reset the counter</td><td>The counter is cleared.</td></tr>
<tr><td>29</td><td>Switch between speed control and torque control</td><td>The VFD switches from torque control mode to speed control mode, or vice versa.</td></tr>
<tr><td>30</td><td>Disable ACC/DEC</td><td>Used to ensure the VFD is not impacted by external signals (except for stop command), and maintains the present output frequency.</td></tr>
<tr><td>31</td><td>Trigger the counter</td><td>Used to enable the counter to count pulses.</td></tr>
<tr><td>33</td><td>Clear the frequency increase/decrease setting temporarily</td><td>When the terminal is closed, the frequency value set by the UP/DOWN key can be cleared and restored to the frequency given by frequency command channel; when the terminal is opened, it is changed to the frequency value after frequency increase/decrease setting.</td></tr>
<tr><td>34</td><td>DC braking</td><td>The VFD starts DC brake immediately after the command becomes valid.</td></tr>
<tr><td>35</td><td>Switch between motor 1 and motor 2</td><td>When the function is enabled, you can realize switchover control of two motors.</td></tr>
</table>

Setting	Function	Description
36	Switch the running command channel to keypad	When the function is enabled, the running command channel is switched to keypad. When the function is disabled, the running command channel is restored to the previous setting.
37	Switch the running command channel to terminal	When the function is enabled, the running command channel is switched to terminal. When the function is disabled, the running command channel is restored to the previous setting.
38	Switch the running command channel to communication	When the function is enabled, the running command channel is switched to communication. When the function is disabled, the running command channel is restored to the previous setting.
39	Pre-exciting command	When the function is enabled, motor pre-exciting is started until the function becomes invalid.
40	Clear power consumption quantity	After this command becomes valid, the power consumption quantity of the VFD will be zeroed out.
41	Keep power consumption quantity	When the function is enabled, the present operation of the VFD does not impact the power consumption quantity.
42	Switch the setting source of braking torque upper limit to keypad	The torque upper limit is set through the keypad when the command is valid.
43	Reserved	-
44	Disable spindle orientation	Spindle positioning is disabled.
45	Spindle zeroing / Local positioning zeroing	Trigger the spindle positioning function.
46	Spindle zeroing position selection 1	Spindle zeroing position 1 selected through terminal.
47	Spindle zeroing position selection 2	Spindle zeroing position 2 selected through terminal.
48	Spindle indexing selection 1	Spindle indexing value 1 selected through terminal.
49	Spindle indexing selection 2	Spindle indexing value 2 selected through terminal.
50	Spindle indexing selection 3	Spindle indexing value 3 selected through terminal.

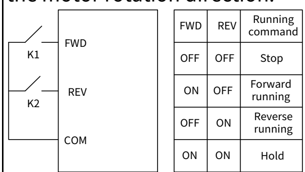
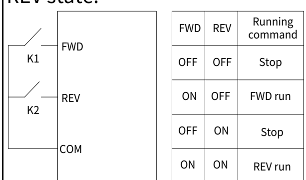
Setting	Function	Description
51	Terminal for switching between position control and speed control	Switch between position control and speed control.
52	Disable pulse input	When the terminal is active, the pulse input is invalid.
53	Clear position deviation	Clear the input deviation of the position loop.
54	Switch position proportional gains	Switch the position proportional gains.
55	Enable cyclic digital positioning	Enabling cyclic positioning function in digital position positioning mode.
56	Emergency stop	When the function is enabled, the motor decelerates to stop in emergency manner according to the time specified by P01.26.
57	Motor overtemperature fault input	When there is motor overtemperature fault input, the motor stops due to the fault.
59	Switch from VC to space voltage vector control	When the function is enabled in stopped state, space voltage vector control is used.
60	Switch to VC control	When the function is enabled in stopped state, VC is used.
61	Switch PID polarities	Used to switch the PID output polarity. It is used together with P09.03.
63	Enable servo	When the thousands place of P21.00 is set to enable servo, the servo enabling terminal is valid, which controls the VFD to enter zero servo control. At this time, the start command is not needed.
64	FWD max. limit	Max frequency limit on forward rotation.
65	REV max limit	Max frequency limit on reverse rotation.
66	Clear encoder counting	Zero out the position counting value.
67	Pulse increase	When the terminal function is valid, the pulse input is increased according to P21.27 (Pulse superposition rate).
68	Enable pulse superposition	When the pulse superimposition is enabled, pulse⊠ increase and pulse decrease are effective.
69	Pulse decrease	If the terminal is valid when the function is selected, the pulse input is decreased according to P21.27 (Pulse superposition rate).

Setting	Function	Description
70	Electronic gear selection	If the terminal is valid when the function is selected, the proportional numerator is switched to P21.30 (Numerator of the 2nd command ratio).
71	Switch to the master	When the function is enabled in stopped state, the unit switches to the master mode.
72	Switch to the slave	When the function is enabled in stopped state, the unit switches to the slave mode.
73	Rolling diameter reset	If the terminal is valid when the tension-specific function is used, the terminal resets the roll diameter.
74	Winding/unwinding switchover	If the terminal is valid when the tension-specific function is used, the terminal switches between the winding mode and unwinding mode.
75	Tension control pre-driving	If the terminal is valid when the tension-specific function is used, the VFD performs tension control pre-driving.
76	Disabling roll diameter calculation	If the terminal is valid when the tension-specific function is used and the terminal is valid, the VFD does not calculate the roll diameter.
77	Clearing alarm display	If the terminal is valid when the tension-specific function is used, tension alarm display is cleared.
78	Manual braking in tension control	If the terminal is valid when the tension-specific function is used, manual braking is allowed.
79	Triggering a forcible material feeding interrupt signal	If the terminal is valid when the tension-specific function is used, the VFD triggers a forcible material feeding interrupt signal.
80	Initial roll diameter selection 1	If the terminal is valid when the tension-specific function is used, initial roll diameter 1 and initial roll diameter 2 are combined for different initial roll diameter selection. For details, see the descriptions for P90.15–P90.19.
81	Initial roll diameter selection 2	
82	Triggering fire control	If the terminal is valid when the fire mode is enabled, the VFD triggers a fire control signal.
83	PID switchover in tension control	If the terminal is valid when the tension-specific function is used, the terminal switches from the first group of PID parameter to the second group. The first group is the default PID parameter group.
84	Pause tension PID	If the terminal is valid when the tension-specific function is used, PID is ineffective temporarily, and the VFD maintains current frequency output. **Note:** Supported by software of version V6.xx or later.

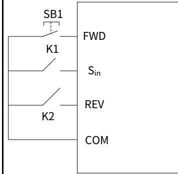
Setting	Function	Description
85	Tension control thickness switchover selection 1	If the terminal is valid when the tension-specific function is used, selection 1 and selection 2 can be combined for the switchover of four thickness parameters P90.34–P90.37. **Note:** Supported by software of version V6.xx or later.
86	Tension control thickness switchover selection 2	
87	Clear tension control length	If the terminal is valid when the tension-specific function is used, the terminal is used to clear the calculated material length. **Note:** Supported by software of version V6.xx or later.
89	Switch between open-loop torque mode and closed-loop speed mode in tension control	If the terminal is valid when the tension-specific function is used, the terminal is used to switch between open-loop torque mode and closed-loop speed mode. **Note:** Supported by software of version V6.xx or later.

Related parameters are listed in the following.

Function code	Name	Default	Setting range	Description
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.01	Function of S1	1	0–95	For details, see the preceding table.
P05.02	Function of S2	4		
P05.03	Function of S3	7		
P05.04	Function of S4	0		
P05.05	Function of HDIA	0		
P05.06	Function of HDIB	0		
P05.07	Reserved	0		
P05.08	Input terminal polarity	0x00	0x00–0x3F	Used to set the input terminal polarity. When a bit is 0, the input terminal is positive. when a bit is 1, the input terminal

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td></td><td>is negative.</td></tr>
<tr><td>P05.09</td><td>Digital input filter time</td><td>0.010s</td><td>0.000–1.000s</td><td>Used to specify the sampling filter time of the S1–S4, HDIA, and HDIB terminals. In strong interference cases, increase the value to avoid maloperation.</td></tr>
<tr><td>P05.10</td><td>Virtual terminal setting</td><td>0x00</td><td>0x000–0x3F</td><td>Bit 0: S1 virtual terminal
Bit 1: S2 virtual terminal
Bit 2: S3 virtual terminal
Bit 3: S4 virtual terminal
Bit 4: HDIA virtual terminal
Bit 5: HDIB virtual terminal</td></tr>
<tr><td>P05.11</td><td>Terminal control mode</td><td>0</td><td rowspan="13">0.000–50.000s</td><td rowspan="13">Used to set the terminal control mode.
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.

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.

2: Three-wire control 1. This</td></tr>
<tr><td>P05.12</td><td>S1 switch-on delay</td><td>0.000s</td></tr>
<tr><td>P05.13</td><td>S1 switch-off delay</td><td>0.000s</td></tr>
<tr><td>P05.14</td><td>S2 switch-on delay</td><td>0.000s</td></tr>
<tr><td>P05.15</td><td>S2 switch-off delay</td><td>0.000s</td></tr>
<tr><td>P05.16</td><td>S3 switch-on delay</td><td>0.000s</td></tr>
<tr><td>P05.17</td><td>S3 switch-off delay</td><td>0.000s</td></tr>
<tr><td>P05.18</td><td>S4 switch-on delay</td><td>0.000s</td></tr>
<tr><td>P05.19</td><td>S4 switch-off delay</td><td>0.000s</td></tr>
<tr><td>P05.20</td><td>HDIA switch-on delay</td><td>0.000s</td></tr>
<tr><td>P05.21</td><td>HDIA switch-off delay</td><td>0.000s</td></tr>
<tr><td>P05.22</td><td>HDIB switch-on delay</td><td>0.000s</td></tr>
<tr><td>P05.23</td><td>HDIB switch-off delay</td><td>0.000s</td></tr>
</table>

Function code	Name	Default	Setting range	Description
				mode defines S_{In} as the enabling terminal, and the running command is generated by FWD, while the direction is controlled by REV. During running, the S_{in} terminal needs to be closed, and when terminal FWD generates a rising edge signal, the VFD starts to run in the direction set by the state of terminal REV; the VFD needs to be stopped by disconnecting terminal S_{in}.



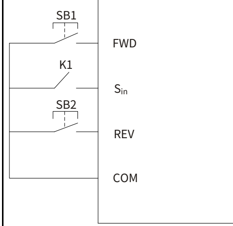
The direction control is as follows during running:

S_{in}	REV	Previous direction	Present direction
ON	OFF→ON	FWD run	REW run
		REW run	FWD run
ON	ON→OFF	REW run	FWD run
		FWD run	REW run
ON→OFF	ON	Decelerate to stop	
	OFF		

S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running

3: Three-wire control 2. This mode defines S_{In} as the enabling terminal, and the running command is generated by FWD or REV, but the direction is controlled by both FWD and REV. During running, the S_{in} terminal needs to be closed, and terminal

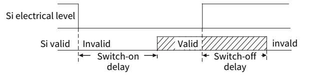
<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
FWD or REV generates a rising edge signal to control the running and direction of the VFD; the VFD needs to be stopped by disconnecting terminal S_{in}.



<table>
<tr><th>S_{in}</th><th>FWD</th><th>REV</th><th>Running direction</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">OFF→ ON</td><td>ON</td><td>FWD run</td></tr>
<tr><td>OFF</td><td>FWD run</td></tr>
<tr><td rowspan="2">ON</td><td>ON</td><td rowspan="2">OFF→ ON</td><td>REW run</td></tr>
<tr><td>OFF</td><td>REW run</td></tr>
<tr><td>ON→ OFF</td><td>-</td><td>-</td><td>Decelerate to stop</td></tr>
</table>

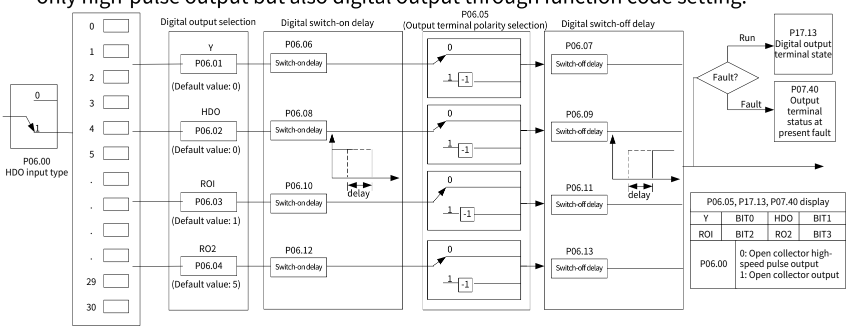
S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running

Note: For two-wire controlled running mode, when the FWD/REV terminal is valid, if the VFD stops due to a stop command given by another source, the VFD does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the VFD run, you need to trigger FWD/REV again, for example, PLC single-cycle stop, fixed-length stop, and valid
</td></tr>
</table>

Function code	Name	Default	Setting range	Description
				STOP/RST based stop during terminal control. (See P07.04.) These function codes specify the delay time corresponding to the electrical level changes when the programmable input terminals switch on or switch off.  **Note:** When the terminal status is changed by means of RS485 communication, the communication address is 0x200A.
P07.39	Input terminal status at present fault	0x0000	0x0000–0xFFFF	-
P17.12	Digital input terminal status	0x00	0x00–0x3F	-

6.10.1.2 Digital output

The VFD carries two groups of relay output terminals, one open collector Y output terminal, and one high-speed pulse output (HDO) terminal. All the digital output terminal functions can be specified by function codes, of which the HDO terminal can be set to not only high-pulse output but also digital output through function code setting.



The following table lists the options of function parameters P06.01–P06.04. A same output terminal function can be repeatedly selected.

Setting	Function	Description
0	Invalid	The output terminal does not have any function.
1	Running	The ON signal is output when there is frequency output during running.
2	Running forward	The ON signal is output when there is frequency output during forward running.
3	Running reversely	The ON signal is output when there is frequency output during reverse running.
4	Jogging	The ON signal is output when there is frequency output during jogging.
5	VFD fault	The ON signal is output when a VFD fault occurred.
6	Frequency level detection FDT1	Refer to the descriptions for P08.32 and P08.33.
7	Frequency level detection FDT2	Refer to the descriptions for P08.34 and P08.35.
8	Frequency reached	Refer to the description for P08.36.
9	Running in zero speed	The ON signal is output when the VFD output frequency and reference frequency are both zero.
10	Upper limit frequency reached	The ON signal is output when the running frequency reaches the upper limit.
11	Lower limit frequency reached	The ON signal is output when the running frequency reaches the lower limit frequency.
12	Ready to run	The ON signal is output when main circuit and control circuit powers are established, the protection functions do not act, and the VFD is ready to run.
13	Pre-exciting	The ON signal is output when the VFD is in pre-exciting.
14	Overload pre-alarm	The ON signal is output when the pre-alarm time elapsed based on the pre-alarm threshold; for details, see descriptions for P11.08–P11.10.
15	Underload pre-alarm	The ON signal is output after the pre-alarm time elapsed based on the pre-alarm threshold. For details, see the descriptions for P11.11–P11.12.
16	Simple PLC stage completed	When the present state of the simple PLC is completed, it outputs a signal.
17	Simple PLC cycle completed	When a single cycle of the simple PLC is completed, it outputs a signal.
23	Modbus/ Modbus TCP communication virtual	A signal is output based on the value set through Modbus/Modbus TCP communication. When the value

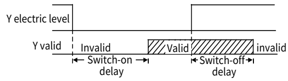
Setting	Function	Description
	terminal output	is 1, the ON signal is output; when the value is 0, the OFF signal is output.
24	PROFIBUS/CANopen/DeviceNet communication virtual terminal output	A signal is output based on the value set through PROFIBUS/CANopen communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
25	Ethernet communication virtual terminal output	A signal is output based on the value set through Ethernet communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
26	DC bus voltage established	When the bus voltage is higher than the VFD undervoltage, the output is valid.
27	Z pulse output	When the encoder Z pulse is reached, the output is valid, which becomes invalid 10 seconds later.
28	Superposing pulses	When the pulse superposition terminal input function is valid, the output is valid.
29	STO action	When an STO fault occurs, the output is valid.
30	Positioning completed	When positioning is completed, the output is valid.
31	Spindle zeroing completed	When spindle zeroing is completed, the output is valid.
32	Spindle indexing completed	When spindle indexing is completed, the output is valid.
33	Speed limit reached in torque control	When the frequency is limited, the output is valid.
34	EtherCAT/PROFINET communication virtual terminal output	A signal is output based on the value set through PROFINET communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
35	Reserved	-
36	Speed/position control switchover completed	When the mode switchover is completed, the output is valid.
37	Any frequency reached	The frequency reaching signal is output when the ramp reference frequency is greater than the detected value of frequency reaching.
38–40	Reserved	-
41	Y1	Y1 from the programmable card (P27.00 must be set to 1).
42	Y2	Y2 from the programmable card (P27.00 must be set to 1).

Setting	Function	Description
43	HDO	HDO from the programmable card (P27.00 must be set to 1).
44	RO1	RO1 from the programmable card (P27.00 must be set to 1).
45	RO2	RO2 from the programmable card (P27.00 must be set to 1).
46	RO3	RO3 from the programmable card (P27.00 must be set to 1).
47	RO4	RO4 from the programmable card (P27.00 must be set to 1).
48	EC PT100 detected OH pre-alarm	Pre-alarm of overheating (OH) detected by the☒ expansion card (EC) with PT100.
49	EC PT1000 detected OH pre-alarm	Pre-alarm of OH detected by the EC with PT1000.
50	AIAO detected OH pre-alarm	Pre-alarm of OH detected by the temperature detection AI or AO terminal.
51	Stopped or running in zero speed	The VFD is stopped or running at zero speed.
52	Tension control disconnection	Disconnection is detected when the tension-specific function disconnection detection is enabled.
53	Specified roll diameter reached	The specified roll diameter P90.26 is reached when the tension-specific function is enabled. **Note:** Supported by software of version V3.xx or earlier.
		The specified roll diameter P90.74 is reached when the tension-specific function is enabled. **Note:** Supported by software of version V6.xx or later.
54	Max. roll diameter reached	The max. roll diameter P90.16 is reached when the tension-specific function is enabled. **Note:** Supported by software of version V3.xx or earlier.
	Roll diameter of stop reached	The roll diameter of stop P90.75 is reached when the tension-specific function is enabled. **Note:** Supported by software of version V6.xx or later.
55	Min. roll diameter reached	The min. roll diameter P90.15 is reached when the tension-specific function is enabled. **Note:** Supported by software of version V3.xx or

Setting	Function	Description
		earlier.
	Length reached	The specified length P92.03 is reached when the tension-specific function is enabled. **Note:** Supported by software of version V6.xx or later.
56	Fire mode enabled	The fire mode is enabled.
57	S1 terminal state	-
58	S2 terminal state	-
59	S3 terminal state	-
60	S4 terminal status	-
61	HDIA terminal state	-
62	HDIB terminal state	-
63	Reserved	-

Related parameters are listed in the following.

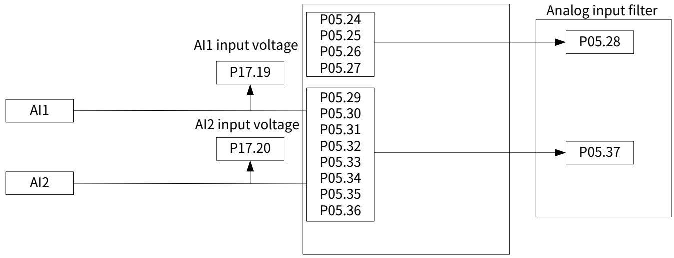
Function code	Name	Default	Setting range	Description
P06.00	HDO output type	0	0–1	0: Open collector high-speed pulse output 1: Open collector output
P06.01	Y1 output	0	0–63	For details, see the preceding table.
P06.02	HDO output	0		
P06.03	RO1 output	1		
P06.04	RO2 output	5		
P06.05	Output terminal polarity	0x00	0x00–0x0F	Used to set the output terminal polarity. When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. Bit3 Bit2 Bit1 Bit0 RO2 RO1 HDO Y1
P06.06	Y switch-on delay	0.000s	0.000–50.000s	-
P06.07	Y switch-off delay	0.000s	0.000–50.000s (valid only when P06.00=1)	Used to specify the delay time corresponding to the electrical level changes when the programmable output terminals
P06.08	HDO switch-on delay			

Function code	Name	Default	Setting range	Description
P06.09	HDO switch-off delay			switch on or switch off.  **Note:** P06.08 and P06.09 are valid only when P06.00=1.
P06.10	RO1 switch-on delay			
P06.11	RO1 switch-off delay			
P06.12	RO2 switch-on delay			
P06.13	RO2 switch-off delay			
P06.33	Detection value for any frequency reached	1.00Hz	0.00Hz–P00.03	-
P06.34	Detection time for any frequency reached	0.5s	0–3600.0s	-
P07.40	Output terminal state at present fault	0x0000	0x0000–0xFFFF	-
P17.13	Digital output terminal state	0x00	0x00–0x0F	Displays the present digital output terminal state of the VFD. The bits correspond to RO2, RO1, HDO, and Y1 respectively.

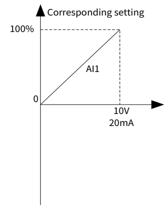
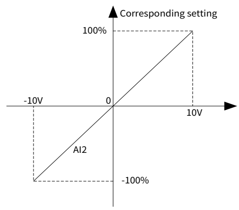
6.10.2 Analog input and output terminal functions

6.10.2.1 Analog input

The VFD carries two analog input terminals AI1 and AI2. The input range of AI1 is 0–10V/0–20mA, and whether AI1 uses voltage input or current input can be specified by P05.50. The input range of AI2 is -10–10V. Each input can be filtered separately, and the corresponding reference curve can be set by adjusting the reference values correspond to the max. value and min. values.



Function code	Name	Default	Setting range	Description
P00.06	Setting channel of A frequency command	0	0–15	1: AI1 2: AI2
P00.07	Setting channel of B frequency command	15		
P03.11	Torque setting method selection	0	0–12	2: AI1 3: AI2
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0	0–12	1: AI1 2: AI2
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0	0–12	1: AI1 2: AI2
P03.18	Setting source of electromotive torque upper limit	0	0–11	1: AI1 2: AI2
P03.19	Setting source of braking torque upper limit	0	0–11	1: AI1 2: AI2

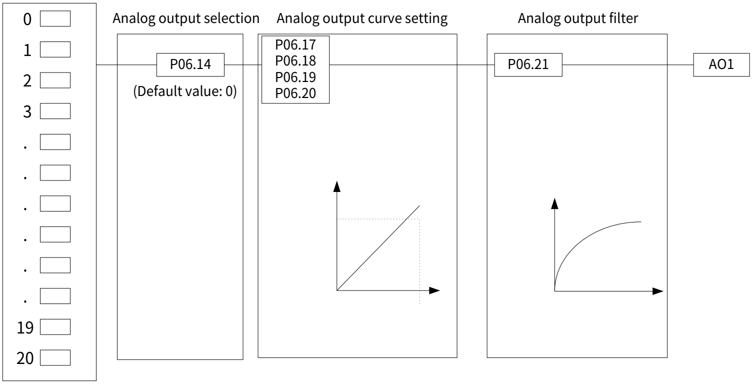
Function code	Name	Default	Setting range	Description
P04.27	Voltage setting channel selection	0	0–13	1: AI1 2: AI2
P05.24	AI1 lower limit	0.00V	0.00V–P05.26	Used to define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range 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 illustrates the cases of several settings:   Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce
P05.25	Corresponding setting of AI1 lower limit	0.0%	-300.0%–300.0%	
P05.26	AI1 upper limit	10.00V	P05.24–10.00V	
P05.27	Corresponding setting of AI1 upper limit	100.0%	-300.0%–300.0%	
P05.28	AI1 input filter time	0.100s	0.000s–10.000s	
P05.29	AI2 lower limit	-10.00V	-10.00V–P05.31	
P05.30	Corresponding setting of AI2 lower limit	-100.0%	-300.0%–300.0%	
P05.31	AI2 middle value 1	0.00V	P05.29–P05.33	
P05.32	Corresponding setting of AI2 middle value 1	0.0%	-300.0%–300.0%	
P05.33	AI2 middle value 2	0.00V	P05.31–P05.35	
P05.34	Corresponding setting of AI2 middle value 2	0.0%	-300.0%–300.0%	
P05.35	AI2 upper limit	10.00V	P05.33–10.00V	
P05.36	Corresponding setting of AI2 upper limit	100.0%	-300.0%–300.0%	
P05.37	AI2 input filter time	0.100s	0.000–10.000s	

Function code	Name	Default	Setting range	Description
				the sensitivity of analog input. Note: AI1 supports the 0–10V/0–20mA input. When AI1 selects the 0–20mA input, the corresponding voltage of 20mA is 10V. AI2 supports the 0–10V input.
P05.50	AI1 input signal type	0	0–1	0: Voltage 1: Current
P09.00	PID reference source selection	0	0–12	1: AI1 2: AI2
P09.02	PID feedback source selection	0	0–10	0: AI1 1: AI2
P21.18	Positioning speed setting selection	0	0–5	1: AI1 2: AI2 3: AI3
P90.04	Linear speed input source selection	0	0–5	1: AI1 2: AI2 **Note:** Supported by software of version V3.xx or earlier.
	Frequency upper limit channel	0	0–6	1: AI1 2: AI2 3: AI3 **Note:** Supported by software of version V6.xx or later.
P90.10	Tension setting source selection	0x00	0x00–0x14	Ones place: Tension setting source selection 0: Keypad digital 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI Tens place: Multiplier selection of max. tension P90.12 0: 1 times 1: 10 times

Function code	Name	Default	Setting range	Description
				Note: Supported by software of version V3.xx or earlier.
P90.13	Roll diameter calculation method selection	0	0–7	1: AI1 2: AI2 **Note:** Supported by software of version V3.xx or earlier.
	Linear speed input method	0	0–8	1: AI1 2: AI2 3: AI3 **Note:** Supported by software of version V6.xx or later.
P90.55	Tension giving method selection	0	0–7	1: AI1 2: AI2 3: AI3 **Note:** Supported by software of version V6.xx or later.
P90.59	Tension taper input method	0	0–6	1: AI1 (relative to digital tension taper value) 2: AI2 3: AI3 **Note:** Supported by software of version V6.xx or later.
P91.00	PID giving method	0	0–7	2: AI1 3: AI2 4: AI3 **Note:** Supported by software of version V6.xx or later.
P91.05	Pendulum/tension feedback selection	1	0–6	0: AI1 1: AI2 2: AI3 **Note:** Supported by software of version V6.xx or later.
P91.24	Tension taper coefficient source	0	0–4	1: AI1 2: AI2 **Note:** Supported by software of version V3.xx or earlier.

6.10.2.2 Analog output

The VFD carries one analog output terminal (supporting the output of 0–10V/0–20mA). Analog output signal can be filtered separately, and the proportional relationship can be adjusted by setting the max. value, min. value, and the percentage of their corresponding output. Analog output signal can output motor speed, output frequency, output current, motor torque and motor power at a certain proportion.



AO output relationship description:

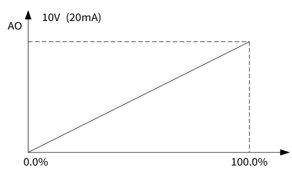
(The min. value and max. value of the output correspond to 0.% and 100.00% of the analog default output. The actual output voltage corresponds to the actual percentage, which can be set through function codes.) Output functions are as follows.

Setting	Function	Description
0	Running frequency	0–Max. output frequency
1	Set frequency	0–Max. output frequency
2	Ramp reference frequency	0–Max. output frequency
3	Rotation speed of running	0–Synchronous speed corresponding to max. output frequency
4	Output current (relative to the VFD)	0–Twice the VFD rated current
5	Output current (relative to motor)	0–Twice the motor rated current
6	Output voltage	0–1.5 times the VFD rated voltage
7	Output power	0–Twice the motor rated power
8	Set torque value (bipolar)	0–Twice the motor rated current. A negative value corresponds to 0.0% by default.
9	Output torque (absolute value)	0–Twice the motor rated torque (electromotive/braking)

Setting	Function	Description
10	AI1 input	0–10V/0–20mA
11	AI2 input	0V–10V. A negative value corresponds to 0.0% by default.
12	AI3 input	0–10V/0–20mA
13	High-speed pulse HDIA input	0.00–50.00Hz
14	Value 1 set through Modbus/Modbus TCP communication	0–1000
15	Value 2 set through Modbus/Modbus TCP communication	0–1000
16	Value 1 set through PROFIBUS/CANopen/DeviceNet communication	0–1000
17	Value 2 set through PROFIBUS/CANopen/DeviceNet communication	0–1000
18	Value 1 set through Ethernet communication	0–1000
19	Value 2 set through Ethernet communication	0–1000
20	High-speed pulse HDIB input	0.00–50.00Hz
21	Value 1 set through EtherCAT/PROFINET communication	0–1000. A negative value corresponds to 0.0% by default.
22	Torque current (bipolar)	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
23	Exciting current	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
24	Set frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
25	Ramp reference frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
26	Rotational speed (bipolar)	0–Synchronous rotation speed corresponding to max. output frequency. A negative value corresponds to 0.0% by default.
27	Value 2 set through EtherCAT/PROFINET	0–1000

Setting	Function	Description
	communication	
28	AO1 from the programmable card	0–1000
29	AO2 from the programmable card	0–1000
30	Rotation speed of running	0–Twice the motor rated synchronous rotation speed
31	Output torque (bipolar)	0–Twice the motor rated torque. A negative value corresponds to 0.0% by default.
32	AIAO detected temperature output	AO output temperature in the AIAO temperature detection.

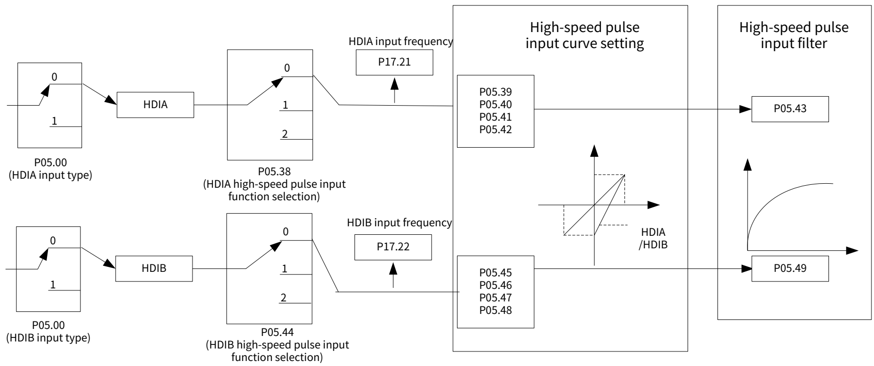
Related parameters are listed in the following.

Function code	Name	Default	Setting range	Description
P06.14	AO1 output	0	0–63	0–32. For details, see the preceding table. 33–63: Reserved
P06.15	Reserved	0		
P06.17	AO1 output lower limit	0.0%	-300.0%–P06.19	Used to define the relationship between the output value and analog output. When the output value exceeds the allowed range, the output uses the lower limit or upper limit. When the analog output is current output, 1mA equals 0.5V. In different cases, the corresponding analog output of 100% of the output value is different.
P06.18	AO1 output corresponding to lower limit	0.00V	0.00–10.00V	
P06.19	AO1 output upper limit	100.0%	P06.17–300.0%	
P06.20	AO1 output corresponding to upper limit	10.00V	0.00–10.00V	
P06.21	AO1 output filter time	0.000s	0.000–10.000s	

6.10.3 High-speed pulse input and output terminal functions

6.10.3.1 High-speed pulse input

The VFD supports two high-speed pulse input terminals HDIA and HDIB. Each input can be filtered separately, and the corresponding reference curve can be set by adjusting the reference values correspond to the max. value and min. values. In addition, the joint use of HDIA and HDIB can provide the 24V encoder quadrature signal speed detection to achieve simplified closed-loop control.



P05.00	Ones: 0: HDIA is high-speed pulse input 1: HDIA is digital input	P05.38	0: Set input via frequency 1: Reserved 2: Input via encoder
P05.00	Tens: 0: HDIB is high-speed pulse input 1: HDIB is digital input	P05.44	0: Set input via frequency 1: Reserved 2: Input via encoder

Related parameters are listed in the following.

Function code	Name	Default	Setting range	Description
P00.06	Setting channel of A frequency command	0	0–15	4: High-speed pulse HDIA 11: High-speed pulse HDIB
P00.07	Setting channel of B frequency command	15		
P03.11	Torque setting method selection	0	0–12	5: Pulse frequency HDIA 10: Pulse frequency HDIB
P03.14	Setting source of forward rotation	0	0–12	4: Pulse frequency HDIA 9: Pulse frequency HDIB

Function code	Name	Default	Setting range	Description
	upper-limit frequency in torque control			
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0	0–12	4: Pulse frequency HDIA 9: Pulse frequency HDIB
P03.18	Setting source of electromotive torque upper limit	0	0–11	4: Pulse frequency HDIA 8: Pulse frequency HDIB
P03.19	Setting source of braking torque upper limit	0	0–11	4: Pulse frequency HDIA 8: Pulse frequency HDIB
P04.27	Voltage setting channel selection	0	0–13	4: HDIA 10: HDIB
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.38	HDIA high-speed pulse input function selection	0	0–2	0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIB
P05.39	HDIA frequency lower limit	0.000kHz	0.000kHz–P05.41	-
P05.40	Corresponding setting of HDIA frequency lower limit	0.0%	-300.0%–300.0%	-

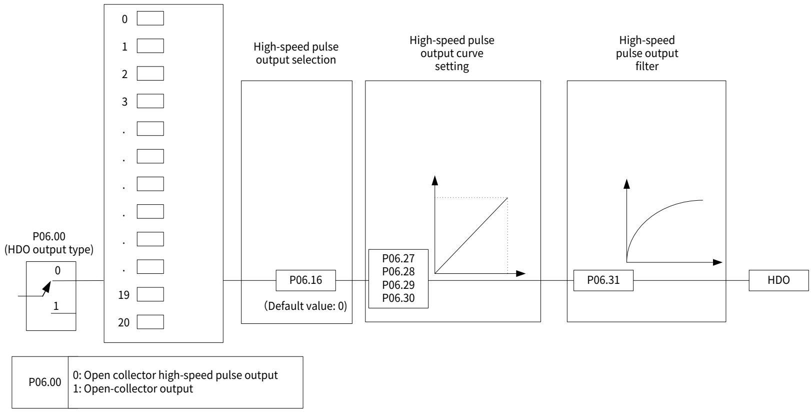
Function code	Name	Default	Setting range	Description
P05.41	HDIA frequency upper limit	50.000kHz	P05.39–50.000 kHz	-
P05.42	Corresponding setting of HDIA upper limit frequency	100.0%	-300.0%–300.0%	-
P05.43	HDIA frequency input filter time	0.030s	0.000–10.000s	-
P05.44	HDIB high-speed pulse input function selection	0	0–2	0: Input set through frequency 1: Reserved 2: Encoder input, used together with HDIA
P05.45	HDIB frequency lower limit	0.000kHz	0.000kHz–P05.47	-
P05.46	Corresponding setting of HDIB frequency lower limit	0.0%	-300.0%–300.0%	-
P05.47	HDIB frequency upper limit	50.000kHz	P05.45–50.000 kHz	-
P05.48	Corresponding setting of HDIB upper limit frequency	100.0%	-300.0%–300.0%	-
P05.49	HDIB frequency input filter time	0.030s	0.000s–10.000s	-
P18.00	Actual frequency of encoder	0.0Hz	-999.9–3276.7 Hz	-
P20.15	Speed measurement mode	0	0–1	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.
P06.14	AO1 output	0	0–63	13: HDIA input value 20: HDIB input value
P06.15	Reserved	0		

Function code	Name	Default	Setting range	Description
P06.16	HDO high-speed pulse output	0		
P09.00	PID reference source selection	0	0–12	4: High-speed pulse HDIA 9: High-speed pulse HDIB
P09.02	PID feedback source selection	0	0–10	3: High-speed pulse HDIA 7: High-speed pulse HDIB
P20.15	Speed measurement mode	0	0–1	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.
P21.18	Positioning speed setting selection	0	0–5	4: High-speed pulse HDIA 5: High-speed pulse HDIB
P24.15	Speed measurement mode	0	0–1	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.
P90.04	Linear speed input source selection	0	0–5	4: High-speed pulse HDI **Note:** Supported by software of version V3.xx or earlier.
	Frequency upper limit channel	0	0–6	4: High-speed pulse HDIA 5: High-speed pulse HDIB **Note:** Supported by software of version V6.xx or later.
P90.10	Tension setting source selection	0x00	0x00–0x14	Ones place: Tension setting source selection 0: Keypad digital 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI Tens place: Multiplier selection of max. tension P90.12 0: 1 times 1: 10 times

Function code	Name	Default	Setting range	Description
				Note: Supported by software of version V3.xx or earlier.
P90.13	Roll diameter calculation method selection	0	0–7	4: High-speed pulse HDI **Note:** Supported by software of version V3.xx or earlier.
	Linear speed input method	0	0–8	4: High-speed pulse HDIA 5: High-speed pulse HDIB **Note:** Supported by software of version V6.xx or later.
P90.16	Roll diameter calculation method	0	0–10	3: HDIA 4: HDIB (Only one from HDIA and HDIB can be selected) **Note:** Supported by software of version V6.xx or later.
P90.55	Tension giving method selection	0	0–7	4: High-speed pulse HDIA 5: High-speed pulse HDIB **Note:** Supported by software of version V6.xx or later.
P90.59	Tension taper input method	0	0–6	4: HDIA 5: HDIB **Note:** Supported by software of version V6.xx or later.
P91.00	PID giving method	0	0–7	5: HDIA reference 6: HDIB reference **Note:** Supported by software of version V6.xx or later.
P91.05	Pendulum/tension feedback selection	1	0–6	3: HDIA 4: HDIB **Note:** Supported by software of version V6.xx or later.
P91.24	Tension taper coefficient source	0	0–4	4: High-speed pulse HDI **Note:** Supported by software of version V3.xx or earlier.
P91.47	Deviation integral action channel selection	0	0–4	3: HDIA 4: HDIB **Note:** Supported by software of version V6.xx or later.

6.10.3.2 High-speed pulse output

The VFD carries one high-speed pulse output terminal. High-speed pulse output signals can be filtered separately, and the proportional relationship can be adjusted by setting the max. value, min. value, and the percentage of their corresponding output. High-speed pulse output signals can output the motor speed, output frequency, output current, motor torque and motor power at a certain proportion.



HDO output relationship description:

(The min. value and max. value of the output correspond to 0.% and 100.00% of the default output. The actual output pulse frequency corresponds to the actual percentage, which can be set through function codes.) Output functions are as follows.

Setting	Function	Description
0	Running frequency	0–Max. output frequency
1	Set frequency	0–Max. output frequency
2	Ramp reference frequency	0–Max. output frequency
3	Rotation speed of running	0–Synchronous speed corresponding to max. output frequency
4	Output current (relative to the VFD)	0–Twice the VFD rated current
5	Output current (relative to motor)	0–Twice the motor rated current
6	Output voltage	0–1.5 times the VFD rated voltage
7	Output power	0–Twice the motor rated power
8	Set torque value (bipolar)	0–Twice the motor rated current. A negative value corresponds to 0.0% by default.

Setting	Function	Description
9	Output torque (absolute value)	0–Twice the motor rated torque, or -Twice the motor rated torque–0
10	AI1 input	0–10V/0–20mA
11	AI2 input	0V–10V. A negative value corresponds to 0.0% by default.
12	AI3 input	0–10V/0–20mA
13	High-speed pulse HDIA input	0.00–50.00Hz
14	Value 1 set through Modbus/Modbus TCP communication	0–1000
15	Value 2 set through Modbus/Modbus TCP communication	0–1000
16	Value 1 set through PROFIBUS/CANopen/DeviceNet communication	0–1000
17	Value 2 set through PROFIBUS/CANopen/DeviceNet communication	0–1000
18	Value 1 set through Ethernet communication	0–1000
19	Value 2 set through Ethernet communication	0–1000
20	High-speed pulse HDIB input	0.00–50.00Hz
21	Value 1 set through EtherCAT/PROFINET communication	0–1000. A negative value corresponds to 0.0% by default.
22	Torque current (bipolar)	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
23	Exciting current	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
24	Set frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
25	Ramp reference frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
26	Rotational speed (bipolar)	0–Synchronous rotation speed corresponding to

Setting	Function	Description
		max. output frequency. A negative value corresponds to 0.0% by default.
27	Value 2 set through EtherCAT/PROFINET communication	0–1000
28	AO1 from the programmable card	0–1000
29	AO2 from the programmable card	0–1000
30	Rotation speed of running	0–Twice the motor rated synchronous rotation speed
31	Output torque (bipolar)	0–Twice the motor rated torque. A negative value corresponds to 0.0% by default.
32	AIAO detected temperature output	AO output temperature in the AIAO temperature detection.
33	Set tension output	-

Related parameters are listed in the following.

Function code	Name	Default	Setting range	Description
P06.00	HDO output type	0	0–1	0: Open collector high-speed pulse output 1: Open collector output
P06.16	HDO high-speed pulse output	0	0–63	0–32. For details, see the preceding table. 33–63: Reserved
P06.27	HDO output lower limit	0.0%	-300.0%–P06.29	-
P06.28	HDO output corresponding to lower limit	0.00kHz	0.00–50.00Hz	-
P06.29	HDO output upper limit	100.0%	P06.27–300.0%	-
P06.30	HDO output corresponding to upper limit	50.00kHz	0.00–50.00Hz	-
P06.31	HDO output filter time	0.000s	0.000s–10.000s	-

6.11 RS485 communication

The communication addresses on the communication network are unique, which is the basis of the point-to-point communication between the host controller and VFD. When the master writes the slave communication address to 0 indicating a broadcast address in a frame, all the salves on the Modbus bus receive the frame but do not respond to it. The local communication address is specified by P14.00. The communication response delay is specified by P14.03, and the RS485 communication timeout time is specified by P14.04.

There are four transmission error processing methods, which can be selected through P14.05. Option 2 (Stop in enabled stop mode without reporting an alarm) is applicable only to the communication mode.

Function code	Name	Default	Setting range	Description
P14.00	Local communication address	1	1–247	**Note:** The communication address of a slave cannot be set to 0.
P14.01	Communication baud rate setting	4	0–7	Used to set the rate of data transmission between the host controller and the VFD. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 115200 bps **Note:** The baud rate set on the VFD must be consistent with that on the host controller. Otherwise, the communication fails. A greater baud rate indicates faster communication.
P14.02	Data bit check setting	1	0–5	The data format set on the VFD must be consistent with that on the host controller. Otherwise, the communication fails. 0: No check (N, 8, 1) for RTU

Function code	Name	Default	Setting range	Description
				1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU
P14.03	Communication response delay	5ms	0–200ms	Indicates the communication response delay, that is, the interval from when the VFD completes receiving data to when it sends response data to the host controller. If the response delay is shorter than the system processing time, the system sends response data to the host controller after processing data. If the delay is longer than the system processing time, the system does not send response data to the host controller until the delay is reached although data has been processed.
P14.04	RS485 communication timeout period	0.0s	0.0 (invalid)–60.0s	When P14.04 is set to 0.0, the communication timeout time is invalid. When P14.04 is set to a non-zero value, the system reports the "RS485 communication fault" (CE) if the communication interval exceeds the value. 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.
P14.05	Transmission fault processing	0	0–3	0: Report an alarm and coast to stop 1: Keep running without reporting

Function code	Name	Default	Setting range	Description
				an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)
P14.06	Modbus communication processing action selection	0x000	0x000–0x111	Ones place: Response upon the write operation 0: Respond to write operations 1: Not respond to write operations Tens place: Communication password protection 0: Communication password protection is invalid. 1: Communication password protection is valid. Hundreds place: User-defined address (valid only for RS485 communication) 0: User-defined addresses specified by P14.07 and P14.08 are invalid. 1: User-defined addresses specified by P14.07 and P14.08 are valid.
P14.07	User-defined running command address	0x2000	0x0000–0xFFFF	-
P14.08	User-defined frequency setting address	0x2001	0x0000–0xFFFF	-

6.12 Monitoring parameters

Monitoring parameters mainly fall in groups P07, P17, P18, and P19, which are used to view and analyze the VFD control and use status. The monitored content is listed in the following.

Group	Type	Monitored content
Group P07	HMI	VFD information, module temperature, run time, power usage, fault history, and software version.
Group P17	Basic status viewing	● Frequency information ● Current information ● Voltage information ● Torque and power information ● Input terminal information ● Output terminal information ● PID regulator information ● Control word and status word information
P18 group	Viewing of status in closed-loop control	● Encoder-based speed detecting information ● Pulse reference based speed detecting information ● Encoder position information ● Pulse reference position information ● Position control information
P19 group	Expansion card status viewing	● Expansion card information ● I/O card input terminal information ● I/O card output terminal information ● Communication card control words and status words

Group P07—Human-machine interface (HMI)

Function code	Name	Default	Setting range	Description
P07.11	Rectifier bridge temperature	0.0°C	-20.0–120.0°C	-
P07.12	Inverter module temperature	0.0°C	-20.0–120.0°C	-
P07.13	Control board software version	Version depended	1.00–655.35	-
P07.14	Local accumulative running time	0h	0–65535h	-
P07.15	VFD electricity	0kkWh	0–65535kkWh	Used to display the electricity

Function code	Name	Default	Setting range	Description
	consumption high bits			consumption of the VFD. VFD electricity consumption = P07.15×1000+P07.16
P07.16	VFD electricity consumption low bits	0kWh	0.0–999.9kWh	
P07.18	VFD rated power	Model depended	0.4–3000.0kW	-
P07.19	VFD rated voltage	Model depended	50–1200V	-
P07.20	VFD rated current	Model depended	0.1–6000.0A	-
P07.27	Present fault type	0	0–76	0: No fault 1: Inverter unit U-phase protection (OUt1) 2: Inverter unit V-phase protection (OUt2) 3: Inverter unit W-phase protection (OUt3) 4: Overcurrent during ACC (OC1) 5: Overcurrent during DEC (OC2) 6: Overcurrent during constant speed running (OC3) 7: Overvoltage during ACC (OV1) 8: Overvoltage during DEC (OV2) 9: Overvoltage during constant speed running (OV3) 10: Bus undervoltage fault (UV) 11: Motor overload (OL1) 12: VFD overload (OL2) 13: Phase loss on input side (SPI) 14: Phase loss on output side (SPO) 15: Rectifier module overheating (OH1) 16: Inverter module overheating (OH2) 17: External fault (EF) 18: Modbus/Modbus TCP communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE)
P07.28	Last fault type	0		
P07.29	2nd-last fault type	0		
P07.30	3rd-last fault type	0		
P07.31	4th-last fault type	0		
P07.32	5th-last fault type	0		

Function code	Name	Default	Setting range	Description
				For details about fault information, see section 8.2 Faults and solutions.
P07.33	Running frequency at present fault	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P07.34	Ramp reference frequency at present fault	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P07.35	Output current at present fault	0V	0–1200V	-
P07.36	Output current at present fault	0.0A	0.0–6300.0A	-
P07.37	Bus voltage at present fault	0.0V	0.0–2000.0V	-
P07.38	Max. temperature at present fault	0.0°C	-20.0–120.0°C	-
P07.39	Input terminal status at present fault	0x0000	0x0000–0xFFFF	-
P07.40	Output terminal state at present fault	0x0000	0x0000–0xFFFF	-
P07.41	Running frequency at last fault	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P07.42	Ramp reference frequency at last fault	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P07.43	Output voltage at last fault	0V	0–1200V	-
P07.44	Output current at last fault	0.0A	0.0–6300.0A	-
P07.45	Bus voltage at	0.0V	0.0–2000.0V	-

Function code	Name	Default	Setting range	Description
	last fault			
P07.46	Temperature at last fault	0.0°C	-20.0–120.0°C	-
P07.47	Input terminal state at last fault	0x0000	0x0000–0xFFFF	-
P07.48	Output terminal state at last fault	0x0000	0x0000–0xFFFF	-
P07.49	Running frequency at 2nd-last fault	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P07.50	Ramp reference frequency at 2nd-last fault	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P07.51	Output voltage at 2nd-last fault	0V	0–1200V	-
P07.52	Output current at 2nd-last fault	0.0A	0.0–6300.0A	-
P07.53	Bus voltage at 2nd-last fault	0.0V	0.0–2000.0V	-
P07.54	Temperature at 2nd-last fault	0.0°C	-20.0–120.0°C	-
P07.55	Input terminal state at 2nd-last fault	0x0000	0x0000–0xFFFF	-
P07.56	Output terminal state at 2nd-last fault	0x0000	0x0000–0xFFFF	-

GroupP17—Basic status viewing

Basic status viewing

Function code	Name	Default	Setting range	Description
P17.40	Motor control mode	0x000	0x000–0x123	Ones place: Control mode 0: Vector 0 1: Vector 1 2: V/F control

Function code	Name	Default	Setting range	Description
				3: Closed-loop vector control Tens place: Control status 0: Speed control 1: Torque control 2: Position control Hundreds place: Motor number 0: Motor 1 1: Motor 2
P17.12	Digital input terminal status	0x00	0x00–0x3F	Displays the present digital input terminal state of the VFD. Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively.
P17.13	Digital output terminal state	0x00	0x00–0x0F	Displays the present digital output terminal state of the VFD. The bits correspond to RO2, RO1, HDO, and Y1 respectively.

Frequency related information

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td>P17.00</td><td>Set frequency</td><td>0.00Hz</td><td>0.00Hz–P00.03</td><td colspan="2">Displays the present set frequency of the VFD.</td></tr>
<tr><td>P17.01</td><td>Output frequency</td><td>0.00Hz</td><td>0.00Hz–P00.03</td><td colspan="2">Displays the present output frequency of the VFD.</td></tr>
<tr><td>P17.02</td><td>Ramp reference frequency</td><td>0.00Hz</td><td>0.00Hz–P00.03</td><td colspan="2">Displays the present ramp reference frequency of the VFD.</td></tr>
<tr><td>P17.05</td><td>Motor rotation speed</td><td>0RPM</td><td>0–65535RPM</td><td colspan="2">Displays the present motor rotation speed.</td></tr>
<tr><td rowspan="2">P17.10</td><td rowspan="2">Estimated motor frequency</td><td rowspan="2">0.00Hz</td><td>0.00–630.00Hz</td><td rowspan="2">Displays the estimated motor rotor frequency under the open-loop vector condition.</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.00Hz–P00.03</td><td>Note: Supported by software of version V6.xx or</td></tr>
</table>

Function code	Name	Default	Setting range	Description	
					later.
P17.14	Digital adjustment value	0.00Hz	0.00–630.00Hz	Displays the adjustment on the VFD through the UP/DOWN terminal.	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03		**Note:** Supported by software of version V6.xx or later.
P17.16	Linear speed	0	0–65535	-	
P17.21	HDIA input frequency	0.000kHz	0.000–50.000 kHz	Displays HDIA input frequency.	
P17.22	HDIB input frequency	0.000kHz	0.000–50.000 kHz	Displays HDIB input frequency.	
P17.43	Forward rotation upper-limit frequency in torque control	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.	
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.	
P17.44	Reverse rotation upper-limit frequency in torque control	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.	
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.	
P17.49	Frequency set by A source	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.	
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.	
P17.50	Frequency set by B source	0.00Hz	0.00–630.00Hz	**Note:** Supported by software of version V3.xx or earlier.	
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.	

Voltage related information

Function code	Name	Default	Setting range	Description
P17.03	Output voltage	0V	0–1200V	Displays the present output voltage of the VFD.
P17.11	DC bus voltage	0.0V	0.0–2000.0V	Displays the present DC bus voltage of the VFD.
P17.19	AI1 input voltage	0.00V	0.00–10.00V	Displays the AI1 input signal.
P17.20	AI2 input voltage	0.00V	-10.00V–10.00V	Displays the AI2 input signal.

Current related information

Function code	Name	Default	Setting range	Description
P17.04	Output current	0.0A	0.0–5000.0A	Displays the valid value of present output current of the VFD.
P17.06	Torque current	0.0A	-3000.0–3000.0A	Displays the present torque current of the VFD.
P17.07	Exciting current	0.0A	-3000.0–3000.0A	Displays the present exciting current of the VFD.
P17.33	Exciting current reference	0.0A	-3000.0–3000.0A	Displays the exciting current reference value under the vector control mode.
P17.34	Torque current reference	0.0A	-3000.0–3000.0A	Displays the torque current reference value under the vector control mode.
P17.35	AC incoming current	0.0A	0.0–5000.0A	Displays the valid value of incoming current on AC side.

Torque and power related information

Function code	Name	Default	Setting range	Description
P17.08	Motor power	0.0%	-300.0 –300.0% (of the motor rated power)	Displays the present motor power; 100% is relative to the rated motor power. A positive value indicates it is the motoring state while a negative value

Function code	Name	Default	Setting range	Description
				indicates it is in the generating state.
P17.09	Motor output torque	0.0%	-250.0–250.0%	Displays the present output torque of the VFD; 100% relative to the rated motor torque. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state.
P17.15	Torque reference value	0.0%	-300.0%–300.0% (of the motor rated current)	Relative to the percentage of the rated torque of the present motor, displaying the torque reference.
P17.25	Motor power factor	1.00	-1.00–1.00	Displays the power factor of the current motor.
P17.36	Output torque	0.0Nm	-3000.0Nm–3000.0Nm	Displays the output torque value. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state.
P17.41	Electromotive torque upper limit	0.0%	0.0%–300.0% (of the motor rated current)	-
P17.42	Braking torque upper limit	0.0%	0.0%–300.0% (of the motor rated current)	-
P17.45	Inertia compensation torque	0.0%	-100.0%–100.0%	-
P17.46	Friction compensation torque	0.0%	-100.0%–100.0%	-

PID regulator information

Function code	Name	Default	Setting range	Description
P17.23	PID reference value	0.0%	-100.0–100.0%	Displays the PID reference value.
P17.24	PID feedback value	0.0%	-100.0–100.0%	Displays the PID feedback value.
P17.51	PID proportional output	0.00%	-100.0–100.0%	-
P17.52	PID integral output	0.00%	-100.0–100.0%	-
P17.53	PID differential output	0.00%	-100.0–100.0%	-
P17.54	PID present proportional gain	0.00%	0.00–100.00%	-
P17.55	PID present integral time	0.00s	0.00–10.00s	-
P17.56	PID present differential time	0.00s	0.00–10.00s	-
P17.38	Process PID output	0.00%	-100.0–100.0%	-

Group P18—Status viewing in closed-loop control

Function code	Name	Default	Setting range	Description
P18.00	Actual frequency of encoder	0.0Hz	-999.9–3276.7Hz	Used to indicate the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative.
P18.01	Encoder position count value	0	0–65535	Encoder count value, quadruple frequency.
P18.02	Encoder Z pulse count value	0	0–65535	Corresponding count value of encoder Z pulse.
P18.14	PG card pulse feedback count	0	0–65535	Encoder pulse count value. The count value is accumulated only

Function code	Name	Default	Setting range	Description
	high bit			if the VFD is powered on.
P18.15	PG card pulse feedback count low bit	0	0–65535	Encoder pulse count value. The count value is accumulated only if the VFD is powered on.

Pulse reference and position control information

Function code	Name	Default	Setting range	Description
P18.17	Pulse command frequency	0.0Hz	-3276.8–3276.7Hz	The pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode.
P18.24	PG card pulse reference count high bit	0	0–65535	Indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on.
P18.25	PG card pulse reference count low bit	0	0–65535	Indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on.
P18.18	Pulse command feedforward	0.0Hz	-3276.8–3276.7Hz	The pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode.
P18.03	High bit of position reference value	0	0–30000	It is cleared after stop.
P18.04	Low bit of position reference value	0	0–65535	It is cleared after stop.
P18.05	High bit of position feedback value	0	0–30000	It is cleared after stop.
P18.06	Low bit of position	0	0–65535	It is cleared after stop.

Function code	Name	Default	Setting range	Description
	feedback value			
P18.07	Position deviation	0	-32768–32767	Deviation between the reference position and actual running position.
P18.19	Position regulator output	0.00Hz	-327.68–327.67Hz	-

Spindle positioning information

Function code	Name	Default	Setting range	Description
P18.08	Position of position reference point	0	0–65535	Z-pulse reference point position of spindle accurate stop.
P18.09	Spindle present position setting	0.00	0.00–359.99	Present position setting of spindle accurate stop.
P18.10	Present position of spindle accurate stop	0	0–65535	Present position of spindle accurate stop.

Group P19—Expansion card status viewing

Function code	Name	Default	Setting range	Description
P19.00	Type of expansion card in slot 1	0	0–65535	0: No card 1: PLC card 2: I/O card 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card 6: DP communication card 7: Bluetooth card 8: Resolver PG card 9: CANopen communication card 10: WiFi card 11: PROFINET communication card 12: Sine-cosine PG card without
P19.01	Type of expansion card in slot 2			
P19.02	Type of expansion card in slot 3			

Function code	Name	Default	Setting range	Description
				CD signals 13: Sine-cosine PG card with CD signals 14: Absolute encoder PG card 15: CAN master/slave communication card 16: Modbus TCP communication card 17: EtherCAT communication card 18: BACnet communication card 19: DeviceNet communication card 20: PT100/PT1000 temperature detection card 21: EtherNet IP card 22: MECHATROLINK communication card 23: Bluetooth card 2 24–65535: Reserved
P19.03	Software version of expansion card in slot 1	0.00	0.00–655.35	-
P19.04	Software version of expansion card in slot 2	0.00	0.00–655.35	-
P19.05	Software version of expansion card in slot 3	0.00	0.00–655.35	-
P19.06	Terminal input status of I/O card	0x0000	0x0000–0xFFFF	-
P19.07	Terminal output status of I/O card	0x0000	0x0000–0xFFFF	-

Function code	Name	Default	Setting range	Description
P19.09	AI3 input voltage of I/O card	0.00V	0.00–10.00V	-

6.13 Encoder-based speed detecting

The VFD supports the speed detecting by the local encoder or by encoder expansion card. The speed detecting method is specified by P20.15.

Method 1 Local encoder based speed detecting

The VFD supports high-speed pulse input, using HDIA and HDIB to input encoder signals (non-differential). You can check the value of P18.00 to obtain the actually detected frequency of encoder.

Function code	Name	Default	Setting range	Description
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.38	HDIA high-speed pulse input function selection	0	0–2	0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIB
P05.44	HDIB high-speed pulse input function selection	0	0–2	0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIA
P18.00	Actual frequency of encoder	0.0Hz	-999.9–3276.7Hz	-
P20.01	Encoder pulse count	1024	0–16000	Number of pulses generated when the encoder revolves for one circle.

Function code	Name	Default	Setting range	Description
P20.02	Encoder direction	0x000	0x000–0x111	Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse
P20.15	Speed measurement mode	0	0–1	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.

Method 2 Encoder expansion card based speed detecting

To check whether the detected speed is normal, do as follows:

Step 1 Restore to default values through the keypad.

Step 2 Set P00.03, P00.04, and motor nameplate parameters in group P02.

Step 3 Perform motor parameter autotuning. The autotuned parameters are automatically saved to related motor parameters in group P02.

Step 4 Check whether the detected speed is normal. Set P20.01 (Encoder pulse count) and set P00.00 to 2 (V/F mode). When P00.10 is 20.00Hz, run the VFD. Then the motor frequency is about 20Hz. Check the value of P18.00 (Actually detected frequency of encoder). If the speed is negative, the encoder is in the reverse direction, and you need to set P20.02 to 1. If the speed deviation is great, the value of P20.01 (Encoder pulse count) is set improperly.

Function code	Name	Default	Setting range	Description
P18.00	Actual frequency of encoder	0.0Hz	-999.9–3276.7Hz	Used to indicate the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative.

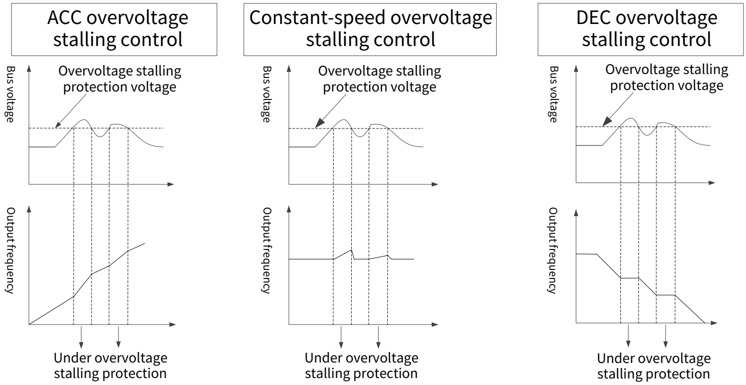
Function code	Name	Default	Setting range	Description
P20.00	Encoder type display	0	0–3	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Reserved
P20.01	Encoder pulse count	1024	0–16000	Number of pulses generated when the encoder revolves for one circle.
P20.02	Encoder direction	0x000	0x000–0x111	Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse

6.14 Protection parameter setting

6.14.1 Overvoltage stall protection

When the motor is in power generation state (the motor speed is greater than the output frequency), the VFD bus voltage will increase continuously. When the detected bus voltage exceeds the value of P11.04 (Overvoltage stalling protection voltage), the overvoltage stalling protection function adjusts the output frequency based on the VFD ACC/DEC status (to be specific, if the VFD is in the ACC or constant speed state, the VFD will increase the output frequency; if the VFD is in the DEC state, the VFD will run at a constant speed and it can decelerate the speed only when the bus voltage is lower than the overvoltage stalling voltage). In this way, the regenerative energy on the bus can be consumed, preventing against VFD overvoltage. If the function does not meet requirements in the actual application, you can adjust parameters related to the current loop and voltage loop.

Figure 6-1 Actions taken for protection against overvoltage stall



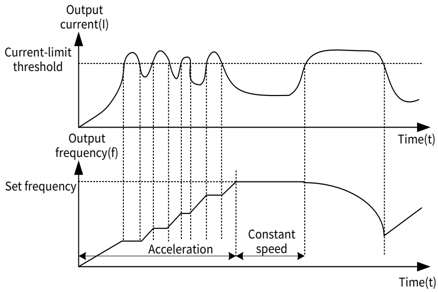
Function code	Name	Default	Setting range	Description
P11.03	Overvoltage stall protection	1	0–1	0: Disable 1: Enable **Note:** If the braking resistor or dynamic braking unit is used, disable the overvoltage stall control function, that is, set P11.03 to 0.
P11.04	Overvoltage stall protection voltage	136%	120–150% (of the standard bus voltage) (for 380V: 136% by default)	-
		120%	120–150% (of the standard bus voltage) (for 220V: 120% by default)	
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	60	0–1000	Specifies the proportional coefficient of the bus voltage regulator during overvoltage stalling. **Note:** Supported by software of version V3.xx or earlier.
			0–127	**Note:** Supported by software of

Function code	Name	Default	Setting range	Description	
					version V6.xx or later.
P11.22	Integral coefficient of voltage regulator during overvoltage stall	10	0–1000	Specifies the integral coefficient of the bus voltage regulator during overvoltage stalling.	**Note:** Supported by software of version V3.xx or earlier.
		5			**Note:** Supported by software of version V6.xx or later.
P11.23	Proportional coefficient of current regulator during overvoltage stall	60	0–1000	Specifies the proportional coefficient of the active current regulator during overvoltage stalling.	
P11.24	Integral coefficient of current regulator during overvoltage stall	250	0–2000	Specifies the integral coefficient of the active current regulator during overvoltage stalling.	

6.14.2 Current-limit protection

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, the VFD may trip due to overcurrent during acceleration.

The current-limit protection function detects output current during running, and compares it with the current-limit level specified by P11.06. If it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or the VFD will run at decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching the lower limit frequency. When the output current is detected to be lower than the current-limit level again, it will continue accelerated running. In some heavy load scenarios, you can increase the value of P11.06 to improve the VFD output torque.

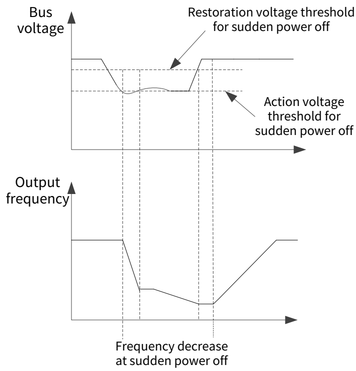


Function code	Name	Default	Setting range	Description
P11.05	Current limit selection	0x001	0x000–0x111	Ones place: Current limit action selection 0: Invalid 1: Always valid Tens: Action selection upon hardware current limit overload 0: Report a fault and stop 1: Keep running Hundreds place: Indicates whether to enable SM hardware current limit action 0: Disable 1: Enable **Note:** The hundreds place is supported only by software of version V6.xx or later.
P11.06	Automatic current limit threshold	For the G type: 160.0% For the P type: 120.0%	50.0–200.0% (of the VFD rated output current)	-
P11.07	Frequency drop rate during current limit	10.00Hz/s	0.00–50.00Hz/s	-

6.14.3 Frequency decrease at sudden power failure

This function enables the system to keep running at sudden short-period power failure. When power failure occurs, the motor is in the power generation state, the bus voltage is kept at the action determination voltage for frequency decrease at sudden power failure, preventing the VFD from stop due to undervoltage.

If this function does not meet actual requirements, you can set parameters P11.17–P11.20. The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral coefficient 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 proportional gain is too small, stable oscillation or speed offset may occur.



Function code	Name	Default	Setting range	Description	
P11.01	Frequency drop at transient power-off	0	0–1	0: Disable 1: Enable	
P11.17	Proportional coefficient of voltage regulator during undervoltage stall	100	0–1000	Specifies the integral coefficient of the bus voltage regulator during undervoltage stalling.	**Note:** Supported by software of version V3.xx or earlier.
		30	0–127		**Note:** Supported by software of

Function code	Name	Default	Setting range	Description
				version V6.xx or later.
P11.18	Integral coefficient of voltage regulator during undervoltage stall	40	0–1000	Specifies the integral coefficient of the bus voltage regulator during undervoltage stalling.
P11.19	Proportional coefficient of current regulator during undervoltage stall	25	0–1000	Specifies the proportional coefficient of the active current regulator during undervoltage stalling.
P11.20	Integral coefficient of current regulator during undervoltage stall	150	0–2000	Specifies the integral coefficient of the active current regulator during undervoltage stalling.

6.14.4 Cooling fan control

There are three cooling fan control modes, which can be specified by P08.39.

Function code	Name	Default	Setting range	Description
P08.39	Cooling-fan running mode	0	0–2	0: Normal mode 1: Permanent running after power-on 2: Run mode 2

Note: The fan automatically runs in any mode if the VFD detects that the rectifier bridge or inverter module temperature reaches 50℃.

Normal mode: P08.39=0

The cooling fan runs when the VFD runs. The cooling fan stops 30s after the VFD stops.

Permanent running after power-on: P08.39=1

The cooling fan runs as long as the VFD is powered on.

Run mode 2: P08.39=2

The cooling fan runs only when the VFD runs and the ramp frequency is greater than 0. The cooling fan stops 30s after the VFD stops.

6.14.5 Dynamic braking

When the VFD driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load-carrying energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a specific value, the VFD reports an overvoltage fault. To prevent this from happening, you need to configure braking components.

You can set the following parameters for the VFD with a built-in dynamic braking unit:

When P08.37=1 and P11.02=0 (software of version V3.xx or earlier) or 1 (software of version V6.xx or later), and the bus voltage exceeds the dynamic braking voltage threshold, the braking pipe is opened regardless of whether the VFD is running or stopped. If the bus voltage is less than dynamic braking voltage threshold minus 10V, the braking pipe is closed.

When P08.37=1 and P11.02=1 (software of version V3.xx or earlier) or 0 (software of version V6.xx or later), and the bus voltage exceeds the dynamic braking voltage threshold, the braking pipe is opened only when the VFD is running. If the bus voltage is less than dynamic braking voltage threshold minus 10V, the braking pipe is closed.

Function code	Name	Default	Setting range	Description	
P08.37	Enabling energy-consumption braking	1	0–1	0: Disable 1: Enable	
P08.38	Energy-consumption braking threshold voltage	For 220V: 380.0V For 380V: 700.0V For 660V: 1120.0V	200.0–2000.0V	Specifies the starting bus voltage of dynamic braking. Adjust this value properly to achieve effective braking for the load. The default value varies depending on the voltage class.	
P11.02	Enabling dynamic braking in	0	0–1	0: Enable 1: Disable	**Note:** Supported by software of

Function code	Name	Default	Setting range	Description	
	standby mode				version V3.xx or earlier.
				0: Disable 1: Enable	**Note:** Supported by software of version V6.xx or later.

6.14.6 Safe torque cut-off

You can enable the safe torque off (STO) function to prevent unexpected startups when the main power supply of the drive is not switched off. The STO function switches off the drive output by turning off the drive signals to prevent unexpected startups of the motor. For details, see Appendix F STO function.

Function code	Name	Default	Setting range	Description
P08.52	STO lock selection	0	0–1	0: Lock upon STO alarm Lock upon STO alarm: indicates resetting is required after state restoration if STO occurs. 1: No lock upon STO alarm "No lock upon STO alarm" indicates the STO alarm disappears automatically after state restoration if STO occurs.

6.15 Typical applications

6.15.1 Counting

When photoelectric switch pulse signals need to be counted, you can use multifunction digital input terminals to collect the signals. That is, set P05.05 and P05.06 to 31 (to trigger the counter).

When P17.18 (Accumulative counting value) reaches P08.25 (Set counting value), counting restarts. Once the value of P17.18 equals that of P08.25, set the digital output function to 18 to output the ON signal. Similarly, Once the value of P17.18 equals that of P08.26, set the digital output function to 19 to output the ON signal.

Function code	Name	Default	Setting range	Description
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.05	Function of HDIA	0	0–83	18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 28: Reset the counter, that is, the counting value is cleared 31: Trigger the counter, that is, the counting value is accumulated
P05.06	Function of HDIB	0		
P06.00	HDO output type	0	0–1	0: Open collector high-speed pulse output. The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For details about the related functions, see P06.02.
P06.01	Y1 output	0	0–63	0: Invalid 18: Set counting value reached 19: Designated counting value reached
P06.02	HDO output	0		
P06.03	RO1 output	1		
P06.04	RO2 output	5		
P08.25	Set counting value	0	P08.26–65535	-
P08.26	Designated counting value	0	0–P08.25	-
P17.18	Accumulative counting value	0	0–65535	-

6.15.2 Motor temperature detecting

The motor temperature can be detected by connecting the VFD carried terminals AO1 and AI1 to a temperature sensor (PT100, PT1000, or KTY84). This function helps to output an overheating alarm and stop the machine. The wiring procedure is as follows:

Step 1 Set the AO1 output signal type to current, and then connect one end of the temperature sensor to AI1 and AO1 and the other end to GND.

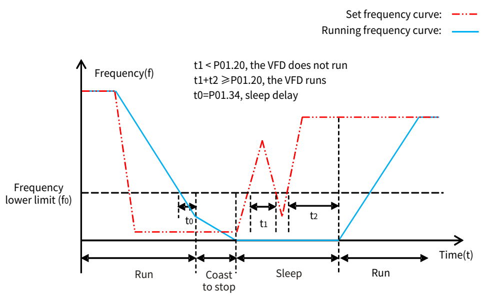
Step 2 Check the value of P19.21 to obtain the actual temperature. When the detected temperature exceeds P28.27 (Motor OT pre-alarm threshold) and digital output terminal function 50 is used, the VFD outputs the ON signal. When the detected temperature exceeds P28.26 (Motor OT protection threshold), the VFD reports the OT fault.

Function code	Name	Default	Setting range	Description
P28.25	Type of sensor for AIAO to detect motor temperature	0	0–4	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84 4: PTC (measuring resistance only) (supported by software of version V3.xx or earlier) **Note:** Motor temperature is displayed through P19.21. To measure temperature, switch the output of AO1 to current, and connect one end of the temperature resistor to AI1 and AO1, and the other end to GND.
P28.26	AIAO detected motor OT protection threshold	110.0°C	0.0–200.0°C	When the motor temperature exceeds the value, the VFD reports the OT fault.
P28.27	AIAO detected motor OT pre-alarm threshold	90.0°C	0.0–200.0°C	When the motor temperature exceeds the value, the DO terminal with function 48 (AI detected motor OT pre-alarm) outputs a valid signal.
P19.21	AIAO detected temperature	0.0°C	-20.0–200.0°C	-
P06.00	HDO output type	0	0–1	0: Open collector high-speed pulse output. The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For

Function code	Name	Default	Setting range	Description
				details about the related functions, see P06.02.
P06.01	Y1 output	0	0–63	0: Invalid 50: AIAO detected OT pre-alarm
P06.02	HDO output	0		
P06.03	RO1 output	1		
P06.04	RO2 output	5		

6.15.3 Sleep and wakeup

According to energy saving requirements, the sleep function can be used in water supply scenarios. When the motor needs to run effectively, you can adjust the set frequency to wake up it. The timing diagram is as follows.



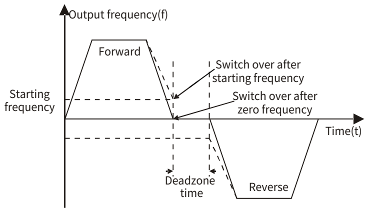
When the set frequency is lower than the frequency lower limit, and the ones place of P01.19 is set to sleep, the VFD stops according to the tens place of P01.19 and sleeps once running at the lower limit for the time specified by P01.34. If the set frequency is higher than the lower limit once again and it lasts for the time specified by P01.20, the VFD restores to the running state automatically and increases to the set frequency.

Function code	Name	Default	Setting range	Description
P01.19	Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	0x00	0x00–0x12	The function code determines the running state of the VFD when the set frequency is lower than the lower-limit one. Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep

Function code	Name	Default	Setting range	Description
				Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop
P01.20	Wake-up-from-sleep delay	0.0s	0.0–3600.0s	Valid when P01.19 is 2.
P01.34	Sleep entry delay	0.0s	0–3600.0s	-

6.15.4 Switchover between FWD run and REV run

In scenarios with the needs of frequent switchover between FWD run and REV run, you can set P01.14 to increase the force and stability in the process to decrease the current impact. When P01.14=0, the switching frequency point is zero (P01.15). When P01.14=1, the switching frequency point is starting frequency (P01.01). See the following figure.



Function code	Name	Default	Setting range	Description
P01.14	FWD/REV run switching mode	1	0–2	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay

Switch at the zero or starting frequency: P01.14=0 or 1

When P01.14=0 or 1, and the switchover between FWD run and REV run is valid, the VFD decelerates to the switching frequency point. If P01.16=1, check whether the motor output frequency is less than the switching frequency point. If yes, wait the time specified by P01.13, and then control the motor to run in the reverse direction. If no, wait the time specified by P01.17 and then the time specified by P01.13, and then control the motor to run in the reverse direction.

Switch after the speed reaches the stop speed with a delay: P01.14=2

When P01.14=2, the DEC process for the switchover between FWD run and REV run is similar to the process of deceleration to stop. In the DEC process for the switchover, you can set related parameters to determine whether to enable short-circuit braking for stop and DC braking based on the work conditions. The difference between the two processes is as follows: When the running frequency reaches the stop speed specified by P01.15 or DC braking ends, the deadzone time specified by P01.13 needs to be waited, and then the motor can be controlled to run in the reverse direction.

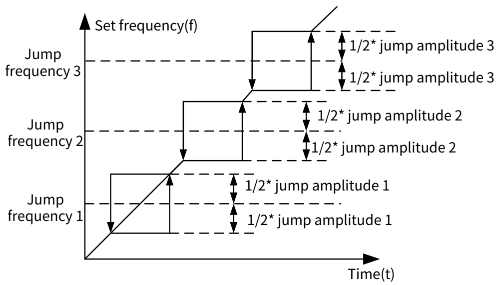
<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">P01.01</td><td rowspan="2">Starting frequency of direct start</td><td rowspan="2">0.50Hz</td><td>0.00–50.00Hz</td><td rowspan="2">The function code indicates the initial frequency during VFD start. For details, see P01.02 (Starting frequency hold time).</td><td>**Note:** Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.00Hz–P00.03</td><td>**Note:** Supported by software of version V6.xx or later.</td></tr>
<tr><td>P01.02</td><td>Starting frequency hold time</td><td>0.0s</td><td>0.0–50.0s</td><td colspan="2">Setting a proper starting frequency can increase the torque during VFD start. During the hold time of the starting frequency, the output frequency of the VFD is the starting frequency. And then, the VFD runs from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the VFD stops running and keeps in the standby state. The starting frequency is not limited in the lower limit frequency.</td></tr>
<tr><td>P01.13</td><td>FWD/REV run deadzone time</td><td>0.0s</td><td>0.0–3600.0s</td><td colspan="2">Specifies the transition time specified in P01.14 during switchover between FWD run and REV run.</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">P01.15</td><td rowspan="2">Stop speed</td><td rowspan="2">0.50Hz</td><td>0.00–100.00Hz</td><td rowspan="2">Specifies the stop speed (frequency).</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.00Hz–P00.03 (Max. output frequency)</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P01.16</td><td>Stop speed detection mode</td><td>0</td><td>0–1</td><td colspan="2">0: Detect by the set speed (unique in space voltage vector control mode)
1: Detect according to speed feedback</td></tr>
<tr><td>P01.17</td><td>Stop speed detection time</td><td>0.50s</td><td>0.00–100.00s</td><td colspan="2">-</td></tr>
</table>

6.15.5 Jump frequency

The VFD can avoid mechanical resonance points by setting jump frequencies. The VFD has three jump frequency parameters P08.09, P08.11, and P08.13. If all jump frequencies are set to 0, this function is invalid. When the set frequency is within the jump frequency range (Jump frequency ± 1/2 * Jump amplitude), if the VFD is in the ACC phase, the VFD runs at the lower bound (Jump frequency – 1/2 * Jump amplitude); if the VFD is in the DEC phase, the VFD runs at the upper bound (Jump frequency + 1/2 * Jump amplitude).

See the following figure.

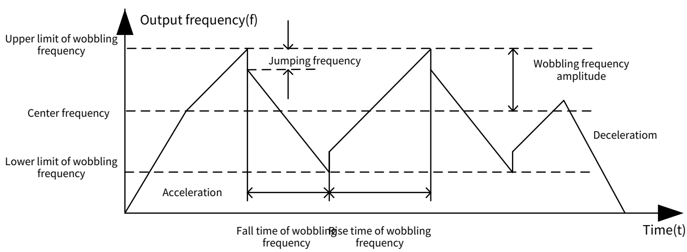


Function code	Name	Default	Setting range	Description
P08.09	Jump frequency 1	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency.
P08.10	Jump amplitude 1	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency. See P08.09 to set it.
P08.11	Jump frequency 2	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency.
P08.12	Jump amplitude 2	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency. See P08.11 to set it.
P08.13	Jump frequency 3	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency.
P08.14	Jump amplitude 3	0.00Hz	0.00Hz–P00.03	P00.03 specifies the max. output frequency. See P08.13 to set it.

6.15.6 Wobbling frequency

Wobbling frequency is mainly applied in the scenarios where transverse movement and winding functions are needed such as textile and chemical fiber industries. The wobbling frequency function indicates that the VFD output frequency wobbles up or down with the set frequency as the center, and the output frequency with the wobbling frequency is impacted by the frequency upper and lower limits.

The time axis tracking is as shown in the following figure.



Wobbling frequency = Central frequency (Set frequency) x P08.15 (Amplitude of wobbling frequency)

Sudden jump frequency = Wobbling frequency x P08.16 (Amplitude of sudden jump frequency)

Function code	Name	Default	Setting range	Description
P08.15	Amplitude of wobbling frequency	0.0%	0.0–100.0%	Relative to the set frequency
P08.16	Amplitude of sudden jump frequency	0.0%	0.0–50.0%	Relative to the wobbling frequency
P08.17	Rise time of wobbling frequency	5.0s	0.1–3600.0s	Time taken to run from the lowest point of wobbling frequency to the highest point.
P08.18	Fall time of wobbling frequency	5.0s	0.1–3600.0s	Time taken to run from the highest point of wobbling frequency to the lowest point.
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.01	Function of S1	1	0–95	0: No function 26: Pause wobbling frequency (stopped at the present frequency) 27: Reset wobbling frequency (returned to the center frequency)
P05.02	Function of S2	4		
P05.03	Function of S3	7		
P05.04	Function of S4	0		
P05.05	Function of HDIA	0		
P05.06	Function of HDIB	0		

6.15.7 CAN master/slave control

This function is applicable to the scenarios that require power balancing for multiple motors driving the same load. The CAN master/slave cards need to be configured for the VFDs. The master needs to run in the speed control mode, while the slave follows the master speed or torque and it can run at the speed or torque control mode.

When the motors driven by the master and slave are connected rigidly through gears or chains, the slave needs to use the torque control mode. When the motors driven by the master and slave are connected softly, the slave needs to use the speed control mode. If the mechanical transmission ratio of the master driven motor and slave driven motor is inconsistent, the running frequency of the slave, when running at the same maximum linear speed as the master, needs to be recalculated using the master's maximum linear speed as the reference. The slave maximum output frequency P00.03 should be set to this running frequency.

When connecting the CAN master and slave cards, check whether the terminal resistor between the master card and the final slave card.

Table 6-2 Master/slave control parameter settings in rigid or soft connection

Master/slave control in rigid connection		**Master/slave control in soft connection**	
Master VFD parameter settings	**Slave VFD parameter settings**	**Master VFD parameter settings**	**Slave VFD parameter settings**
P08.30	P08.30	P08.20	P08.20
P28.00–P28.02	P08.53	P08.30	P08.30
P28.06	P28.00–P28.04	P28.00–P28.02	P28.00–P28.03
-	P28.09	P28.06	-

<table>
<tr><th>Function code</th><th>Name</th><th>Default</th><th>Setting range</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">P08.20</td><td rowspan="2">Frequency threshold of the start of droop control</td><td rowspan="2">2.00Hz</td><td>0.00–50.00Hz</td><td rowspan="2">If unbalanced low-speed current occurs at start, increase this value properly to enable the droop control in advance.</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
<tr><td>0.00Hz–P00.03</td><td>Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P08.30</td><td>Frequency decrease ratio in droop control</td><td>0.00Hz</td><td>0.00–50.00Hz</td><td>The output frequency of the VFD changes as the load changes. The function code is mainly used to</td><td>Note: Supported by software of version V3.xx or earlier.</td></tr>
</table>

Function code	Name	Default	Setting range	Description
			0.00Hz–P00.03 (Max. output frequency)	balance the power when several motors drive a same load. **Note:** In rigid connection, set it to 0 since the master and slave VFDs do not need the droop function. In soft connection, set it to a proper value (below 5.00Hz) for the master VFD. A small mechanical transmission ratio requires a small value of this parameter. **Note:** Supported by software of version V6.xx or later.
P08.53	Upper limit frequency bias value in torque control	0.00Hz	0.00Hz–P00.03 (Max. output frequency)	It is valid only for torque control. A great slave mechanical transmission ratio requires a great value of this parameter.
P15.28	Master/slave CAN communication address	1	0–127	-
P15.29	Master/slave CAN communication baud rate	2	0–5	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 1Mbps

Function code	Name	Default	Setting range	Description
P15.30	Master/slave CAN communication timeout period	0.0s	0.0 (invalid)–60.0s	-
P28.00	Master/slave mode	0	0–2	0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.
P28.01	Master/slave communication data selection	0	0: CAN 1: Reserved	-
P28.02	Master/slave control mode	0x001	0x000–0x112	Ones place: Master/slave running mode selection 0: Master/slave mode 0 The master and slave use speed control, with power balanced through droop control. 1: Master/slave mode 1 The master and slave must be in the same type of vector control. When the master is in speed control, the slave is forced into torque control. 2: Master/slave mode 2 The slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point. Tens place: Slave start command source 0: Master 1: Determined by P00.01 Hundreds place: Whether to enable master/slave to send/receive data 0: Enable 1: Disable
P28.03	Slave speed gain	100.0%	0.0–500.0%	Used to adjust the upper frequency in slave torque control. 100.0% is relative to the linear

Function code	Name	Default	Setting range	Description
				speed same as the master. When the slave mechanical transmission ratio is great, you can set this parameter to a value greater than 100.0%
P28.04	Slave torque gain	100.0%	0.0–500.0%	Used to adjust the slave torque reference. 100.0% is relative to the percentage of the torque current same as the master.
P28.05	Frequency point for switching between speed mode and torque mode in master/slave mode 2	5.00Hz	0.00–10.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P28.06	Number of slaves	1	0–15	-
P28.09	Slave torque offset	0.0%	-100.0–100.0%	Used to adjust the slave torque reference, imposing an offset value. 100.0% is relative to the motor rated current of the slave.

6.15.8 Pulse train positioning control

Pulse train positioning control is based on closed-loop vector control. Before using this function, verify the encoder installation and the speed measurement accuracy of closed-loop vector speed control. For details about speed measurement, see section 6.13 Encoder-based speed detecting. The commissioning description is as follows:

1. Set P21.00=0x0001 set positioning mode to position control, namely pulse train control. There are four types of pulse command mode, which can be set through P21.01.

In position control mode, you can view parameters P18.00, P18.02, P18.03–P18.06, P18.17 and P18.19 in group P18 and find the relationship between P18.08 and P18.02, and between P18.17, P18.18, and P18.19.

2. The position regulator has two gains, namely P21.02 and P21.03, and they can be switched through speed or torque commands or terminals.

3. When P21.08 (Position controller output limit) is set to 0, the position control will be invalid, and at this point, the pulse train acts as frequency source, P21.13(Position feedforward gain) should be set to 100%, the speed ACC/DEC time is determined by the pulse string ACC/DEC time, and the pulse train ACC/DEC time of the system can be adjusted.

If the pulse train acts as the frequency source in speed control, you can also set P21.00 to 0x0000, and set the frequency source reference P00.06 or P00.07 to 12 (set by pulse train AB). At this point, the ACC/DEC time is determined by the VFD ACC/DEC time, meanwhile, the parameters of pulse train AB is still specified by group P21. In speed mode, the filter time of pulse train AB is determined by P21.29.

4. Pulse train input frequency is consistent with encoder pulse feedback frequency. You can change the relationship by setting P21.11 and P21.12. In addition, you can set any parameters among P05.01–P05.06 to 70 (Electric gear selection) to switch the numerator of the 2nd command ratio.

Function code	Name	Default	Setting range	Description
P21.00	Positioning mode	0x0001	0x0000–0x7121	Ones place: Control mode selection (only for closed-loop vector control) 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train. The pulse giving signals from PG card terminals A2 and B2 are used for position control. 1: Digital position. The setting of P21.17 is used for positioning, while the positioning mode can be set through P21.16. 2: Positioning of photoelectric switch during stop. When a terminal receives a photoelectric switch signal (terminal function 43 selected), the VFD starts positioning for stop, and the stop distance can be set through P21.17.

Function code	Name	Default	Setting range	Description
				Hundred place: Position feedback source 0: PG1 1: PG2 Thousands place: Servo mode (Reserved) 0: Disable servo, without position deviation 1: Disable servo, with position deviation 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved **Note:** In the pulse train or spindle positioning mode, the VFD enters the servo operation mode if there is a valid servo enabling signal. If there is no servo enabling signal, the VFD enter the servo operation mode only after it receives a forward running or reverse running command.
P21.01	Pulse command mode	0x0000	0x0000–0x3133	Ones place: Pulse mode 0: A/B quadrature pulse; A leads B 1: A is PULSE and B is SIGN Note: If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A is positive pulse Note: Channel A is positive pulse; channel B needs no wiring. 3: A/B dual-channel pulse; channel A pulse edge counts up, channel B pulse edge counts

Function code	Name	Default	Setting range	Description
				down Tens place: Pulse direction 0: Pulse direction setting: forward 1: Pulse direction setting: reverse 2: Pulse direction set by running direction 3: Pulse direction set by running direction Hundreds place: Frequency multiplication selection for pulse +direction (reserved) 0: No frequency multiplication 1: Frequency multiplication Thousands place: Pulse control selection 0: Inertia filter, without overspeed control 1: Average moving filter, without overspeed control 2: Inertia filter, with overspeed control 3: Average moving filter, with overspeed control
P21.02	Position-loop gain 1	20.0	0.0–400.0	The switchover between the two position loop gains is specified by P21.04.
P21.03	Position-loop gain 2	30.0		
P21.04	Position-loop gain switchover mode	0	0–5	Used to select the mode for switching between position loop gains. To use torque command-based switching, you need to set P21.05; and to use speed command-based switching, you need to set P21.06. 0: No switchover 1: Torque command 2: Speed command

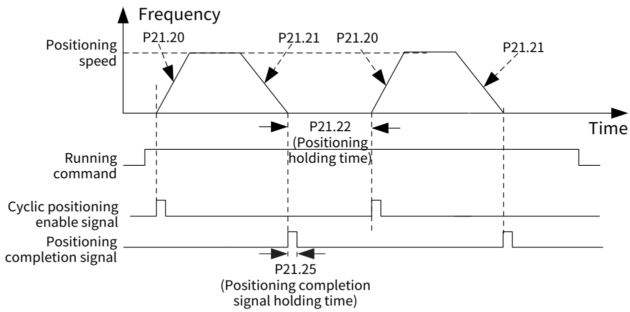
Function code	Name	Default	Setting range	Description
				3–5: Reserved
P21.05	Position gain switchover threshold in torque command	10.0%	0.0–100.0%	Motor rated torque
P21.06	Position gain switchover threshold in speed command	10.0%	0.0–100.0%	Motor rated speed
P21.07	Smooth filter coefficient for gain switchover	5	0–15	Smooth filter coefficient for APR gain switchover.
P21.08	Position regulator output limit	20.0%	0.0–100.0%	The max. output frequency is P00.03. Position regulator output Value. When the output limit is 0, the position regulator is invalid, and no position control can be performed, however, speed control is valid.
P21.09	Positioning completion zone	10	0–1000	When the position deviation is less than P21.09, and the duration is greater than P21.10, positioning completion signal will be outputted.
P21.10	Detection time for positioning completion	10.0ms	0.0–1000.0ms	-
P21.11	Numerator of position command ratio	1000	1–65535	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement.

Function code	Name	Default	Setting range	Description
P21.12	Denominator of position command ratio	1000	1–65535	-
P21.13	Position feedforward gain	100.00%	0.00–120.00%	For pulse string reference only (position control)
P21.14	Position feedforward filter time constant	3.0ms	0.0–3200.0ms	For pulse string reference only (position control)
P21.15	Position command filter time constant	0.0ms	0.0–3200.0ms	Position feedforward filter time constant during the pulse string positioning.
P21.29	Speed feedforward filtering time constant (pulse string-based speed mode)	10.0ms	0.0–3200.0ms	The filter time constant detected by the pulse train when the speed reference source is set to the pulse train (P00.06=12 or P00.07=12).
P21.30	Numerator of the 2nd command ratio	1000	1–65535	You can select terminal function 70 to switch to the numerator of the 2nd command ratio.
P20.17	Pulse filter handling selection	0x0033	0x0000–0xFFFF	Bit 0: Indicates whether to enable encoder P-channel input filter 0: Do not filter 1: Filter Bit 1: Encoder P-channel input filter method 0: Self-adaptive filter 1: Use P20.18 as the filter parameter Bit 2: Indicates whether to enable encoder P-channel frequency-division output filter

Function code	Name	Default	Setting range	Description
				0: Do not filter 1: Filter Bit 3: Indicates whether to enable filter for pulse reference F-channel frequency-division output 0: Do not filter 1: Filter Bit 4: Indicates whether to enable pulse reference F-channel filter 0: Do not filter 1: Filter Bit 5: Pulse reference F-channel filter method 0: Self-adaptive filter 1: Use P20.19 as the filter parameter Bit 6: Frequency-divided output source selection (valid only for incremental encoders) 0: Encoder signals 1: Pulse reference signals Bit7–15: Reserved
P20.19	Pulse reference F-channel filter width	2	0–63	The filter time is P20.19*0.25μs, but both 0 and 1 indicate 0.25μs.
P20.20	Pulse reference F-channel pulse count	1024	0–16000	It is the same as the value of P20.01 in most cases, which indicates the number of pulses per turn.

6.15.9 Digital positioning control

Digital positioning control is based on closed-loop vector control. Before using this function, verify the encoder installation and the speed measurement accuracy of closed-loop vector speed control. For details about speed measurement, see section 6.13 Encoder-based speed detecting. Digital positioning control is shown in the following figure.



The commissioning description is as follows:

1. Set P21.00=0x0011 to enable digital positioning. According to the actual situation, set the positioning offset through P21.17, P21.11, and P21.12, set the positioning speed through P21.18 and P21.19, and set the positioning ACC/DEC time through P21.20 and P21.21.
2. Set bit 1 of P21.16 to select a positioning operation. Setting it to 0 enables one-time positioning. Then the motor executes a single positioning action and keeps at the positioning position according to the setup at step 1. Setting it to 1 enables the cyclic positioning, which is divided into continuous mode and repetitive mode. Or you can set any one of P05.01–P05.06 to 55 to perform cyclic positioning.

Function code	Name	Default	Setting range	Description
P21.00	Positioning mode	0x0011	0x0000–0x7121	Ones place: Control mode selection 0: Speed control 1: Position control **Note:** Position control is valid only in the closed-loop vector control mode. Tens place: Position command source 0: Pulse train 1: Digital position. The setting of P21.17 is used for positioning, while the positioning mode can be set through P21.16. Hundreds place: Reserved Thousands place: Reserved

Function code	Name	Default	Setting range	Description
P21.02	Position-loop gain 1	20.0	0.0–400.0	The switchover between the two position loop gains is specified by P21.04.
P21.03	Position-loop gain 2	30.0		
P21.04	Position loop gain switchover mode	0	0–5	Used to select the mode for switching between position loop gains. To use torque command-based switching, you need to set P21.05; and to use speed command-based switching, you need to set P21.06. 0: No switchover 1: Torque command 2: Speed command 3–5: Reserved
P21.05	Position gain switchover threshold in torque command	10.0%	0.0–100.0%	Motor rated torque
P21.06	Position gain switchover threshold in speed command	10.0%	0.0–100.0%	Motor rated speed
P21.07	Smooth filter coefficient for gain switchover	5	0–15	Smooth filter coefficient for APR gain switchover.
P21.08	Position regulator output limit	20.0%	0.0–100.0%	The max. output frequency is P00.03. When the position regulator output limit is 0, the position regulator is invalid, and no position control can be performed, however, speed control is valid.
P21.09	Positioning completion zone	10	0–1000	When the position deviation is less than P21.09, and the duration

Function code	Name	Default	Setting range	Description
				is greater than P21.10, positioning completion signal will be outputted.
P21.10	Detection time for positioning completion	10.0ms	0.0–1000.0ms	-
P21.11	Numerator of position command ratio	1000	1–65535	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement.
P21.12	Denominator of position command ratio	1000	1–65535	-
P21.16	Digital positioning mode	0x0000	0x0000–0xFFFF	Bit 0: Positioning mode 0: Relative position 1: Absolute position (Origin mode. This function is reserved.) Bit 1: Cyclic positioning setting. You can enable positioning through a terminal (function 55) or choose automatic cyclic positioning. Terminals support only the enabling of continuous positioning, and automatic cyclic positioning can be set to cyclic positioning or reciprocating positioning through bit 2 of P21.16. 0: Terminal-based cyclic positioning 1: Automatic cyclic positioning Bit 2: Cyclic mode 0: Continuous 1: Reciprocating (support the automatic cyclic positioning) Bit 3: P21.17 based digital setting mode. You can select incremental or position type. The incremental type indicates that P21.17

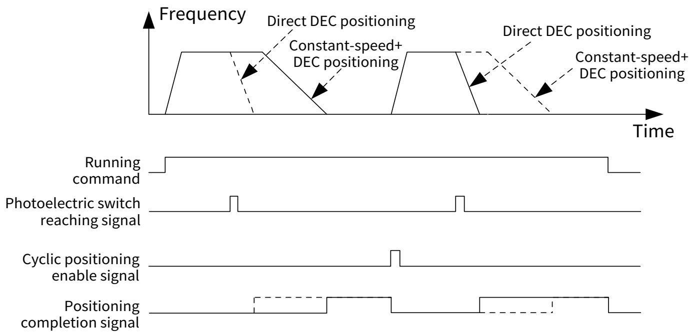
Function code	Name	Default	Setting range	Description
				positioning distance needs to be conducted again after each positioning is enabled. The position type indicates that the displacement is set through P21.17, and the new position is be located automatically if P21.17 is changed. 0: Incremental 1: Position type (do not support the continuous mode) Bit 4: Origin searching mode. This function is reserved. 0: Search for the origin only for once 1: Search for the origin in every time of running Bit 5: Origin calibration mode. This function is reserved. 0: Calibration in real time 1: One-time calibration Bit 6: Positioning completion signal setting. You can set the positioning completion signal in the pulse or electrical level form. The positioning completion signal is valid in the positioning completion signal holding time set in P21.25. 0: Valid in the positioning completion signal holding time (P21.25) 1: Always valid Bit 7: First positioning setting. You can set whether the first positioning is performed when a running command is received. If no, the first positioning is performed only after the positioning enabling terminal or automatic cyclic positioning is

Function code	Name	Default	Setting range	Description
				enabled. 0: Invalid 1: Enable Bit 8: Positioning enabling signal setting (for terminal-based cyclic positioning). In the pulse form, after positioning is completed or in the first positioning, the jump edge of the positioning enabling terminal needs to be detected for performing positioning. In the electrical level mode, after positioning is completed or in the first positioning, positioning is performed after it is detected that the positioning enabling terminal is switched on. 0: Pulse signal 1: Electrical level signal Bit 9: Position source 0: Setting of P21.17 1: PROFIBUS/CANopen setting Bit 10: Indicates whether to save encoder pulse count value at power-off 0: No 1: Yes Bit 11: Reserved Bit12: Reserved
P21.17	Position set in digital mode	0	0–65535	Used for digital positioning. Actual position = P21.17*P21.11/P21.12
P21.18	Positioning speed setting selection	0	0–5	0: Setting of P21.19 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB

Function code	Name	Default	Setting range	Description
P21.19	Positioning speed set in digital mode	20.0%	0–100.0% (of the max. frequency)	-
P21.20	Positioning ACC time	3.00s	0.01–300.00s	Used to set the ACC/DEC time in the positioning process. Positioning ACC time means the time needed if the VFD speeds up from 0Hz to the max. output frequency (P00.03).
P21.21	Positioning DEC time	3.00s	0.01–300.00s	Positioning DEC time means the time needed if the VFD speeds down from the max. output frequency (P00.03) to 0Hz.
P21.22	Positioning holding time	0.100s	0.000–60.000s	Used to set the holding time after the destination position is reached.
P21.25	Positioning completion signal holding time	0.200s	0.000–60.000s	Time for holding the positioning completion signal. This parameter is also valid for the positioning completion signal of spindle accurate stop.

6.15.10 Photoelectric switch stop positioning

Photoelectric switch stop positioning is based on closed-loop vector control. Before using this function, verify the encoder installation and the speed measurement accuracy of closed-loop vector speed control. For details about speed measurement, see section 6.13 Encoder-based speed detecting. Photoelectric switch stop positioning is shown in the following figure.



The commissioning description is as follows:

1. Set P21.00=0x0021 to enable photoelectric switch stop positioning.

The photoelectric switch signal must connect to S8, and P05.08 is set to 43. Based on the actual situation, position the displacement through P21.17, P21.11, and P21.12, and determine the DEC time through P21.21.

Note: If the running speed is too high or the set positioning displacement is too small, the positioning DEC time will fail, and the direct DEC positioning mode is entered.

2. Cyclic positioning operation

After positioning is completed, the motor will keep at the current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in group P05; when the terminal receives cyclic positioning enable signal (that is pulse signal), the motor will continue running in the set speed as per the speed mode and re-enter the positioning state after encountering the photoelectric switch.

3. Hold positioning.

The position loop gain during positioning is P21.03; while the position loop gain in positioning-completion-hold state is P21.02. In order to keep sufficient position-hold force and ensure no system oscillation occurred, adjust P03.00, P03.01, P20.05, and P21.02.

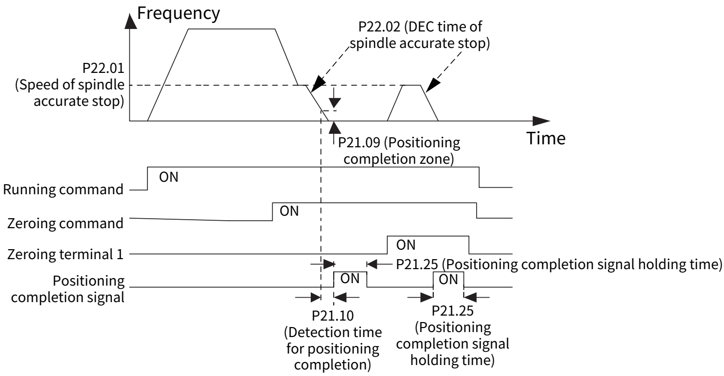
Function code	Name	Default	Setting range	Description
P21.00	Positioning mode	0x0011	0x0000–0x7121	Ones place: Control mode selection 0: Speed control 1: Position control **Note:** Position control is valid only in the closed-loop vector

Function code	Name	Default	Setting range	Description
				control mode. Tens place: Position command source 0: Pulse train 1: Digital position. The setting of P21.17 is used for positioning, while the positioning mode can be set through P21.16. Hundreds place: Reserved Thousands place: Reserved
P21.02	Position-loop gain 1	20.0	0.0–400.0	The switchover between the two position loop gains is specified by P21.04.
P21.03	Position-loop gain 2	30.0		
P21.04	Position-loop gain switchover mode	0	0–5	Used to select the mode for switching between position loop gains. To use torque command-based switching, you need to set P21.05; and to use speed command-based switching, you need to set P21.06. 0: No switchover 1: Torque command 2: Speed command 3–5: Reserved
P21.05	Position gain switchover threshold in torque command	10.0%	0.0–100.0%	Motor rated torque
P21.06	Position gain switchover threshold in speed command	10.0%	0.0–100.0%	Motor rated speed
P21.07	Smooth filter coefficient for gain switchover	5	0–15	Smooth filter coefficient for APR gain switchover.

Function code	Name	Default	Setting range	Description
P21.08	Position regulator output limit	20.0%	0.0–100.0%	When the position regulator output limit is 0, the position regulator is invalid, and no position control can be performed, however, speed control is valid.
P21.09	Positioning completion zone	10	0–1000	When the position deviation is less than P21.09, and the duration is greater than P21.10, positioning completion signal will be outputted.
P21.10	Detection time for positioning completion	10.0ms	0.0–1000.0ms	-
P21.11	Numerator of position command ratio	1000	1–65535	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement.
P21.12	Denominator of position command ratio	1000	1–65535	-
P21.17	Position set in digital mode	0	0–65535	Used for digital positioning. Actual position = P21.17*P21.11/P21.12
P21.21	Positioning DEC time	3.00s	0.01–300.00s	Positioning DEC time means the time needed if the VFD speeds down from the max. output frequency (P00.03) to 0Hz.
P21.22	Positioning holding time	0.100s	0.000–60.000s	Used to set the holding time after the destination position is reached.
P21.25	Positioning completion signal holding time	0.200s	0.000–60.000s	Time for holding the positioning completion signal. This parameter is also valid for the positioning completion signal of spindle accurate stop.

6.15.11 Spindle zeroing

Spindle zeroing is based on closed-loop vector control. Before using this function, verify the encoder installation and the speed measurement accuracy of closed-loop vector speed control. For details about speed measurement, see section 6.13 Encoder-based speed detecting. Spindle zeroing is shown in the following figure.



The commissioning description is as follows:

Set bit 0 of P22.00 to 1 to enable spindle positioning, and bit 1 of P22.00 to select spindle zero-point input. Set bit 2 of P22.00 to select a zero-point search mode, set bit 3 of P22.00 to enable or disable zero-point calibration, and set bit 7 of P22.00 to select a zero-point calibration mode.

Function code	Name	Default	Setting range	Description
P22.00	Spindle positioning mode selection	0x0000	Bit0–Bit15	Bit0: Indicates whether to enable spindle accurate stop when spindle positioning is enabled. 0: Disable 1: Enable Bit1: Spindle positioning reference point selection. Select the encoder Z pulse or the photoelectric switch (set to function 43) as the spindle accurate stop reference point. 0: Z pulse input 1: S2/S3/S4 terminal input Bit2: Reference point search

Function code	Name	Default	Setting range	Description
				selection. Choose whether to search for the reference point for every run. 0: Search only once 1: Search every time Bit 3: Indicates whether to enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1. Select the set direction or the nearest direction to perform spindle accurate stop. 0: Set direction positioning 1: Nearest direction positioning Bit5: Positioning mode selection 2. It is valid when bit4 is set to 0. 0: Forward positioning 1: Reverse positioning Bit 6: Zeroing command selection 0: Electric level mode. The positioning (zeroing and indexing) command can be executed only when there is a run command. 1: Pulse mode. Executing the positioning (zeroing and indexing) command does not need a running command. If there is a run command, it will automatically switch back to the speed mode. Bit 7: Reference point calibration mode 0: Calibrate at the first time 1: Calibration in real time Bit 8: Action selection after zeroing signal (electric level type)

Function code	Name	Default	Setting range	Description
				cancellation 0: Switch to speed mode 1: Position lock mode Bit 9: Positioning completion signal selection 0: Electrical level signal 1: Pulse signal Bit 10: Z pulse signal source 0: Motor 1: Spindle Bit11–15: Reserved
P22.01	Speed of spindle accurate stop	10.00Hz	0.00–100.00Hz	Used to indicate the speed of searching for the accurate-stop start position during spindle accurate stop. After finding the accurate-stop start position, switch to position control mode for an accurate stop.
P22.02	DEC time of spindle accurate stop	3.0s	0.1–100.0s	DEC time of spindle accurate stop. The DEC time of spindle accurate stop indicates the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz.

6.15.11.1 Spindle zeroing

The spindle zeroing procedure is as follows:

Step 1Select a positioning direction through bit 4 of P22.00.

Step 2Set multifunction input terminals to 46 and 47 through group P05, and select one zeroing position (there are four zero points in group P22). When performing the zeroing function, the motor stops the corresponding zeroing position according to the set positioning direction. You can check the value of P18.10 to view the information.

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	43: Reserved 44: Disable spindle orientation 45: Spindle zeroing / Local positioning zeroing 46: Spindle zero position selection 1 47: Spindle zeroing position selection 2
P18.10	Present position of spindle accurate stop	0	0–65535	Present position of spindle accurate stop.
P22.03	Spindle zeroing position 0	0	0–65535	-
P22.04	Spindle zeroing position 1	0	0–65535	-
P22.05	Spindle zeroing position 2	0	0–65535	-
P22.06	Spindle zeroing position 3	0	0–65535	-

Note: The positioning length of spindle zeroing is determined by the deceleration time and the speed of accurate stop.

6.15.11.2 Spindle indexing operation

Set multifunction input terminals to 48, 49, and 50 through group P05, and select one indexing position (there are seven indexing positions in group P22). After the motor completes accurate stop, if the corresponding indexing terminal is enabled, the motor will query the indexing position status table and turn to the corresponding position in an incremental manner. You can check the value of P18.09 to view the information.

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	48: Spindle indexing selection 1 49: Spindle indexing selection 2 50: Spindle indexing selection 3
P18.09	Spindle present position setting	0.00	0.00–359.99	Present position setting of spindle accurate stop.
P22.07	Spindle indexing angle 1	15.00	0.00–359.99	-
P22.08	Spindle indexing angle 2	30.00	0.00–359.99	-
P22.09	Spindle indexing angle 3	45.00	0.00–359.99	-
P22.10	Spindle indexing angle 4	60.00	0.00–359.99	-
P22.11	Spindle indexing angle 5	90.00	0.00–359.99	-
P22.12	Spindle indexing angle 6	120.00	0.00–359.99	-
P22.13	Spindle indexing angle 7	180.00	0.00–359.99	-

6.15.11.3 Priority of speed control, position control, zeroing, and indexing

Speed control takes priority over indexing. When the system runs in indexing mode, only if spindle positioning is disabled, the motor uses the speed mode or position mode.

Zeroing takes priority over indexing. The indexing command is valid when the indexing terminal changes from the 000 state to a non-000 state. For example, for the change from 000 to 011, the spindle executes indexing 3. The transition time during terminal switchover needs to be less than 10ms; otherwise, an incorrect indexing command may be executed.

6.15.11.4 Hold positioning.

The position loop gain during positioning is P21.03; while the position loop gain in positioning-completion-hold state is P21.02. In order to keep sufficient position-hold force and ensure no system oscillation occurred, adjust P03.00, P03.01, P20.05, and P21.02.

Function code	Name	Default	Setting range	Description
P03.00	Speed-loop proportional gain 1 of motor 1	20.0	0.0–200.0	-
P03.01	Speed-loop integral time 1 of motor 1	0.200s	0.000–10.000s	-
P20.05	Filter times of encoder detection	0x33	0x00–0x99	Ones place: Low-speed filter count, corresponding to 2^(0–9)×125μs Tens place: High-speed filter count, corresponding to 2^(0–9)×125μs
P21.02	Position-loop gain 1	20.0	0.0–400.0	The two position-loop gains are switched based on the switching mode set through P21.04. When the spindle accurate stop function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state.
P21.03	Position-loop gain 2	30.0	0.0–400.0	

6.15.11.5 Positioning command selection

Set bit 6 of P22.00 to select a positioning command.

Note: When bit 6 is 0, the positioning command can be executed only after the run command or servo enabling command is given under the level signal.

6.15.11.6 Spindle reference point selection

Set bit 0 of P22.00 to select the spindle reference point. Encoder Z-pulse positioning supports the following spindle positioning methods:

Method 1 When the encoder is installed on the motor shaft, and the transmission ratio is 1:1, the motor shaft and spindle is in rigid connection.

Method 2 When the encoder is installed on the motor shaft, and the transmission ratio is 1:1, the motor shaft and spindle is in belt connection. The belt may slip during high-speed running and cause inaccurate positioning, it is recommended to install a proximity switch on the spindle.

Method 3 When the encoder is installed on the spindle and the motor shaft is connected to the spindle through a belt with a transmission ratio not equal to 1:1, you need to set P20.06, and set P22.14 to 1.

Note: As the encoder is not installed on the motor, using method 3 affects closed-loop vector control performance.

Method 4 When the encoder is installed on the motor shaft, but the transmission ratio is not 1:1, you need to set P22.14 (Spindle transmission ratio).

Function code	Name	Default	Setting range	Description
P22.06	Spindle zeroing position 3	0	0–65535	-
P22.14	Spindle drive ratio	1.000	0.001–30.000	Used to set the reduction ratio of the spindle to the encoder mounting shaft

6.15.12 Rigid tapping

The rigid tapping function is applicable to pulse string position control or speed control mode, which is often used for machine workpiece processing. It is not applicable to position control. When using analog to give frequency for speed control, you can switch to the rigid tapping mode by setting P22.18, and improve the analog signal identifying speed by setting P22.19 to quickly respond to frequency changes and improve processing effects.

Function code	Name	Default	Setting range	Description
P22.18	Rigid tapping selection	0x00	0x00–0x31	Ones place: Enabling selection 0: Disable (This function can be enabled through a terminal (configured with function 58) 1: Enable (internally) Tens place: Analog input port selection 0: Invalid 1: AI1 2: AI2 3: AI3
P22.19	Analog filter time of rigid tapping	1.0ms	0.0–1000.0ms	-
P22.20	Max. frequency of rigid tapping	50.00Hz	0.00–400.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.
P22.21	Corresponding frequency of analog zero drift of rigid tapping	0.00Hz	0.00–10.00Hz	**Note:** Supported by software of version V3.xx or earlier.
			0.00Hz–P00.03	**Note:** Supported by software of version V6.xx or later.

6.15.13 Zero servo running

The zero servo function is valid only in position control or spindle positioning. The VFD enters the zero servo running mode by setting P21.00 to 0x2001. If there is no servo enabling signal, the VFD enter the servo running mode only after it receives a forward or reverse running command.

Function code	Name	Default	Setting range	Description
P21.00	Positioning mode	0x2001	0x0000–0x7121	Ones place: Control mode selection 0: Speed control 1: Position control **Note:** Position control is valid

Function code	Name	Default	Setting range	Description
				only in the closed-loop vector control mode. Tens place: Position command source 0: Pulse train. The pulse giving signals from PG card terminals A2 and B2 are used for position control. Hundreds place: Reserved Thousands place: Servo mode 0: Enable servo through terminals, without position deviation 1: Enable servo through terminals, with position deviation 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved **Note:** In the pulse train or spindle positioning mode, the VFD enters the servo operation mode if there is a valid servo enabling signal. If there is no servo enabling signal, the VFD enter the servo operation mode only after it receives a forward running or reverse running command.
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.01	S1 function selection	1	0–95	0: No function 63: Enable servo

Function code	Name	Default	Setting range	Description
P05.02	S2 function selection	4		
P05.03	S3 function selection	7		
P05.04	S4 function selection	0		
P05.05	Function of HDIA	0		
P05.06	Function of HDIB	0		

Note: You can set the thousands place of P21.00 to 2 or set the digital input terminal function to 63 to implement servo enabling.

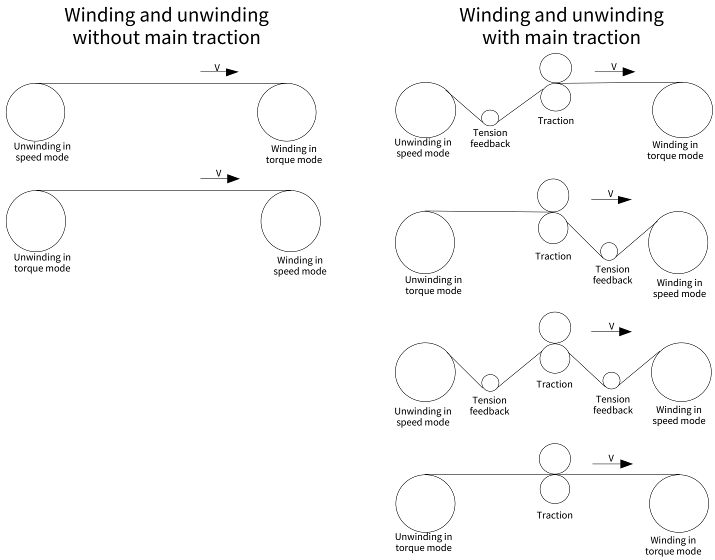
6.15.14 Tension control (supported by software of version V3.xx or earlier)

To improve product quality, constant tension is required in the winding and unwinding processes in industrial production fields such as paper making, paper processing, printing, dyeing, packaging, wire and cable, fiber optic cable, tape manufacturing, textile, leather, metal foil material processing and other industries.

The VFD controls tension by controlling motor output torque or speed. The control modes include: tension speed control mode, open-loop tension torque control mode, and closed-loop tension torque control mode.

Tension control is mainly specified by groups P90–P93, in which P90–P92 are parameter setting groups, while P93 is the parameter monitoring group.

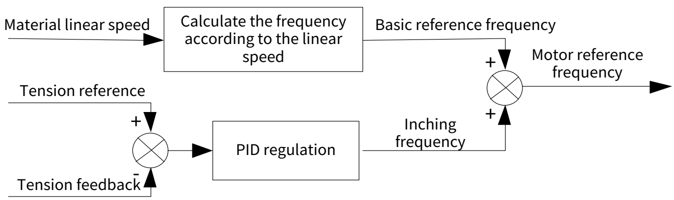
6.15.14.1 Typical winding/unwinding diagrams



6.15.14.2 Control flowchart

- **Closed-loop tension speed control mode**

Closed-loop tension speed control is implemented through tension detection feedback signal. In this mode, PID calculation is executed according to feedback signal, so as to adjust the motor rotation speed directly to control linear speed synchronization and tension stability. When using a tension pendulum or floating roller as feedback, changing the set value (PID given) can change the actual tension, or changing the mechanical configuration such as the counterweight of the tension pendulum or floating roller can also change the tension. The control schematic diagram is shown as follows.

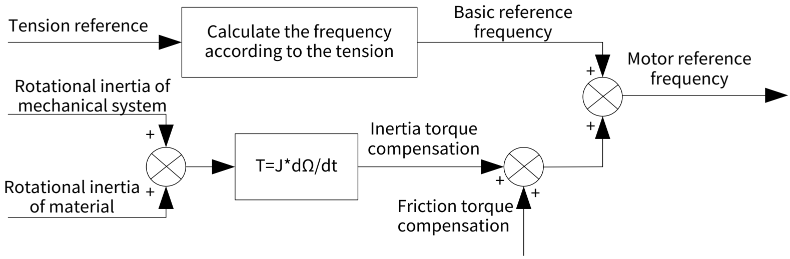


- **Open-loop tension torque control mode**

There is no tension feedback signal in the open-loop tension torque control mode, but stable tension control can be achieved by directly adjusting the motor torque magnitude, and its speed follows the linear speed of the material automatically. Its control feasibility is based on: for the winding/unwinding control system, the relationship between the reel material-feeding tension (*F*), the current roll diameter (*D*) and the output reel shaft output torque (*T*) is as follows:

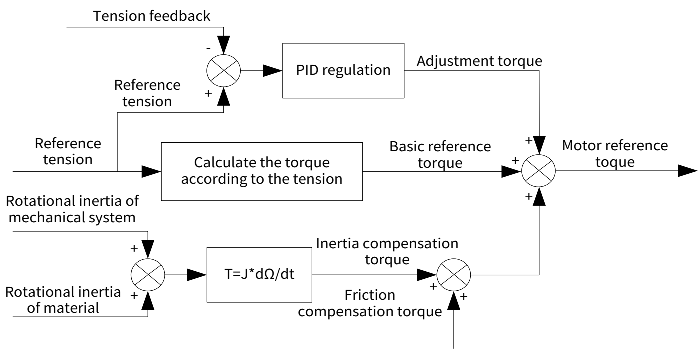
$T = F * D/2$

Adjusting the output torque of winding shaft according to the roll diameter change can control the tension on the material. To ensure constant tension during the acceleration and deceleration processes, the VFD is equipped with built-in friction compensation and inertia compensation modules. It calculates the present drum's rotation inertia in real time and applies inertia compensation to the torque based on the present rate of speed change. The control schematic diagram is shown as follows.



■ **Closed-loop tension torque control mode**

Similar to the open-loop tension torque control mode, it supports all the functional modules of open-loop tension torque control, the difference is that the closed-loop mode has a tension detection sensor installed on the winding and unwinding side and the closed-loop mode has an additional tension feedback PID closed-loop adjustment module. The control schematic diagram is shown as follows.



6.15.14.3 Control mode selection

Different tension control modes can be selected by setting P90.00.

Function code	Name	Default	Setting range	Description
P90.00	Tension control mode	0	0–3	0: Invalid 1: Tension speed control 2: Open-loop tension torque control 3: Closed-loop tension torque control

Invalid: P90.00= 0

The tension control function is not used.

Tension speed control: P90.00 = 1

In the case where there is tension detection feedback signal (such as a tension sensor or tension pendulum), the VFD controls the output frequency through PID tension closed-loop regulation to make the tension reach the set tension and keep the line speed constant.

In scenarios of winding and unwinding control without tension detection feedback signal, if constant line speed control is required and the PID function is disabled, the VFD adjusts its own output frequency according to the change of the roll diameter, so that the line speed remains constant.

Note: This tension control mode is applicable to space voltage, SVC, and closed-loop vector control modes. When accurate tension control is required, the closed-loop vector control mode must be used.

Open-loop tension torque control mode: P90.00=2

No tension detection feedback signal is required. The VFD keeps the tension on the material constant by controlling the motor output torque and needs to operate in the closed-loop vector control mode with an encoder installed.

Closed-loop tension torque control mode: P90.00=3

No tension detection feedback signal is required. The VFD keeps the tension on the material constant by controlling the motor output torque and needs to operate in the closed-loop vector control mode with an encoder installed. It is applicable to scenarios with tension detection sensors, which obtains higher tension control accuracy.

6.15.14.4 Linear speed setting

Set P90.04 to select a linear speed input source.

Function code	Name	Default	Setting range	Description
P90.03	Max. linear speed	1000.0m/min	0.0–6000.0m/min	-
P90.04	Linear speed input source selection	0	0–5	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Main traction encoder frequency-division input **Note:** The keypad set value is the default linear speed of the linear speed setting source.
P90.05	Linear speed set through keypad	20.0%	0.0–100.0%	Default linear speed of the linear speed setting source.
P90.06	Main traction diameter	99.0mm	0.0–6000.0mm	-
P90.07	Main traction drive ratio	1.000	0.000–60.000	Master traction drive ratio = Motor rotation speed/Master traction roller rotation speed = Master traction roller diameter/Motor shaft diameter

Setting through the keypad: P90.04=0

It is applicable to commissioning or selectable when functioning as the main traction. The default linear speed is specified by P90.05.

Setting through analog: P90.04=1, 2, or 3

It is determined by analog input voltage or current. 10V or 20mA corresponds to 100.0% of the max. linear speed.

Setting through the high-speed pulse: P90.04=4

It is determined by external input pulse frequency. P05.47 (HDIB frequency upper limit) corresponds to 100.0% of the max. linear speed.

Setting through master traction encoder frequency-division input: P90.04=5

The linear speed is calculated based on the master traction reel or motor encoder pulse frequency-division reference, with the working with P90.06 and P90.07.

Note: When the VFD using the tension control function works as the master, setting P90.08 and P90.09 can control the linear speed ACC/DEC time; when it works as a slave, set P90.08 and P90.09 to 0.

Function code	Name	Default	Setting range	Description
P90.08	Linear speed ACC time	0.00	0.00–600.00s	-
P90.09	Linear speed DEC time	0.00	0.00–600.00s	-

6.15.14.5 Frequency upper limit setting

The frequency upper limit setting source in torque control is specified by P91.03, and the additional superimposed value of the frequency upper limit in torque control is specified by P91.04.

Function code	Name	Default	Setting range	Description
P91.03	Upper-limit frequency source of torque control	3	0–3	0: Set by P03.14 and P03.15 1: Forward rotation limit set by linear speed 2: Reverse rotation limit set by linear speed 3: Forward/reverse rotation limit set by linear speed
P91.04	Running frequency upper limit offset of tension control	5.0	0.0–100.0%	Additional superimposed value of the frequency upper limit in torque control

Setting source is P03.14 and P03.15: P91.03=0

P03.14 and P03.15 specify the frequency upper limit.

Forward rotation limit set by linear speed: P91.03=1

The forward rotation limit is specified by the linear speed (main given frequency), while the reverse rotation limit is specified by P03.15.

Reverse rotation limit set by linear speed: P91.03=2

The reverse rotation limit is specified by the linear speed (main given frequency), while the forward rotation limit is specified by P03.14.

Forward/reverse rotation limit set by linear speed: P91.03=3

The forward or reverse rotation limit is specified by the linear speed (main given frequency).

At zero speed, if the speed control mode is used, P91.02 (Relative max. frequency) is used as the current speed reference; if the torque control mode is used, P91.02 (Relative max. tension) is used as the current torque reference.

Function code	Name	Default	Setting range	Description
P91.01	Tension control zero speed threshold	3.0	0.0–50.0%	Zero speed threshold for tension system determination. If it is less than the value, the system is in the zero speed state.
P91.02	Zero speed offset	2.0%	0.0–50.0%	-
P91.06	Zero-speed PID reverse limiting	0	0–1	0: Allow active reverse material tightening by PID at zero speed. 1: Do not allow active reverse material tightening by PID at zero speed. If disabled, at the zero speed, the output torque is 0, and the PID output is 0 also.

6.15.14.6 Roll diameter calculation

- **Initial roll diameter selection**

Set any one of P05.01–P05.06 to 80 or 81.

The following table lists the initial roll diameter selection methods (DI1=80, DI2=81).

DI2	DI1	Initial roll diameter
OFF	OFF	P90.15 (Winding) or P90.16 (Unwinding)
OFF	ON	P90.17
ON	OFF	P90.18
ON	ON	P90.19

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	80: Initial roll diameter selection 1 81: Initial roll diameter selection 2
P90.15	Min. roll diameter	50.0mm	0.0mm–P90.16	Lower limit of roll diameter calculation Initial roll diameter of winding. Calculate the related parameters such as the initial linear speed and initial frequency.
P90.16	Max. roll diameter	1000.0mm	P90.15–5000.0mm	Lower limit of roll diameter calculation and initial roll diameter of unwinding. Calibration of roll diameter related values, such as P90.13 (Roll diameter calculation method selection), P90.26 (Roll diameter set value), and P92.11 (Error range of feeding interrupt).
P90.26	Roll diameter set value	80.0%	0.0–100.0%	Relative to the max. roll diameter
P90.17	Initial roll diameter 1	100.0mm	P90.15–P90.16mm	Set P90.17–P90.19 and select terminal functions 80 (Initial roll diameter selection 1) and 81 (Initial roll diameter selection 2) for combined setting. Unwinding does not need to take the max. roll diameter as the initial roll diameter; winding does not need to take the min. roll diameter as the initial roll diameter.
P90.18	Initial roll diameter 2	100.0mm	P90.15–P90.16mm	
P90.19	Initial roll diameter 3	100.0mm	P90.15–P90.16mm	

Function code	Name	Default	Setting range	Description
P90.27	Roll diameter reset setting	0x1000	0x0000–0x1111	Ones place: During stop 0: Remain the present roll diameter 1: Restore to the initial roll diameter Tens place: Power failure at running 0: Remain the present roll diameter 1: Restore to the initial roll diameter Hundreds place: Roll diameter set value reached 0: Remain the present roll diameter 1: Restore to the initial roll diameter after stop Thousands place: Terminal reset restriction 0: Roll diameter reset allowed at running 1: Roll diameter reset only allowed during stop **Note:** Rolling diameter reset can be specified by P90.27. If manual reset is needed, you also need to select digital terminal function 73.
P91.33	Present roll diameter setting	0.0mm	0.0–5000.0mm	Changing the present roll diameter setting is also a reset method.

■ **Roll diameter calculation**

P90.13 specifies the roll diameter calculation method selection.

Function code	Name	Default	Setting range	Description
P90.13	Roll diameter	0	0–7	0: No calculation

Function code	Name	Default	Setting range	Description
	calculation method selection			1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Linear speed calculation method 6: Thickness (of wire) 7: Thickness (of strip)

No roll diameter calculation: P90.13 = 0

Control applications without winding do not need roll diameter calculation.

Setting through analog: P90.13=1, 2, or 3

For applications where the roll diameter is detected with a roll diameter detection sensor, in which P90.16 (Max. roll diameter) must be set correctly. For example, if you select "1: AI1", 100.0% of AI1 input corresponds to the roll diameter specified by P90.16.

Setting through the high-speed pulse: P90.13=4

For applications where the roll diameter is detected with a roll diameter detection sensor, in which P90.16 (Max. roll diameter) must be set correctly.

Calculation method based on linear speed: P90.13=5

The calculation method is independent of the material thickness, based on the linear speed and running frequency in real time, and the errors are not cumulative. When the present frequency is lower than P90.38 or the linear speed is lower than P90.39, keep the current roll diameter value without calculation. When the present frequency is higher than P90.38 and the linear speed is higher than P90.39, the roll diameter calculation needs to be performed again. When selecting the method, certain conditions must be met for linear speed setting, and P90.02 must be set correctly.

Function code	Name	Default	Setting range	Description
P90.02	Reel mechanical transmission rate	1.00	0.01–600.00	When the roll diameter is calculated based on the linear speed, a great reel mechanical transmission rate indicates a great roll diameter. Refer to this rule, and calibrate the parameter according to the deviation of the calculated value of the roll

Function code	Name	Default	Setting range	Description
				diameter from the actual value. Reel mechanical transmission rate = Motor rotation speed/Reel rotation speed = Reel diameter/Motor shaft diameter
P90.20	Linear speed roll diameter calculation filter time	2.000s	0.000–60.000s	A great setting value indicates a smoother roll diameter calculation value, while the delay of the roll diameter change increases.
P90.21	Linear speed roll diameter calculation restriction	0x00	0x00–0x11	Ones place: 0: No limit (Regardless of winding or unwinding, the calculated roll diameter is not limited.) 1: Limit on the reverse change (During winding, the present roll diameter cannot be reduced; during unwinding, the present roll diameter cannot be increased.) Tens place: 0: No limit (No limit on the roll diameter change rate, which is obtained according to the running frequency and material thickness) 1: Automatic limit according to the running frequency and material thickness (When there are different material thickness settings, the present roll diameter change rate is automatically calculated and limited.)
P90.38	Min. frequency for roll diameter calculation	0.30Hz	0.00–50.00Hz	Applicable to the scenarios where the running frequency is low or the roll diameter calculation is inaccurate during ACC.

Function code	Name	Default	Setting range	Description
P90.39	Min. linear speed for roll diameter calculation	3.0%	0.0–100.0%	Relative to the max. linear speed. Applicable to the scenarios where the running frequency is low or the roll diameter calculation is inaccurate during ACC.

Thickness calculation: P90.13=6 or 7

This method does not require a linear speed, and the calculation is cumulative based on the material thickness and the circle count signal, and the calculation result is smooth, but it will accumulate errors. When selecting this method, you need to set P90.22–P90.25 and select terminal function 31 counting (counter trigger).

Function code	Name	Default	Setting range	Description
P90.22	Material thickness	0.010mm	0.001–65.535mm	-
P90.23	Number of coils per layer	1	1–10000	-
P90.24	Revolution counting function selection	0	0–2	0: Digital terminal input 1: PG card input (applicable to thickness calculation method) 2: Running frequency (automatic revolution counting if no input)
P90.25	PPR count	1	1–60	-

6.15.14.7 Tension PID control

P90.28 specifies the tension PID output reference.

Function code	Name	Default	Setting range	Description
P90.28	Tension PID output reference	0	0–1	0: Max. value 1: Given value

Max. reference: P90.28=0

Relative to the max. output frequency in speed mode; relative to the max. torque in the torque mode.

Given value reference: P90.28=1

Relative to the main given frequency in speed mode; relative to the main given torque in torque mode.

Set P90.29 to specify the tension PID parameter source.

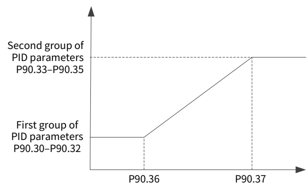
Function code	Name	Default	Setting range	Description
P90.29	Tension PID parameter source	0	0–5	0: Fixed to the first group of PID parameter in P90. 1: Roll diameter (max. roll diameter) 2: Main reference frequency (max. frequency) 3: Running linear speed (max. linear speed) 4: Deviation (reference 100%) 5: Terminal

Fixed to the first group of PID parameter in P90: P90.29=0

Parameters P90.30–P90.32 are used (the first group of PID parameter).

Ratio of present value to max. value: P90.29=1, 2, 3, or 4

If the ratio of the present value to the max. value is less than the value of P90.36, parameters P90.30–P90.32 (first group of PID parameter) are used; if the ratio is greater than the value of P90.37, parameters P90.33–P90.35 (second group of PID parameter) are used; if the ratio is between P90.36 and P90.37, the linear change values are taken between the first group and second group. See the following figure for the linear change.



Terminal based switchover: P90.29=5

Select function 83 for any of parameters P05.01–P05.06 to select different PIDs. By default, if the terminal is not on, the first group (P90.30–P90.32) is selected; if the terminal is on, the second group (P90.33–P90.35) is selected.

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	83: Tension PID switchover
P90.30	Proportional gain of group 1	0.030	0.000–30.000	-
P90.31	Integral time of group 1	5.00s	0.00–30.00s	-
P90.32	Differential time of group 1	0.00s	0.00–10.00s	-
P90.33	Proportional gain of group 2	0.030	0.000–30.000	-
P90.34	Integral time of group 2	5.00s	0.00–30.00s	-
P90.35	Differential time of group 2	0.00s	0.00–10.00s	-
P90.36	PID parameter adjustment reference point 1	10.0%	0.0%–P90.37	-
P90.37	PID parameter adjustment reference point 2	50.0%	P90.36–100.0%	-

6.15.14.8 Tension setting

When P90.00 is set to 2 or 3 and torque control is used, tension setting must be made. The set torque can be calculated based on the roll diameter and the set tension.

Function code	Name	Default	Setting range	Description
P90.10	Tension setting source selection	0x00	0x00–0x14	Ones place: Tension setting source selection 0: Keypad digital 1: AI1

Function code	Name	Default	Setting range	Description
				2: AI2 3: AI3 4: High-speed pulse HDI Tens place: Multiplier selection of max. tension P90.12 0: 1 times 1: 10 times
P90.11	Tension set through keypad	10.0%	0.0–100.0%	-
P90.12	Max. tension	1000	0–60000(N, tens place of P90.10=0) or 0–60000 (10N, tens place of P90.10=1)	-

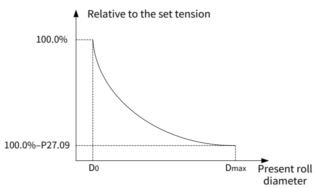
6.15.14.9 Tension taper

Tension taper is generally used for winding, which can control the tension to decrease accordingly as the roll diameter increases, in order to prevent damage to the roll and improve the product curl effect. The VFD provides two tension taper calculation methods.

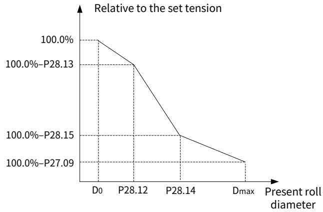
Method 1 Set P91.27 to 0 to select the inverse proportional curve calculation method. The algorithm is as follows.

$$F = F_0 \times [1 - k(1 - \frac{D_0 + D_1}{D + D_1})]$$

In the algorithm, F_0 is the tension setting, k is the tension taper coefficient, D_0 is the empty-roll diameter, D is the present roll diameter, D_1 is the tension taper compensation used to compensate for the difference between the calculated roll diameter value and the actual roll diameter. See the following figure.



Method 2 Set P91.27 to 1 to select the multi-point folding line calculation method, which needs to be used in conjunction with P91.28–P91.31. See the following figure.



Function code	Name	Default	Setting range	Description
P91.24	Tension taper coefficient source	0	0–4	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI
P91.25	Tension taper set through keypad	30.0%	0.0–100.0%	-
P91.26	Tension taper compensation correction	0.0mm	0.0–5000.0mm	-
P91.27	Tension taper curve selection	0	0–1	0: Inverse proportional curve 1: Multi-point polyline
P91.28	Roll diameter value 1	200.0mm	0.0–5000.0mm	-
P91.29	Tension taper coefficient for roll diameter value 1	3.0%	0.0–50.0%	-
P91.30	Roll diameter value 2	500.0mm	0.0–5000.0mm	-
P91.31	Tension taper coefficient for roll diameter value 2	7.0%	0.0–50.0%	-

6.15.14.10 Friction compensation

Friction compensation is valid when P90.00 is set to 2 or 3. In the process of material winding or unwinding, there is frictional resistance on the machinery. In the case of winding, for example, the frictional resistance will make the material tension smaller. By appropriately setting the friction compensation value, the friction resistance can be reduced to some extent, and the tension control effect can be improved. The system has inconsistent resistance values at high speed and low speed, and constant tension cannot be obtained throughout the entire process only by using constant friction compensation torque. Proper setting of P91.07–P91.18 can compensate for the effects caused by system resistance.

Function code	Name	Default	Setting range	Description
P91.07	Torque compensation selection	0x000	0x000–0x111	Ones place: Frictional torque compensation 0: No 1: Yes Tens place: Inertia compensation 0: No 1: Yes Hundreds place: Compensation direction 0: Consistent with the torque direction 1: Opposite to the torque direction **Note:** If P90.01 is set to 0 (in winding mode), the hundreds place of P91.07 is set to 0 generally; if P90.01 is set to 1 (in unwinding mode), the hundreds place of P91.07 is set to 1 generally.
P91.08	System mechanical parameter identification	0	0–2	0: No operation 1: Enable system mechanical inertia identification 2: Enable mechanical friction torque identification **Note:** When P91.08 is set to 2,

Function code	Name	Default	Setting range	Description
				the system can automatically perform friction torque autotuning, the VFD will control the motor to run at the frequency points specified by P91.14–P91.18. The autotuned torque compensation coefficients are saved to P91.09–P91.13. You can modify the autotuned torque compensation coefficients manually.
P91.09	Static friction torque compensation coefficient	0.0%	0.0–100.0%	-
P91.10	Sliding friction torque compensation coefficient 1	0.0%	0.0–100.0%	-
P91.11	Sliding friction torque compensation coefficient 2	0.0%	0.0–100.0%	-
P91.12	Sliding friction torque compensation coefficient 3	0.0%	0.0–100.0%	-
P91.13	High speed torque compensation coefficient	0.0%	0.0–100.0%	-
P91.14	Compensation frequency point of static friction torque	1.0%	0.0%–P91.15	-
P91.15	Compensation frequency	20.0%	P91.14–P91.16(%)	-

Function code	Name	Default	Setting range	Description
	point of sliding friction torque 1			
P91.16	Compensation frequency point of sliding friction torque 2	50.0%	P91.15–P91.17(%)	-
P91.17	Compensation frequency point of sliding friction torque 3	80.0%	P91.16–P91.18(%)	-
P91.18	High-speed friction torque compensation frequency point	100.0%	P91.17–100.0(%)	-

6.15.14.11 Inertia compensation

Inertia compensation is valid when P90.00 is set to 2 or 3. In the case of fast ACC/DEC control, at the winding side, materials are apt to loose in the ACC process and materials are apt to tighten in the DEC process; at the unwinding side, materials are apt to tighten in the ACC process and materials are apt to loose in the DEC process. Inertia compensation is required in these cases.

When the keypad is used as the control channel and there are empty axes, setting P03.44 to 1 allows inertia recognition of the mechanical system and give the VFD the start command. If the motor runs for a long period of time, stop the VFD and increase the value of P03.43, and then restart the VFD. During inertia identification, the motor starts the ACC/DEC process twice. When the inertia identification is completed, the VFD stops automatically, and P03.44 is updated to 0 automatically.

Function code	Name	Default	Setting range	Description
P03.40	Enabling inertia compensation	0	0–1	0: Disable 1: Enable

Function code	Name	Default	Setting range	Description
P03.41	Upper limit of inertia compensation torque	10.0%	0.0–150.0% (of the motor rated torque)	The max. inertia compensation torque is limited to prevent inertia compensation torque from being too large.
P03.42	Inertia compensation filter times	7	0–10	Filter times of inertia compensation torque, used to smooth inertia compensation torque.
P03.43	Inertia identification torque	10.0%	0.0–100.0% (of the motor rated torque)	Due to friction force, certain identification torque needs to be set for the inertia identification to be performed properly.
P03.44	Enabling motor inertia identification	0	0–1	0: No operation 1: Enable
P90.00	Tension control mode	0	0–3	0: Invalid 1: Tension speed control 2: Open-loop tension torque control 3: Closed-loop tension torque control **Note:** The value 0 indicates invalid and the VFD implements the general function. A non-zero value indicates enabling the tension control function.
P90.01	Winding/unwinding mode	0	0–1	0: Winding 1: Unwinding **Note:** The forward rotation direction of motor is fixed as the winding direction. When using the tension control mode, check whether the motor rotation direction is correct in the winding mode (if not, change the rotation direction by swapping two phase wires of the motor). After the rotation direction is

Function code	Name	Default	Setting range	Description
				corrected, the winding mode can be switched to the unwinding mode by setting P90.01 to 1 or changing the winding/unwinding switchover terminals.
P91.07	Torque compensation selection	0x000	0x000–0x111	Ones place: Frictional torque compensation 0: No 1: Yes Tens place: Inertia compensation 0: No 1: Yes Hundreds place: Compensation direction 0: Consistent with the torque direction 1: Opposite to the torque direction **Note:** If P90.01 is set to 0 (in winding mode), the hundreds place of P91.07 is set to 0 generally; if P90.01 is set to 1 (in unwinding mode), the hundreds place of P91.07 is set to 1 generally.
P91.20	Material density	0kg/m^3	0–30000kg/m^3	-
P91.21	Reel width	0.000m	0.000–60.000m	-
P91.22	ACC inertia compensation coefficient	10.0%	0.0–100.0%	-
P91.23	DEC inertia compensation coefficient	10.0%	0.0–100.0%	-

6.15.14.12 Related I/O parameters

Function code	Name	Default	Setting range	Description
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.01	Function of S1	1	0–95	0: No function 73: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving 76: Disable roll diameter calculation 77: Clear alarm display 78: Manual braking in tension control 79: Trigger a forcible material feeding interrupt signal 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 83: Tension PID switchover
P05.02	Function of S2	4		
P05.03	Function of S3	7		
P05.04	Function of S4	0		
P05.05	Function of HDIA	0		
P05.06	Function of HDIB	0		
P06.00	HDO output type	0	0–1	0: Open collector high-speed pulse output. The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For details about the related functions, see P06.02.
P06.01	Y1 output	0	0–63	0: Invalid 52: Tension control disconnection 53: Specified roll diameter reached
P06.02	HDO output	0		
P06.03	RO1 output	1		
P06.04	RO2 output	5		

Function code	Name	Default	Setting range	Description
				54: Max. roll diameter reached 55: Min. roll diameter reached

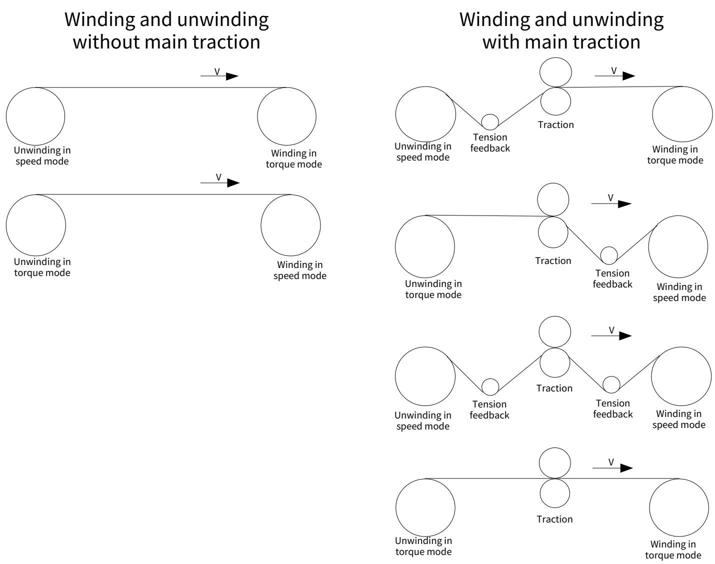
6.15.15 Tension control (supported by software of version V6.xx or later)

To improve product quality, constant tension is required in the winding and unwinding processes in industrial production fields such as paper making, paper processing, printing, dyeing, packaging, wire and cable, fiber optic cable, tape manufacturing, textile, leather, metal foil material processing and other industries.

The VFD controls the tension by regulating the motor output torque or speed. There are six control modes: closed-loop tension speed control mode, open-loop tension torque control mode, closed-loop tension torque control mode, master drive traction mode, standard winding/unwinding mode, and torque debugging mode.

The tension control function is primarily implemented through groups P90–P92. Group P90 is the basic function group for tension control, group P91 is the closed-loop function group for tension control, and group P92 is the auxiliary function group for tension control.

6.15.15.1 Typical winding/unwinding diagrams



6.15.15.2 Control mode selection

Different tension control modes can be selected by setting P90.00.

Function code	Name	Default	Setting range	Description
P90.00	Tension control mode	0	0–8	0: Standard model 1: Open-loop control mode 2: Closed-loop speed mode 3: Closed-loop torque mode 4: Reserved (Constant linear speed mode) 5: Traction mode 6: Standard winding/unwinding mode (feedforward speed mode) 7: Direct speed torque mode (torque debugging mode) 8: Reserved (Wiring mode) **Note:** The value 0 indicates the VFD enables general-purpose functions. A non-zero value indicates the VFD enables the tension control function.

Standard model: P90.00=0

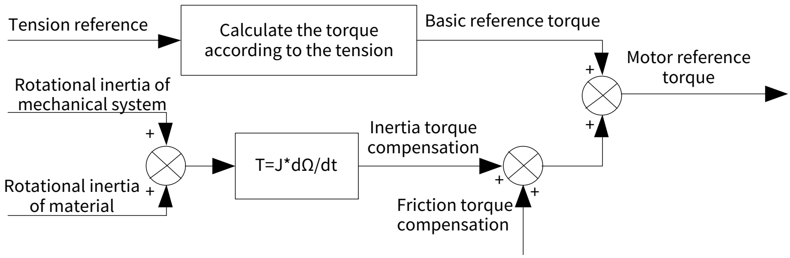
The tension control function is not used.

Closed-loop control mode: P90.00=1

There is no tension feedback signal in the open-loop tension torque control mode, but stable tension control can be achieved by directly adjusting the motor torque magnitude, and its speed follows the linear speed of the material automatically. Its control feasibility is based on: for the winding/unwinding control system, the relationship between the reel material-feeding tension (*F*), the current roll diameter (*D*) and the output reel shaft output torque (*T*) is as follows:

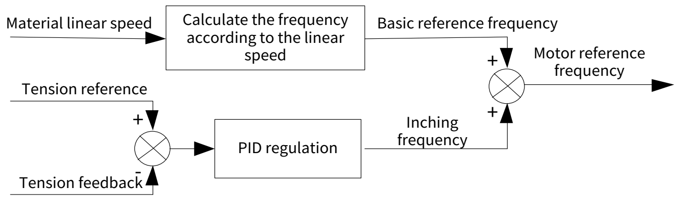
$T = F \times D/2$

Adjusting the output torque of winding shaft according to the roll diameter change can control the tension on the material. To ensure constant tension during the acceleration and deceleration processes, the VFD is equipped with built-in friction compensation and inertia compensation modules. It calculates the present drum's rotation inertia in real time and applies inertia compensation to the torque based on the present rate of speed change. To ensure tension control accuracy, the system must run in the closed-loop vector control mode with an installed encoder. The control schematic diagram is shown as follows.



Closed-loop speed mode: P90.00=2

Closed-loop tension speed control is implemented through tension detection feedback signal (such as tension sensor or tension pendulum). In this mode, PID calculation is executed according to feedback signal, so as to adjust the motor rotation speed directly to control linear speed synchronization and tension stability. When using a tension pendulum or floating roller as feedback, changing the set value (PID given) can change the actual tension, or changing the mechanical configuration such as the counterweight of the tension pendulum or floating roller can also change the tension. The control schematic diagram is shown as follows.

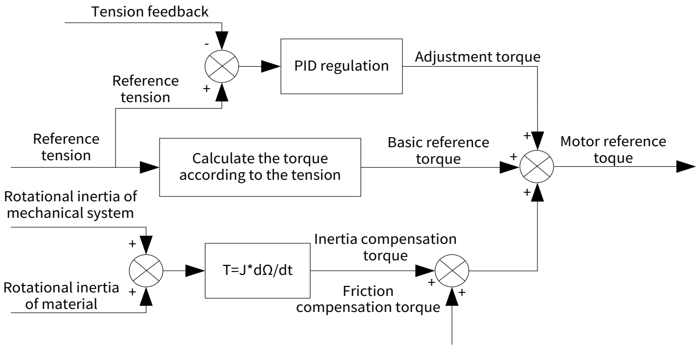


Note: This tension control mode is applicable to space voltage, SVC, and closed-loop vector control modes. When accurate tension control is required, the closed-loop vector control mode must be used.

Closed-loop torque mode: P90.00=3

No tension detection feedback signal is required. The VFD keeps the tension on the material constant by controlling the motor output torque and needs to operate in the closed-loop vector control mode with an encoder installed. It is applicable to scenarios with tension detection sensors, which obtains higher tension control accuracy.

Similar to the open-loop tension torque control mode, it supports all the functional modules of open-loop tension torque control, the difference is that the closed-loop mode has a tension detection sensor installed on the winding and unwinding side and the closed-loop mode has an additional tension feedback PID closed-loop adjustment module. The control schematic diagram is shown as follows.



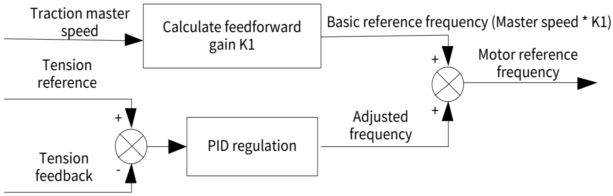
Traction mode: P90.00=5

In applications with a dual VFD wire drawing machine featuring a pendulum and a traction main drive, the traction VFD is set to this mode during the winding/unwinding process. If the system needs to run in constant speed mode, it is generally set to the standard winding/unwinding mode (P90.00=6) in coordination with the rewinding VFD.

Standard winding/unwinding mode (feedforward speed mode): P90.00=6

The standard winding/unwinding mode is a type of closed-loop speed control mode, also implemented through tension feedback signals (such as from a tension sensor or pendulum). It is suitable for simple tension applications, such as dual-VFD wire drawing machines with a pendulum and a traction main drive.

The difference from closed-loop tension speed control is that there is no roll diameter calculation frequency (using line speed calculation or thickness accumulation method). Instead, the PID tuning frequency is superimposed by the feedforward gain K1 * Traction main drive speed. The feedforward gain K1 is calculated by dividing the feedback pendulum position into multiple zones, with integration performed based on the integration time set for each zone. At the same time, the real-time speed of the traction main drive needs to be transmitted to the rewinding VFD through the analog output port to respond to the acceleration and deceleration processes of the traction main drive in real time. In this mode, PID calculation is also performed based on feedback signal, and the motor speed is directly adjusted to achieve synchronized line speed and stable tension control. The control schematic diagram is shown as follows.



Direct speed torque mode (torque debugging mode): P90.00=7

During equipment debugging, the torque debugging mode can be selected, and torque setting can be directly adjusted through P90.07, facilitating the debugging process.

6.15.15.3 Winding/unwinding mode

The winding/unwinding mode can be selected by simultaneously setting the function codes P09.01 and P05.05–P05.06 to 74.

Function code	Name	Default	Setting range	Description
P90.01	Winding/unwinding mode	0	0–1	0: Winding 1: Unwinding

P90.01 (0: Winding; 1: Unwinding)	#74 DI terminal (0: Invalid; 1: Valid)	Mode
0	0	Winding
1	0	Unwinding
0	1	Unwinding
1	1	Winding

6.15.15.4 Frequency upper limit of winding/unwinding

Set P90.04 to select the frequency upper limit channel in torque control.

Function code	Name	Default	Setting range	Description
P90.01	Winding/unwinding mode	0	0–1	0: Winding 1: Unwinding
P90.02	Frequency upper limit of winding	50.00Hz	0.00Hz–P00.03	-
P90.03	Frequency upper limit of unwinding	1.00Hz	0.00Hz–P00.03	-

Function code	Name	Default	Setting range	Description
P90.04	Frequency upper limit channel	0	0–6	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB 6: Automatic upper limit frequency (actual frequency for winding)
P90.05	Actual frequency upper limit	20.0Hz	0.01Hz–P00.03	Displays the actual frequency upper limit.

Speed limit in torque mode for winding/unwinding:

Setting through the keypad: P90.04=0

The frequency upper limit of winding is specified by P90.02, while the frequency upper limit of unwinding is specified by P90.03.

Setting through analog: P90.04=1, 2, or 3

It is determined by analog input voltage or current. 10V or 20mA corresponds to the frequency upper limit specified by P90.02 or P90.03.

Setting through the high-speed pulse: P90.04=4 or 5

It is determined by external input pulse frequency. The HDI frequency upper limit corresponds to the frequency upper limit specified by P90.02 or P90.03.

Automatic upper limit value: P90.04=6

The frequency is calculated based on the linear speed. The following formula shows how to calculate the frequency based on the linear speed and present roll diameter:

F=××/(60××)

(v indicates the linear speed, i indicates the transmission rate, p indicates the motor pole pairs, and D indicates the present roll diameter.)

6.15.15.5 Linear speed setting

Set P90.13 to select a linear speed input source.

Function code	Name	Default	Setting range	Description
P90.13	Linear speed input method	0	0–8	0: Linear speed=0 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB 6: Communication (200FH:0.0–P90.14) 7: Max. linear speed 8: Based on master pulses (encoder pulse train)
P90.14	Max. linear speed	300.0m/min	0.0–3000.0 m/min	Specifies the max. linear speed.
P90.15	Real-time linear speed	0.0m/min	0.0m/min–P90.14	Displays the real-time linear speed.
P90.78	Traction wheel roll diameter	500mm	1–10000mm	Specifies the main traction wheel roll diameter.
P90.79	Traction wheel transmission ratio	1.00	0.01–300.00	Master traction drive ratio = Motor rotation speed/Master traction roller rotation speed = Master traction roller diameter/Motor shaft diameter

Linear speed=0: P90.13=0

The linear speed input is invalid.

Setting through analog: P90.13=1, 2, or 3

It is determined by analog input voltage or current. 10V or 20mA corresponds to the max. linear speed specified by P90.14.

Setting through the high-speed pulse: P90.13=4 or 5

It is determined by external input pulse frequency. The HDI frequency upper limit corresponds to the max. linear speed specified by P90.14.

Setting through communication: P90.13=6

It is written by communication, of which the address is 200F in hex format, with the value ranging from 0.0 to P90.14.

Max. linear speed: P90.13=7

The linear speed is set to the max. linear speed specified by P90.14.

Setting through main traction encoder frequency-division input: P90.13=8

The linear speed is calculated based on the master traction reel or motor encoder pulse frequency-division reference, with the working with P90.78 and P90.79.

Note: When the VFD using the tension control function works as the master, setting P90.48 and P90.49 can control the linear speed ACC/DEC time; when it works as a slave, set P90.48 and P90.49 to 0.

Function code	Name	Default	Setting range	Description
P90.48	Traction machine ACC time	15.00s	0.00–300.00s	-
P90.49	Traction machine DEC time	15.00s	0.00–300.00s	-

6.15.15.6 Roll diameter calculation

- **Initial roll diameter selection**

Set any one of P05.01–P05.06 to 80 or 81.

The following table lists the initial roll diameter selection methods (DI1=80, DI2=81).

DI2	DI1	Initial roll diameter	
OFF	OFF	P90.18 (Winding)	P90.22 (Unwinding)
OFF	ON	P90.19 (Winding)	P90.23 (Unwinding)
ON	OFF	P90.20 (Winding)	P90.24 (Unwinding)
ON	ON	P90.21 (Winding)	P90.25 (Unwinding)

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	80: Initial roll diameter selection 1 81: Initial roll diameter selection 2
P90.17	Max. roll diameter	1200mm	1–10000mm	-
P90.18	Initial roll	80mm	0mm–P90.17	-

Function code	Name	Default	Setting range	Description
	diameter 0 of winding			
P90.19	Initial roll diameter 1 of winding	100mm		
P90.20	Initial roll diameter 2 of winding	120mm		
P90.21	Initial roll diameter 3 of winding	150mm		
P90.22	Initial roll diameter 0 of unwinding	800mm		
P90.23	Initial roll diameter 1 of unwinding	900mm		
P90.24	Initial roll diameter 2 of unwinding	1000mm		
P90.25	Initial roll diameter 3 of unwinding	1200		
P90.27	Roll diameter reset method selection	0	0–2	0: Terminal 1: Stop 2: Communication reset (set to 2, auto changed to 0, reset once)

- **Roll diameter calculation**

Set P90.16 to select a roll diameter calculation method.

Function code	Name	Default	Setting range	Description
P90.16	Roll diameter calculation method	0	0–10	0: No calculation 1: Linear speed calculation method 2: PG thickness accumulation

Function code	Name	Default	Setting range	Description
				method 3: HDIA 4: HDIB (Only one from HDIA and HDIB can be selected) 5: Reserved 6: AI1 calibration method 7: AI2 calibration method 8: AI3 calibration method 9: SVC evaluation method 10: Reserved (Automatic identifying switchover)

No roll diameter calculation: P90.16=0

Control applications without winding do not need roll diameter calculation.

Calculation method based on linear speed: P90.16=1

This calculation method is not related to material thickness, applicable to wires. You need to set P90.32=0 in this case. The calculation method is based on the linear speed and running frequency in real time, and errors are not cumulative. When the linear speed is lower than P90.28, keep the present roll diameter value without calculation. When the linear speed is higher than P90.28, the roll diameter calculation needs to be performed again. When selecting the method, certain conditions must be met for Linear speed setting, and P90.06 must be set correctly.

PG thickness accumulation method: P90.16=2

This method is applicable to strips. You need to set P90.32=1 in this case. This method does not require a linear speed, and the calculation is cumulative based on the material thickness and the circle count signal, and the calculation result is smooth, but it will accumulate errors.

Note:

- Material thickness is determined by digital input terminal functions 85 (material thickness terminal 1) and 86 (material thickness terminal 2).

Material thickness terminal 2 (0: Invalid; 1: Valid)	Material thickness terminal 1 (0: Invalid; 1: Valid)	Material thickness
0	0	P90.34
0	1	P90.35

Material thickness terminal 2 (0: Invalid; 1: Valid)	Material thickness terminal 1 (0: Invalid; 1: Valid)	Material thickness
1	0	P90.36
1	1	P90.37

- For each motor rotation of i×k turns, the roll diameter increases by twice the material thickness (i is the transmission ratio P90.06, and k is the number of turns per layer).

Setting through the high-speed pulse: P90.16=3 or 4

It is applicable to scenarios where the roll diameter is detected with a roll diameter detection sensor, in which P90.17 (Max. roll diameter) must be set correctly.

Setting through analog: P90.13=6, 7, or 8

For applications where the roll diameter is detected with a roll diameter detection sensor, in which P90.17 (Max. roll diameter) must be set correctly. For example, if you set P90.16 =1 (Set by AI1), 100.0% of AI1 input corresponds to the roll diameter specified by P90.17.

SVC evaluation method: P90.16=9

When the motor driving mode is SVC, the roll diameter is calculated based on the evaluation of motor rotation speed.

Function code	Name	Default	Setting range	Description
P90.06	Reel mechanical transmission rate	1.00	0.01–300.00	When the roll diameter is calculated based on the linear speed, a great reel mechanical transmission rate indicates a great roll diameter. Refer to this rule, and calibrate the parameter according to the deviation of the calculated value of the roll diameter from the actual value. Reel mechanical transmission rate = Motor rotation speed/Reel rotation speed = Reel diameter/Motor shaft diameter
P90.28	Min. linear speed for roll diameter calculation	15.0m/min	0.1–300.0m/min	-

Function code	Name	Default	Setting range	Description
P90.29	Roll diameter calculation interval time	1.000s (P90.16=1) 0.000s (P90.16=Other)	0.000–30.000s	-
P90.30	Roll diameter calculation monotonicity selection	1	0–1	0: No requirement 1: Increasing only for winding, and decreasing only for unwinding
P90.31	Roll diameter change rate 1	0.10mm/T (P90.16=1) 0.00mm/T (P90.16=Other)	0.00: No limit 0.01mm/T–P90.26	-
P90.41	Roll diameter calculation filter time	3.000s	0.000–10.000s	A great setting value indicates a smoother roll diameter calculation value, while the delay of the roll diameter change increases.

6.15.15.7 Tension PID control

Set P91.09 to select tension adjustment parameters.

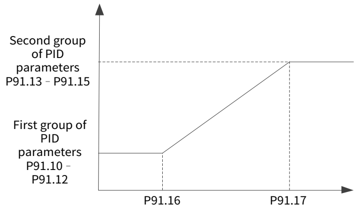
Function code	Name	Default	Setting range	Description
P91.09	PID control parameter selection	0	0–5	Setting range: 0–5 0: Use the first group of parameter 1: Control based on roll diameter (winding/unwinding initial roll diameter has linear change) 2: Control based on frequency 3: Control based on linear speed 4: Control based on deviation 5: Switch over through terminals **Note:** P90.00=6 or 4 (winding); 2 (unwinding)

Fixed to the first group of PID parameter in P91: P91.09=0

Parameters P91.10–P91.12 are used (the first group of PID parameter).

Ratio of present value to max. value: P91.09=1, 2, 3, or 4

If the ratio of present value to max. value is less than P91.16, use P91.10–P91.12 (first group of PID parameter); if the ratio is greater than P91.17, use P91.13–P91.15 (send group of PID parameter); if the ratio is between P91.16 and P91.17, the linear change values are taken between the first group and second group. See the following figure for the linear change.



Terminal based switchover: P91.09=5

Set any one of P05.01–P05.06 to 83 to select different PIDs. By default, if the terminal is not on, the first group (P91.10–P91.12) is selected; if the terminal is on, the second group (P91.13–P91.15) is selected.

Function code	Name	Default	Setting range	Description
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	1 4 7 0 0 0	0–95	83: Tension PID switchover
P91.10	Proportional gain 1	0.200	0.000–30.000	**Note:** When P90.00=6, 0.060 (winding); 0.300 (unwinding)
P91.11	Integral time 1	0.00s	0.00–30.00s	-
P91.12	Differential time 1	0.000s	0.000–30.000s	-
P91.13	Proportional gain 2	0.200	0.000–30.000	**Note:** When P90.00=6, 0.100 (winding); 0.400 (unwinding)
P91.14	Integral time 2	0.00s	0.00–30.00s	-
P91.15	Differential time 2	0.000s	0.000–30.000s	-
P91.16	PID1 switchover	4.00%	0.00–100.00%	-

Function code	Name	Default	Setting range	Description
	point			
P91.17	PID2 switchover point	45.00%	0.00–100.00%	**Note:** When P90.00=6, 45 (winding); 90 (unwinding)

6.15.15.8 Tension setting

When P90.00 is set to 1 or 3 and torque control is used, tension setting must be made. The set torque can be calculated based on the roll diameter and the set tension.

Function code	Name	Default	Setting range	Description
P90.00	Tension control mode	0	0–8	Setting range: 0–8 0: Standard model 1: Open-loop torque mode 2: Closed-loop speed mode 3: Closed-loop torque mode 4: Constant linear speed mode (reserved) 5: Traction mode 6: Standard winding/unwinding mode 7: Direct speed torque mode (inertia/friction compensation required) 8: Cable routing mode (reserved) **Note:** The value 0 indicates the VFD enables general-purpose functions. A non-zero value indicates the VFD enables the tension control function.
P90.55	Tension giving method selection	0	0–7	0: Keypad digital 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB 6: Communication 7: Direct torque setting
P90.56	Reference	0N	0N–P90.57	-

Function code	Name	Default	Setting range	Description
	tension setting through digital			
P90.57	Max. tension	10000N	0–60000N	-
P90.58	Tension giving change time	0.00s	0–60.00s	-

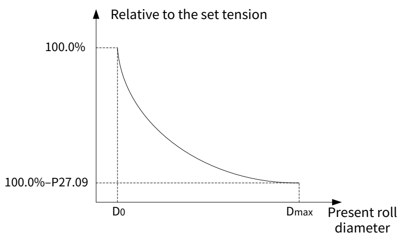
6.15.15.9 Tension taper

Tension taper is generally used for winding, which can control the tension to decrease accordingly as the roll diameter increases, in order to prevent damage to the roll and improve the product curl effect. The VFD provides four tension taper calculation methods.

Method 1 Set P90.61 to 0 to select the inverse proportional curve calculation method. The algorithm is as follows.

$$F = F_0 \times [1 - k(1 - \frac{D_0 + D_1}{D + D_1})]$$

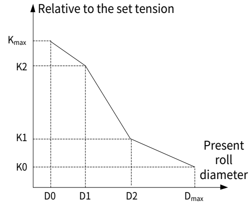
In the algorithm, F_0 is the tension setting, k is the tension taper coefficient, D_0 is the empty-roll diameter, D is the present roll diameter, D_1 is the tension taper compensation used to compensate for the difference between the calculated roll diameter value and the actual roll diameter. See the following figure.



Method 2 Set P90.61 to 1 to select the single-segment linear method.

Mode 3 Set P90.61 to 2 to select the two-segment linear method.

Method 4 Set P90.61 to 3 to select the multi-segment line method (20 segments), which needs to be used in conjunction with P92.08–P92.47. See the following figure.



Function code	Name	Default	Setting range	Description
P90.59	Tension taper input method	0	0–6	0: Digital 1: AI1 (relative to digital tension taper value) 2: AI2 3: AI3 4: HDIA 5: HDIB 6: Communication (2011H: 0.00–100.00%)
P90.60	Digital tension taper	0.00%	0.00–100.00%	-
P90.61	Tension taper type	1	0–3	0: Curve type 1: Single-segment line type (denominator 1000) 2: Two-segment line type (interpolation) 3: 20-segment line type (interpolation)
P90.62	Tension taper compensation value	1mm	0–10000mm	-
P90.63	Middle roll diameter	500	P90.18–90.22	-
P90.64	Middle tension	80.00%	0.00–100.00%	-
P90.65	Tension of max. roll diameter	50.00%	0.00–100.00%	-

6.15.15.10 Multi-segment integration

Multi-segment integration is used to calculate the feedforward gain K1 in the standard winding/unwinding mode, which is also implemented through tension feedback signals (such as from a tension sensor or pendulum). It is suitable for simple tension applications, such as dual-VFD wire drawing machines with a pendulum and a traction main drive. The feedforward gain K1 is calculated by dividing the feedback pendulum position into multiple zones, with integration performed based on the integration time set for each zone. At the same time, the real-time speed of the traction main drive needs to be transmitted to the rewinding VFD through the analog output port to respond to the acceleration and deceleration processes of the traction main drive in real time.

Function code	Name	Default	Setting range	Description
P91.33	Deviation 0	4.00%	0.00%–P91.34	-
P91.34	Deviation 1	12.00%	P91.33–P91.35(%)	-
P91.35	Deviation 2	22.00%	P91.34–P91.36(%)	-
P91.36	Deviation 3	37.00%	P91.35–P91.37(%)	-
P91.37	Deviation 4	52.00%	P91.36–P91.38(%)	-
P91.38	Deviation 5	72.00%	P91.37–100.00(%)	-
P91.39	Soft start integral time	167.0s (Winding) 143.0s (Unwinding)	0.0–1000.0s	-
P91.40	Integral time 1	909.0s (Winding) 555.0s (Unwinding)	0.0–1000.0s	-
P91.41	Integral time 2	333.0s (Winding) 200.0s (Unwinding)	0.0–1000.0s	-
P91.42	Integral time 3	133.0s (Winding) 77.0s (Unwinding)	0.0–1000.0s	-
P91.43	Integral time 4	67.0s (Winding) 36.0s (Unwinding)	0.0–1000.0s	-
P91.44	Integral time 5	25.0s (Winding)	0.0–1000.0s	-

Function code	Name	Default	Setting range	Description
		13.5s (Unwinding)		
P91.45	Integral time 6	9.0s (Winding) 5.0s (Unwinding)	0.0–1000.0s	-
P91.46	Deviation integral actual value	0.00%	0.00–500.00%	-
P91.47	Deviation integral action channel selection	0 or 1 (Winding) 2 (Unwinding)	0–4	0: Feedforward gain * AI1 1: Feedforward gain * AI1 2: Feedforward gain * 10V 3: HDIA 4: HDIB
P91.48	Deviation integral range selection	1 (Winding) 2 (Unwinding)	0–2	0: Feedforward gain unchanged 1: 0–Feedforward gain upper limit 2: Negative feedforward gain upper limit – Positive feedforward gain upper limit
P91.49	Deviation integral upper limit	500.00% (Winding) 100.00% (Unwinding)	0.00–500.00%	-
P91.50	Deviation integral gain	50.00% (Winding) 0.00% (Unwinding)	0.00–500.00%	-
P91.51	Deviation integral power-failure memory selection	0x10	0x00–0x11	Ones place: 0: Automatic reset 1: Terminal based reset (sharing the roll diameter reset terminal) Tens place: 0: Save at power failure 1: Not save at power failure

6.15.15.11 Friction compensation

Friction compensation is valid when P90.00 is set to 1 or 3. In the process of material winding or unwinding, there is frictional resistance on the machinery. In the case of winding, for example, the frictional resistance will make the material tension smaller. By appropriately setting the friction compensation value, the friction resistance can be reduced to some extent, and the tension control effect can be improved. The system has inconsistent resistance values at high speed and low speed, and constant tension cannot be obtained throughout the entire process only by using constant friction compensation torque. Proper setting of P90.08–P90.12 can compensate for the effect caused by system resistance.

Function code	Name	Default	Setting range	Description
P90.08	Static friction torque compensation	0.0%	0.0–100.0%	-
P90.09	Dynamic friction torque compensation	0.0%	0.0–100.0%	-
P90.10	Torque compensation corresponding to max. linear speed	0.0%	0.0–100.0%	-
P90.11	Static friction frequency threshold	1.00Hz	0.01Hz–P00.03	-
P90.12	Dynamic friction frequency threshold	5.00Hz	0.01Hz–P00.03	-

6.15.15.12 Inertia compensation

Inertia compensation is valid when P90.00 is set to 1 or 3. In the case of fast ACC/DEC control, at the winding side, materials are apt to loose in the ACC process and materials are apt to tighten in the DEC process; at the unwinding side, materials are apt to tighten in the ACC process and materials are apt to loose in the DEC process. Inertia compensation is required in these cases.

When the keypad is used as the control channel and there are empty axes, setting P03.44 to 1 allows inertia recognition of the mechanical system and give the VFD the start command. If the motor runs for a long period of time, stop the VFD and increase the value of P03.43, and then restart the VFD. During inertia identification, the motor starts the

ACC/DEC process twice. When the inertia identification is completed, the VFD stops automatically, and P03.44 is updated to 0 automatically.

Function code	Name	Default	Setting range	Description
P03.40	Enabling inertia compensation	0	0–1	0: Disable 1: Enable
P03.41	Inertia compensation torque upper limit	10.0%	0.0–150.0% (of the motor rated torque)	The max. inertia compensation torque is limited to prevent inertia compensation torque from being too large.
P03.42	Inertia compensation filter times	7	0–10	Filter times of inertia compensation torque, used to smooth inertia compensation
P03.43	Inertia identification torque	10.0%	0.0–100.0% (of the motor rated torque)	Due to friction force, certain identification torque needs to be set for the inertia identification to be performed properly.
P03.44	Enabling motor inertia identification	0	0–1	0: No operation 1: Enable
P90.45	Material density	0kg/m³	0–60000kg/m³	-
P90.46	Material inertia	0.00kg・m²	0.00–300.00 kg・m²	-
P90.47	Mechanical inertia	0.00kg・m²	0.00–300.00 kg・m²	-
P90.50	Inertia compensation torque value	0.0%	0.0–300.0%	Display
P90.51	Linear ACC	0.00m/s²	-99.00–99.00m/s²	Display
P90.52	Inertia compensation ACC/DEC time	0.100s	0.000–10.000s	-

6.15.15.13 Related I/O parameters

Function code	Name	Default	Setting range	Description
P05.00	HDI input type	0x00	0x00–0x11	Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input
P05.01	Function of S1	1	0–95	0: No function 73: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving 79: Trigger a forcible material feeding interrupt signal 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 83: Tension PID switchover 84: Pause PID 85: Thickness switchover selection 1 86: Thickness switchover selection 2 87: Clear length 88: Stop roll diameter calculation
P05.02	Function of S2	4		
P05.03	Function of S3	7		
P05.04	Function of S4	0		
P05.05	Function of HDIA	0		
P05.06	Function of HDIB	0		
P06.00	HDO output type	0	0–1	0: Open collector high-speed pulse output. The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For details about the related functions, see P06.02.
P06.01	Y1 output	0	0–63	0: Invalid 1: Running 2: Running forward 3: Running reversely 4: Jogging 5: VFD in fault 53: Specified roll diameter reached 54: Roll diameter of stop reached 55: Length reached

7 Communication

7.1 Standard communication interface

The VFD provides RS485 communication as a standard function. The following table lists the communication interfaces and terminals.

Table 7-1 RJ45 interface definition

Interface	Network signal	Signal description	Description
RJ45 interface	RS485+ RS485-	RS485 communication	Internal RS485 communication terminal, used to connect to the external keypad or PC. The interface type is RJ45.
	CANH CANL	CAN communication	Internal CAN communication terminal. The interface type is RJ45. The CAN communication supports CANopen.
	15V GND	External keypad power supply	Voltage is accurate to 10% and current to 100mA.

Table 7-2 Standard communication terminal

Interface	Network signal	Signal description	Description
I/O terminal	485+ 485-	RS485 communication	Terminal for external RS485 communication, supporting the Modbus communication protocol

7.2 Communication data address

The communication data includes VFD-related function parameter data, VFD status parameter data, and VFD control parameter data.

7.2.1 Function parameter address

The address of a function code consists of two bytes, with the MSB on the left and LSB on the right. Both the MSB and LSB also range from 00 to ffH. The MSB is the hexadecimal form of the group number on the left of the dot mark, and LSB is that of the number on the right of the dot mark. Take P05.06 as an example. The group number is 05, that is, the MSB of the parameter address is the hexadecimal form of 05; and the number on the right of the dot mark is 06, that is, the LSB is the hexadecimal form of 05. Therefore, the function code address is 0506H in the hexadecimal form. For P10.01, the parameter address is 0A01H.

Note:

- The parameters in the P99 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.
- Frequently writing to EEPROM will reduce its life time. 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 highest-order bit 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.

7.2.2 Non-function parameter address

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as starting and stopping it, and monitoring the operation status of the VFD. The following describes status parameter data addresses and control parameter data addresses.

1. Status parameters

Note: Status parameters are read only.

Parameter	Address	Description
VFD status word 1	2100H	0001H: Forward running
		0002H: Running reversely
		0003H: Stopped
		0004H: Faulty
		0005H: In POFF state
		0006H: In pre-exciting state
VFD status word 2	2101H	Bit0： =0: Not ready to run =1: Ready to run Bit2–Bit1: =00: Motor 1 =01: Motor 2 Bit3: =0: AM =1: SM Bit4: = 0: No pre-alarm upon overload =1: Overload pre-alarm Bit6–Bit5=00: Keypad-based control

Parameter	Address	Description
		=01: Terminal-based control =10: Communication-based control Bit 7: Reserved Bit8: =0: Speed control =1: Torque control Bit9: =0: Non position control =1: Position control Bit11–Bit10: =0: Vector 0 =1: Vector 1 =2: Closed-loop vector = 3: Space voltage vector
VFD fault code	2102H	See the description of fault types.
VFD identification code	2103H	0x01a0
Running frequency	3000H	0–Fmax (Unit: 0.01Hz)
Set frequency	3001H	0–Fmax (Unit: 0.01Hz)
Bus voltage	3002H	0.0–2000.0V (Unit: 0.1V)
Output voltage	3003H	0–1200V (Unit: 1V)
Output current	3004H	0.0–3000.0A (Unit: 0.1A)
Rotation speed of running	3005H	0–65535 (Unit: 1 RPM)
Output power	3006H	-300.0–300.0% (Unit: 0.1%)
Output torque	3007H	-250.0–250.0% (Unit: 0.1%)
Closed-loop setting	3008H	-100.0–100.0% (Unit: 0.1%)
Closed-loop feedback	3009H	-100.0–100.0% (Unit: 0.1%)
Input I/O state	300AH	0x00–0x3F Corresponding to the local HDIB/ HDIA/S4/S3/S2/S1
Output I/O state	300BH	0x00–0x0F Corresponding to local RO2/RO1/HDO/Y1
Analog input 1	300CH	0.00–10.00V (Unit: 0.01V)
Analog input 2	300DH	0.00–10.00V (Unit: 0.01V)
Analog input 3	300EH	-10.00–10.00V (Unit: 0.01V)
Analog input 4	300FH	-
Read input of HDIA high-speed pulse	3010H	0.00–50.00kHz (Unit: 0.01Hz)
Read input of HDIB	3011H	-

Parameter	Address	Description
high-speed pulse		
Read the actual step of multi-step speed	3012H	0–15
External length value	3013H	0–65535
External counting value	3014H	0–65535
Torque setting	3015H	-300.0–300.0% (Unit: 0.1%)
VFD identification code	3016H	-
Fault code	5000H	-

2. Control parameter

Note: VFD control parameters can be read and written.

Parameter	Address	Description
Communication-based control command	2000H	0001H: Forward running
		0002H: Reverse running
		0003H: Forward jogging
		0004: Reverse jogging
		0005H: Stop
		0006H: Coast to stop
		0007H: Fault reset
		0008H: Jogging to stop
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax; unit: 0.01 Hz)
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)
	2003H	PID feedback (0–1000, in which 1000 corresponds to 100.0%)
	2004H	Torque setting (-3000–3000, in which 1000 corresponds to 100.0% of the motor rated current)
	2005H	Upper limit setting of forward running frequency (0–Fmax; unit: 0.01 Hz)
	2006H	Upper limit setting of reverse running frequency (0–Fmax; unit: 0.01 Hz)
	2007H	Electromotive torque upper limit (0–3000, in which 1000

Parameter	Address	Description
		corresponds to 100.0% of the motor rated current)
	2008H	Braking torque upper limit. (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
	2009H	Special control command word Bit1–Bit0: = 00: Motor 1 =01: Motor 2 Bit2: =1 Enable speed/torque control switchover =0: Disable speed/torque control switchover Bit3: =1 Clear electricity consumption data =0: Keep electricity consumption data Bit4: =1 Enable pre-excitation =0: Disable pre-excitation Bit5=1: Enable DC braking =0: Disable DC braking
	200AH	Virtual input terminal command. Range: 0x000–0x3FF (corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1 in sequence)
	200BH	Virtual output terminal command (0x00–0x0F) Corresponding to local RO2/RO1/HDO/Y1
	200CH	Voltage setting (used for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the motor rated voltage)
	200DH	AO setting 1 (-1000–+1000, in which 1000 corresponding to 100.0%)
	200EH	AO setting 2 (-1000–+1000, in which 1000 corresponding to 100.0%)

Note: When control operations are performed on the VFD, some parameters take effect only after the associated function has been enabled. For example, for the running or stop operation, you must set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to "Modbus".

The following table describes the encoding rules of device codes (corresponding to the identification code 2103 H of the VFD).

8 MSBs	Meaning	8 LSBs	Meaning
0x01	Goodrive	0x08	GD35 series VFD
		0x09	GD35-H1 series VFD
		0x0a	GD300 series VFD
		0xa0	Goodrive350 vector VFD

7.3 Modbus networking

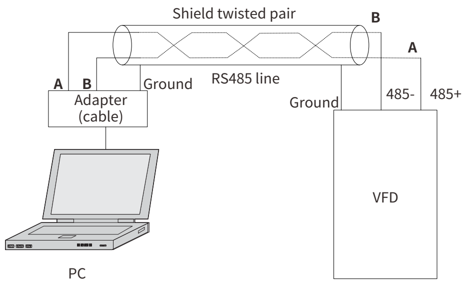
A Modbus network is a control network with one master and multiple slaves, that is, on one Modbus network, there is only one device serving as the master, and other devices are the slaves. The master can communicate with any single slave or with all slaves. For separate access commands, a slave needs to return a response. For broadcast information, slaves do not need to return responses.

Generally, the PC, industry control device, or programmable logic controller (PLC) functions as the master, while VFDs function as slaves.

7.3.1 Network topology

Application to one VFD

Figure 7-1 Application to one VFD



Application to multiple VFDs

In practical application to multiple VFDs, the daisy chain connection and star connection are commonly used.

Figure 7-2 Practical daisy chain connection application

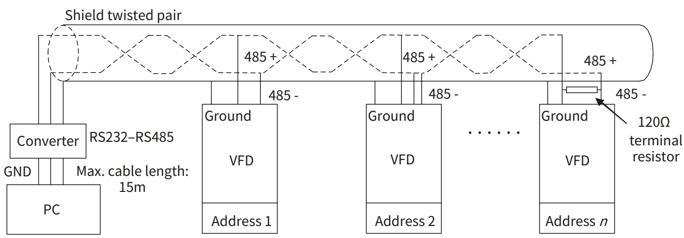
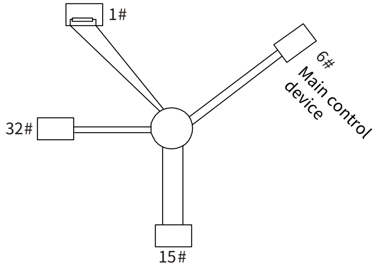


Figure 7-3 shows the star connection. When this connection mode is adopted, the two devices that are farthest away from each other on the line must be connected with a terminal resistor (the two devices are devices #1 and #15).

Figure 7-3 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 duplicated.

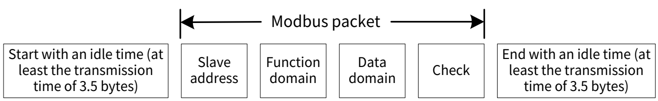
7.3.2 RTU mode

7.3.2.1 RTU communication frame structure

When a controller is set to use the RTU communication mode on a Modbus network, every byte (including 8 bits) in the message includes 2 hexadecimal characters (each includes 4 bits). Compared with the ASCII mode, the RTU mode achieves transmission of more data at the same baud rate.

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, 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.

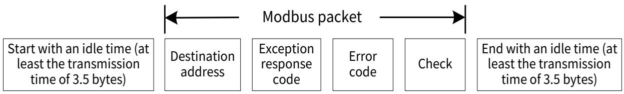
RTU data frame format



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.

If the slave detects a communication fault or read/write failure due to another cause, an error frame is replied.

RTU data frame format



The following table describes the 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 parameter; 06H: Write slave parameter
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 (transmission time of 3.5 bytes)

7.3.2.2 RTU communication frame error check methods

During the transmission of data, errors may occur due to various factors. Without error 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 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).

7.3.2.3 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.

7.3.2.4 Cyclic redundancy check (CRC)

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, stop, and parity 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 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 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.

7.3.3 RTU command code

7.3.3.1 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, if the master reads two contiguous pieces of data (that is, to read content from the data addresses 0004 H and 0005 H) from the VFD whose address is 01H, the command frame structure is described in the following.

RTU master command (from the master to the VFD) is as follows:

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)

"T1-T2-T3-T4 (transmission time of 3.5 bytes)" in "START" and "END" indicates that the RS485 communication needs to be 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" is "01H", indicating that the command is sent to the VFD whose address is 01H. "ADDR" occupies one byte.

"CMD" is "03H", indicating that the command is used to read data from the VFD. "CMD" occupies one byte.

"Start address" indicates the address from which data is read. "Start address" 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", which indicates reading data from the addresses 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) is as follows:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
Number of bytes	04H
Address 0004H data MSB	13H
Address 0004H data LSB	88H
Address 0005H data MSB	00H
Address 0005H data LSB	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 command is sent from the VFD whose address is 01H. "ADDR" occupies one byte.

"CMD" is "03H", indicating that the message is a VFD response to the 03H command from the master for reading data. "CMD" occupies one byte.

"Number of bytes" indicates the number of bytes between the 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, "Address 0004H data MSB", "Address 0004H data LSB", "Address 0005H data MSB", and "Address 0005H data LSB".

A record 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.

7.3.3.2 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,

RTU master command (from the master to the VFD) is as follows:

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 data content	13H
LSB of data content	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) is as follows:

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 data content	13H

LSB of data content	88H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

7.3.3.3 Command code 10H, continuous writing

The command code 10H is used by the master to write data to the VFD. The quantity of data to be written is determined by "Data quantity", and a maximum of 16 pieces of data can be written.

For example: Writing 5000 (1388H) and 50 (0032H) to 0004H and 0005H of the VFD (as the slave) whose address is 02H

RTU master command (from the master to the VFD) is as follows:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H
Number of bytes	04H
MSB of data 0004H content	13H
LSB of data 0004H content	88H
MSB of data 0005H content	00H
LSB of data 0005H content	32H
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) is as follows:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H

CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

7.3.4 Fieldbus scale

In practical applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. You can multiply a non-integer by a multiple to obtain an integer, in which the multiple is considered 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*. For example:

Function code	Name	Description	Setting range	Default
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid only when P01.19 ones place=2)	0.00–3600.0	0.0s

The value specified in "Setting range" or "Default" contains one decimal place, and therefore the fieldbus scale is 10. If the value received by the master is 50, "Delay of auto fault reset" of the VFD is 5.0 (5.0=50/10).

To set "Wake-up-from-sleep delay" 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**	**01 14**	**00 32**	**49 E7**
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 sending the "Wake-up-from-sleep delay" 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, and therefore 5.0 is obtained based on the fieldbus scale (50/10=5.0). Then, the master confirms that the wake-up-from-sleep delay is 5.0s.

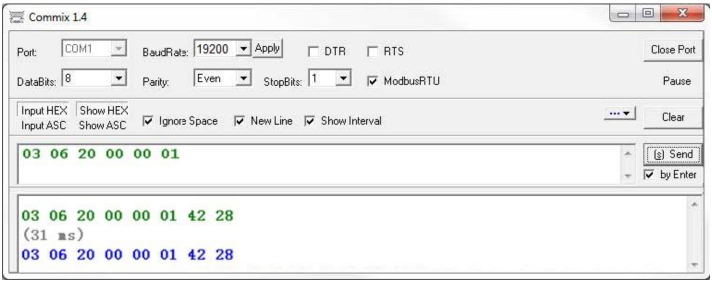
7.3.5 Error message response

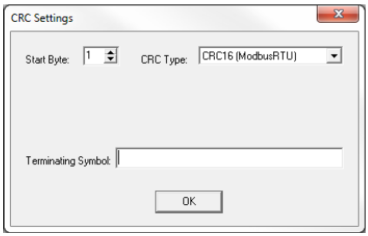
Error message responses are sent from the VFD to the master. The following table lists the codes and definitions of the error message responses.

Code	Name	Meaning
01H	Invalid command	The command code received by the host controller 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 VFD, the data address in the request of the host controller 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.
04H	Operation failure	The parameter setting is invalid in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that specified by P07.00.
06H	Incorrect data frame	The data frame sent from the host controller is incorrect in the length, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the host controller is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the host controller cannot be modified during the running of the VFD.
09H	Password protection	If the host controller 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.

7.3.6 Communication commissioning

In the following example, a PC is used as the master, an RS232-RS485 converter is used for signal conversion, and the PC serial port used by the converter is COM1 (an RS232 port). The host controller commissioning software is the serial port commissioning assistant Commix1.4, 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.





Set **Port** to **COM1**. Set **BaudRate** consistently with P14.01. **DataBits**, **Parity**, and **StopBits** must be set consistently with P14.02. If the RTU mode is selected, choose **Input HEX** and **Show HEX**. To implement automatic CRC, you need to choose **ModbusRTU**, and set **Start Byte** to **1** and **CRC Type** to **CRC16 (MODBU SRTU)** in the **CRC Settings** window. After the automatic CRC is enabled, do not enter CRC in commands. Otherwise, command errors may occur due to repeated CRC.

The commissioning command for setting the VFD whose address is 03H to run forward is as follows:

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

Note:

- The VFD address (P14.00) must be set to 03.
- "Channel of running commands" (P00.01) must be set to "Communication", and

"Communication channel of running commands" (P00.02) to the Modbus channel.

- Click **Send**. If the line configuration and settings are correct, a response from the VFD is received.

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

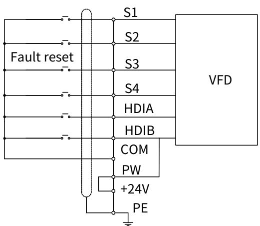
8 Fault handling

8.1 Fault indication and reset

When the TRIP indicator is on, the VFD is in abnormal state, with the keypad showing the fault code. For details about fault causes and solutions, see section 8.2 Faults and solutions. If the fault cause cannot be located, contact our local office for technical support. There are three methods to reset VFD faults:

Method 1 Press the  key on the keypad.

Method 2 Set the corresponding parameter in P05.01–P05.06 to 7 for fault reset.



Method 3 Cut off the VFD power supply.

8.2 Faults and solutions

When a fault occurred, handle the fault as follows:

Step 1 Check whether the keypad display is improper. If yes, contact the local INVT office.

Step 2 If no, check the function codes in P07 group to determine the real state when the fault occurred.

Step 3 Check the following table for the exception and solution.

Step 4 Rectify the fault or ask for help.

Step 5 After confirming the fault is removed, perform fault reset, and start running.

8.2.1 Common faults and solutions

Fault code display	Fault type	Possible cause	Solution
OUt1	[1] Inverter unit U-phase protection	● ACC/DEC is too fast. ● IGBT module damaged. ● Maloperation caused by interference. ● Drive wires are poorly connected. ● To-ground short circuit occurred. ● Sparks occurred inside due to poor use environment conditions.	● Increase ACC/DEC time. ● Replace the inverter unit. ● Check whether the devices and system are grounded reliably. ● Check for loose drive wires. ● Check for abnormal motor wiring and motor-to-ground short connection. ● Remove the dust or oil stain inside the VFD regularly.
OUt2	[2] Inverter unit V-phase protection		
OUt3	[3] Inverter unit W-phase protection		
OC1	[4] Overcurrent during ACC	● ACC/DEC is too fast. ● Grid voltage is too low. ● VFD power is too small. ● Load transient or exception occurred. ● 3PH output current imbalance. ● There are strong external interference sources (contactor switchover or improper grounding).	● Increase ACC/DEC time. ● Increase grid input voltage. ● Select a VFD with larger power. ● Check for motor stalling, short connection, and load device exceptions. ● Check for abnormal VFD 3PH output voltage and motor 3PH resistance imbalance. ● Check for strong interference (whether motor cable far away from contactor and system grounded reliably).
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent during constant speed running		
OV1	[7] Overvoltage during ACC	● ACC/DEC time is too short. ● Abnormal input voltage. ● Start during motor	● Increase ACC/DEC time. ● Check the input voltage. ● Use the speed-tracking start function.
OV2	[8] Overvoltage during DEC		

Fault code display	Fault type	Possible cause	Solution
OV3	[9] Overvoltage during constant speed running	rotating. ● Load energy regeneration is too large. ● Dynamic brake is not enabled.	● Add dynamic braking devices or regenerative units. ● Set dynamic braking function parameters.
UV	[10] Bus undervoltage	● Grid voltage is too low. ● Abnormal bus voltage display. ● Abnormal precharge contactor closing.	● Increase grid input voltage. ● Contact us. ● Contact us.
OL1	[11] Motor overload	● Grid voltage is too low. ● Motor rated current is set incorrectly. ● Motor stall or load jumps violently.	● Increase grid input voltage. ● Reset the motor rated current in the motor parameter group. ● Check the load and adjust torque boost.
OL2	[12] VFD overload	● ACC is too fast. ● The motor is restarted during rotating. ● Grid voltage is too low. ● Load is too heavy. ● VFD power is too small.	● Increase ACC time. ● Avoid restart upon stop or enable speed-tracking start. ● Increase grid input voltage. ● Select a VFD with larger power.
SPI	[13] Phase loss on input side	● Phase loss or violent fluctuation occurred on inputs RST. ● Input-side screws are loose.	● Check for abnormal input power and loose input cables. ● Set P11.00 to screen out the fault.
SPO	[14] Phase loss on output side	● Output cables are broken or short connected to the ground. ● UVW phase loss (or the three phases of load are	● Check for loose or broken output cables. ● Check for sharp load fluctuation and motor 3PH resistance imbalance.

Fault code display	Fault type	Possible cause	Solution
		seriously asymmetrical).	
OH1	[15] Rectifier module overheating	● Air duct is blocked or fan is damaged. ● Ambient temperature is too high. ● Long-time overload running.	● Ventilate the air duct or replace the fan. ● Keep good ventilation to lower ambient temperature. ● Select a VFD with larger power.
OH2	[16] Inverter module overheating		
EF	[17] External fault	● S terminal external fault input signal action.	● Check whether external device input is normal.
CE	[18] RS485 communication fault	● Incorrect baud rate ● Communication line fault. ● Incorrect communication address. ● Communication suffers from strong interference.	● Set a proper baud rate. ● Check the communication port wiring. ● Set the communication address correctly. ● You are recommended to use shielded cables to improve anti-interference.
ItE	[19] Current detection fault	● Abnormal motor cable or motor insulation. ● Hall cable in poor contact. ● Hall component or current sampling optocoupler damaged.	● Remove motor cables to check. ● Check the Hall cable connector. ● Contact us.
tE	[20] Motor autotuning fault	● Motor capacity does not match with the VFD capacity. This fault may occur if the capacity difference exceeds five power classes. ● Incorrect motor parameter setting. ● The parameters gained	● Change the VFD model, or adopt V/F mode for control ● Check motor wiring, motor type, and parameter settings. ● Empty the motor load and re-perform autotuning.

Fault code display	Fault type	Possible cause	Solution
		from autotuning deviate sharply from the standard parameters. ● Autotuning timeout. ● Pulse current setting is too large.	● Check whether the upper limit frequency is larger than 2/3 of the rated frequency. ● Decrease the pulse current setting properly.
EEP	[21] EEPROM operation fault	● Error in reading or writing control parameters ● EEPROM damaged.	● Press STOP/RST to reset. ● Replace the main control board.
PIDE	[22] PID feedback offline fault	● PID feedback offline. ● PID feedback source disappears.	● Check PID feedback signal wires. ● Check PID feedback source.
bCE	[23] Braking unit fault	● Fault occurred to the braking circuit or the braking pipe is damaged. ● External braking resistor with small resistance.	● Check the braking unit, and replace with new braking pipe ● Increase the braking resistance.
END	[24] Running time reached	● Actual VFD running time longer than internally set running time.	● Contact us.
OL3	[25] Electronic overload fault	● The VFD reports overload pre-alarm according to the setting.	● Check whether the overload pre-alarm point is set properly.
PCE	[26] Keypad communication fault	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad or mainboard communication circuit error	● Check the keypad cable and re-plug to determine whether a fault occurs. ● Check the surroundings to rule out interference source ● Replace the hardware and seek maintenance services.

Fault code display	Fault type	Possible cause	Solution
UPE	[27] Parameter upload error	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad or mainboard communication circuit error	● Check the keypad cable and re-plug to determine whether a fault occurs. ● Check the surroundings to rule out interference source ● Replace the hardware and seek maintenance services.
DNE	[28] Parameter download error	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad data storage error	● Check the surroundings to rule out interference source ● Replace the hardware and seek maintenance services. ● Back up the data in the keyboard again, and check whether the version of the original control board software of parameter copy is the same as the version of the control board software to be downloaded.
ETH1	[32] To-ground short-circuit fault 1	● The output of the VFD is short circuited to the ground. ● Current detection circuit fault. ● Actual motor power setup deviates sharply from the VFD power.	● Check whether the motor is short circuited to the ground and wiring is normal. ● Check whether the motor wiring is normal. ● Replace the hall component. ● Replace the main control board. ● Reset the motor parameters properly.
ETH2	[33] To-ground short-circuit fault 2		

Fault code display	Fault type	Possible cause	Solution
dEu	[34] Speed deviation fault	● The load is too heavy or stalled.	● Check for overload, increase speed deviation detection time, or prolong ACC/DEC time. ● Check motor parameter settings and re-perform motor parameter autotuning. ● Check speed loop control parameter settings.
STo	[35] Mal-adjustment fault	● Load exception. ● Incorrect SM parameter settings. ● Autotuned motor parameters are inaccurate. ● The VFD is not connected to the motor. ● Flux weakening application.	● Check for overload or stalling. ● Check motor parameter and counter EMF settings. ● Re-perform motor parameter autotuning. ● Increase the maladjustment detection time. ● Adjust flux weakening coefficient and current loop parameters.
LL	[36] Electronic underload fault	● The VFD reports underload pre-alarm according to the setting.	● Check the load and overload pre-alarm threshold.
ENC1o	[37] Encoder disconnection fault	● Incorrect encoder line sequence, or signal wires poorly connected. ● The encoder signal is interfered. ● Encoder is damaged.	● Check whether the encoder wiring is normal, and route the encoder cable separately from the power cable. ● Use a shielded cable for the encoder cable, and ensure the shield layer is grounded reliably. Ensure the system is grounded reliably.

Fault code display	Fault type	Possible cause	Solution
			● Replace the encoder with a new one.
ENC1d	[38] Encoder reversal fault	● The encoder speed signal is contrary to the motor running direction.	● Reset encoder direction.
ENC1Z	[39] Encoder Z pulse disconnection fault	● Z signal wires are disconnected.	● Check the wiring of Z signal and perform the wiring again.
OT	[59] Motor overtemperature fault	● Motor overtemperature input terminal is valid. ● The temperature detection resistance is abnormal. ● Long-time overload running or exception occurred.	● Check the wiring of the motor overtemperature input terminal (terminal function 57). ● Check whether the temperature sensor is proper. ● Check the motor and perform maintenance on the motor.
STO	[40] Safe torque off	● Safe torque off function is enabled by external forces.	-
STL1	[41] Exception occurred to safe circuit of channel 1	● The wiring of STO is improper ● Fault occurred to external switch of STO. ● Channel safety circuit hardware fault.	● Check whether terminal wiring of STO is proper and firm enough. ● Check whether the external switch of STO can work properly ● Replace the control board.
STL2	[42] Exception occurred to safe circuit of channel 2		
STL3	[43] Exception occurred to both channel 1 and channel 2	● Hardware fault occurred to STO circuit.	● Replace the control board.
CrCE	[44] Safety code FLASH CRC check fault	● Control board is faulty.	● Replace the control board.

Fault code display	Fault type	Possible cause	Solution
E-Err	[55] Duplicate expansion card type	● The two inserted expansion cards are of the same type	● You should not insert two cards with the same type. Check the type of expansion card, and remove one card after power-off.
ENCUV	[56] Encoder UVW loss	● No electric level variation occurred to UVW signal	● Check the UVW wiring. ● Check whether the encoder is damaged.
F1-Er	[60] Failed to identify the expansion card in card slot 1	● There is data transmission in interfaces of card slot 1, however, it cannot read the card type.	● Check whether the expansion card in the slot is supported. ● Stabilize the expansion card interface after power-off, and check whether the fault persists at next power-on. ● Check whether the insertion port or card slot is damaged. If yes, replace the insertion port or card slot after power-off.
F2-Er	[61] Failed to identify the expansion card in card slot 2	● There is data transmission in interfaces of card slot 2, however, it cannot read the card type.	
F3-Er	[62] Failed to identify the expansion card in card slot 3	● There is data transmission in interfaces of card slot 3, however, it cannot read the card type.	
C1-Er	[63] Communication timeout of expansion card in card slot 1	● There is no data transmission in interface of card slot 1.	
C2-Er	[64] Communication timeout of expansion card in card slot 2	● There is no data transmission in interface of card slot 2.	
C3-Er	[65] Communication timeout of expansion card in card slot 3	● There is no data transmission in interface of card slot 3.	
E-DP	[29] PROFIBUS card communication timeout fault	● No data transmission between the communication card and the host controller	● Check whether the communication card wiring is loose or disconnected.

Fault code display	Fault type	Possible cause	Solution
		(or PLC).	
E-NET	[30] Ethernet card communication timeout fault	● There is no data transmission between the communication card and the host controller.	
E-CAN	[31] CANopen card communication timeout fault	● No data transmission between the communication card and the host controller (or PLC).	
E-PN	[57] PROFINET card communication timeout fault	● No data transmission between the communication card and the host controller (or PLC).	
E-CAT	[66] EtherCAT card communication timeout fault	● No data transmission between the communication card and the host controller (or PLC).	
E-BAC	[67] BACNet card communication timeout fault	● No data transmission between the communication card and the host controller (or PLC).	
E-DEV	[68] DeviceNet card communication timeout fault	● No data transmission between the communication card and the host controller (or PLC).	
SECAN	[58] CAN master/slave card communication timeout fault	● There is no data transmission between the CAN master and slave communication cards.	
S-Err	[69] CAN slave fault	● Fault occurred to one of	● Detect the CAN slave VFD

Fault code display	Fault type	Possible cause	Solution
	in master/slave synchronization	the CAN slave VFDs.	and analyze the corresponding fault cause.
P-E1–P-E10	[45]–[54]: Programmable card customized faults 1–10	● Programmable card user program logic error. ● Programmable card customized fault points experienced malfunctions.	● Check the programmable card user program logic. ● Conduct troubleshooting based on actual customized faults.
OtE1	[70] EC PT100 detected OT	● The EC PT100 temperature sensor obtains inaccurate temperature or it is calibrated inaccurately. ● Equipment or ambient temperature too high.	● Set related parameters for calibration. ● Lower the equipment or ambient temperature.
OtE2	[71] EC PT1000 detected overtemperature fault	● The temperature sensor obtains inaccurate temperature or it is calibrated inaccurately. ● Equipment or ambient temperature too high.	
E-EIP	[72] EtherNet IP communication timeout	● No data transmission between the communication card and the host controller (or PLC).	● Check whether the communication card wiring is loose or disconnected.
E-PAO	[73] No upgrade bootloader	● Upgrade bootloader missing.	● Contact us.
E-AI1	[74] AI1 disconnection	● AI1 input too low. ● AI1 wiring disconnected.	● Connect a 5V or 10mA power source to check whether the input is normal. ● Check the wiring or replace the cable.
E-AI2	[75] AI2 disconnection	● AI2 input too low. ● AI2 wiring disconnected.	
E-AI3	[76] AI3	● AI3 input too low.	

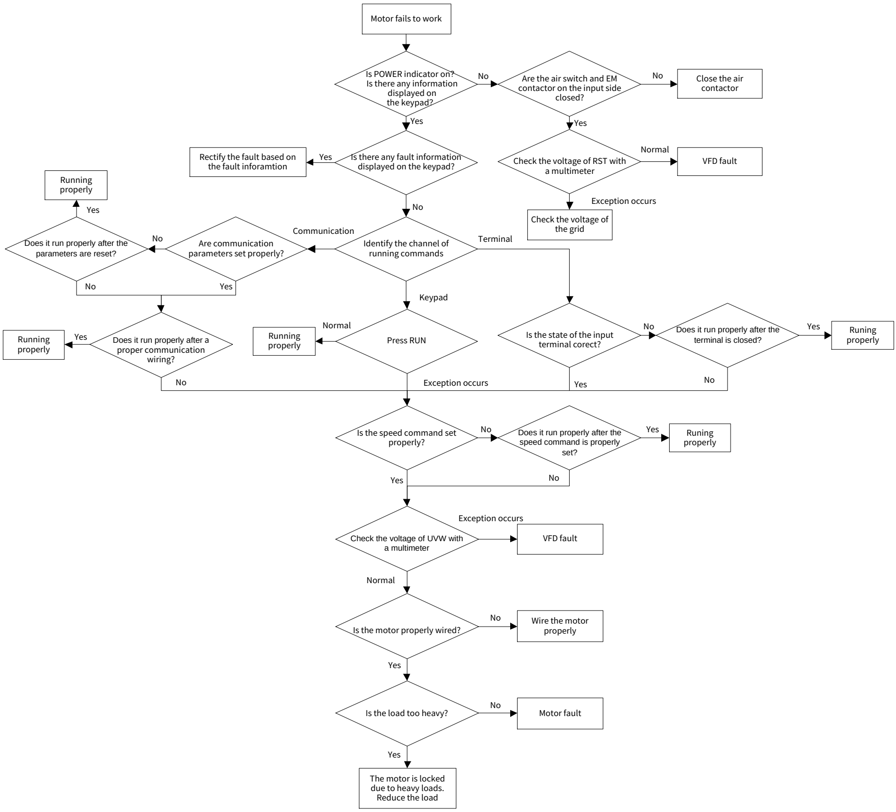
Fault code display	Fault type	Possible cause	Solution
	disconnection	● AI3 wiring disconnected.	

8.2.2 Other status

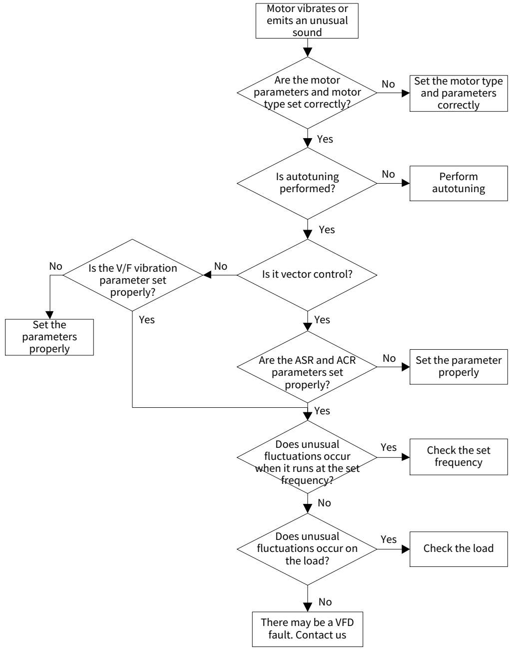
Fault code display	Status type	Possible cause	Solution
PoFF	System power failure	● The system is powered off or the bus voltage is too low.	● Check the grid conditions.

8.3 Analysis on common faults

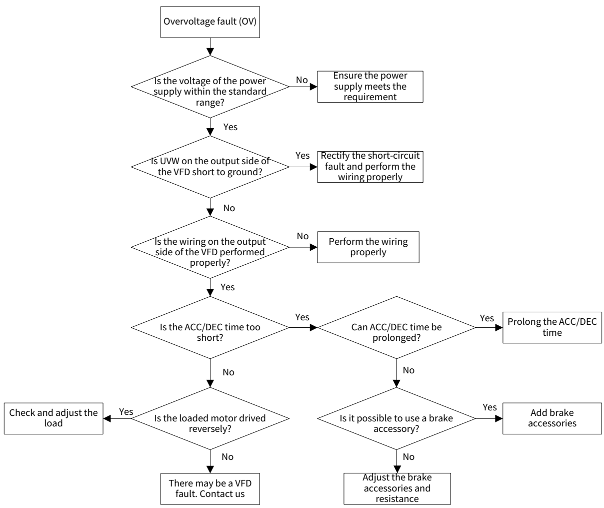
8.3.1 Motor fails to work



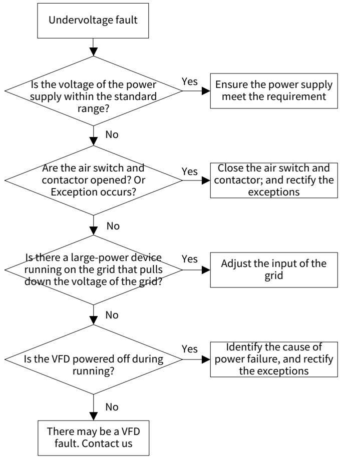
8.3.2 Motor vibrates



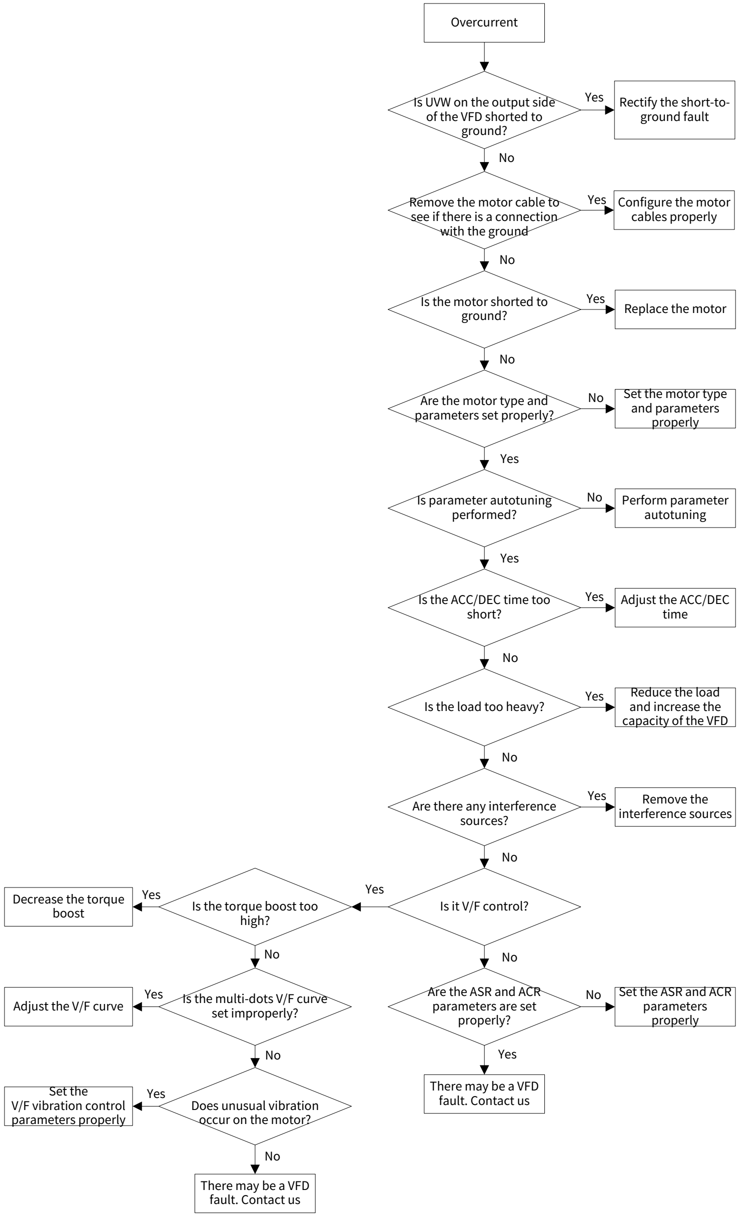
8.3.3 Overvoltage



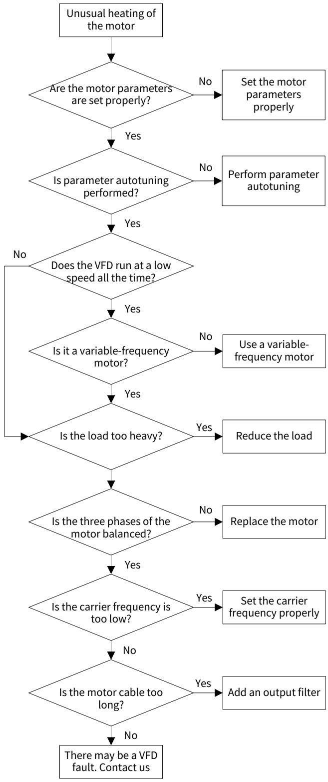
8.3.4 Undervoltage



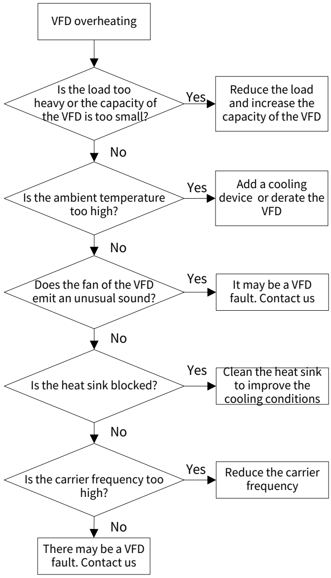
8.3.5 Overcurrent



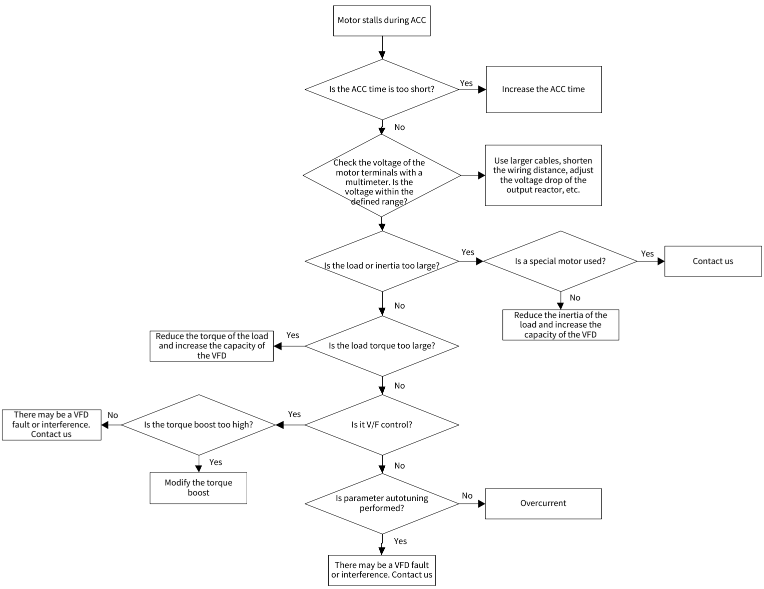
8.3.6 Motor overheating



8.3.7 VFD overheating



8.3.8 Motor stalls during ACC



8.4 Countermeasures on common interference

8.4.1 Interference problems of meter switch and sensors

■ **Symptom and solution**

<table>
<tr><th>Symptom</th><th>Solution</th></tr>
<tr><td>The upper or lower limit is wrongly displayed, for example, 999 or -999.</td><td rowspan="6">● Check and ensure that the sensor feedback cable is 20cm or farther away from the motor cable.
● Check and ensure that the ground wire of the motor is connected to the PE terminal of the VFD (if the ground wire of the motor has been connected to the ground block, you need to use a multimeter to measure and ensure that the resistance between the ground block and PE terminal is lower than 1.5 Ω). At the same time, you can short connect J10 at the VFD input end.
● Try to add a safety capacitor of 0.1μF to the signal end of the feedback signal terminal of the sensor.
● Try to add a safety capacitor of 0.1μF to the power end of the sensor meter (pay attention to the voltage of the power supply and the voltage endurance of the capacitor).
● For interference on meters connected to the AO terminal of the VFD, If AO uses 0–20mA current signal, add a capacitor of 0.47μF between the AO and GND terminals; if AO uses 0–10V voltage signal, add a capacitor of 0.1μF between the AO and GND terminals.
● The signal cable needs to use the shielded cable, and the shield layer must be grounded reliably to the PE or GND.</td></tr>
<tr><td>The display of values jumps (usually occurring on pressure transmitters).</td></tr>
<tr><td>The display of values is stable, but there is a large deviation, for example, the temperature is dozens of degrees higher than the common temperature (usually occurring on thermocouples).</td></tr>
<tr><td>A signal collected by a sensor is not displayed but functions as a drive system running feedback signal. For example, the VFD is expected to decelerate when the upper pressure limit of the compressor is reached, but in actual running, it starts to decelerate before the upper pressure limit is reached.</td></tr>
<tr><td>All kinds of meters (such as frequency meter and current meter) connected to the VFD AO terminals display very inaccurate values.</td></tr>
<tr><td>Proximity switches are used in the system. After the VFD is started, the indicator of a proximity switch flickers, and the output level flips.</td></tr>
</table>

Note:

- When a decoupling capacitor is required, add it to the terminal of the device connected to the sensor. For example, if a thermocouple is to transmit signals of 0 to 20 mA to a temperature meter, the capacitor needs to be added on the terminal of the temperature meter.; if an electronic ruler is to transmit signals of 0 to 30 V to a PLC signal terminal, the capacitor needs to be added on the terminal of the PLC.

- If a large number of meters or sensors are disturbed, it is recommended that you configure an external C2 filter on the VFD input power end. For details, see section D.3.2 EMC filter.

8.4.2 Interference on RS485 communication

■ **Symptom and solution**

<table>
<tr><th>Symptom</th><th>Solution</th></tr>
<tr><td>The RS485 communication bus is disconnected or in poor contact.</td><td rowspan="3">● Arrange the communication cables and motor cables in different cable trays.
● In multi-VFD application scenarios, adopt the chrysanthemum connection mode to connect the communication cables between VFDs, which can improve the anti-interference capability.
● In multi-VFD application scenarios, check and ensure that the driving capacity of the master is sufficient.
● In the connection of multiple VFDs, you need to configure one 120 Ω terminal resistor on each end.
● Check and ensure that the ground wire of the motor is connected to the PE terminal of the VFD (if the ground wire of the motor has been connected to the ground block, you need to use a multimeter to measure and ensure that the resistance between the ground block and PE terminal is lower than 1.5 Ω). At the same time, you can short connect J10 at the VFD input end.
● Do not connect the VFD and motor to the same ground terminal as the host controller (such as the PLC, HMI, and touch screen). It is recommended that you connect the VFD and motor to the power ground, and connect the host controller separately to a ground stud.
● Try to short the signal reference ground terminal (GND) of the VFD with that of the host controller to ensure that ground potential of the communication chip on the control board of the VFD is consistent with that of the communication</td></tr>
<tr><td>The A and B wires of the RS485 communication bus are connected reversely.</td></tr>
<tr><td>Check whether the communication protocol of the VFD is consistent with that of the host controller. Check whether the communication protocol (such as the baud rate, data bits, and check bit) of the VFD is consistent with that of the host computer.</td></tr>
</table>

Symptom	Solution
	chip of the host controller. ● Try to short GND of the VFD to its ground terminal (PE). ● Try to add a safety capacitor of 0.1μF at the power supply end of the host controller (PLC, HMI, or touch screen). Alternatively, use a magnet ring (Fe-based nanocrystalline magnet rings are recommended). Pass the L/N cable or +/- cable of the host controller power supply through the magnet ring in the same direction and wind around the magnet ring for 8 turns.

8.4.3 Failure to stop and indicator shimmering due to motor cable coupling

■ Symptom and solution

<table>
<tr><th>Symptom</th><th>Solution</th></tr>
<tr><td>● Failure to stop
In a VFD system where an S terminal is used to control the start and stop, the motor cable and control cable are arranged in the same cable tray. After the system is started properly, the S terminal cannot be used to stop the inverter.</td><td rowspan="2">● Check and ensure that the exception signal cable is arranged 20 cm or farther away from the motor cable.
● Add a safety capacitor of 0.1μF between the digital input terminal (S) and the COM terminal.
● Connect the digital input terminal (S) that controls the start and stop to other idle digital input terminals in parallel. For example, if S1 is used to control the start and stop and S4 is idle, you can try to short connect S1 to S4.</td></tr>
<tr><td>● Indicator shimmering
After the VFD is started, the relay indicator, power distribution box indicator, PLC indicator, and indication buzzer shimmer, blink, or emit unusual sounds unexpectedly.</td></tr>
</table>

Note: If the controller (such as PLC) in the system controls more than five VFDs at the same time through digital input terminals (S), this scheme is not applicable.

8.4.4 Leakage current and interference on RCD

■ **Working principle**

VFDs output high-frequency PWM voltage to drive motors. In this process, the distributed capacitance between the internal IGBT of a VFD and the heat sink and that between the stator and rotor of a motor may inevitably cause the VFD to generate high-frequency leakage current to the ground. A residual current operated protective device (RCD) is used to detect the power-frequency leakage current when a grounding fault occurs on a circuit. The application of a VFD may cause maloperation of a RCD.

■ **Rules for selecting RCDs**

- Inverter systems are special. In these systems, it is required that the rated residual current of common RCDs at all levels is larger than 200 mA, and the VFDs are grounded reliably.
- For RCDs, the time limit of an action needs to be longer than that of a next action, and the time difference between two actions need to be longer than 20ms, for example, 1s, 0.5s, or 0.2s.
- For circuits in VFD systems, electromagnetic RCDs are recommended. Electromagnetic RCDs have strong anti-interference capability, and thus can prevent the impact of high-frequency leakage current.

Electronic RCD	Electromagnetic RCD
Low cost, high sensitivity, small in volume, susceptible to voltage fluctuation of the grid and ambient temperature, and weak anti-interference capability	Requiring highly sensitive, accurate, and stable zero-phase sequence current transformer, using permalloy high-permeability materials, complex process, high cost, not susceptible to voltage fluctuation of the power supply and ambient temperature, strong anti-interference capability

■ **Symptom and solution**

<table>
<tr><th>Symptom</th><th>Solution</th></tr>
<tr><td>RCD maloperation at the transient VFD power-on</td><td rowspan="2">● Solution to RCD maloperation (handling the VFD)
Try to remove the jumper cap at "EMC/" from the middle housing of the VFD.
Try to decrease the carrier frequency to 1.5kHz (P00.14=1.5).
Try to modify the modulation method to "3PH</td></tr>
<tr><td>RCD maloperation after VFD running</td></tr>
</table>

	modulation and 2PH modulation" (P08.40=0x0000). ● Solution to RCD maloperation (handling the system power distribution) Check and ensure that the power cable is not soaking in water. Check and ensure that cables are not damaged or spliced. Check and ensure that no secondary grounding is performed on the neutral wire. Check and ensure that the main power cable terminal is in good contact with the air switch or contactor (all screws are tightened). Check 1PH powered devices, and ensure that no earth wires are used as neutral wires by these devices. Do not use shielded cables as VFD power cables and motor cables.

8.4.5 Live device housing

■ **Live device housing description**

After the VFD is started, there is sensible voltage on the housing, and you may feel an electric shock when touching the housing. The chassis, however, is not live (or the voltage is far lower than the human safety voltage) when the VFD is powered on but not running.

■ **Symptom and solution**

Symptom	Solution
Live device housing	● If there is power distribution grounding or ground stud on the site, ground the VFD cabinet housing through the power ground or stud. ● If there is no grounding on the site, you need to connect the motor housing to the VFD grounding terminal PE, and ensure that the jumper at "EMC/J10" at the middle of the VFD housing is shorted already.

9 Inspection and maintenance

9.1 Daily inspection and regular maintenance

The VFD internal components will become aging due to the influence of environmental temperature, humidity, dust, vibration and other factors, which causes the potential failure or shortens the service life. Therefore, to extend the VFD service life and prevent safety hazards, daily inspection and regular maintenance are required.

Check item	Content	Method
Daily inspection: Recommended on each day.		
Ambient environment	Whether the ambient temperature, humidity, vibration, dust, gas, and oil are too great, and whether there is condensation or water droplets inside and outside the machine	Visual inspection, and use instruments for measurement.
	Whether there are foreign matters, such as tools, or dangerous substances placed nearby	Visual inspection
Power supply voltage	Whether the voltage between the main circuit and control circuit is normal	Multimeter or voltage meter
Keypad	Whether display is clear	Visual inspection
	Whether some characters or fields are displayed incompletely	Visual inspection
Fan	Whether it runs normally	Visual inspection
Load	Whether the motor is overloaded or overheating, or it sounds abnormally.	Visual and auditory inspection, instrument based inspection
Regular maintenance: Recommended on a quarterly basis, especially in harsh environments such as with dust, oil, or corrosive gases. Before regular maintenance, cut off the power and wait at least 15 min.		
Complete machine	Whether the bolts become loose or come off	Visual inspection
	Whether the machine is deformed, cracked, or damaged, or the color changes due to overheating and aging	Visual inspection
	Whether much dirt or dust is attached	Visual inspection
	Whether there is abnormal sound or vibration, odor, discoloration (transformer, reactor and fan)	Auditory, olfactory, and visual inspection
Motor	Whether the installation is secure, motor insulation is normal, and the fan runs properly	Instrument or visual inspection

Check item	Content	Method
Cable	Whether there is discoloration, deformation, or damage	Visual inspection
	Whether the cable connectors or bolts become loose	Visual inspection
Connection terminal	Whether there is overheating or damage	Visual inspection, instrument based inspection
Electrolytic capacitor	Whether there is electrolyte leakage, discoloration, cracks, and housing expansion	Visual inspection
	Whether the safety valve is exposed outside	Visual inspection
External braking resistor	Whether there is displacement caused due to overheating	Olfactory and visual inspection
	Whether aging, skin breakage, or wire damage occurs to the resistor cable	Visual inspection, or measuring with a multimeter after removing one cable end
Contactor and relay	Whether there is vibration sound during running	Auditory inspection
	Whether the contacts are in good contact	Visual inspection
Control PCB and connector	Whether the screws and connectors become loose	Screw them up.
	Whether there is unusual smell or discoloration	Olfactory and visual inspection
	Whether there is corrosion or rust stains	Visual inspection
Ventilation duct	Whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets	Visual inspection

For more details about maintenance, contact the local INVT office, or visit our website https://www.invt.com, and choose **Support** > **Services**.

9.2 Replacement of wearing parts

The wearing parts of VFD mainly include the cooling fan and electrolytic capacitor, of which the service life is closely related to the running environment and maintenance condition. In normal use at the ambient temperature of 40°C, the general life time is as follows:

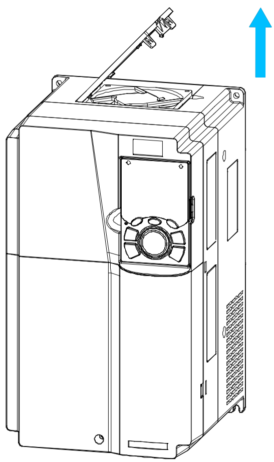
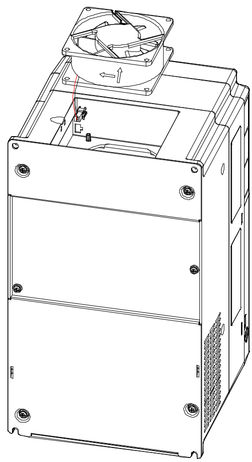
Part	Service life
Fan	⩾ 5 years
Electrolytic capacitor	⩾ 5 years

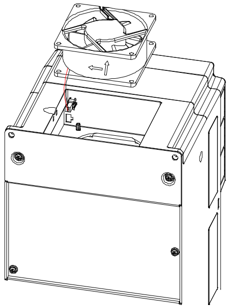
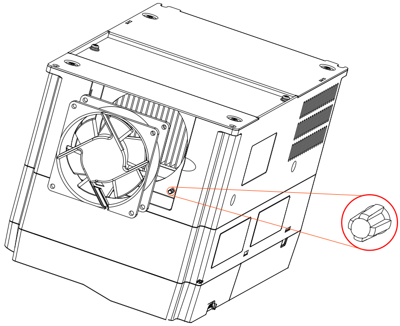
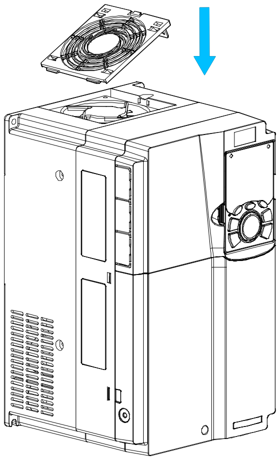
9.2.1 Cooling fan

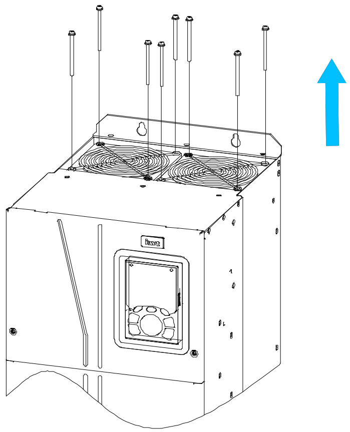
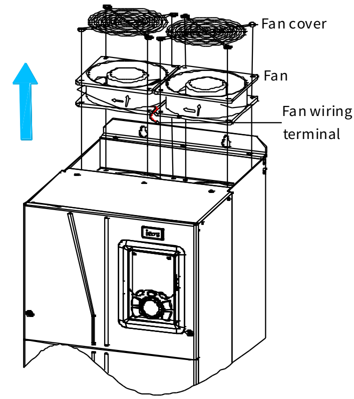
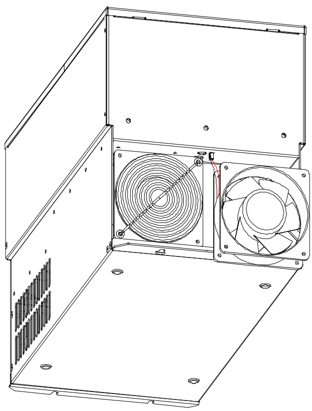
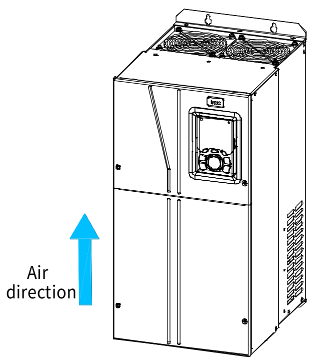
- **Possible damage cause**

  Bearing wear, blade aging, water, oil, dust and other environmental factors may cause circuit board damage.

- **Cooling fan replacement procedure**

<table>
<tr><th colspan="2">Disassembling a fan (380V 75kW or lower)</th></tr>
<tr><td>Step 1 Press the snap of the plastic fan cover gently to remove the fan cover.
</td><td>Step 2 Lift the fan upward, and remove the fan connection terminal.
</td></tr>
<tr><th colspan="2">Assembling a fan (380V 75kW or lower)</th></tr>
<tr><td>Step 1 Insert the fan connection terminal into the power outlet that comes with the machine. See the following figure.</td><td>Step 2 Place the fan into the target mounting area and align the four fixing holes at the fan bottom with the positioning posts.</td></tr>
</table>

	
Step 3 Close the fan cover and press the snap. 	

<table>
<tr><th colspan="2">Disassembling a fan (380V 90–500kW, 660V 110kW or higher)</th></tr>
<tr><td>Step 1 Remove screws from the fan cover with a screwdriver.
</td><td>Step 2 Take out the fan cover and fan, and remove the fan connection terminal.

</td></tr>
<tr><th colspan="2">Assembling a fan (380V 90–500kW, 660V 110kW or higher)</th></tr>
<tr><td>Step 1 Insert the fan connection terminal into the power outlet that comes with the machine. See the following figure.
</td><td>Step 2 When putting the fan and fan cover into the mounting place, align the mounting holes with the fixing holes, and fasten the screws.
Step 3 After replacement, check the air direction and ensure that the fan blows upward.

</td></tr>
</table>

Note:

- Before disassembling or installing the VFD, stop the VFD, cut off the power, and wait at least 15 minutes.
- Different VFD models may be slightly different in the fan quantity and position. The fan disassembly and assembly methods may be different.
- When installing the fan, ensure the air arrow points upward, and regardless of whether the fan is installed at the bottom or the top, to ensure that the fan blows upward.

9.2.2 Electrolytic capacitor

■ **Possible damage cause**

The possible causes include high input power harmonics, high ambient temperature, frequent load jumps, and electrolyte aging.

■ **Filter capacitor replacement**

It is recommended that a professional be asked for the replacement because the filter capacitor involves VFD internal components.

9.3 Reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus electrolytic capacitor before using it. The storage time is calculated from the date the VFD is delivered. For detailed operation, contact us.

Storage time	Operation principle
Less than 1 year	No charging operation is required.
1 to 2 years	Before the first run, apply the voltage of one class lower than the VFD voltage class to the VFD for 1 hour.
2 to 3 years	Use a voltage controlled power supply to charge the VFD: ● Charge the VFD at 25% of the rated voltage for 30 minutes, ● and then charge it at 50% of the rated voltage for 30 minutes, ● at 75% for another 30 minutes, ● and finally charge it at 100% of the rated voltage for 30 minutes.
More than 3 years	Use a voltage controlled power supply to charge the VFD: ● Charge the VFD at 25% of the rated voltage for 2 hours, ● and then charge it at 50% of the rated voltage for 2 hours, ● at 75% for another 2 hours, ● and finally charge it at 100% of the rated voltage for 2 hours.

The method for using a voltage controlled power supply to charge the VFD is described as follows:

The selection of a voltage controlled power supply depends on the power supply of the VFD. For VFDs with an incoming voltage of 1PH/3PH 230 V AC, you can use a 230 V AC/2 A voltage regulator. Both 1PH and 3PH VFDs can be charged with a 1PH voltage controlled power supply (connect L+ to R, and N to S or T). All the DC bus capacitors share one rectifier, and therefore they are all charged.

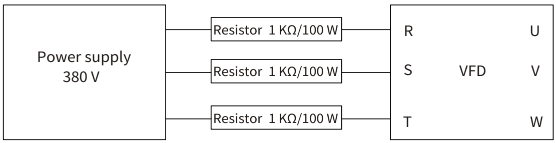
For VFDs of a high voltage class, ensure that the voltage requirement (for example, 380 V) is met during charging. Capacitor changing requires little current, and therefore you can use a small-capacity power supply (2 A is sufficient).

The method for using a resistor (incandescent lamp) to charge the drive is described as follows:

If you directly connect the drive device to a power supply to charge the DC bus capacitor, it needs to be charged for a minimum of 60 minutes. The charging operation must be performed at a normal indoor temperature without load, and you must connect a resistor in series mode in the 3PH circuit of the power supply.

For a 380V drive device, use a resistor of 1 kΩ/100W. If the voltage of the power supply is no higher than 380 V, you can also use an incandescent lamp of 100W. If an incandescent lamp is used, it may go off or the light may become very weak.

Figure 9-1 380V driving-device charging circuit example



Appendix A Derating

If the ambient temperature at the VFD installation site exceeds 40°C, the VFD installation site altitude exceeds 1000m, a ventilation cover is used, or the carrier frequency is higher than the recommended (see P00.14), the VFD needs to be derated.

A.1 Derating due to temperature

When the temperature is higher than +40°C, the rated output current is derated by 1% for each increased 1°C.

Note: It is not recommended to use the VFD at an environment with the temperature higher than 50°C. If you do, we shall not hold accountable for the consequences caused.

A.2 Derating due to altitude

When the VFD installation site altitude is lower than 1000m, the VFD can run at the rated power. When the altitude exceeds 1000m, derate by 1% for every increase of 100m. When the altitude exceeds 3000m, consult our local dealer or office for details.

A.3 Derating due to carrier frequency

The carrier frequency of the VFD varies with power class. The VFD rated power is defined based on the carrier frequency factory setting. If the carrier frequency exceeds the factory setting, the VFD power is derated. For specific derating requirements at different carrier frequencies, see Table A-1, Table A-2, and Table A-3.

Table A-1 Derating for 380V 2–8kHz carrier frequencies

Model	Carrier frequency						
	2kHz	3kHz	4kHz	5kHz	6kHz	7kHz	8kHz
GD350-1R5G-4	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
GD350-2R2G-4	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
GD350-004G-4	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
GD350-5R5G-4	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
GD350-7R5G-4	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
GD350-011G-4	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
GD350-015G-4	100.00%	100.00%	100.00%	90.44%	82.13%	75.00%	68.69%
GD350-018G-4	100.00%	100.00%	100.00%	92.26%	85.42%	79.37%	73.95%
GD350-022G-4	100.00%	100.00%	100.00%	92.40%	85.60%	79.47%	74.00%
GD350-030G-4	100.00%	100.00%	100.00%	100.00%	100.00%	97.70%	90.58%
GD350-037G-4	100.00%	100.00%	100.00%	91.79%	84.56%	78.16%	72.47%

Model	Carrier frequency						
	2kHz	3kHz	4kHz	5kHz	6kHz	7kHz	8kHz
GD350-045G-4	100.00%	100.00%	100.00%	89.52%	80.49%	72.83%	66.20%
GD350-055G-4	100.00%	100.00%	100.00%	90.43%	82.61%	75.22%	69.39%
GD350-075G-4	100.00%	90.33%	82.00%	74.67%	68.20%	62.53%	57.60%
GD350-090G-4	100.00%	89.36%	80.03%	72.09%	65.17%	59.17%	53.94%
GD350-110G-4	100.00%	91.53%	83.95%	77.21%	71.16%	65.81%	60.98%
GD350-132G-4	100.00%	89.23%	80.00%	72.12%	65.38%	59.54%	54.42%
GD350-160G-4	100.00%	100.00%	100.00%	94.26%	86.39%	79.38%	73.18%
GD350-185G-4	100.00%	100.00%	92.50%	84.56%	77.50%	71.21%	65.65%
GD350-200G-4	100.00%	90.92%	82.76%	75.66%	69.34%	63.71%	58.74%
GD350-220G-4	100.00%	100.00%	92.71%	84.47%	77.20%	70.87%	65.27%
GD350-250G-4	100.00%	90.42%	82.08%	74.79%	68.35%	62.75%	57.79%
GD350-280G-4	100.00%	100.00%	94.34%	86.42%	79.34%	73.11%	67.55%
GD350-315G-4	100.00%	91.17%	83.33%	76.33%	70.08%	64.58%	59.67%
GD350-355G-4	100.00%	90.31%	81.92%	74.46%	68.00%	62.31%	57.28%
GD350-400G-4	100.00%	100.00%	97.85%	88.82%	80.83%	73.81%	67.61%
GD350-450G-4	100.00%	94.82%	85.91%	77.99%	70.98%	64.80%	59.37%
GD350-500G-4	100.00%	90.41%	81.92%	74.36%	67.67%	61.79%	56.60%

Table A-2 Derating for 380V 9–15kHz carrier frequencies

Model	Carrier frequency						
	9kHz	10kHz	11kHz	12kHz	13kHz	14kHz	15kHz
GD350-1R5G-4	93.24%	86.49%	81.08%	76.22%	71.89%	67.84%	64.05%
GD350-2R2G-4	94.60%	89.60%	84.60%	80.60%	76.80%	73.00%	69.60%
GD350-004G-4	94.00%	88.42%	83.37%	78.74%	74.53%	70.53%	66.74%
GD350-5R5G-4	93.71%	88.00%	83.00%	78.21%	74.00%	70.14%	66.57%
GD350-7R5G-4	92.97%	86.76%	81.00%	76.00%	71.46%	67.30%	63.68%
GD350-011G-4	93.68%	87.92%	82.64%	77.80%	73.41%	69.28%	65.52%
GD350-015G-4	63.13%	58.28%	54.00%	50.16%	-	-	-
GD350-018G-4	69.11%	64.82%	60.92%	57.37%	-	-	-
GD350-022G-4	69.11%	64.67%	60.71%	57.11%	-	-	-
GD350-030G-4	84.30%	78.72%	73.70%	69.20%	-	-	-
GD350-037G-4	67.44%	62.97%	58.96%	55.36%	-	-	-
GD350-045G-4	60.43%	55.43%	51.09%	47.28%	-	-	-
GD350-055G-4	51.30%	47.48%	44.00%	41.00%	-	-	-
GD350-075G-4	53.27%	49.40%	45.93%	42.87%	-	-	-
GD350-090G-4	49.39%	45.44%	41.94%	38.83%	-	-	-

Model	Carrier frequency						
	9kHz	10kHz	11kHz	12kHz	13kHz	14kHz	15kHz
GD350-110G-4	56.63%	52.74%	49.26%	46.09%	-	-	-
GD350-132G-4	50.00%	46.12%	42.69%	39.65%	-	-	-
GD350-160G-4	67.64%	62.75%	58.39%	54.46%	-	-	-
GD350-185G-4	60.68%	56.29%	52.38%	48.85%	-	-	-
GD350-200G-4	54.29%	50.37%	46.87%	43.71%	-	-	-
GD350-220G-4	60.33%	56.00%	52.09%	48.64%	-	-	-
GD350-250G-4	53.42%	49.58%	46.13%	43.06%	-	-	-
GD350-280G-4	62.57%	58.15%	54.19%	50.60%	-	-	-
GD350-315G-4	55.27%	51.37%	47.87%	44.70%	-	-	-
GD350-355G-4	52.89%	48.98%	45.51%	42.42%	-	-	-
GD350-400G-4	62.14%	57.25%	52.92%	49.08%	-	-	-
GD350-450G-4	54.56%	50.27%	46.46%	43.10%	-	-	-
GD350-500G-4	52.02%	47.93%	44.30%	41.09%	-	-	-

Table A-3 Derating for 660V 2–10kHz carrier frequencies

Model	Carrier frequency								
	2kHz	3kHz	4kHz	5kHz	6kHz	7kHz	8kHz	9kHz	10kHz
GD350-022G-6	100.00%	100.00%	100.00%	100.00%	93.70%	81.30%	71.41%	63.33%	56.67%
GD350-030G-6	100.00%	100.00%	100.00%	84.40%	72.29%	62.71%	55.09%	48.86%	43.71%
GD350-037G-6	100.00%	100.00%	100.00%	98.44%	84.89%	74.18%	65.42%	58.27%	52.33%
GD350-045G-6	100.00%	100.00%	100.00%	85.19%	73.46%	64.19%	56.62%	50.42%	45.29%
GD350-055G-6	100.00%	100.00%	100.00%	86.58%	75.73%	66.84%	59.48%	53.39%	48.15%
GD350-075G-6	100.00%	90.00%	72.91%	60.47%	51.16%	43.97%	38.16%	-	-
GD350-090G-6	100.00%	78.98%	63.98%	53.06%	44.90%	38.58%	33.49%	-	-
GD350-110G-6	100.00%	100.00%	84.25%	71.38%	61.50%	53.72%	47.50%	-	-
GD350-132G-6	100.00%	81.13%	67.40%	57.10%	49.20%	42.97%	38.00%	-	-
GD350-160G-6	100.00%	78.03%	62.74%	51.69%	43.51%	37.30%	32.40%	-	-
GD350-185G-6	100.00%	96.00%	78.90%	66.30%	56.75%	49.35%	43.40%	-	-
GD350-200G-6	100.00%	87.27%	71.73%	60.27%	51.59%	44.86%	39.45%	-	-
GD350-220G-6	100.00%	80.00%	65.75%	55.25%	47.29%	41.13%	36.17%	-	-
GD350-250G-6	100.00%	80.56%	66.59%	56.22%	48.30%	42.11%	37.13%	-	-
GD350-280G-6	100.00%	100.00%	83.77%	70.53%	60.50%	52.63%	46.38%	-	-
GD350-315G-6	100.00%	87.14%	71.80%	60.46%	51.86%	45.11%	39.75%	-	-
GD350-355G-6	100.00%	80.26%	66.13%	55.68%	47.76%	41.55%	36.61%	-	-
GD350-400G-6	100.00%	78.95%	64.02%	53.05%	44.84%	38.47%	33.44%	-	-
GD350-450G-6	100.00%	100.00%	83.12%	69.08%	58.45%	50.22%	43.74%	-	-

Model	Carrier frequency								
	2kHz	3kHz	4kHz	5kHz	6kHz	7kHz	8kHz	9kHz	10kHz
GD350-500G-6	100.00%	88.06%	71.57%	59.48%	50.33%	43.24%	37.67%	-	-
GD350-560G-6	100.00%	79.25%	64.42%	53.53%	45.30%	38.92%	33.90%	-	-
GD350-630G-6	100.00%	79.24%	64.19%	53.06%	44.71%	38.24%	33.16%	-	-

Appendix B Application standards

B.1 List of application standards

The following table describes the application standards that VFDs comply with.

EN/ISO 13849-1	Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
IEC/EN 60204-1	Safety of machinery. Electrical equipment of machines. Part 1: General requirements
IEC/EN 62061	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
IEC/EN 61800-3	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
IEC/EN 61800-5-1	Adjustable speed electrical power drive systems—Part 5-1: Safety requirements—Electrical, thermal and energy
IEC/EN 61800-5-2	Adjustable speed electrical power drive systems—Part 5-2: Safety requirements—Function

B.2 CE/TUV/UL/CCS certification

The CE mark affixed to the VFD indicates that the VFD is CE-compliant, meeting the regulations of the European low-voltage directive (2014/35/EU) and EMC directive (2014/30/EU).

The TUV mark affixed to the VFD indicates that the VFD is TUV-compliant. TUV certification includes TUV-MARK, TUV-CE, TUV-CB, GS, and VDE certifications, which has high authority and recognition in the field of electronic appliances and components.

The UL mark affixed to the VFD indicates that the VFD has passed UL certification. UL certification is a voluntary certification in the United States (but mandatory in some states), and products that have passed the certification meet the relevant UL standard requirements can enter the US market.

The CCS mark affixed to the VFD indicates that the VFD is CCS-compliant. CCS is the ship inspection certification of China Classification Society. The certified products can be used on ships.

B.3 EMC compliance declaration

Electro Magnetic Compatibility (EMC) describes the ability of electronic and electrical devices to work properly in the electromagnetic environment and not to generate electromagnetic interference that affects other local devices or systems. The VFD is compliant with the EMC product standard (EN 61800-3) and applied to both the first environment and the second environment.

B.4 EMC product standard

The EMC product standard (EN 61800-3) describes the EMC requirements on VFDs.

Application environment categories:

First environment: Civilian environment, including application scenarios where the VFD is directly connected without intermediate transformer to a low-voltage power supply network which supplies residential buildings.

Second environment: All locations outside a residential area.

VFDs of C1: Rated voltage lower than 1000V, applied to the first environment.

VFDs of C2: Rated voltage lower than 1000V, neither a non-plug, socket, nor mobile devices, and must be installed and commissioned by a professional person when used in the first environment.

Note: The product may generate radio interference in some environments, you need to take measures to reduce the interference.

VFDs of C3: Rated voltage lower than 1000V, applied to the second environment. They cannot be applied to the first environment.

Note: VFDs of C3 cannot be applied to civilian low-voltage public grids. When applied to such grids, the VFD may generate radio frequency electromagnetic interference.

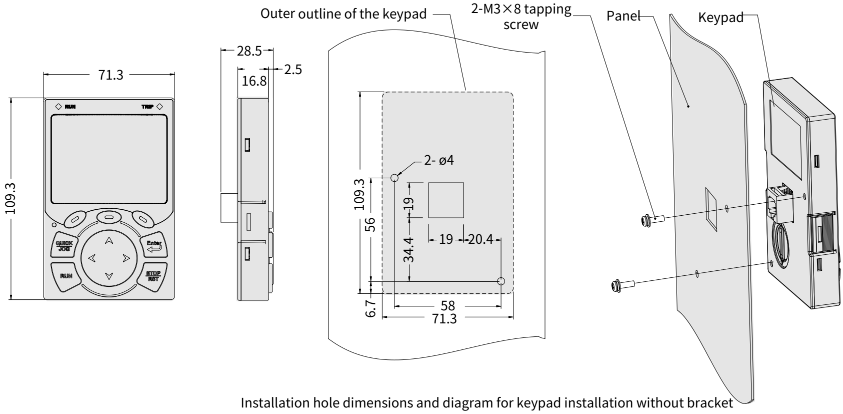
Category C4: VFD of rated voltage higher than 1000V, or rated current higher or equal to 400A, applied to complex systems in the second environment.

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of the VFD, but defines the use, installation, and commissioning of the VFD. Specialized personnel or organizations must have the necessary skills (including the EMC-related knowledge) for installing and/or performing commissioning on the electrical drive systems.

Appendix C Dimension drawings

C.1 Keypad structure

Figure C-1 Keypad structure



Installation hole dimensions and diagram for keypad installation without bracket

Note: The flat keypad cable must be selected for the following power ratings; both flat and standard keyboard cables are applicable to other power ratings.

Name	Length (m)	Ordering information	Applied to
Flat keypad cable	1	67004-00053	380V 1.5–22kW 380V 355–500kW
	2	67004-00010	
	3	67004-00013	
	5	67004-00052	

C.2 VFD overall dimensions

C.2.1 AC 3PH 380V(-15%)–440V(+10%)

Figure C-2 Outline and mounting dimensions of 380V 1.5–37kW VFD models

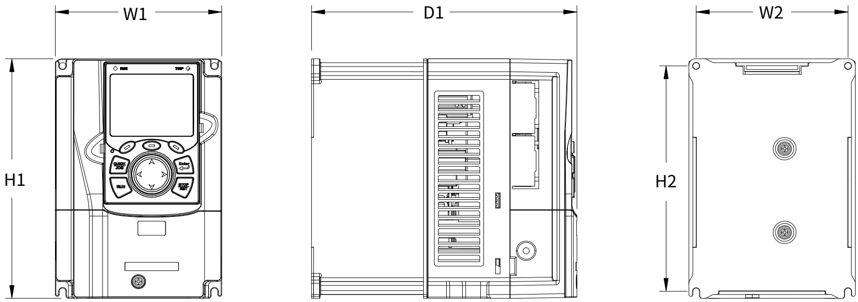


Figure C-3 Outline and mounting dimensions of 380V 45–75kW VFD models

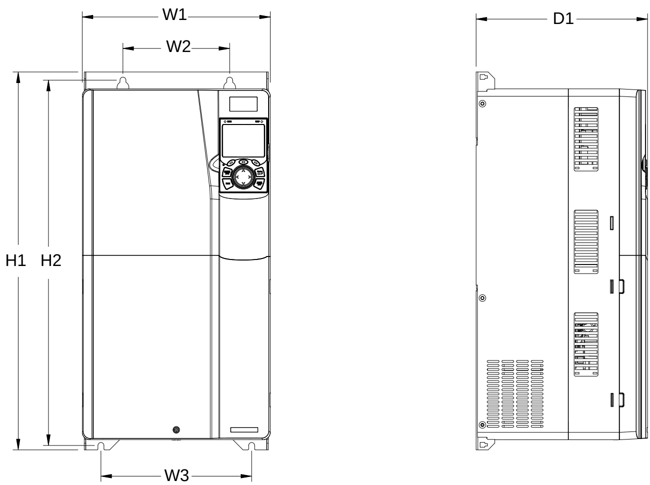


Figure C-4 Outline and mounting dimensions of 380V 90–110kW VFD models

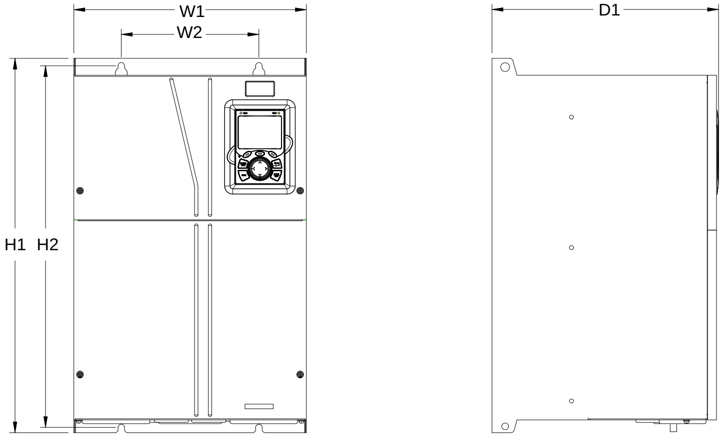


Figure C-5 Outline and mounting dimensions of 380V 132–200kW VFD models

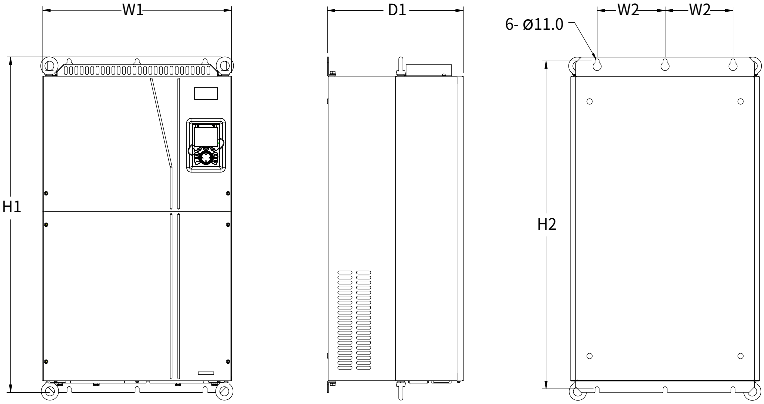


Figure C-6 Outline and mounting dimensions of 380V 220–315kW VFD models

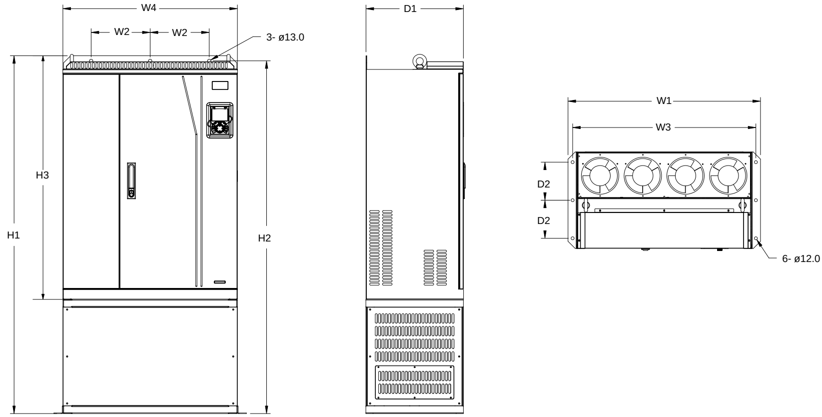


Figure C-7 Outline and mounting dimensions of 380V 355–500kW VFDs

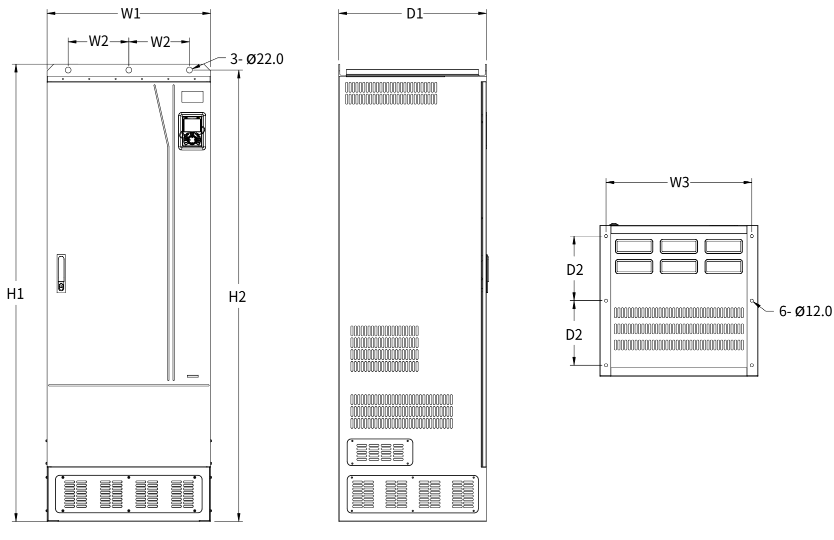


Table C-1 Outline dimensions and mounting holes of 380V VFD models

VFD model	Outline dimensions (mm)					Mounting hole distance (mm)				Mounting hole diameter (mm)
	W1	W4	H1	H3	D1	W2	W3	H2	D2	
1.5–2.2kW	126	-	186	-	185	115	-	175	-	Ø 5
4–5.5kW	126	-	186	-	201	115	-	175	-	Ø 5
7.5kW	146	-	256	-	192	131	-	243.5	-	Ø 6
11–15kW	170	-	320	-	220	151	-	303.5	-	Ø 6
18.5–22kW	200	-	340.6	-	208	185	-	328.6	-	Ø 6
30–37kW	250	-	400	-	223	230	-	380	-	Ø 6
45–75kW	282	-	560	-	258	160	226	542	-	Ø 9
90–110kW	338	-	554	-	330	200	-	535	-	Ø 10
132–200kW	500	-	872	-	360	180	-	850	-	Ø 11
220–315kW	750	680	1410	960	380	230	714	1390	150	Ø 13/12
355–500kW	620	-	1700	-	560	230	572	1678	240	Ø 22/12

C.2.2 AC 3PH 520V(-15%)–690V(+10%)

Figure C-8 Outline and mounting dimensions of 660V 22–45kW VFD models

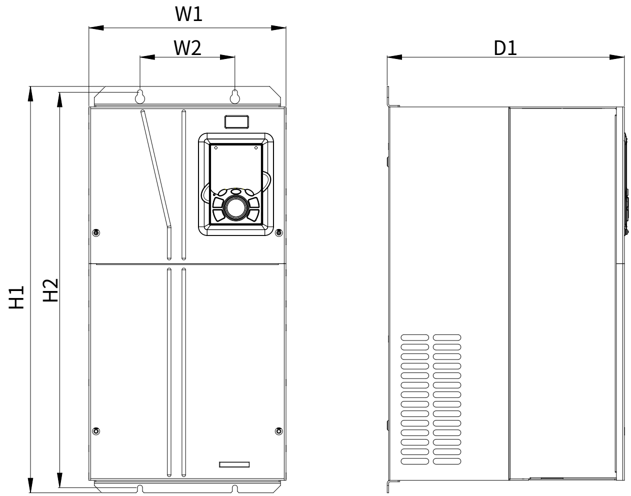


Figure C-9 Outline and mounting dimensions of 55–132kW VFD models

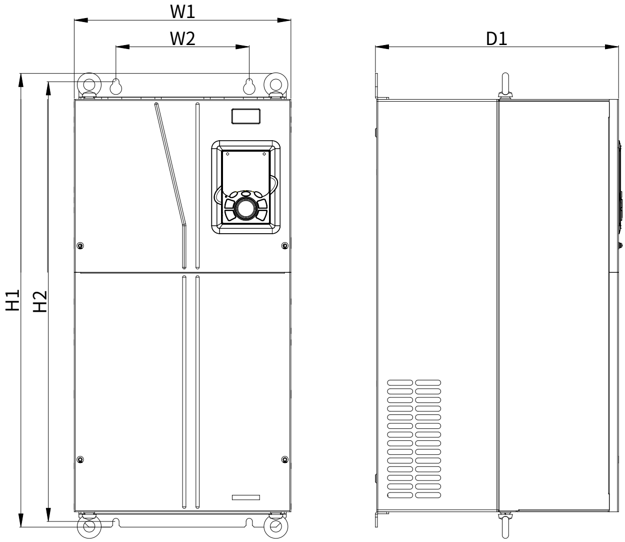


Figure C-10 Outline and mounting dimensions of 660V 160–220kW VFD models

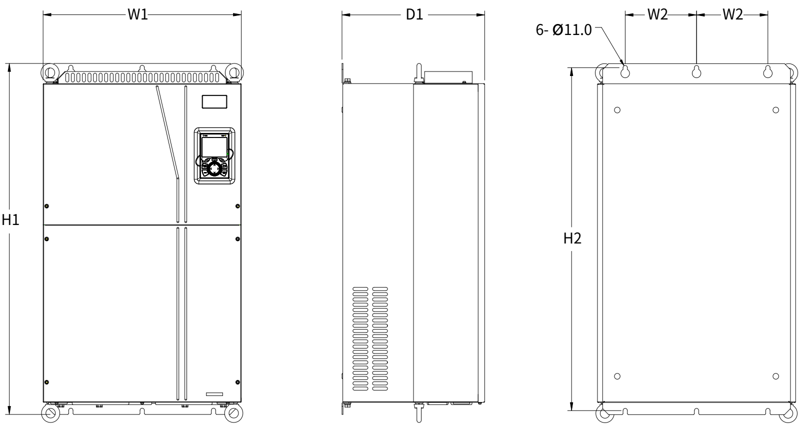


Figure C-11 Outline and mounting dimensions of 660V 250–355kW VFD models

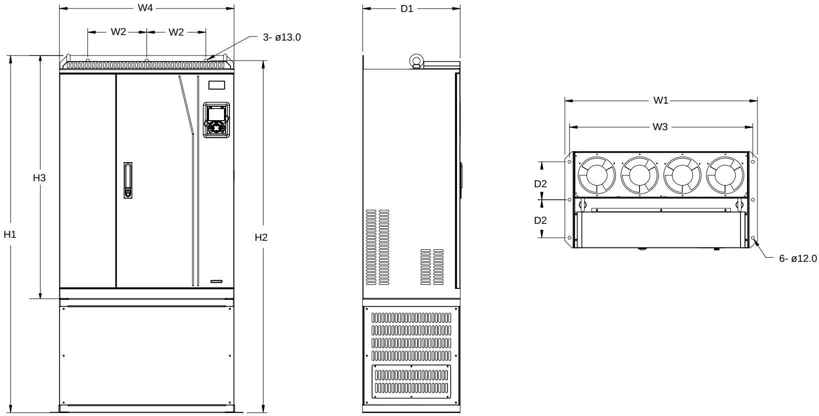


Figure C-12 Outline and mounting dimensions of 660V 400–630kW VFD models

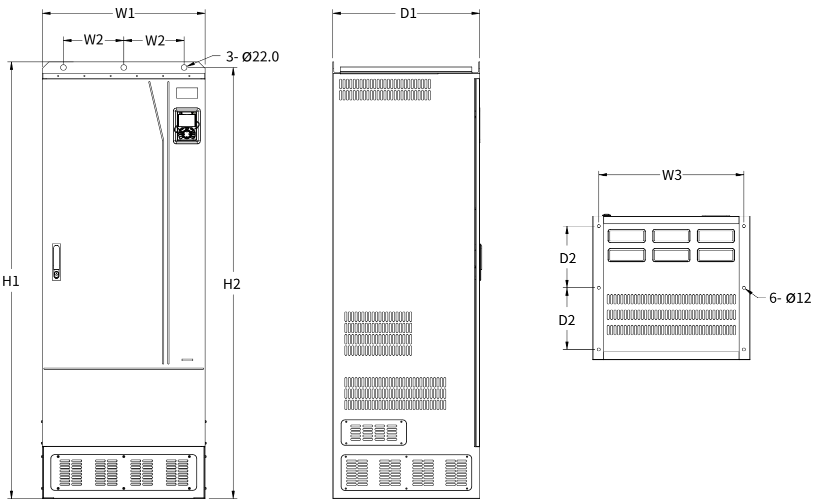


Table C-2 Outline dimensions and mounting holes of 660V VFDs

VFD model	Outline dimensions (mm)					Mounting hole (mm)				Mounting hole diameter (mm)
	W1	W4	H1	H3	D1	W2	W3	H2	D2	
22–45kW	270	-	557	-	325	130	-	540	-	Ø 7

VFD model	Outline dimensions (mm)					Mounting hole (mm)				Mounting hole diameter (mm)
	W1	W4	H1	H3	D1	W2	W3	H2	D2	
55–132kW	325	-	682	-	365	200	-	661	-	Ø 9.5
160–220kW	500	-	872	-	360	180	-	850	-	Ø 11
250–355kW	750	680	1410	960	380	230	714	1390	150	Ø 13/12
400–630kW	620	-	1700	-	560	230	572	1678	240	Ø 22/12

C.3 Dimensions for parallel VFDs

C.3.1 AC 3PH 380V(-15%)–440V(+10%)

Figure C-13 Parallel outline and mounting dimensions of 380V 560–630kW VFD models

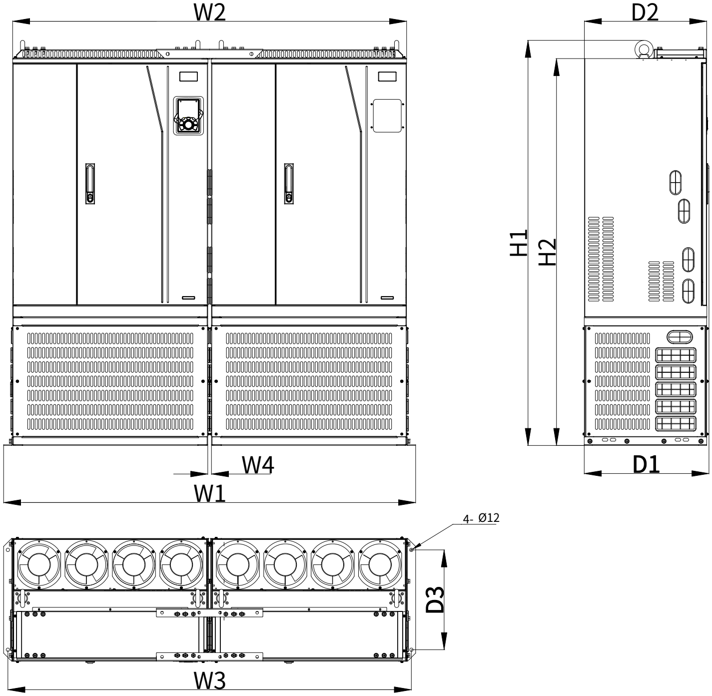


Figure C-14 Parallel outline and mounting dimensions of 380V 710–3000kW VFD models

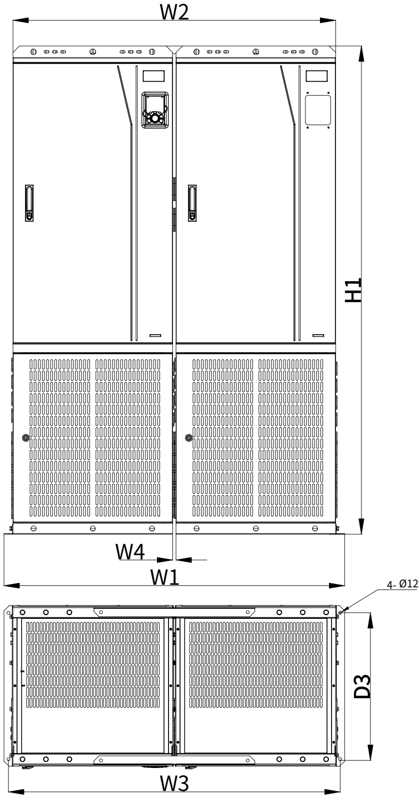


Table C-3 Parallel outline dimensions and mounting holes of 380V VFD models

VFD model	Outline dimensions (mm)						Mounting hole spacing (mm)			Mounting hole diameter (mm)
	W1	W2	W4	H1	H2	D1	D2	W3	D3	
560–630kW	1447	1383	13	1419.9	1356	442.5	429.5	1417	350	Ø12
710–1000kW	1323	1253	13	1900	-	636.3	625.5	1288	570	Ø12
1200–1500kW	1956	1886	13	1900	-	636.3	625.5	1921	570	Ø12
2000kW	2589	2519	13	1900	-	636.3	625.5	2554	570	Ø12
2500kW	3222	3152	13	1900	-	636.3	625.5	3187	570	Ø12
3000kW	3855	3785	13	1900	-	636.3	625.5	3820	570	Ø12

C.3.2 AC 3PH 520V(-15%)–690V(+10%)

Figure C-15 Parallel outline and mounting dimensions of 660V 710kW VFD models

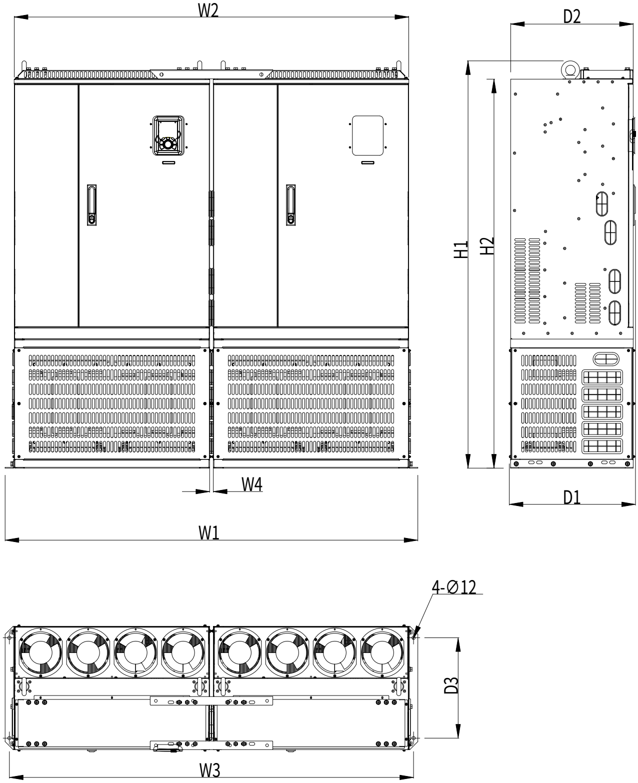


Figure C-16 Parallel outline and mounting dimensions of 660V 800–3000kW VFD models

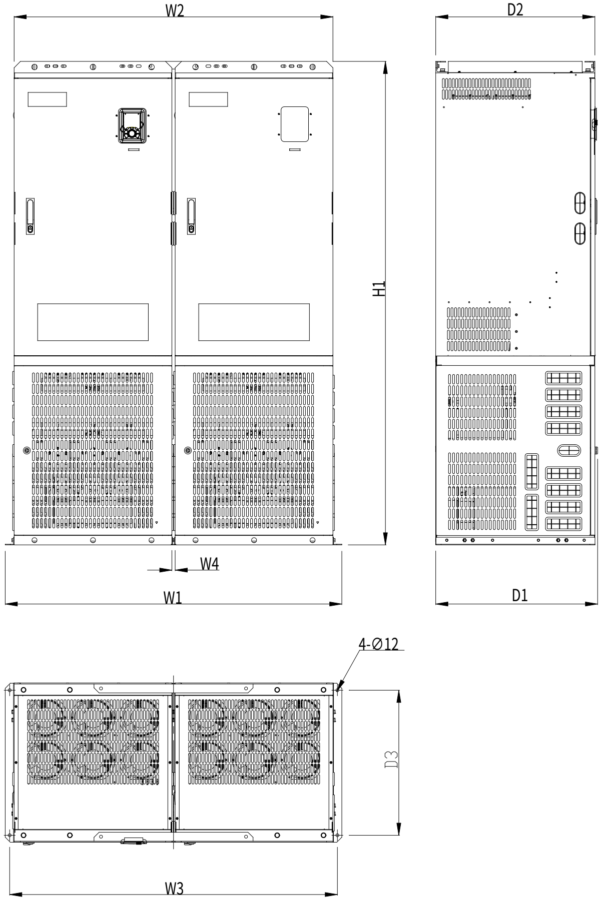


Table C-4 Parallel outline dimensions and mounting holes of 660V VFD models

VFD model	Outline dimensions (mm)						Mounting hole spacing (mm)			Mounting hole diameter (mm)
	W1	W2	W4	H1	H2	D1	D2	W3	D3	
710kW	1447	1383	13	1419.9	1356	442.5	429.5	1417	350	Ø12
800–1200kW	1323	1253	13	1900	-	636.3	625.5	1288	570	Ø12
1500kW	1956	1886	13	1900	-	636.3	625.5	1921	570	Ø12
2000–2500kW	2589	2519	13	1900	-	636.3	625.5	2554	570	Ø12
3000kW	3222	3152	13	1900	-	636.3	625.5	3187	570	Ø12

Appendix D Peripheral accessories and options

D.1 Cable

Cables mainly include power cables and control cables. For the selection of cable types, see the following table.

Cable type		Symmetrical shielded cable	Four-core cable	Double-shielded twisted-pair cable	Single-shielded twisted-pair cable
Power cable	Input power cable	√	-	-	-
	Motor cable	√	-	-	-
Control cable	Analog signal control cable	-	-	√	-
	Digital signal control cable	-	-	√	√

D.1.1 Power cable

Power cables mainly include input power cables and motor cables. To meet the EMC requirements stipulated in the CE standards, it is recommended to use symmetrical shielded cables as motor cables and input power cables (as shown in the following figure). Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.

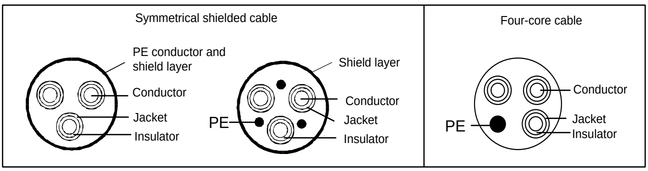


Table D-1 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Recommended cable size (mm^2)				Fixing screw	
	R, S, T U, V, W	PE	P1 (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-1R5G-4	1.0	1.0	1.0	1.0	M4	1.2–1.5
GD350-2R2G-4	1.0	1.0	1.0	1.0	M4	1.2–1.5
GD350-004G-4	1.5	1.5	1.5	1.5	M4	1.2–1.5

VFD model	Recommended cable size (mm²)				Fixing screw	
	R, S, T U, V, W	PE	P1 (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-5R5G-4	1.5	1.5	1.5	1.5	M4	1.2–1.5
GD350-7R5G-4	2.5	2.5	2.5	2.5	M4	1.2–1.5
GD350-011G-4	4	4	4	4	M5	2–2.5
GD350-015G-4	6	6	6	6	M5	2–2.5
GD350-018G-4	10	10	10	10	M5	2–2.5
GD350-022G-4	10	10	10	10	M5	2–2.5
GD350-030G-4	16	16	16	16	M6	4–6
GD350-037G-4	25	16	25	25	M6	4–6
GD350-045G-4	25	16	25	25	M8	9–11
GD350-055G-4	35	16	35	35	M8	9–11
GD350-075G-4	50	25	50	50	M8	9–11
GD350-090G-4	70	35	70	70	M12	31–40
GD350-110G-4	95	50	95	95	M12	31–40
GD350-132G-4	95	50	95	95	M12	31–40
GD350-160G -4	150	70	150	150	M12	31–40
GD350-185G-4	185	95	185	185	M12	31–40
GD350-200G-4	185	95	185	185	M12	31–40
GD350-220G-4	2×95	95	2×95	2×95	M12	31–40
GD350-250G-4	2×95	95	2×95	2×95	M12	31–40
GD350-280G-4	2×150	150	2×150	2×150	M12	31–40
GD350-315G-4	2×150	150	2×150	2×150	M12	31–40
GD350-355G-4	2×185	185	2×185	2×185	M12	31–40
GD350-400G-4	3×150	2×120	3×150	3×150	M12	31–40
GD350-450G-4	3×185	2×150	3×185	3×185	M12	31–40
GD350-500G-4	3×185	2×150	3×185	3×185	M12	31–40

Table D-2 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Recommended cable size (mm²)				Fixing screw	
	R, S, T U, V, W	PE	P1 (+)	PB (+) (-)	Terminal screw	Fastening torque (Nm)
GD350-022G-6	4	4	4	4	M8	9–11
GD350-030G-6	6	6	6	6	M8	9–11
GD350-037G-6	6	6	6	6	M8	9–11

VFD model	Recommended cable size (mm²)				Fixing screw	
	R, S, T U, V, W	PE	P1 (+)	PB (+) (-)	Terminal screw	Fastening torque (Nm)
GD350-045G-6	10	10	10	10	M8	9–11
GD350-055G-6	16	16	16	16	M10	18–23
GD350-075G-6	16	16	16	16	M10	18–23
GD350-090G-6	16	16	16	16	M10	18–23
GD350-110G-6	25	16	25	25	M10	18–23
GD350-132G-6	35	16	35	35	M10	18–23
GD350-160G -6	50	25	50	50	M12	31–40
GD350-185G-6	70	35	70	70	M12	31–40
GD350-200G-6	70	35	70	70	M12	31–40
GD350-220G-6	95	50	95	95	M12	31–40
GD350-250G-6	95	50	95	95	M12	31–40
GD350-280G-6	120	70	120	120	M12	31–40
GD350-315G-6	150	70	150	150	M12	31–40
GD350-355G-6	185	95	185	185	M12	31–40
GD350-400G-6	2×70	70	2×70	2×70	M12	31–40
GD350-450G-6	2×95	95	2×95	2×95	M12	31–40
GD350-500G-6	2×120	120	2×120	2×120	M12	31–40
GD350-560G-6	2×150	150	2×150	2×150	M12	31–40
GD350-630G-6	2×150	150	2×150	2×150	M12	31–40

Note:

- The cables recommended for the main circuit can be used in scenarios where the ambient temperature is lower than 40°C, the wiring distance is shorter than 100m, and the current is the rated current.
- In the table, the cable conductor temperature limit is 70 °C. If you use a cable with the conductor temperature limit of 90 °C, the cable must comply with relevant national standards and specifications.
- The terminals P1, (+), PB, and (-) are used to connect to DC reactors and braking accessories.
- If the electrical conductivity of the motor cable shield layer does not meet the requirements, a separate PE conductor must be used.
- The input power cables and motor cables must be able to carry the corresponding load currents.

- The maximum temperature margin of the motor cables in continuous operation cannot be lower than 70°C.
- The conductivity of the PE grounding conductor is the same as that of the phase conductor, that is, the cross-sectional areas are the same.
- For cable selection of parallel VFDs, see the manual for Goodrive series parallel VFDs.

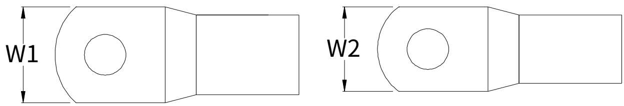
■ **Crimp terminal selection**

The cross-sectional area of the cable needs to be increased for some reasons, for example, excessive long cables or cable laying. When the width of the copper tube terminal exceeds the allowable width of the VFD terminal, the SG narrow head terminals can be used. The W2 size of the SG narrow-head series terminal is smaller than the W1 size of the GTNR or SC series terminal in the same specifications.

GTNR terminal reference brand: Suzhou Yuanli

SC, SG terminal reference brands: Richeng

The series name of the crimp terminal varies from manufacturers.



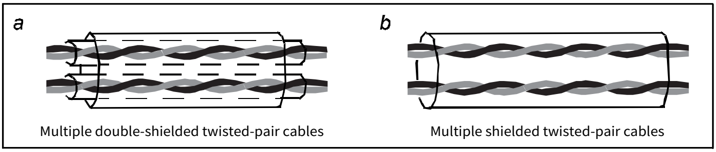
GTNR, SC series SG narrow-head series

VFD power range	GTNR series, SC series	SG narrow-head series
30kW and lower	√	-
37kW and higher	√	-

D.1.2 Control cable

Control cables mainly include analog signal control cables and digital signal control cables. Analog signal control cables use twisted double shielded cables (Figure a), with a separate shielded twisted pair for each signal and different ground wires for different analog signals. For digital signals, a double-shielded cable is preferred, but single-shielded or unshielded twisted pairs can also be used (Figure b).

Figure D-1 Control cable routing



Note:

- Analog signal cables and digital signal cables must be routed separately.
- For frequency signals, only shielded cables can be used. A relay cable needs to carry the metal braided shield layer.

D.2 Breaker and electromagnetic contactor

The circuit breaker is mainly used to prevent electric shock accidents and short circuits to the ground that may cause leakage current fire. The electromagnetic contactor is mainly used to control the main circuit power on and off, which can effectively cut off the input power of the VFD in case of system failure to ensure safety. The fuse/breaker model selection for a VFD in a parallel product is consistent with that for a single VFD, and the total capacity of the fuse/breaker for a parallel product is twice the rated current of the parallel product. (For details about the rated current of each parallel product, see 2.3 Ratings of parallel products.)

Table D-3 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current AC-3 (A)
GD350-1R5G-4	6	10	9
GD350-2R2G-4	10	10	9
GD350-004G-4	20	25	16
GD350-5R5G-4	25	32	26
GD350-7R5G-4	32	40	26
GD350-011G-4	40	50	38
GD350-015G-4	50	63	40
GD350-018G-4	63	80	50
GD350-022G-4	80	100	63
GD350-030G-4	100	125	75
GD350-037G-4	100	160	95
GD350-045G-4	125	160	110
GD350-055G-4	160	200	145

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current AC-3 (A)
GD350-075G-4	200	250	145
GD350-090G-4	225	315	185
GD350-110G-4	250	355	210
GD350-132G-4	400	450	300
GD350-160G -4	400	500	300
GD350-185G-4	500	630	400
GD350-200G-4	500	630	400
GD350-220G-4	630	800	460
GD350-250G-4	630	800	460
GD350-280G-4	630	900	580
GD350-315G-4	800	1000	580
GD350-355G-4	800	1000	750
GD350-400G-4	1000	1250	750
GD350-450G-4	1250	1400	750
GD350-500G-4	1250	1600	1250(AC-1)

Table D-4 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current (A)
GD350-022G-6	50	63	40
GD350-030G-6	50	80	50
GD350-037G-6	63	80	63
GD350-045G-6	63	100	63
GD350-055G-6	80	125	75
GD350-075G-6	125	160	110
GD350-090G-6	125	160	110
GD350-110G-6	160	200	145
GD350-132G-6	200	250	185
GD350-160G -6	200	250	185
GD350-185G-6	250	315	210
GD350-200G-6	250	355	210
GD350-220G-6	315	400	260
GD350-250G-6	315	450	300
GD350-280G-6	350	500	300
GD350-315G-6	400	630	400
GD350-355G-6	500	630	460

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current (A)
GD350-400G-6	500	800	460
GD350-450G-6	630	800	580
GD350-500G-6	630	900	580
GD350-560G-6	800	1000	750
GD350-630G-6	800	1250	750

Note: The accessory specifications described in the preceding table are ideal values. You can select accessories based on the site conditions, but try not to use those with lower values.

D.3 Optional parts

Reactors, filters, braking components, and mounting brackets are external accessories and need to be specifically specified when purchasing.

D.3.1 Harmonic filters

To enhance grid protection, reduce harmonic interference from the VFD to the grid, and improve input power factor, consider configuring external DC reactors, input reactors, or passive harmonic filters based on your specific application needs.

If you want to use long cables between the VFD and the motor, select external output reactors, dv/dt attenuation filters, or sine-wave filters based on the motor cable length. This helps mitigate excessive dv/dt, reducing voltage stress on the motor windings as well as protecting them, and extending the motor's lifespan. Refer to the following table for recommended output filter selections according to motor cable length.

Table D-5 Motor cable length by output filter

Non-shielded cable length	50m–150m	150m–450m	450m–1000m
Shielded cable length	30m–100m	100m–230m	230m–500m
Output filter type	Output reactor (1%)	/	/
	/	dv/dt filters	/
	/	/	Sine-wave filters

D.3.1.1 AC 3PH 380V(-15%)–440V(+10%)

Table D-6 Reactor model selection for 380V VFD models

VFD power	Input reactor	DC reactor	Output reactor
1.5kW	GDL-ACL0005-4CU	-	GDL-OCL0005-4CU
2.2kW	GDL-ACL0006-4CU	-	GDL-OCL0006-4CU
4kW	GDL-ACL0014-4CU	-	GDL-OCL0010-4CU
5.5kW	GDL-ACL0020-4CU	-	GDL-OCL0014-4CU
7.5kW	GDL-ACL0025-4CU	-	GDL-OCL0020-4CU
11kW	GDL-ACL0035-4AL	-	GDL-OCL0025-4CU
15kW	GDL-ACL0040-4AL	-	GDL-OCL0035-4AL
18.5kW	GDL-ACL0051-4AL	Standard	GDL-OCL0040-4AL
22kW	GDL-ACL0051-4AL	Standard	GDL-OCL0050-4AL
30kW	GDL-ACL0070-4AL	Standard	GDL-OCL0060-4AL
37kW	GDL-ACL0090-4AL	Standard	GDL-OCL0075-4AL
45kW	GDL-ACL0110-4AL	Standard	GDL-OCL0092-4AL
55kW	GDL-ACL0150-4AL	Standard	GDL-OCL0115-4AL
75kW	GDL-ACL0150-4AL	Standard	GDL-OCL0150-4AL
90kW	GDL-ACL0220-4AL	Standard	GDL-OCL0220-4AL
110kW	GDL-ACL0220-4AL	Standard	GDL-OCL0220-4AL
132kW	GDL-ACL0265-4AL	GDL-DCL0300-4AL	GDL-OCL0265-4AL
160kW	GDL-ACL0330-4AL	GDL-DCL0365-4AL	GDL-OCL0330-4AL
185kW	GDL-ACL0390-4AL	GDL-DCL0455-4AL	GDL-OCL0400-4AL
200kW	GDL-ACL0390-4AL	GDL-DCL0455-4AL	GDL-OCL0400-4AL
220kW	GDL-ACL0450-4AL	GDL-DCL0505-4AL	GDL-OCL0450-4AL
250kW	GDL-ACL0500-4AL	GDL-DCL0550-4AL	GDL-OCL0500-4AL
280kW	GDL-ACL0500-4AL	GDL-DCL0675-4AL	GDL-OCL0560-4AL
315kW	GDL-ACL0580-4AL	GDL-DCL0675-4AL	GDL-OCL0660-4AL
355kW	Standard	GDL-DCL0810-4AL	GDL-OCL0660-4AL
400kW	Standard	GDL-DCL0810-4AL	GDL-OCL0720-4AL
450kW	Standard	GDL-DCL1000-4AL	GDL-OCL0820-4AL
500kW	Standard	GDL-DCL1000-4AL	GDL-OCL1000-4AL

Note:

- The rated input voltage drop of input reactors is designed to ≥1.5%.
- The rated output voltage drop of output reactor is designed to 1%.
- For reactor selection of parallel VFDs, see the manual for Goodrive series parallel VFDs.

Table D-7 Filter model selection for 380V VFD models

VFD power	Input filter	Output filter	
	Passive harmonic filter	dv/dt filter	Sine-wave filter
1.5kW	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
2.2kW	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
4kW	GDL-H0014-4AL	GDL-DUL0010-4CU	GDL-OSF0010-4AL
5.5kW	GDL-H0020-4AL	GDL-DUL0014-4CU	GDL-OSF0014-4AL
7.5kW	GDL-H0025-4AL	GDL-DUL0020-4CU	GDL-OSF0020-4AL
11kW	GDL-H0032-4AL	GDL-DUL0025-4CU	GDL-OSF0025-4AL
15kW	GDL-H0040-4AL	GDL-DUL0032-4CU	GDL-OSF0032-4AL
18.5kW	GDL-H0047-4AL	GDL-DUL0040-4AL	GDL-OSF0040-4AL
22kW	GDL-H0056-4AL	GDL-DUL0045-4AL	GDL-OSF0045-4AL
30kW	GDL-H0070-4AL	GDL-DUL0060-4AL	GDL-OSF0060-4AL
37kW	GDL-H0080-4AL	GDL-DUL0075-4AL	GDL-OSF0075-4AL
45kW	GDL-H0100-4AL	GDL-DUL0100-4AL	GDL-OSF0095-4AL
55kW	GDL-H0130-4AL	GDL-DUL0120-4AL	GDL-OSF0120-4AL
75kW	GDL-H0160-4AL	GDL-DUL0150-4AL	GDL-OSF0150-4AL
90kW	GDL-H0190-4AL	GDL-DUL0180-4AL	GDL-OSF0180-4AL
110kW	GDL-H0225-4AL	GDL-DUL0220-4AL	GDL-OSF0220-4AL
132kW	GDL-H0265-4AL	GDL-DUL0260-4AL	GDL-OSF0260-4AL
160kW	GDL-H0320-4AL	GDL-DUL0320-4AL	GDL-OSF0320-4AL
185kW	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL
200kW	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL
220kW	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
250kW	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
280kW	GDL-H0545-4AL	GDL-DUL0540-4AL	GDL-OSF0600-4AL
315kW	GDL-H0610-4AL	GDL-DUL0600-4AL	GDL-OSF0600-4AL
355kW	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
400kW	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
450kW	GDL-H1000-4AL	GDL-Dul1000-4AL	GDL-OSF1000-4AL
500kW	GDL-H1000-4AL	GDL-DUL1000-4AL	GDL-OSF1000-4AL

Note: The input voltage of passive harmonic filter for 380V VFD models is 380–400V 50Hz.

D.3.1.2 AC 3PH 520V(-15%)–690V(+10%)

Table D-8 Reactor model selection for 660V VFD models

VFD power	Input reactor	DC reactor	Output reactor
22kW	GDL-ACL0045-6CU	GDL-DCL0045-6CU	GDL-OCL0045-6CU
30kW	GDL-ACL0045-6CU	GDL-DCL0050-6CU	GDL-OCL0045-6CU
37kW	GDL-ACL0050-6CU	GDL-DCL0080-6CU	GDL-OCL0045-6CU
45kW	GDL-ACL0060-6CU	GDL-DCL0080-6CU	GDL-OCL0060-6CU
55kW	GDL-ACL0090-6CU	GDL-DCL0080-6CU	GDL-OCL0090-6CU
75kW	GDL-ACL0090-6CU	GDL-DCL0165-6CU	GDL-OCL0090-6CU
90kW	GDL-ACL0110-6CU	GDL-DCL0165-6CU	GDL-OCL0110-6CU
110kW	GDL-ACL0150-6CU	GDL-DCL0165-6CU	GDL-OCL0150-6CU
132kW	GDL-ACL0150-6CU	GDL-DCL0265-6CU	GDL-OCL0150-6CU
160kW	GDL-ACL0200-6CU	GDL-DCL0265-6CU	GDL-OCL0200-6CU
185kW	GDL-ACL0200-6CU	GDL-DCL0265-6CU	GDL-OCL0200-6CU
200kW	GDL-ACL0250-6CU	GDL-DCL0330-6CU	GDL-OCL0250-6CU
220kW	GDL-ACL0250-6CU	GDL-DCL0330-6CU	GDL-OCL0250-6CU
250kW	GDL-ACL0300-6CU	GDL-DCL0330-6CU	GDL-OCL0300-6CU
280kW	GDL-ACL0300-6CU	GDL-DCL0475-6CU	GDL-OCL0300-6CU
315kW	GDL-ACL0400-6CU	GDL-DCL0475-6CU	GDL-OCL0400-6CU
355kW	GDL-ACL0400-6CU	GDL-DCL0475-6CU	GDL-OCL0400-6CU
400kW	Standard	GDL-DCL0600-6CU	GDL-OCL0480-6CU
450kW	Standard	GDL-DCL0600-6CU	GDL-OCL0480-6CU
500kW	Standard	GDL-DCL0750-6CU	GDL-OCL0600-6CU
560kW	Standard	GDL-DCL0750-6CU	GDL-OCL0600-6CU
630kW	Standard	GDL-DCL0805-6CU	GDL-OCL0800-6CU

Note:

- The rated input voltage drop of input reactor is designed to ≥1.5%.
- The rated output voltage drop of output reactor is designed to 1%.
- For reactor selection of parallel VFDs, see the manual for Goodrive series parallel VFDs.

Table D-9 Filter model selection for 660V VFD models

VFD power	Input filter	Output filter	
	Passive harmonic filter	dv/dt filter	Sine-wave filter
22kW	GDL-H0035-6AL	GDL-DUL0030-6CU	GDL-OSF0030-6CU

VFD power	Input filter	Output filter	
	Passive harmonic filter	dv/dt filter	Sine-wave filter
30kW	GDL-H0047-6AL	GDL-DUL0045-6CU	GDL-OSF0045-6CU
37kW	GDL-H0047-6AL	GDL-DUL0045-6CU	GDL-OSF0045-6CU
45kW	GDL-H0060-6AL	GDL-DUL0065-6CU	GDL-OSF0065-6CU
55kW	GDL-H0090-6AL	GDL-DUL0065-6CU	GDL-OSF0065-6CU
75kW	GDL-H0090-6AL	GDL-DUL0090-6CU	GDL-OSF0090-6CU
90kW	GDL-H0110-6AL	GDL-DUL0110-6CU	GDL-OSF0110-6CU
110kW	GDL-H0150-6AL	GDL-DUL0150-6CU	GDL-OSF0150-6CU
132kW	GDL-H0150-6AL	GDL-DUL0150-6CU	GDL-OSF0150-6CU
160kW	GDL-H0200-6AL	GDL-DUL0220-6CU	GDL-OSF0200-6CU
185kW	GDL-H0200-6AL	GDL-DUL0220-6CU	GDL-OSF0200-6CU
200kW	GDL-H0250-6AL	GDL-DUL0220-6CU	GDL-OSF0250-6CU
220kW	GDL-H0250-6AL	GDL-DUL0260-6CU	GDL-OSF0250-6CU
250kW	GDL-H0300-6AL	GDL-DUL0320-6CU	GDL-OSF0300-6CU
280kW	GDL-H0300-6AL	GDL-DUL0320-6CU	GDL-OSF0300-6CU
315kW	GDL-H0400-6AL	GDL-DUL0400-6CU	GDL-OSF0400-6CU
355kW	GDL-H0400-6AL	GDL-DUL0400-6CU	GDL-OSF0400-6CU
400kW	GDL-H0480-6AL	GDL-DUL0480-6CU	GDL-OSF0480-6CU
450kW	GDL-H0480-6AL	GDL-DUL0480-6CU	GDL-OSF0480-6CU
500kW	GDL-H0600-6AL	GDL-DUL0600-6CU	GDL-OSF0600-6CU
560kW	GDL-H0600-6AL	GDL-DUL0600-6CU	GDL-OSF0600-6CU
630kW	GDL-H0800-6AL	GDL-DUL0800-6CU	GDL-OSF0800-6CU

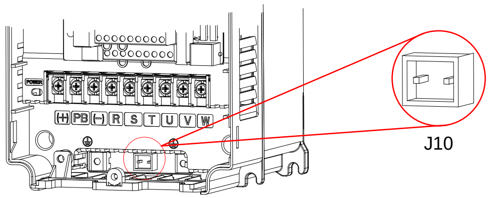
Note: The input voltage of passive harmonic filter for 660V VFD models is 660–690V 50Hz.

D.3.2 EMC filter

A filter is used to prevent the surrounding interference and prevent the interference from the VFD during running Optional filters can be used to meet the conductivity and transmission requirements of CE/EN 61800-3 C2 electrical drive systems. J10 is not connected in factory for the 380V 110kW and lower VFDs. Connect the J10 packaged with the manual if the requirements of C3 need to be met. J10 is connected in factory for the 380V 132kW and higher VFDs, all of which meet the requirements of C3.

Disconnect J10 in any of the following situations:

- The EMC filter is applicable to the neutral-grounded grid system. If it is used an IT power grid system (neutral not grounded), disconnect J10.
- If leakage protection occurs during startup when a residual-current circuit breaker has been configured, disconnect J10.



Note: Do not connect C3 filters in IT power systems.

D.3.2.1 AC 3PH 380V(-15%)–440V(+10%)

Table D-10 Filter model selection for 380V VFD models

VFD model	Input filter	Output filter
GD350-1R5G-4	FLT-P04006L-B	FLT-L04006L-B
GD350-2R2G-4		
GD350-004G-4	FLT-P04016L-B	FLT-L04016L-B
GD350-5R5G-4		
GD350-7R5G-4	FLT-P04032L-B	FLT-L04032L-B
GD350-011G-4		
GD350-015G-4	FLT-P04045L-B	FLT-L04045L-B
GD350-018G-4		
GD350-022G-4	FLT-P04065L-B	FLT-L04065L-B
GD350-030G-4		
GD350-037G-4	FLT-P04100L-B	FLT-L04100L-B
GD350-045G-4		
GD350-055G-4	FLT-P04150L-B	FLT-L04150L-B
GD350-075G-4		
GD350-090G-4	FLT-P04240L-B	FLT-L04240L-B
GD350-110G-4		
GD350-132G-4		
GD350-160G -4	FLT-P04400L-B	FLT-L04400L-B
GD350-185G-4		
GD350-200G-4		
GD350-220G-4	FLT-P04600L-B	FLT-L04600L-B
GD350-250G-4		

VFD model	Input filter	Output filter
GD350-280G-4		
GD350-315G-4	FLT-P04800L-B	FLT-L04800L-B
GD350-355G-4		
GD350-400G-4		
GD350-450G-4	FLT-P041000L-B	FLT-L041000L-B
GD350-500G-4		

D.3.2.2 AC 3PH 520V(-15%)–690V(+10%)

Table D-11 Filter model selection for 660V VFD models

VFD model	Input filter	Output filter
GD350-022G-6	FLT-P06050H-B	FLT-L06050H-B
GD350-030G-6		
GD350-037G-6		
GD350-045G-6	FLT-P06100H-B	FLT-L06100H-B
GD350-055G-6		
GD350-075G-6		
GD350-090G-6		
GD350-110G-6	FLT-P06200H-B	FLT-L06200H-B
GD350-132G-6		
GD350-160G -6		
GD350-185G-6		
GD350-200G-6	FLT-P06300H-B	FLT-L06300H-B
GD350-220G-6		
GD350-250G-6		
GD350-280G-6		
GD350-315G-6	FLT-P06400H-B	FLT-L06400H-B
GD350-355G-6		
GD350-400G-6	FLT-P061000H-B	FLT-L061000H-B
GD350-450G-6		
GD350-500G-6		
GD350-560G-6		
GD350-630G-6		

Note:

- The input EMI meets the C2 requirements after an input filter is configured.

- For filter selection of parallel VFDs, see the manual for Goodrive series parallel VFDs.

D.3.3 Braking component

The braking component includes braking resistors and braking units, which can be used to dissipate the regenerative energy generated by the motor, greatly improving braking and deceleration capabilities. When the VFD driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load-carrying energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a specific value, the VFD reports an overvoltage fault. To prevent this from happening, you need to configure braking components. An external braking unit is required for the GD series high power parallel VFD. Select braking resistors according to the specific requirements (such as the braking torque and braking usage) on site.

D.3.3.1 AC 3PH 380V(-15%)–440V(+10%)

Table D-12 Braking component selection for 380V VFD models

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
GD350-1R5G-4	Built-in braking unit	326	0.23	1.1	1.8	170
GD350-2R2G-4		222	0.33	1.7	2.6	130
GD350-004G-4		122	0.6	3	4.8	80
GD350-5R5G-4		89	0.75	4.1	6.6	60
GD350-7R5G-4		65	1.1	5.6	9	47
GD350-011G-4		44	1.7	8.3	13.2	31
GD350-015G-4		32	2	11	18	23
GD350-018G-4		27	3	14	22	19
GD350-022G-4		22	3	17	26	17
GD350-030G-4		17	5	23	36	17
GD350-037G-4		13	6	28	44	11.7
GD350-045G-4	DBU100H-110-4	10	7	34	54	6.4
GD350-055G-4		8	8	41	66	
GD350-075G-4		6.5	11	56	90	

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
GD350-090G-4	DBU100H-160-4	5.4	14	68	108	4.4
GD350-110G-4		4.5	17	83	132	
GD350-132G-4	DBU100H-220-4	3.7	20	99	158	3.2
GD350-160G -4	DBU100H-320-4	3.1	24	120	192	2.2
GD350-185G-4		2.8	28	139	222	
GD350-200G-4		2.5	30	150	240	
GD350-220G-4	DBU100H-400-4	2.2	33	165	264	1.8
GD350-250G-4		2.0	38	188	300	
GD350-280G-4	Quantity: Two DBU100H-320-4	3.6*2	21*2	105*2	168*2	2.2*2
GD350-315G-4		3.2*2	24*2	118*2	189*2	
GD350-355G-4		2.8*2	27*2	132*2	210*2	
GD350-400G-4		2.4*2	30*2	150*2	240*2	
GD350-450G-4	Quantity: Two DBU100H-400-4	2.2*2	34*2	168*2	270*2	1.8*2
GD350-500G-4		2.0*2	38*2	186*2	300*2	

D.3.3.2 AC 3PH 520V(-15%)–690V(+10%)

Table D-13 Braking component selection for 660V VFD models

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
GD350-022G-6	DBU100H-110-6	55	4	17	27	10.0
GD350-030G-6		40.3	5	23	36	
GD350-037G-6		32.7	6	28	44	
GD350-045G-6		26.9	7	34	54	
GD350-055G-6		22.0	8	41	66	
GD350-075G-6		16.1	11	56	90	
GD350-090G-6		13.4	14	68	108	
GD350-110G-6		11.0	17	83	132	
GD350-132G-6	DBU	9.2	20	99	158	6.9

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
GD350-160G -6	100H-160-6	7.6	24	120	192	
GD350-185G-6	DBU100H-220-6	6.5	28	139	222	5.0
GD350-200G-6		6.1	30	150	240	
GD350-220G-6		5.5	33	165	264	
GD350-250G-6	DBU100H-320-6	4.8	38	188	300	3.4
GD350-280G-6		4.3	42	210	336	
GD350-315G-6		3.8	47	236	378	
GD350-355G-6		3.5	53	263	420	
GD350-400G-6	DBU100H-400-6	3.0	60	300	480	2.8
GD350-450G-6	Quantity: Two DBU100H-320-6	5.5*2	34*2	168*2	270*2	3.4*2
GD350-500G-6		4.8*2	38*2	188*2	300*2	
GD350-560G-6		4.3*2	42*2	210*2	336*2	
GD350-630G-6		3.8*2	47*2	236*2	378*2	

Note:

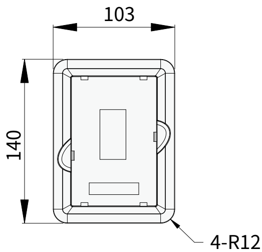
- Select braking resistors according to the resistance and power data provided by INVT.
- The braking resistor may increase the braking torque of the VFD. The preceding table designs the resistor power by 100% braking torque, 10% braking ratio, 50% braking ratio, and 80% braking ratio. You can select the braking system based on the actual operation conditions.
- When using an external braking unit, set the brake voltage class of the braking unit properly by referring to the manual of the dynamic braking unit. If the voltage class is set incorrectly, the VFD may not run properly.
- For braking component selection of parallel VFDs, see the manual for Goodrive series parallel VFDs.

D.3.4 Mounting bracket

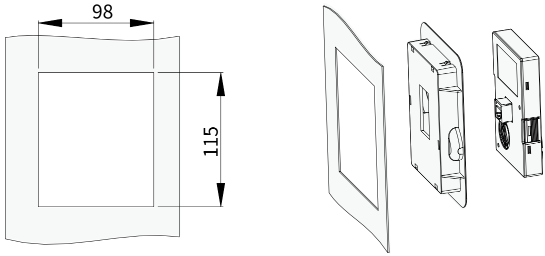
D.3.4.1 Keypad mounting bracket

The external keypad can be mounted directly with M3 threaded screws or with a keypad bracket. For VFDs of 380V 1.5–75kW, the keypad mounting bracket is an optional part. For those of 380V 90–500kW and 660V 22–630kW, you can use optional brackets or use the standard keypad brackets externally.

Figure D-2 (Optional) Keypad mounting bracket for 380V 1.5–500kW and 660V 22–630kW VFDs



Keypad adapter bracket



Installation dimensions

Table D-14 Keypad mounting bracket selection

Name	Ordering information	Applied to
Keypad mounting bracket	19005–00149	380V 1.5–500kW 660V 22–630kW

D.3.4.2 Flange mounting bracket

Flange-mounting is applicable to VFDs of 380V 200kW and lower, and VFDs of 660V 220kW and lower. A flange-mounting plate must be selected for the flange mounting of 380V 1.5–110kW VFDs; while no flange-mounting plate is not needed for the flange mounting of 380V 132–200kW and 660V 22–220kW VFDs.

Table D-15 Flange mounting bracket selection

Name	Ordering information	Applied to
Flange mounting bracket	19005–00005	380V 1.5–5.5kW
	19005–00013	380V 7.5kW
	19005–00006	380V 11–15kW
	19005–00094	380V 18.5–22kW
	19005–00093	380V 30–37kW
	19005–00092	380V 45–75kW
	19005–00091	380V 90–110kW

- **AC 3PH 380V(-15%) – 440V(+10%)**

Figure D-3 Flange mounting dimensions and hole spacings for VFDs of 380V 1.5–75kW

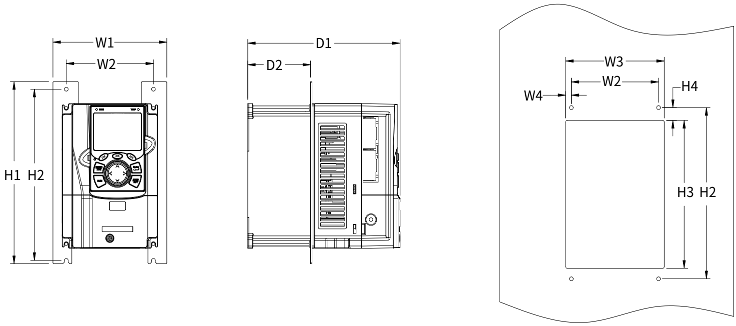


Figure D-4 Flange mounting dimensions and hole spacings for VFDs of 380V 90–110kW

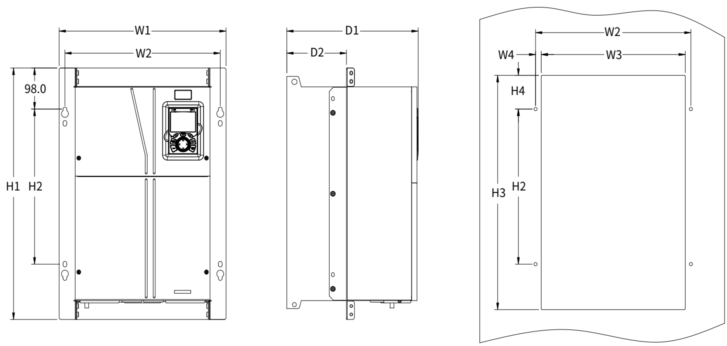


Figure D-5 Flange mounting dimensions and hole spacings for VFDs of 380V 132–200kW

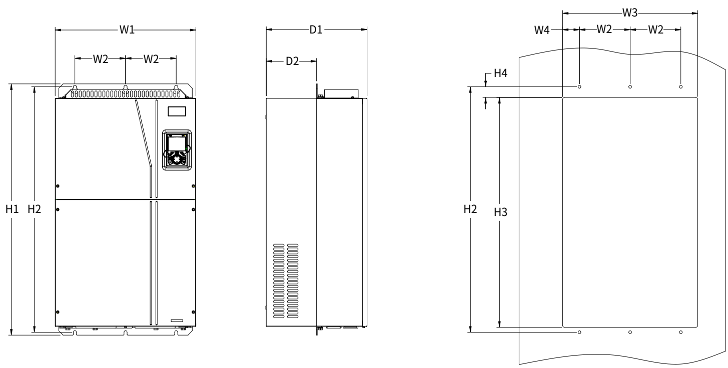


Table D-16 Flange mounting dimensions for 380V VFDs (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter
1.5–2.2kW	150.2	115	130	7.5	234	220	190	13.5	185	65.5	Ø5
4–5.5kW	150.2	115	130	7.5	234	220	190	13.5	201	83	Ø5
7.5kW	170.2	131	150	9.5	292	276	260	6	192	84.5	Ø6
11–15kW	191.2	151	174	11.5	370	351	324	12	220	113	Ø6
18.5–22kW	266	250	224	13	371	250	350.6	20.3	208	104	Ø6
30–37kW	316	300	274	13	430	300	410	55	223	118.3	Ø6
45–75kW	352	332	306	12	580	400	570	80	258	133.8	Ø9
90–110kW	418.5	389.5	361	14.2	600	370	559	108.5	330	149.5	Ø10
132–200kW	500	180	480	60	872	850	796	37	360	178.5	Ø11

■ **AC 3PH 520V(-15%)–690V(+10%)**

Figure D-6 Flange mounting dimensions and hole spacings for VFDs of 660V 22–45kW

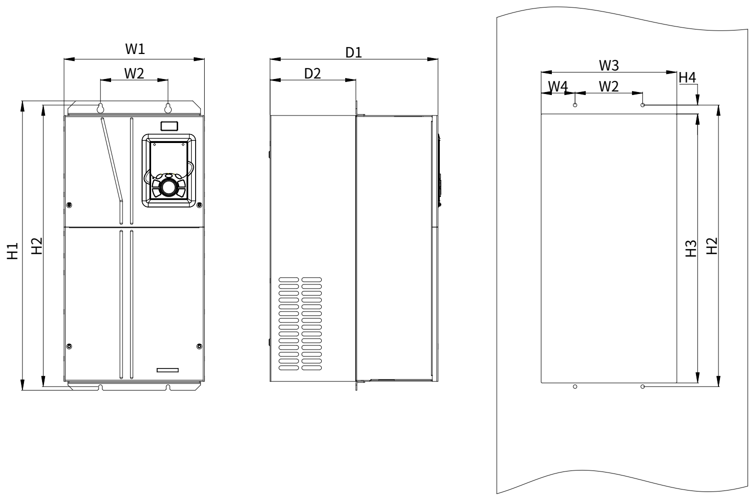


Figure D-7 Flange mounting dimensions and hole spacings for VFDs of 660V 55–132kW

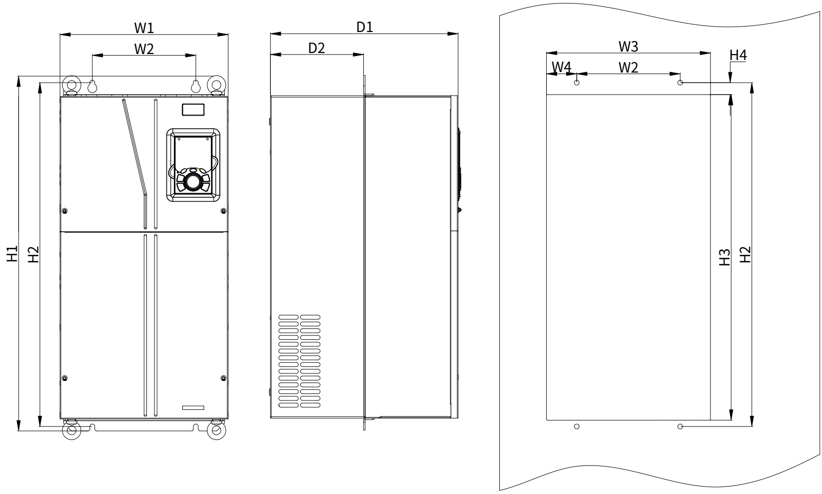


Figure D-8 Flange mounting dimensions and hole spacings for VFDs of 660V 160–220kW

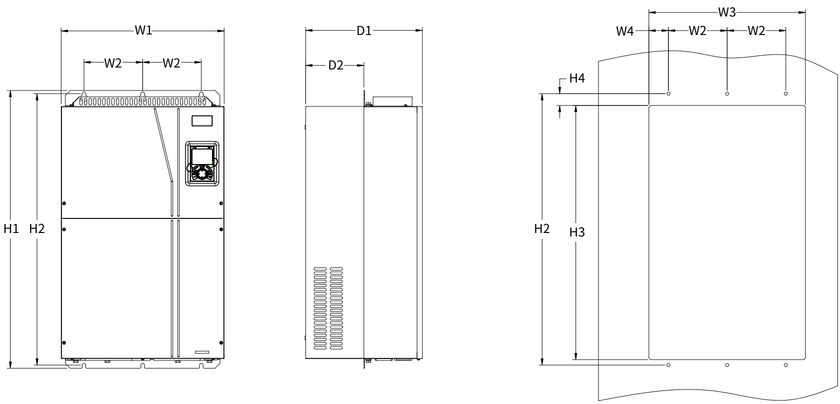


Table D-17 Flange mounting dimensions for 660V VFDs (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter
22–45kW	270	130	261	65.5	557	540	516	17.5	325	167	Ø 7
55–132kW	325	200	317	58.5	682	661	626	23.5	365	184	Ø 9.5
160–220kW	500	180	480	60	872	850	796	37	358	178.5	Ø 11

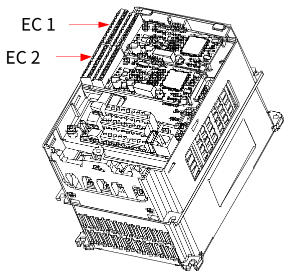
Appendix E Expansion card

E.1 Expansion card function description and installation

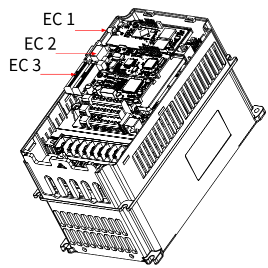
E.1.1 Function description

The VFD can be equipped with various expansion cards to extend its application functions. The VFDs of 5.5kW and lower can be configured with two expansion cards at the same time, while the VFDs of 7.5kW and higher can be configured with three expansion cards at the same time. Expansion cards need to be purchased separately. Each expansion card size is 108x39mm.

Figure E-1 Expansion card (EC) installation position



5.5kW and lower



7.5kW and higher

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Figure E-2 Expansion card model definition

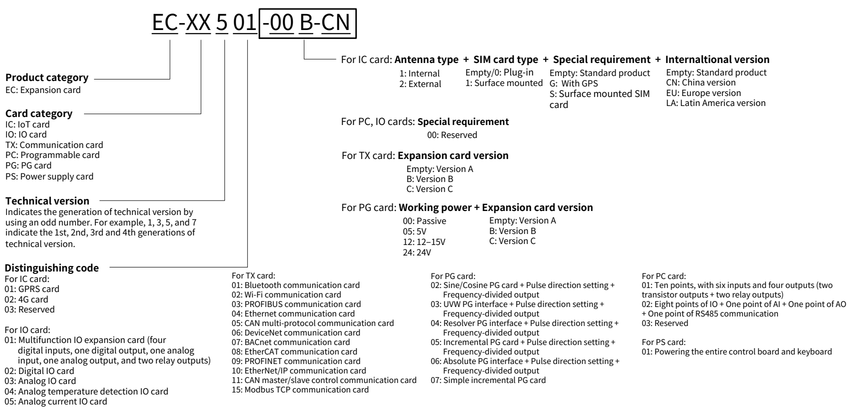


Table E-1 Expansion card function description

Expansion card type	Model	Specification	Ordering code
I/O expansion card 1	EC-IO501-00	● Four digital inputs ● One digital output ● One analog input ● One analog output ● Two relay outputs: one double-contact output and one single-contact output	11023–00083
I/O expansion card 2	EC-IO502-00	● Four digital inputs ● One PT100 ● One PT1000 ● Two relay outputs: single-contact NO output	11023–00119
Programmable card	EC-PC502-00	● Adopting the global mainstream programmable card development environment, supporting multiple programming languages such as the instruction language, ladder diagram, and sequential function chart. ● Supporting resumable commissioning and task period execution mode selection ● Providing a user program storage space of 16K steps and data storage space of 8K words ● Six digital inputs ● Two relay outputs ● One analog input and one analog output ● One RS485 communication channel, master/slave switchover by host controller ● Supporting saving data of 1K words at power off	11023–00146
Bluetooth communication card	EC-TX501-1	● Supporting Bluetooth 4.0 ● With INVT's mobile APP, you can set the parameters and monitor the VFD status through Bluetooth communication. ● Max. communication distance in an unobstructed environment: 30m ● EC-TX501-1 with a built-in antenna,	11023–00088
	EC-TX501-2		11023–00089

Expansion card type	Model	Specification	Ordering code
		applicable to molded case machines ● EC-TX501-2 with an external sucker antenna, applicable to sheet metal machines	
Wi-Fi communication card	EC-TX502-1	● Meeting requirements of IEEE802.11b/g/n ● Enabling local or remote monitoring through Wi-Fi communication with the mobile APP INVT Workshop ● Max. communication distance in an unobstructed environment: 30m ● EC-TX502-1 with a built-in antenna, applicable to molded case machines ● EC-TX502-2 with an external sucker antenna, applicable to sheet metal machines	11023–00101
	EC-TX502-2		11023–00102
PROFIBUS-DP communication card	EC-TX503D	Supporting the PROFIBUS-DP protocol	11023–00151
CAN multi-protocol communication card	EC-TX505D	● Based on the CAN2.0A and CAN2.0B physical layer ● Supporting the CANopen protocol ● Adopting INVT master-slave control proprietary protocol	11023–00164
PROFINET communication card	EC-TX509C	● Supporting the PROFINET protocol	11023–00149
EtherNet IP communication card	EC-TX510B	● When the switch selects EtherNet IP: ✧ Supporting the Ethernet IP protocol, Modbus TCP protocol, or Ethernet internal protocol ✧ Equipped with two EtherNet IP ports, supporting 10/100M half/full duplex operating ✧ Equipped with two RJ45 interfaces, which do not distinguish the direction and can	11023–00197

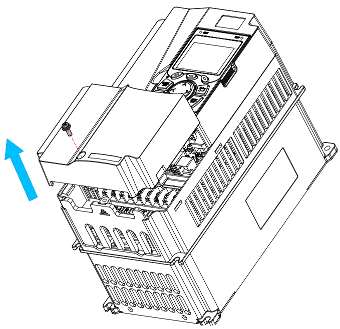
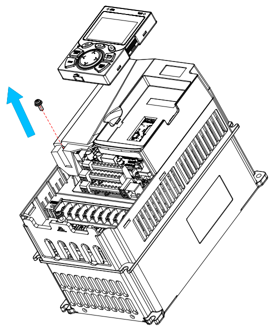
Expansion card type	Model	Specification	Ordering code
		be swappable ✧ Supporting star and line IP network topologies ● When the switch selects Modbus TCP: ✧ Supporting the Modbus TCP protocol and Modbus TCP slave nodes ✧ Equipped with two Modbus TCP ports, supporting 10/100M half/full duplex operating ✧ Supporting star and line TCP network topologies ● When the switch selects Ethernet: ✧ Supporting INVT Ethernet protocol ● Supporting the connection to INVT's host controller monitoring software INVT Workshop for monitoring and oscillography, allowing multi-card networking monitoring	
Sin/Cos PG card	EC-PG502	● Applicable to Sin/Cos encoders with or without CD signals ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023–00109
Incremental PG card with UVW	EC-PG503-05	● Applicable to differential encoders of 5V ● Supporting the orthogonal input of A, B, and Z ● Supporting the pulse input of phase U, V, and W ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023–00085
Resolver PG card	EC-PG504-00	● Applicable to resolver encoders ● Supporting frequency-divided output of resolver-simulated A, B, Z ● Supporting input of pulse train reference	11023–00086
Multi-function incremental PG card	EC-PG505-12	● Applicable to OC encoders of 5V or 12V ● Applicable to push-pull encoders of 5V or 12V ● Applicable to differential encoders of 5V	11023–00087

Expansion card type	Model	Specification	Ordering code
		● Supporting the orthogonal input of A, B, and Z ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	
24V incremental PG card	EC-PG505-24B	● Applicable to OC encoders of 24V ● Applicable to push-pull encoders of 24V ● Supporting the orthogonal input of A, B, and Z ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023–00139
Simplified incremental PG card	EC-PG507-12	● Applicable to OC encoders of 5V or 12V ● Applicable to push-pull encoders of 5V or 12V ● Applicable to differential encoders of 5V	11023–00115
24V simplified incremental PG card	EC-PG507-24	● Applicable to OC encoders of 24V ● Applicable to push-pull encoders of 24V ● Applicable to differential encoders of 24V	11023–00121
GPRS expansion card	EC–IC501-2	● Supporting IoT monitoring ● Supporting remote VFD upgrade	11023–00130 (2G not recommended)
4G expansion card	EC-IC502-2-CN	● Supporting standard RS485 interfaces ● Supporting 4G communication	11095–00009
	EC-IC502-2-EU		11095–00017
	EC-IC502-2-LA		11095–00018

E.1.2 Installation and wiring

	Make sure the VFD has been powered off before installation.
Note	● The expansion card can be installed in SLOT1, SLOT2, or SLOT3, depending on the actual wiring. ● If there is interference with external wiring after the expansion card is installed, flexibly adjust the installation slot position of each expansion card to the most convenient wiring state. For example, since the connector of the DP card connection cable is large, you are recommended

	to install the card in SLOT1. ● To ensure high anti-interference capability in closed-loop control, you need to use a shielded cable as the encoder cable and ground the two ends of the cable. That is, connect the motor side shield layer to the motor housing, and connect the PG card side shield layer to the PE terminal.

Step 1 Unscrew the lower part of the housing and remove the lower cover. 	Step 2 Unscrew the screws in the middle of the housing and remove the upper cover. 

<table>
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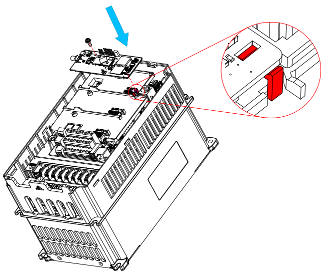
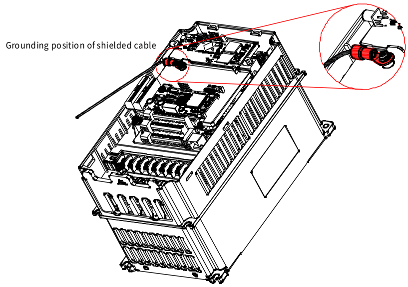
<td>Step 3 Align the expansion card positioning holes with the machine positioning studs, insert the expansion card and secure it with screws (M3*10).
</td>
<td>Step 4 Conduct wiring based on the expansion card type and connect the shielded cable as follows.

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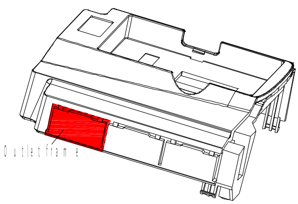
<td>Step 5 Cut off the outlet frame on the left side of the upper cover.

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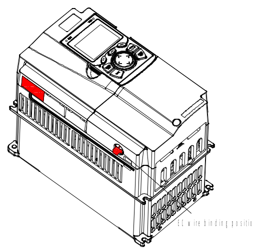
<td>Step 6 Lead the cable out of the outlet frame and then install the upper cover, keypad and lower cover in order.
</td>
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</table>

E.2 I/O expansion card

E.2.1 I/O expansion card 1 (EC-IO501-00)

The EC-IO501-00 expansion card is a multi-functional I/O expansion card that can be applied to scenarios where the local I/O interfaces are insufficient. It expands four digital inputs, one digital output, one analog input, one analog output, and two relay outputs. It uses European-style screw terminals for relay output and spring terminals for the others. CME and COM are shorted through J3 before delivery, while J5 is a jumper for selecting the output type (voltage or current) of AO2.

Figure E-3 EC-IO501-00 drawing

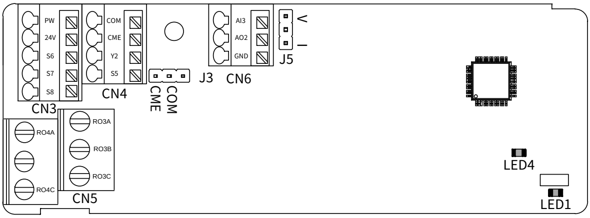


Table E-2 Terminal function description

Category	Symbol	Name	Specifications
Power supply	PW	External power	● Used to provide input digital working power from the external to the internal ● Voltage range: 12–30V ● PW and +24V have been short connected before delivery.
Analog input/output	AI3—GND	Analog input 1	● Input range: For AI3, 0–10V or 0–20mA ● Input impedance: 20kΩ for voltage input or 250Ω for current input ● Whether voltage or current is used for input is set through the corresponding function code. ● Resolution: 5mV when 10V corresponds to 50Hz ● Deviation: ±0.5% (input of 5V or 10mA or higher at the temperature of 25°C)
	AO2—GND	Analog output 1	● Output range: 0–10V or 0–20mA ● Whether voltage or current is used for output is set through the jumper J5. ● Deviation: ±0.5% (output of 5V or 10mA or higher at the temperature of 25°C)
Digital input and output	S5—COM	Digital input 1	● Internal impedance: 3.3kΩ ● 12–30V voltage input is acceptable ● Bi-direction input terminal ● Max. input frequency: 1kHz
	S6—COM	Digital input 2	
	S7—COM	Digital input 3	
	S8—COM	Digital input 4	
	Y2—CME	Digital output	● Switch capacity: 50mA/30V ● Output frequency range: 0–1kHz ● The terminals CME and COM are shorted through J3 before delivery.

Category	Symbol	Name	Specifications
Relay output	RO3A	NO contact of relay 3	● Contact capacity: 3A/AC250V, 1A/DC30V ● Cannot be used as high frequency digital output.
	RO3B	NC contact of relay 3	
	RO3C	Common contact of relay 3	
	RO4A	NO contact of relay 4	
	RO4C	Common contact of relay 4	

Table E-3 Indicator function description

Symbol	Name	Description
LED1	Status 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.
LED4	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

E.2.2 I/O expansion card 2 (EC-IO502-00)

The EC-IO502-00 expansion card can be used in scenarios where the local I/O interfaces of VFD cannot meet the application requirements. It can provide four digital inputs, one PT100 temperature measuring input (PT1+), one PT1000 temperature measuring input (PT2+), and two relay outputs. It provides relay outputs and digital inputs through European-style screw terminals and temperature measuring inputs through spring terminals.

Figure E-4 EC-IO502-00 drawing

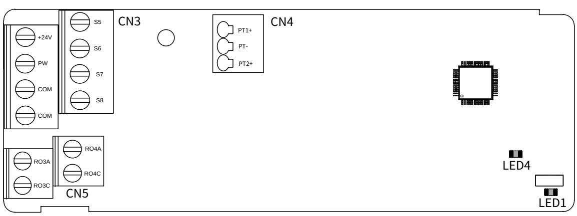


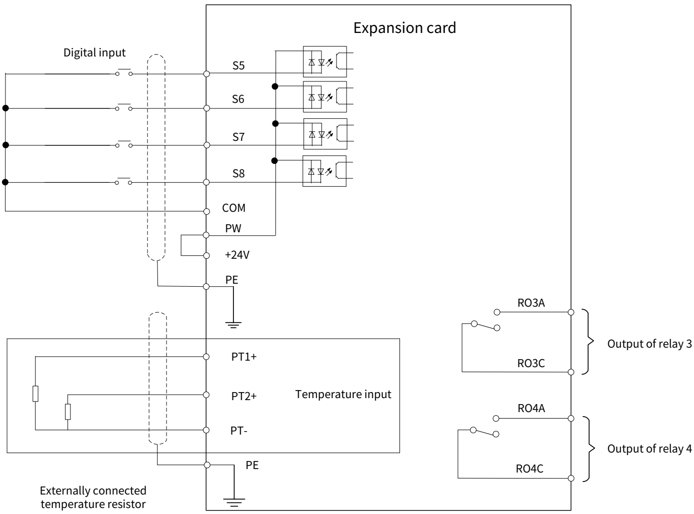
Table E-4 Terminal function description

Category	Symbol	Name	Specifications
Power supply	PW	External power	External power input terminal for digital input circuits Voltage range: 24VDC(-20%)–48VDC(+10%), 24VAC(-10%)–48VAC(+10%)
	+24V	Internal power	User power supply provided by the VFD. Max. output current: 200mA
	COM	Power reference	Common terminal of +24V
Digital input	S5—COM	Digital input 5	● Internal impedance: 6.6kΩ ● Supporting the voltage input of external power (-20%)24–48VDC(+10%) and (-10%)24–48VAC(+10%) ● Supporting the internal power 24V ● Bi-direction input terminal, supporting both NPN and PNP ● Max. input frequency: 1kHz ● All are programmable digital input terminals, the functions of which can be set through function codes
	S6—COM	Digital input 6	
	S7—COM	Digital input 7	
	S8—COM	Digital input 8	
Temperature detection input	PT1+	PT100 resistor input	Independent PT100 and PT1000 inputs: PT1+ connects to PT100 resistor, while PT2+ connects to PT1000 resistor. ● Resolution: 1°C ● Range: -20°C–150°C ● Detection precision: 3°C ● Supporting offline protection
	PT2+	PT1000 resistor input	
	PT-	Reference input of PT100/PT1000	Reference zero potential of PT100/PT1000
Relay output	RO3A	Contact A of NO relay 3	● RO3 output; RO3A: NO; RO3C: common ● Contact capacity: 3A/AC250V, 1A/DC30V
	RO3C	Contact C of NO relay 3	
	RO4A	Contact A of NO relay 4	● RO4 output; RO4A: NO; RO4C: common ● Contact capacity: 3A/AC250V, 1A/DC30V
	RO4C	Contact C of NO relay 4	

Table E-5 Indicator function description

Symbol	Name	Description
LED1	Status 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.
LED4	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Figure E-5 Control circuit wiring of I/O expansion card 2

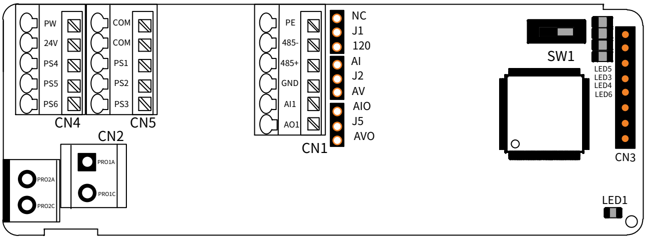


E.3 Programmable expansion card (EC-PC502-00)

The EC-PC502-00 expansion card adopts the global mainstream programmable expansion card development environment and supports the instruction language (IL), ladder diagram (LD), and sequential function chart (SFC), which can replace some micro PLC applications. It supplies a user program storage space of 16K steps and data storage space of 8K words, and supports saving data of 1K words at power off, facilitating secondary development.

EC-PC502-00 has six switching inputs, two relay outputs, one analog input, one analog output, one RS485 communication channel (supporting master/slave switchover). It uses European-style screw terminals for relay outputs and uses spring terminals for the others.

Figure E-6 EC-PC502-00 drawing



"SW1" indicates the start/stop switch of the programmable expansion card and "120" indicates 120Ω terminal resistor. By default, J1 connects to NC, J2 to AV, and J5 to AVO.

Table E-6 Terminal function description

Category	Terminal symbol	Terminal name	Specifications
Power supply	PW	External power	● Used to provide input digital working power from the external to the internal ● Voltage range: 12–30V ● PW and +24V should be short-connected.
	24V	Internal power	● Internal output power, 100mA
Digital input/output	PS1—COM	Digital input 1	● Internal impedance: 4kΩ ● 12–30V voltage input is acceptable ● Bi-direction input terminal ● Max. input frequency: 1kHz ● Source/sink inputs, and the input type should be consistent
	PS2—COM	Digital input 2	
	PS3—COM	Digital input 3	
	PS4—COM	Digital input 4	
	PS5—COM	Digital input 5	
	PS6—COM	Digital input 6	
Analog input/output	AI1	Analog input 1	● Input range: For AI1, 0–10V or 0–20mA ● Input impedance: 20kΩ for voltage input or 250Ω for current input ● Whether voltage or current is used for input is set through "AI/AV" and J2. ● Resolution: 5mV when 10V corresponds to 50Hz ● Deviation: ±1% (25°C, full measuring range)
	AO1	Analog output 1	● Output range: 0–10V or 0–20mA

Category	Terminal symbol	Terminal name	Specifications
			● Whether voltage or current is used for output is set through "AIO/AVO" and J5. ● Deviation: ±1% (25°C, full measuring range)
Relay output	PRO1A	NO contact of relay 1	● Contact capacity: 2A/AC250V, 1A/DC30V ● Cannot be used as high frequency digital output.
	PRO1C	Common contact of relay 1	
	PRO2A	NO contact of relay 2	
	PRO2C	Common contact of relay 2	

Table E-7 Indicator function description

Symbol	Name	Description
LED1	Power indicator	PWR power indicator On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Communication indicator	COMM communication 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.
LED4	Fault indicator	ERR fault indicator Blinking (On: 500ms; Off: 500ms): An error occurs to the expansion card. (The error type can be queried through the host controller software Auto Station.) Off: No fault
LED5	Power indicator	PWR power indicator On: The expansion card is powered on. Off: The expansion card is not powered on.
LED6	Status indicator	RUN status indicator On: The PLC program is running. Off: The PLC program stops.

E.4 Communication card

E.4.1 Bluetooth communication card (EC-TX501) and Wi-Fi communication card (EC-TX502)

Wireless communication cards are usually used in scenarios where direct operation from the local keypad is not possible due to limited space for inverter installation. With the use of wireless communication cards, a long-distance control up to 30 meters is possible through the mobile APP.

Figure E-7 EC-TX501/502 drawing

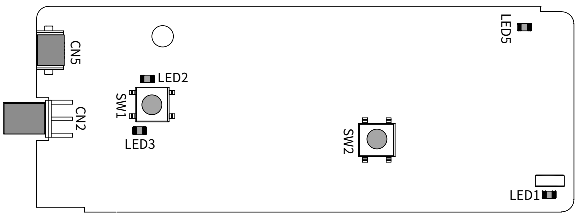
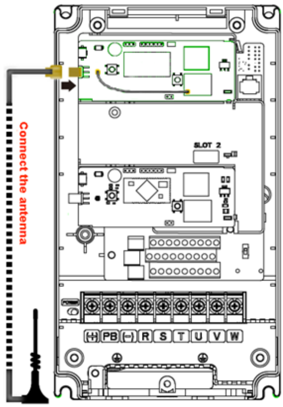


Table E-8 Indicator function description

Symbol	Name	Description
LED1/LED3	Status indicator	Expansion card status 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	Bluetooth communication status indicator On: Bluetooth is online and data can be exchanged. Off: Bluetooth is offline.
LED5	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
SW1	Wi-Fi factory reset button	It is used to restore the expansion card to default values and return to the local monitoring mode.
SW2	Wi-Fi hardware reset button	It is used to restart the expansion card.

You can choose a PCB antenna or an external sucker antenna according to the actual installation environment to get good Bluetooth signal. If the VFD is a molded case machine and located in an open space, you can use a built-in PCB antenna; and if it is a sheetmetal machine and located in a metal cabinet, you need to use an external sucker antenna.

Step 1 Install a wireless communication card and an external sucker antenna. Install a wireless communication card on the VFD, and then lead the SMA connector of the sucker antenna into the VFD and screw it to the CN2 terminal, as shown in the following figure. Place the antenna base on the housing upper part, ensuring it is exposed and not obstructed nearby.  	Step 2 Download the APP INVT Workshop. Scan the QR code from the VFD nameplate to download INVT Workshop. For details, see the manual for the wireless communication card. 

E.4.2 PROFIBUS-DP communication card (EC-TX503D)

Figure E-8 EC-TX503D drawing

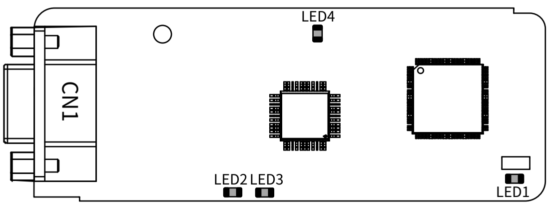
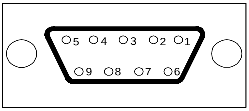


Table E-9 CN1 description

CN1	Connector pin		Description
 9-pin D-type connector	1	-	Unused
	2	-	Unused
	3	B-Line	Data+ (twisted pair 1)
	4	RTS	Request sending
	5	GND_BUS	Isolation ground
	6	+5V BUS	Isolated power supply of 5 V DC
	7	-	Unused
	8	A-Line	Data- (twisted pair 2)
	9	-	Unused
	Housing	SHLD	PROFIBUS cable shielding line

Note:

- +5V BUS and GND_BUS are bus terminators. Devices such as optical transceivers (RS485) may need to obtain power through these pins.
- Some devices use RTS to determine the direction of transmission and reception. In normal applications, only A-Line B-Line, and the shield layer need to be used.

Table E-10 Indicator function description

Symbol	Name	Description
LED1	Status 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.

Symbol	Name	Description
		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, see the manual of the communication card.

E.4.3 CAN multi-protocol communication card (EC-TX505D)

Figure E-9 EC-TX505D drawing

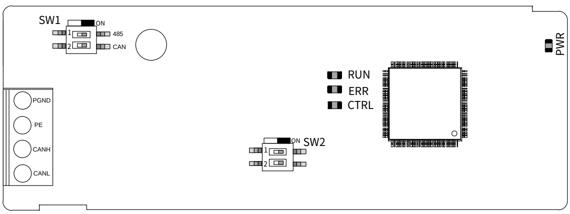


Table E-11 EC-TX505D expansion card description

Symbol	Name	Description
PGND	Isolation ground	Isolation ground
PE	Shielded cable	CAN bus shielding
CANH	CAN positive input	CAN bus high level signal
CANL	CAN negative input	CAN bus low level signal
CAN	CAN terminal resistor switch	OFF: CAN_H and CAN_L are not connected to the terminal resistor
		ON: CAN_H and CAN_L are connected to the terminal resistor

Note: For this card, before power-on, set the SW2 switch according to the mapping between protocols and positions.

SW2		
1	**2**	**Protocol type**
OFF	OFF	CANopen
ON	OFF	CAN master/slave

Table E-12 Indicator function description

Indicator	Definition	Function
LED1	Status 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	Run indicator	On: The communication card is in the operating state. Blinking (On: 250 ms; Off: 250 ms): The communication card is in the pre-operation state. Off: A fault occurs; the reset pin of the communication card and the power supply are not properly connected; the expansion card is in a stopped state.
LED3	Fault indicator	On: The CAN controller bus is off; a fault occurs on the VFD; received frame lost or incorrect. Off: The communication card is in the working state.
LED4	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Note: For details, see the manual of the communication card.

E.4.4 PROFINET communication card (EC-TX509C)

The terminal CN2 of the PROFINET communication card adopts standard RJ45 interfaces, which are not distinguished from each other and can be interchangeably inserted.

Figure E-10 EC-TX509C drawing

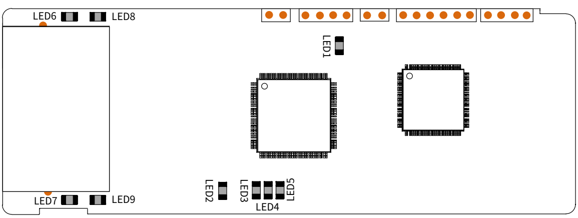


Table E-13 Indicator function description

Symbol	Name	Description
LED1	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED2	Status indicator	Bus status 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	Status 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	Status 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.

The PROFINET communication card can be used in a linear network topology and a star network topology.

Figure E-11 Linear network topology electrical connection

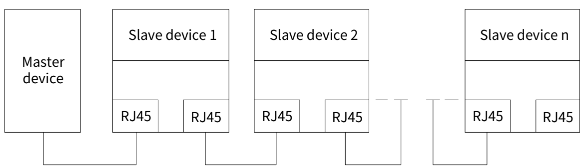
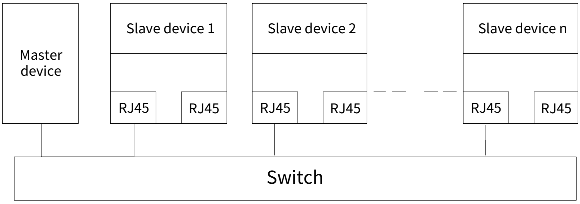


Figure E-12 Star network topology electrical connection

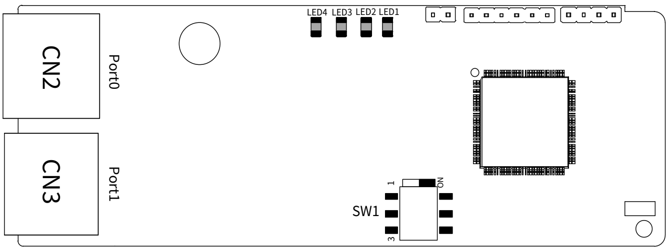


Note: For the star network topology, you need to prepare PROFINET switches.

E.4.5 EtherNet IP multi-protocol communication card (EC-TX510B)

The expansion card has two communication ports, both of which adopt standard RJ45 interfaces and can be interchangeably inserted. It supports selecting the protocol through a switch before power-on. The default selection is EtherNet IP, with Modbus TCP and Ethernet communication as optional choices.

Figure E-13 EC-TX510B drawing



Note: For this card, before power-on, set the SW1 switch according to the mapping between protocols and positions.

Table E-14 SW1 switch definition

SW1			
1	**2**	**3**	**Protocol type**
ON	ON	ON	EtherNet IP
OFF	ON	ON	Ethernet
ON	OFF	ON	Modbus TCP
Other	Other	Other	Reserved

Table E-15 Indicator function description when EtherNet IP selected

Indicator	Color	Definition	Function
LED1	Green	On	The expansion card is shaking hands with the VFD.
		Blinking (1Hz)	The expansion card and VFD communicate properly.
		Off	The expansion card and VFD communicate improperly.
LED2	Green	On	The communication between the expansion card and PLC is online and data exchange is allowed.
		Off	The communication between the expansion card and PLC is not online.
LED3	Red	On	Failed to set up I/O between the expansion card and the PLC.
		Blinking (1Hz)	Incorrect PLC configuration.
		Blinking (2Hz)	The expansion card failed to send data to the PLC.
		Blinking (4Hz)	The connection between the expansion card and PLC timed out.
		Off	No fault
LED4	Red	On	3.3V power indicator

Table E-16 Indicator function description when Modbus TCP selected

Indicator	Color	Definition	Function
LED1	Green	On	The expansion card is shaking hands with the VFD.
		Blinking (1Hz)	The expansion card and VFD communicate properly.
		Off	The expansion card and VFD communicate improperly.
LED2	Green	On	The communication between the expansion card and PLC is online and data exchange is allowed.
		Off	The communication between the expansion card and PLC is not online.
LED3	Red	On	Expansion card has no valid data received.
		Blinking (1Hz)	The message function code is not used or defined
		Blinking (8Hz)	Message address error
		Off	No fault
LED4	Red	On	3.3V power indicator

Table E-17 Indicator function description when Ethernet selected

Indicator	Color	Definition	Function
LED1	Green	On	The expansion card is shaking hands with the VFD.
		Blinking (1Hz)	The expansion card and VFD communicate properly (handshake successful).
		Off	The expansion card and VFD communicate improperly.
LED2	Green	On	The connection between the expansion card and PC is successful.
		Off	The expansion card fails to connect with PC (abnormal network cable).
LED3	Red	Blinking (4Hz)	The expansion card is successfully connected to the PC but communication fails (abnormal IP address).
		Off	No fault
LED4	Red	On	3.3V power indicator

Electrical connection

The communication card adopts standard RJ45 interfaces, supporting both linear and star network connections. The electrical connection diagram is shown as follows.

Note: Use CAT5, CAT5e, or CAT6 network cables for electrical wiring. When the communication distance is greater than 50m, use high-quality network cables that meet the high-quality standards.

Figure E-14 Linear network topology electrical connection

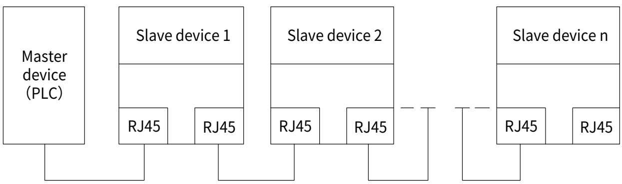
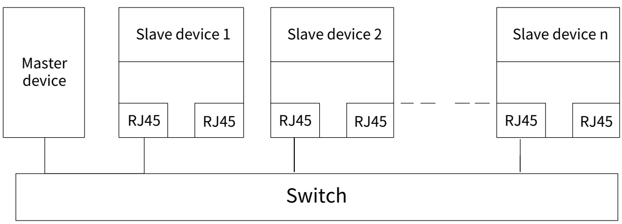


Figure E-15 Star network topology electrical connection



Note: For the star network topology, you need to prepare Ethernet switches.

E.5 PG expansion card

E.5.1 Sin/Cos PG card (EC-PG502)

Figure E-16 EC-PG502 drawing

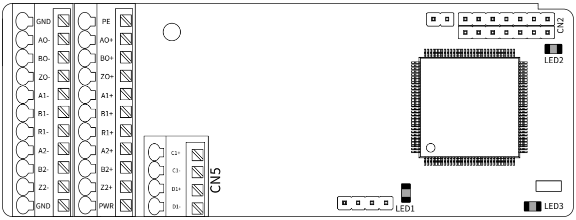


Table E-18 Terminal function description

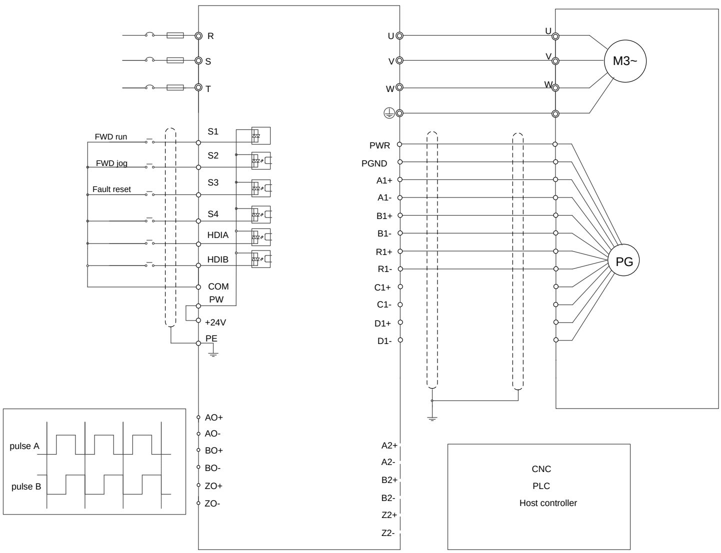
Terminal symbol	Terminal name	Specifications
PWR	Encoder power	Voltage: 5V ± 5%⊠ Max. output current: 150mA
GND		
A1+	Encoder interface	● Supporting Sin/Cos encoders ● SINA/SINB/SINC/SIND 0.6–1.2Vpp; SINR 0.2–0.85Vpp ● Max. frequency response of A/B signals: 200kHz⊠ Max. frequency response of C/D signals: 1kHz
A1-		
B1+		
B1-		
R1+		
R1-		
C1+		
C1-		
D1+		
D1-		
A2+	Pulse setting	● Supporting 5V differential signal ● Response frequency: 200kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5V ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16. Max. output frequency: 200kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

Table E-19 Indicator function description

Symbol	Name	Description
LED1	Encoder signal indicator	On: Encoder signals are normal. Blinking (On: 500ms; Off: 500ms): C1 or D1 of the encoder is disconnected. Off: A1 or B1 of the encoder is disconnected.
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status 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.

The following figure shows the external wiring of the PG card when it is used in combination with an encoder with CD signals.

Figure E-17 External wiring of the PG card and an encoder with CD signals



Note: If the connected encoder does not have CD signals, you do not need to connect the C1+, C1-, D1+, and D1- terminals of the PG card.

E.5.2 Incremental PG card with UVW (EC-PG503-05)

The EC-PG503-05 expansion card supports the input of absolute position signals, integrating the advantages of absolute and incremental encoders and adopts spring terminals for easy use.

Figure E-18 EC-PG503-05 drawing

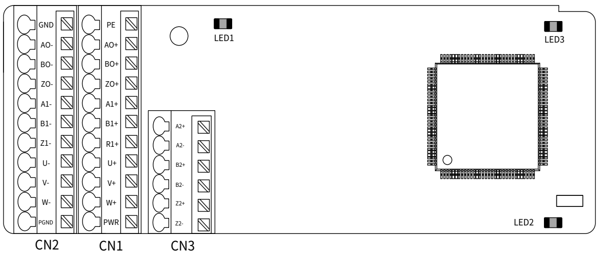


Table E-20 Terminal function description

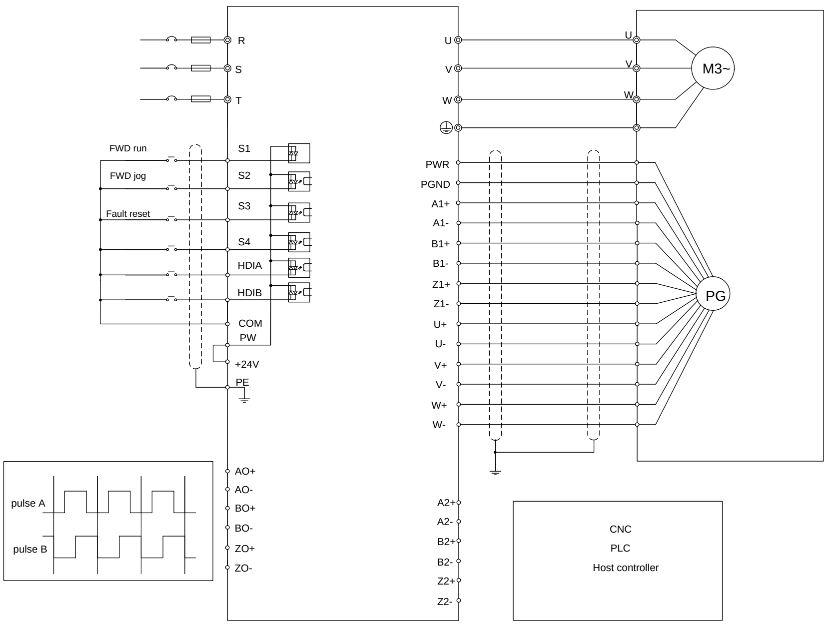
Terminal symbol	Terminal name	Specifications
PWR	Encoder power	Voltage: 5V ± 5% Max. current: 200mA
PGND		
A1+	Encoder interface	● Differential incremental PG interface of 5V ● Response frequency: 400kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse setting	● Differential input of 5V ● Response frequency: 200kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5V ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		
U+	UVW encoder interface	● Absolute position (UVW information) of the hybrid encoder, differential input of 5V
U-		

Terminal symbol	Terminal name	Specifications
V+		● Response frequency: 40kHz
V-		
W+		
W-		

Table E-21 Indicator function description

Symbol	Name	Description
LED1	Encoder signal indicator	Blinking (On: 500ms; Off: 500ms): A1 or B1 signal is disconnected during encoder rotating. On: Encoder signals are normal.
LED2	Status 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.
LED3	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Figure E-19 External wiring when EC-PG503-05 used



E.5.3 Resolver PG card (EC-PG504-00)

The EC-PG504-00 expansion card adopts spring terminals and can be used in combination with a resolver with an excitation voltage of 7Vrms.

Figure E-20 EC-PG504-00 drawing

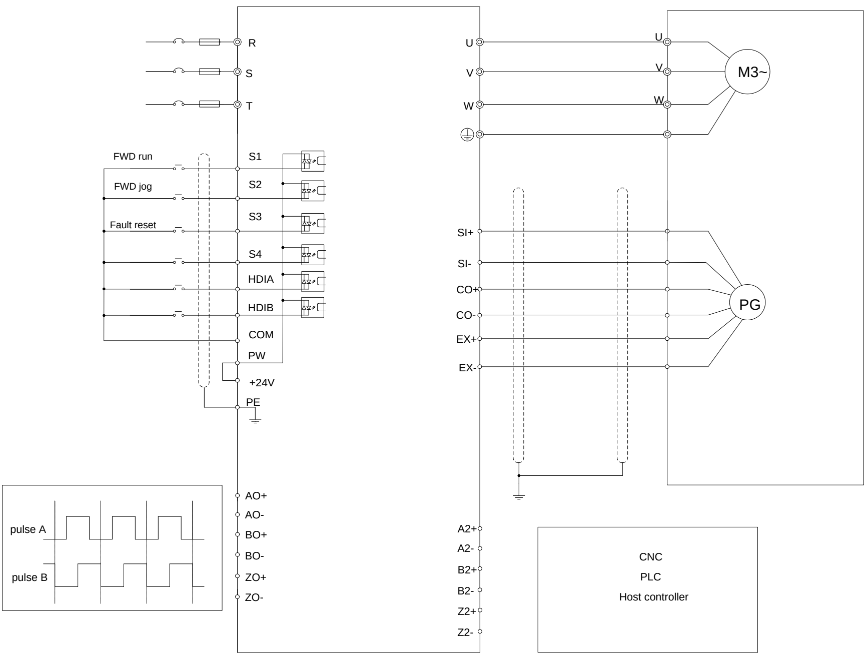
Table E-22 Terminal function description

Terminal symbol	Terminal name	Specifications
SI+	Encoder signal input	Recommended resolver transformation ratio: 0.5
SI-		
CO+		
CO-		
EX+	Encoder excitation signal	● Factory setting of excitation: 10kHz ● Supporting resolvers with an excitation voltage of 7Vrms
EX-		
A2+	Pulse setting	● Differential input of 5V ● Response frequency: 200kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5V ● Frequency-divided output of resolver simulated A1, B1, and Z1, which is equal to an incremental PG card of 1024 pps. Supporting frequency division of 1–255N, which can be set through P20.16 or P24.16 Max. output frequency: 200kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

Table E-23 Indicator function description

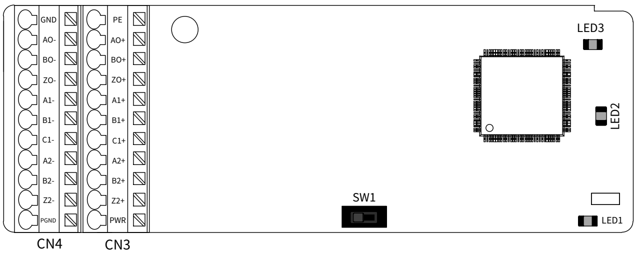
Symbol	Name	Description
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is connected to the control board properly. Off: The expansion card is disconnected from the control board.
LED2	Encoder signal indicator	On: Encoder signals are normal. Blinking (On: 500ms; Off: 500ms): The encoder signals are not stable. Off: Encoder is disconnected.
LED3	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Figure E-21 External wiring when EC-PG504-00 used



E.5.4 Multifunction incremental PG card (EC-PG505-12)

Figure E-22 EC-PG505-12 drawing



SW1: the switch used to set the voltage class (5V or 12V) of the power supply of the encoder. It can be operated with an auxiliary tool.

Table E-24 Terminal function description

Terminal symbol	Terminal name	Specifications
PWR	Encoder power	Voltage: 5V/12V ± 5% Max. output: 150 mA Select the voltage class through SW1 based on the voltage class of the used encoder.
PGND		
A1+	Encoder interface	● Applicable to 5V/12V push-pull encoders ● Applicable to 5V/12V OC encoders ● Applicable to 5V differential encoders ● Response frequency: 400kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse setting	● Supporting the same signal types as the encoder signal types ● Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5V ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		

Table E-25 Indicator function description

Symbol	Name	Description
LED1	Signal indicator	Blinking (On: 500ms; Off: 500ms): A1 or B1 signal is disconnected during encoder rotating. On: Other cases
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status 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.

The EC-PG505-12PG card is equipped with pull-up resistors internally and can be used with various incremental encoders through different external wiring configurations. For the specific wiring, see Figure E-23, Figure E-24, and Figure E-25.

Figure E-23 External wiring when used with an open collector encoder

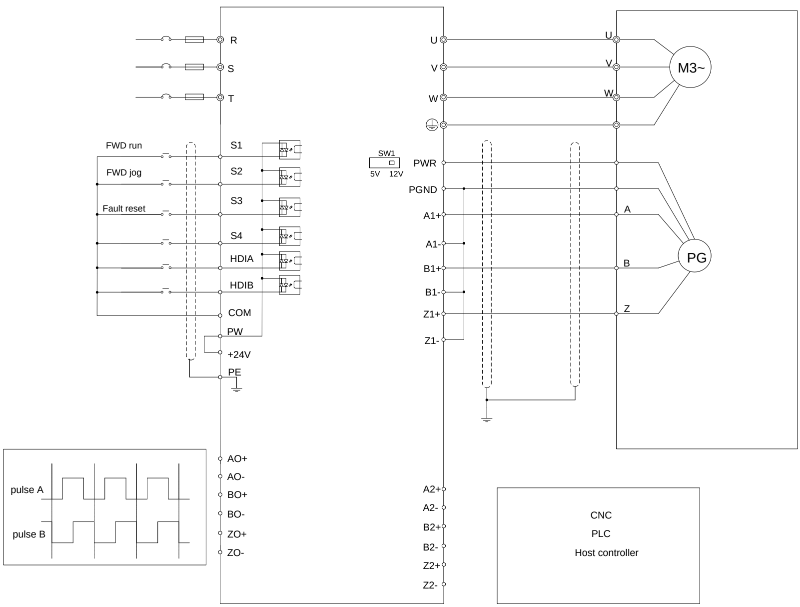


Figure E-24 External wiring when used with a push-pull encoder

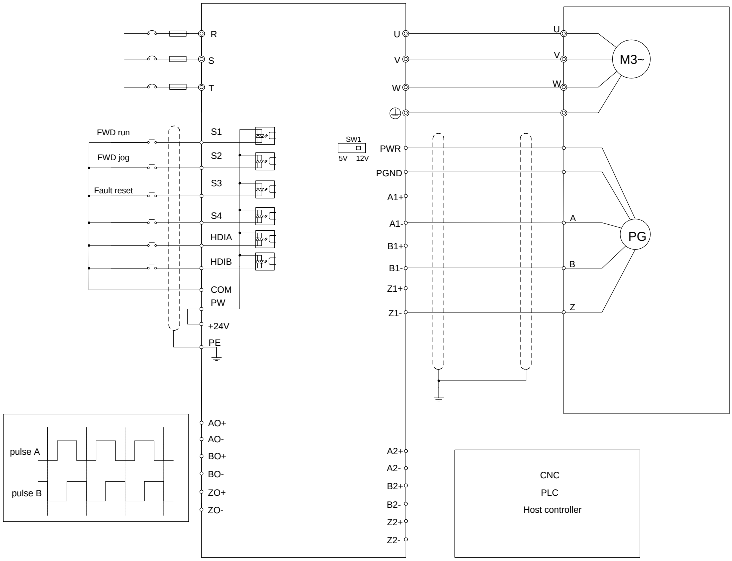
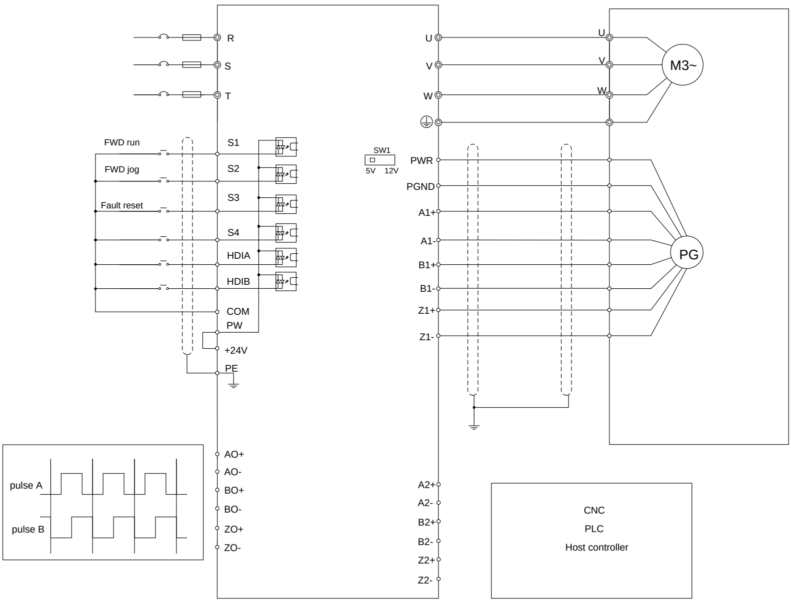


Figure E-25 External wiring when used with a differential encoder



E.5.5 24V incremental PG card (EC-PG505-24B)

Figure E-26 EC-PG505-24B drawing

Table E-26 Terminal function description

Symbol	Name	Specifications
PWR	Encoder power	Voltage: 24V ± 5% Max. output current: 150mA
PGND		
A1+	Encoder interface	● Applicable to 24V push-pull encoders ● Applicable to 24V OC encoders ● Applicable to 24V differential encoders ● Response frequency: 400kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse setting	● Applicable to 24V push-pull and OC encoders ● Applicable to 5V differential encoders ● Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Supporting open collector output with a pull-up resistor externally connected to the input port ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16 ● Supporting frequency-divided output source selection, which can be set through P20.17 or P24.17
BO+		
ZO+		

Table E-27 Indicator function description

Symbol	Name	Description
LED1	Signal indicator	Blinking (On: 500ms; Off: 500ms): A1 or B1 signal is

Symbol	Name	Description
		disconnected during encoder rotating. On: Other cases
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status 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.

The EC-PG505-24B uses spring terminals, and AO-, BO-, and ZO- are internally shorted to PGND. The PG expansion card is configured with a pull-up resistor and can work in combination with multiple types of incremental encoders through various external wiring modes. For the specific wiring, see Figure E-27 and Figure E-28.

Figure E-27 External wiring when used with an open collector encoder

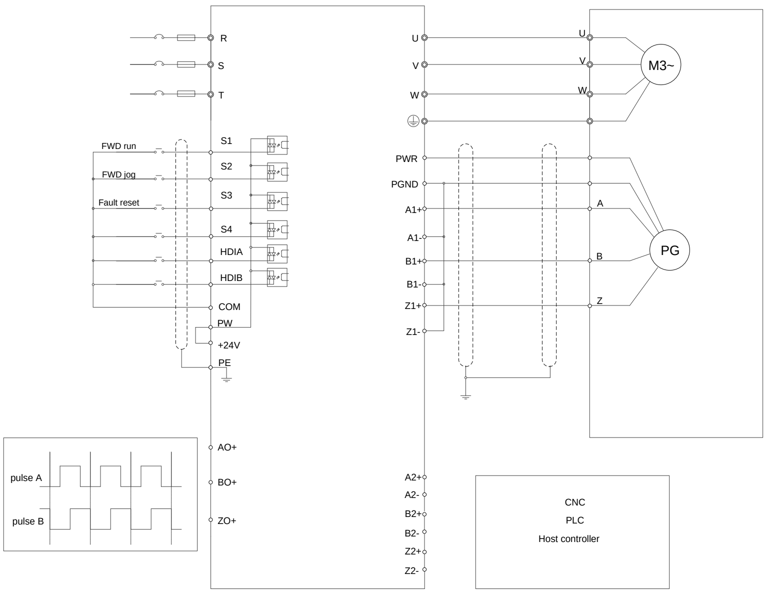
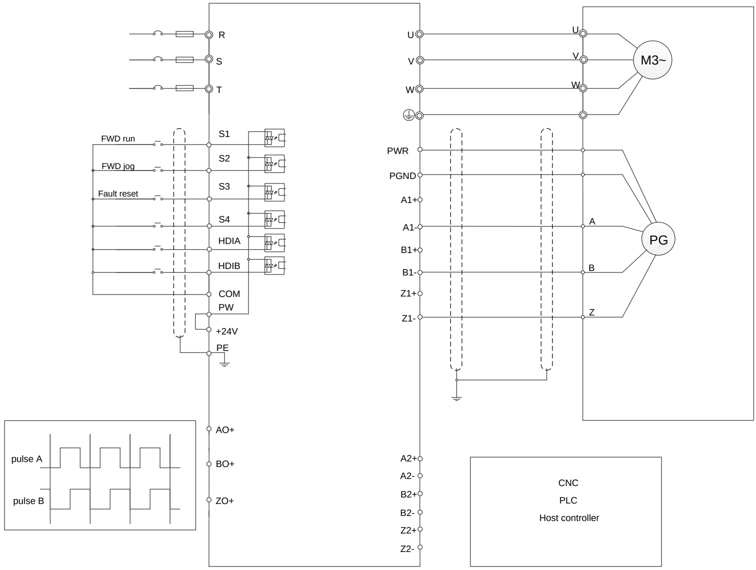
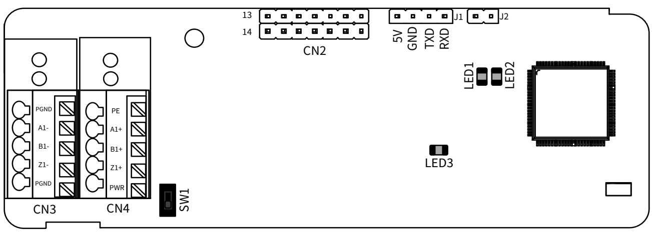


Figure E-28 External wiring when used with a push-pull encoder



E.5.6 Simplified incremental PG card (EC-PG507-12)

Figure E-29 EC-PG507-12 drawing



SW1: the switch used to set the voltage class (5V or 12V) of the power supply of the encoder. It can be operated with an auxiliary tool.

Table E-28 Terminal function description

Symbol	Name	Specifications
PWR	Encoder power	Voltage: 5V/12V ± 5% Max. output: 150mA Select the voltage class through SW1 based on the voltage class of the used encoder.
PGND		

Symbol	Name	Specifications
A1+	Encoder interface	● Applicable to 5V/12V push-pull encoders ● Applicable to 5V/12V OC encoders ● Applicable to 5V differential encoders ● Response frequency: 400kHz ● Supporting the encoder cable length of up to 50m
A1-		
B1+		
B1-		
Z1+		
Z1-		

Table E-29 Indicator function description

Symbol	Name	Description
LED1	Status 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	Signal indicator	Off: A1 or B1 of the encoder is disconnected. On: Encoder signals are normal.
LED3	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Note: EC-PG507-12 can work in combination with multiple types of incremental encoders through various external wiring modes, which are similar to the wiring methods of EC-PG505-12.

E.5.7 24V simplified incremental PG card (EC-PG507-24)

Figure E-30 EC-PG507-24 drawing

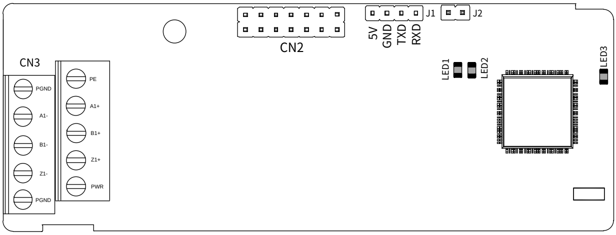


Table E-30 Terminal function description

Symbol	Name	Specifications
PE	Grounding terminal	Connected to the ground to enhance the anti-interference performance
PWR	Encoder power	Voltage: 24V ± 5% Max. output current: 150mA (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	● Applicable to 24V push-pull encoders ● Applicable to 24V OC encoders ● Applicable to 24V differential encoders ● Response frequency: 200kHz ● Supporting the encoder cable length of up to 100m
A1-		
B1+		
B1-		
Z1+		
Z1-		

Table E-31 Indicator function description

Symbol	Name	Description
LED1	Status 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	Signal indicator	On: Encoder pulses are normal. Off: A1 or B1 of the encoder is disconnected.
LED3	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

The EC-PG507-24 expansion card uses 5.08mm pitch terminals. It is equipped with a pull-up resistor internally. It can work in combination with multiple types of incremental encoders through various external wiring methods, as shown in the following figures.

Figure E-31 External wiring when used with an open collector encoder

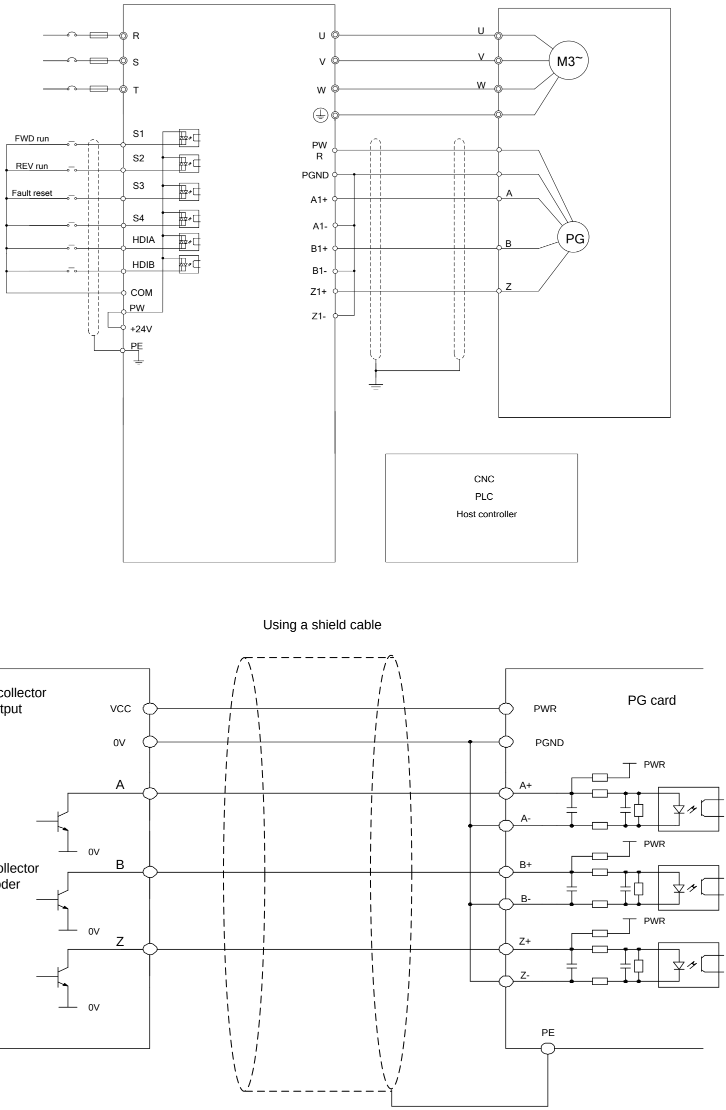
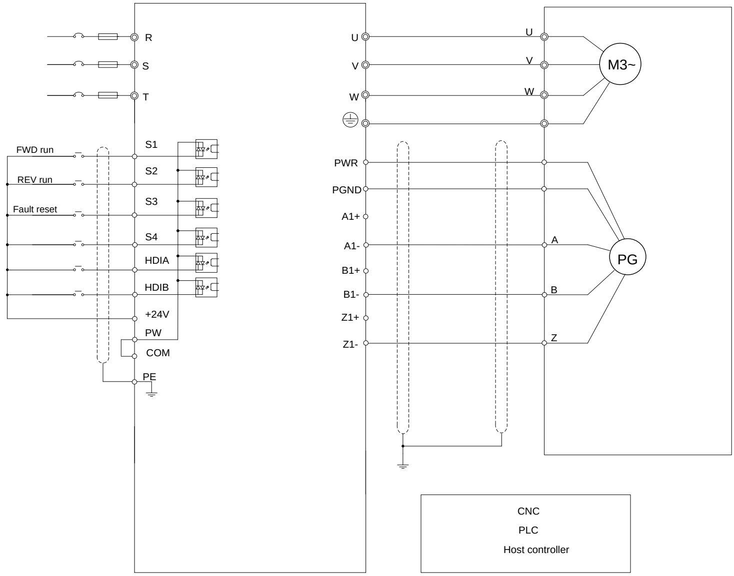


Figure E-32 External wiring when used with a push-pull encoder



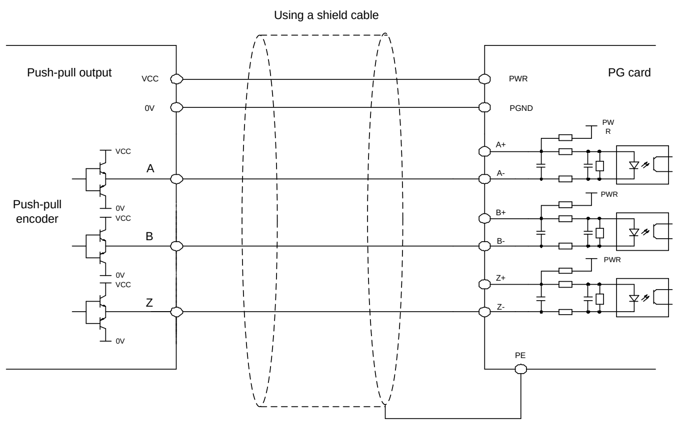
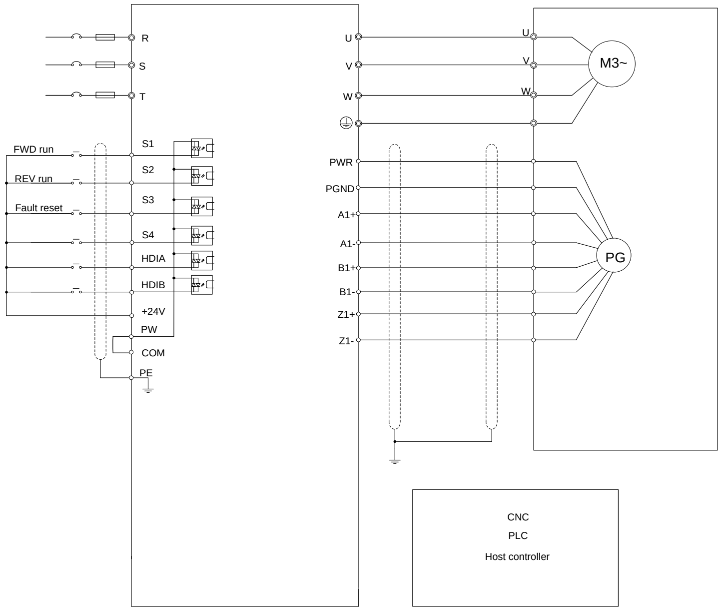
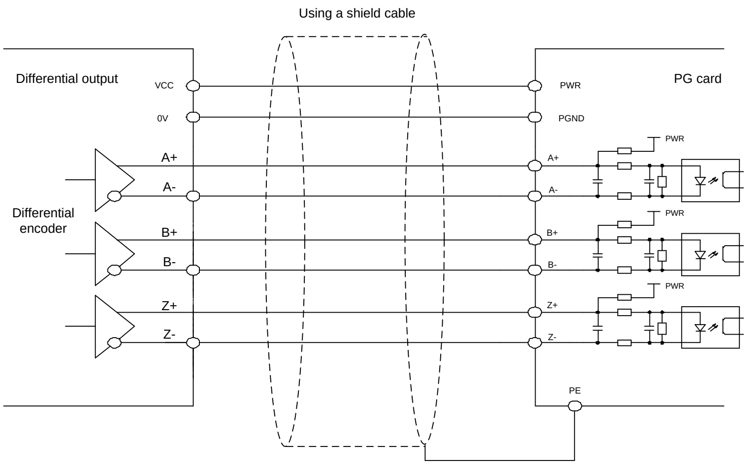


Figure E-33 External wiring when used with a differential encoder





E.6 IoT expansion card

E.6.1 GPRS expansion card (EC-IC501-2)

After configuring the EC-IC501-2 expansion card, the functions of remote device monitoring, historical data query, fault alarm push, and remote device upgrade can be realized through the INVT industrial Internet platform.

Figure E-34 EC-IC501-2 drawing

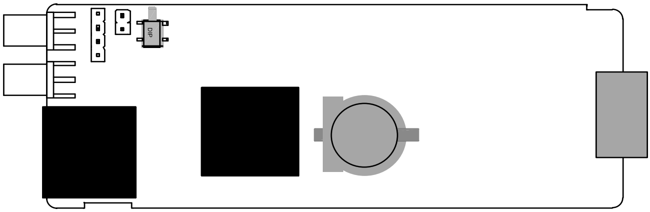


Table E-32 CN6 pin function description

Pin	Name	Description
1	485-	485B
2	485+	485A
3	GND	Power ground
4	24V	24V power supply

Table E-33 Indicator function description

Symbol	Name	Description
LED1	Status indicator	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	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Run indicator	On: The expansion card communicates properly. Off: The expansion card is not communicating.
LED4	Signal indicator	GPRS status indicator Blinking (On: 64ms; Off: 300ms): GPRS connects to the network. Blinking (On: 64ms; Off: 800ms): No network registered.
LED5	Status indicator	GPRS module status indicator On: The GPRS module is turned on. Off: The GPRS module is not turned on.

Note: For details about the operation, see the manual of the EC series GPRS expansion card.

E.6.2 4G expansion card (EC-IC502-2-CN, EC-IC502-2-EU, EC-IC502-2-LA)

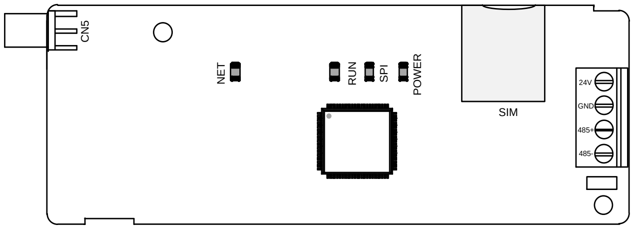


Table E-34 Terminal function description

Port ID	Port description
24V	Power supply +
GND	Power supply -
485+	485A
485-	485B
4G	4G antenna
CN5	SIM card socket

Table E-35 Indicator function description

Symbol	Name	Description
NET	Network indicator	Slow flashing (On: 600ms; Off: 600ms): No SIM card, network registration in progress, or registration failed. Fast flashing (On: 75ms; Off: 75ms): Data link established.
RUN	Run indicator	On: System exceptions happened. Slow flashing (On: 1s; Off: 1s): The system runs properly. Off: System exceptions happened.
SPI	Signal indicator	On: Connection failed or no connection. Slow flashing (On: 1s; Off: 1s): Connection between the expansion card and VFD control board is successful.
POWER	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Note:

- Only the domestic version comes with a 4G SIM card as standard.
- For details, see the manual of the EC series 4G expansion card.

Appendix F STO function

The Safe Torque Off (STO) function turns off the drive output by shutting down the drive signal, cutting off the electrical power supply to the motor and thus stopping the outward torque output (see Figure F-1). When STO is activated, this function prevents the motor from accidentally starting if the motor is in static state. If the motor is rotating, it will continue to rotate by inertia until it comes to rest. If the motor has a brake, the brake closes immediately.

The VFD is integrated with the STO function and conforms to the IEC 61508, IEC 61800-5-2, IEC62061, and ISO13849-1 standards.

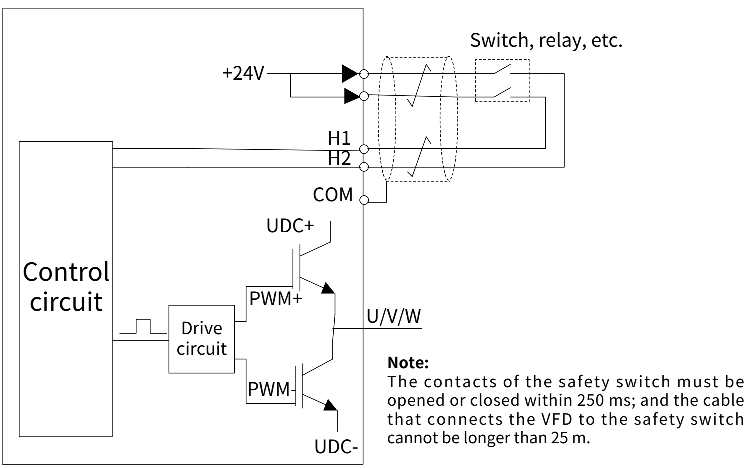
Safety standard related data

IEC/EN 61508 (Class A system)							ISO 13849**			
SIL	PFH	HFT	SFF	λdu	λdd	PTI*	PL	CCF	DC	Category
2	8.73×10^{-10}	1	71.23%	1.79×10^{-9}	0	1 year	d	57	60%	3

* PTI: Proof test interval

** Depends on the classification defined on the EN ISO 13849-1.

Figure F-1 STO circuit diagram



F.1 STO function logic table

The following table describes the input states and corresponding faults of the STO function.

STO input state	Corresponding fault
H1 and H2 opened simultaneously	The STO function is triggered, and the drive stops running. Fault code: 40: Safe torque off (STO)
H1 and H2 closed simultaneously	The STO function is not triggered, and the drive runs properly.
One of H and H2 opened, and the other closed	STL1, STL2, or STL3 fault occurred. Fault code: 41: Channel H1 exception (STL1) 42: Channel H2 exception (STL2) 43: Exception to both channel H1 and H2 (STL3)

F.2 STO channel delay description

The following table describes the trigger and indication delay of the STO channels.

STO mode	STO trigger delay [1] and indication delay [2]
STO fault: STL1	Trigger delay < 10ms Indication delay < 280ms
STO fault: STL2	Trigger delay < 10ms Indication delay < 280ms
STO fault: STL3	Trigger delay < 10ms Indication delay < 280ms
STO fault: STO	Trigger delay < 10ms Indication delay < 100ms

STO trigger delay [1] : Time interval between triggering the STO function and switching off the drive output

STO instruction delay [2]: Time interval between triggering the STO function and indicating STO output status

F.3 STO function checklist

Check the items described in the following table to ensure that the STO function can be properly used.

	Item
☐	Ensure that the drive can be run or stopped randomly during commissioning.
☐	Stop the drive (if it is running), disconnect the input power supply, and isolate the drive from the power cable through the switch.
☐	Check the STO circuit connection according to the circuit diagram.

☐	Check whether the shielding layer of the STO input cable is connected to the +24 V reference ground COM.
☐	Connect to the power.
☐	Test the STO function as follows after the motor stops running: ● If the drive is running, send a stop command to it and wait until the shaft of the motor stops rotating. ● Activate the STO circuit and send a start command to the drive. Ensure that the motor does not start. ● Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.
☐	Test the STO function as follows when the motor is running: ● Start the drive. Ensure that the motor is running properly. ● Activate the STO circuit. ● The drive reports an STO fault (for details, see chapter 8 Fault handling). Ensure that the motor coasts to stop and then stops rotation. ● Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.

Appendix G Function parameter list

The function parameters of the VFD are divided into groups by function. Among the function parameter groups, the P98 group is the analog input and output calibration group, while the P99 group contains the factory function parameters, which are user inaccessible. Each group includes several function codes (each function code identifies a function parameter). A three-level menu style is applied to function codes. For example, "P08.08" indicates the 8th function code in the P08 group. The VFD supplies the password protection function. For detail settings, see P07.00. The parameters adopt the decimal system (DEC) and hexadecimal system (0–F). If the hexadecimal system is adopted, all bits are mutually independent on data during parameter editing. The symbols in the table are described as follows:

"○" 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. (When "Restore factory settings" is performed, the actual detected parameter values or recorded values will not be restored.)

Group P00—Basic functions

Function code	Name	Description	Default	Modify
P00.00	Speed control mode	Specifies a speed control mode. Setting range: 0–3 0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Closed-loop vector control mode **Note:** When using a vector control mode (0, 1, or 3), enable the VFD to perform motor parameter autotuning first.	2	◎
P00.01	Channel of running commands	Specifies a channel of running commands. Setting range: 0–2 0: Keypad 1: Terminal 2: Communication	0	○
P00.02	Communication	Used to select a communication mode of	0	○

<table>
<tr><th>Function code</th><th>Name</th><th colspan="2">Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>mode of running commands</td><td colspan="2">running commands.
Setting range: 0–6
0: Modbus/Modbus TCP communication
1: PROFIBUS/CANopen/DeviceNet communication
2: Ethernet communication
3: EtherCAT/PROFINET/Ethernet IP communication
4: Programmable expansion card
5: Wireless communication card
6: Reserved
Note: The Modbus TCP communication mode of option 0, and options 1, 2, 3, 4, and 5 are extended functions, which are valid only when corresponding expansion cards are configured.</td><td></td><td></td></tr>
<tr><td rowspan="2">P00.03</td><td rowspan="2">Max. output frequency</td><td rowspan="2">Specifies the max. output frequency of the VFD, which is the basis of the frequency setting and the acceleration (ACC) and deceleration (DEC) speed.</td><td>Setting range: Max(P00.04,10.00)–630.00Hz
Note: Supported by software of version V3.xx or earlier.</td><td rowspan="2">50.00Hz</td><td rowspan="2">◎</td></tr>
<tr><td>Setting range: Max(P00.04,10.00)–599.00Hz
Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P00.04</td><td>Upper limit of running frequency</td><td colspan="2">Specifies the upper limit of the VFD output frequency, which should be smaller than or equal to the max. output frequency. If the set frequency is higher than the upper limit of the running frequency, the upper limit of the running frequency is used for running.
Setting range: P00.05–P00.03 (Max. output</td><td>50.00Hz</td><td>◎</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>frequency)</td><td></td><td></td></tr>
<tr><td>P00.05</td><td>Lower limit of running frequency</td><td>Specifies the lower limit of the VFD output frequency. If the set frequency is lower than the lower limit of the running frequency, the lower limit of the running frequency is used for running.
Setting range: 0.00Hz–P00.04 (Upper limit of running frequency)
Note: Max. output frequency ≥ Upper limit of frequency ≥ Lower limit of frequency</td><td>0.00Hz</td><td>◎</td></tr>
<tr><td>P00.06</td><td>Setting channel of A frequency command</td><td rowspan="2">Specifies the frequency command source.
Setting range: 0–15
0: Keypad digital
1: AI1
2: AI2
3: AI3
4: High-speed pulse HDIA
5: Simple PLC program
6: Multi-step speed running
7: PID control
8: Modbus/Modbus TCP communication
9: PROFIBUS/CANopen/DeviceNet communication
10: Ethernet communication
11: High-speed pulse HDIB
12: Pulse train AB
13: EtherCAT/PROFINET/EtherNet IP communication
14: Programmable card
15: Reserved</td><td>0</td><td>○</td></tr>
<tr><td>P00.07</td><td>Setting channel of B frequency command</td><td>15</td><td>○</td></tr>
<tr><td>P00.08</td><td>Reference object of B frequency command</td><td>Specifies the reference object of B frequency command.
Setting range: 0–1
0: Max. output frequency
1: A frequency command</td><td>0</td><td>○</td></tr>
<tr><td>P00.09</td><td>Combination</td><td>Specifies the combination mode of A/B</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
	mode of setting source	frequency setting source. Setting range: 0–5 0: A 1: B 2: (A+B) 3: (A-B) 4: Max(A, B) 5: Min. (A, B)		
P00.10	Setting frequency through keypad	Specifies the initial VFD frequency set value when A and B frequency commands are set by keypad. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P00.11	ACC time 1	Specifies the ACC time of ramp frequency. Setting range: 0.0–3600.0s	Model depended	○
P00.12	DEC time 1	Specifies the DEC time of ramp frequency. Setting range: 0.0–3600.0s	Model depended	○
P00.13	Running direction	Specifies the running direction. Setting range: 0–2 0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running.	0	○
P00.14	Carrier frequency setting	Specifies the carrier frequency. A high carrier frequency will have an ideal current waveform, few current harmonics, and small motor noise, but it will increase the switch loss, increase VFD temperature, and impact the output capacity. At the same time, the VFD current leakage and electrical magnetic interference will increase. On the contrary, an extremely-low a carrier frequency may cause unstable operation at low frequency, decrease the torque, or even lead to oscillation. The carrier frequency has been properly set in the factory before the VFD is	Model depended	○

Function code	Name	Description	Default	Modify
		delivered. In general, you do not need to modify it. The mapping between VFD models and default carrier frequency values is as follows: 380V 1.5–11kW: 8kHz 380V 15–55kW: 4kHz 380V 75kW and higher: 2kHz 660V 22–55kW: 4kHz 660V 75kW and higher: 2kHz Setting range: 1.0–15.0kHz **Note:** When the frequency used exceeds the default carrier frequency, the VFD needs to derate by 10% for each increased of 1kHz.		
P00.15	Motor parameter autotuning	Specifies the motor autotuning function. Setting range: 0–5 0: No operation 1: Dynamic autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning 4: Dynamic autotuning 2 (valid only for AMs) 5: Partial parameter static autotuning 2 (valid only for AMs) **Note:** Supported by software of version V3.xx or earlier.	0	◎
		Setting range: 0x000–0x133 Ones place: Motor basic parameter autotuning 0: No operation 1: Complete parameter rotary autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning Tens place: Initial pole angle autotuning 0: No operation 1: Rotary autotuning 2: Static autotuning 1: Rotary autotuning 2 Hundreds place: Inertia autotuning	0x000	

Function code	Name	Description	Default	Modify
		0: Disable 1: Enable **Note:** Supported by software of version V6.xx or later.		
P00.16	AVR function	Specifies the VFD automatic voltage regulation (AVR) function, which can eliminate the impact of the bus voltage fluctuation on the VFD output voltage. Setting range: 0–1 0: Invalid 1: Valid during the whole process	1	○
P00.17	Reserved	-	-	-
P00.18	Function parameter restoration	Specifies the function parameter restoration. Setting range: 0–6 0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Reserved 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) **Note:** Restoring to default values will delete the user password. After the selected operation is performed, the function code is automatically restored to 0. The options 5 and 6 should be used under the instructions of the manufacturer.	0	◎

Group P01—Start and stop control

<table>
<tr><th>Function code</th><th>Name</th><th colspan="2">Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P01.00</td><td>Running mode of start</td><td colspan="2">Specifies the start mode.
Setting range: 0–4
0: Direct start
1: Start after DC braking
2: Start after speed tracking (with exciting)
3: Start after speed tracking (without exciting)
4: Start after speed tracking (software, supported only by version V6.xx or later)</td><td>0</td><td>◎</td></tr>
<tr><td rowspan="2">P01.01</td><td rowspan="2">Starting frequency of direct start</td><td rowspan="2">Specifies the initial frequency during VFD start.</td><td>Setting range: 0.00–50.00Hz
Note: Supported by software of version V3.xx or earlier.</td><td rowspan="2">0.50Hz</td><td rowspan="2">◎</td></tr>
<tr><td>Setting range: 0.00Hz–P00.03
Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P01.02</td><td>Starting frequency hold time</td><td colspan="2">Specifies the hold time of starting frequency.
Setting range: 0.0–50.0s</td><td>0.0s</td><td>◎</td></tr>
<tr><td>P01.03</td><td>Braking current before start</td><td colspan="2">Specifies the DC braking current before startup.
Setting range: 0.0–100.0%</td><td>0.0%</td><td>◎</td></tr>
<tr><td>P01.04</td><td>Braking time before start</td><td colspan="2">Specifies the DC braking time before startup.
Setting range: 0.00–50.00s</td><td>0.00s</td><td>◎</td></tr>
<tr><td>P01.05</td><td>ACC/DEC mode</td><td colspan="2">Specifies the changing mode of the frequency during start and running.
0: Linear type. The output frequency increases or decreases linearly.
1: S curve. The output frequency increases or decreases according to the S curve.</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		Note: The S curve is generally applied to elevators, conveyors, and other application scenarios where smoother start or stop is required. When S curve mode is selected, P01.06, P01.07, P01.27, and P01.28 need to be set accordingly.		
P01.06	Time of starting segment of ACC S curve	Specifies the time of the starting segment of the ACC S curve. It works with P01.07 to determine the curvature of the S curve. Setting range: 0.0–50.0s	0.1s	◎
P01.07	Time of ending segment of ACC S curve	Specifies the time of the ending segment of the ACC S curve. It works with P01.06 to determine the curvature of the S curve. Setting range: 0.0–50.0s	0.1s	◎
P01.08	Stop mode	Specifies the stop mode. Setting range: 0–1 0: Decelerate to stop. After a stop command takes effect, the VFD lowers output frequency based on the DEC mode and the defined DEC time; after the frequency drops to the stop speed (P01.15), the VFD stops. 1: Coast to stop. After a stop command takes effect, the VFD ceases the output immediately, and the load coasts to stop according to mechanical inertia.	0	○
P01.09	Starting frequency of braking for stop	Specifies the starting frequency of DC braking for stop. Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P01.10	Demagnetization time	Specifies the demagnetization time, that is, the wait time before DC braking for stop. Setting range: 0.00–30.00s	0.00s	○
P01.11	DC braking current for stop	Specifies the DC braking current for stop, that is, the DC braking energy. Setting range: 0.0–100.0% (of the VFD rated output current)	0.0%	○

Function code	Name	Description	Default	Modify
P01.12	DC braking time for stop	Specifies the duration of DC braking. Setting range: 0.00–50.00s **Note:** If the value is 0, DC braking is invalid, and the VFD decelerates to stop within the specified time.	0.00s	○
P01.13	FWD/REV run deadzone time	Specifies the transition time of the FWD/REV run switching, the mode of which is specified by P01.14. Setting range: 0.0–3600.0s	0.0s	○
P01.14	FWD/REV run switching mode	Specifies the forward/reverse running switching mode. Setting range: 0–2 0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1	◎
P01.15	Stop speed	Specifies the stop speed (frequency). Setting range: 0.00–100.00Hz **Note:** Supported by software of version V3.xx or earlier. Specifies the stop speed (frequency). Setting range: 0.00Hz–P00.03 (Max. output frequency) **Note:** Supported by software of version V6.xx or later.	0.50Hz	◎
P01.16	Stop speed detection mode	Specifies the stop speed detection mode. The VFD stops when the value in the selected mode is less than P01.15. Setting range: 0–1 0: Detect by the set speed (unique in V/F mode) 1: Detect according to speed feedback	0	◎
P01.17	Stop speed detection time	Specifies the stop speed detection time. Setting range: 0.00–100.00s	0.50s	◎
P01.18	Terminal-based running command protection at power-on	Specifies whether the terminal running command is valid at power-on. Setting range: 0–1 0: Invalid at power-on	0	○

Function code	Name	Description	Default	Modify
		1: Valid at power-on		
P01.19	Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	Specifies the run status of the VFD when the set frequency is below the lower limit. Setting range: 0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop	0x00	◎
P01.20	Wake-up-from-sleep delay	Specifies the wake-up-from-sleep delay time. Setting range: 0.0–3600.0s (Valid only when the ones place of P01.19 is 2.)	0.0s	○
P01.21	Power-off restart selection	Specifies whether the VFD automatically runs after re-power on. Setting range: 0–1 0: Disable 1: Enable. If the restart condition is met, the VFD will run automatically after waiting the time defined by P01.22.	0	○
P01.22	Wait time for restart after power-off	Specifies the wait time before the automatic running of the VFD that is re-powered on. Setting range: 0.0–3600.0s (Valid only when P01.21=1)	1.0s	○
P01.23	Start delay time	Setting range: 0.0–600.0s	0.0s	○
P01.24	Stop speed delay	Setting range: 0.0–600.0s	0.0s	○
P01.25	Open-loop 0Hz output selection	Setting range: 0–2 0: Output without voltage 1: Output with voltage 2: Output with DC braking current for stop	0	○
P01.26	DEC time for emergency stop	Setting range: 0.0–60.0s	2.0s	○
P01.27	Time of starting segment of DEC S curve	Setting range: 0.0–50.0s	0.1s	◎

Function code	Name	Description	Default	Modify
P01.28	Time of ending segment of DEC S curve	Setting range: 0.0–50.0s	0.1s	◎
P01.29	Short-circuit braking current	Setting range: 0.0–150.0% (of the rated VFD output current)	0.0%	○
P01.30	Hold time of short-circuit braking for start	When the VFD starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to enter short-circuit braking. Setting range: 0.00–50.00s	0.00s	○
P01.31	Hold time of short-circuit braking for stop	During stop, if the running frequency of VFD is lower than the starting frequency of brake for stop (P01.09), set P01.31 to a non-zero value to enter short-circuit braking for stop, and then carry out DC braking in the time set by P01.12. (For details, see the descriptions for P01.09–P01.12.) Setting range: 0.00–50.00s	0.00s	○
P01.32	Pre-exciting time for jogging	Setting range: 0.000–10.000s	0.300s	○
P01.33	Starting frequency of braking for stop in jogging	Setting range: 0.00Hz–P00.03	0.00Hz	○
P01.34	Sleep delay	Setting range: 0–3600.0s	0.0s	○
P01.35	Speed tracking method	Setting range: 0x000–0x112 Ones place: Speed tracking method selection 0: Track according to stop frequency 1: Track according to rated frequency 2: Track according to max. frequency Tens place: Tracking direction 0: Single (set) direction 1: Dual (forward and reverse) directions Hundreds place: Tracking current limit (sending no wave when the value exceeded) 0: 20% (relative to the larger of VFD current and motor current) 1: 10% (relative to the larger of VFD current	0x000	○

Function code	Name	Description	Default	Modify
		and motor current) ✎**Note:** Supported by software of version V6.xx or later.		
P01.36	Quick/slow selection for speed tracking	Setting range: 0–10000 ✎**Note:** Supported by software of version V6.xx or later.	300	○
P01.37	Speed tracking voltage coefficient	Setting range: 0–50 ✎**Note:** Supported by software of version V6.xx or later.	10	○

Group P02—Parameters of motor 1

Function code	Name	Description	Default	Modify
P02.00	Type of motor 1	Setting range: 0–1 0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P02.01	Rated power of AM 1	Setting range: 0.1–3000.0kW	Model depended	◎
P02.02	Rated frequency of AM 1	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.03	Rated speed of AM 1	Setting range: 1–60000RPM	Model depended	◎
P02.04	Rated voltage of AM 1	Setting range: 0–1200V	Model depended	◎
P02.05	Rated current of AM 1	Setting range: 0.8–6000.0A	Model depended	◎
P02.06	Stator resistance of AM 1	Setting range: 0.001–65.535Ω	Model depended	○
P02.07	Rotor resistance of AM 1	Setting range: 0.001–65.535Ω	Model depended	○
P02.08	Leakage inductance of AM 1	Setting range: 0.1–6553.5mH	Model depended	○
P02.09	Mutual inductance of AM 1	Setting range: 0.1–6553.5mH	Model depended	○
P02.10	No-load current of AM 1	Setting range: 0.1–6553.5A	Model depended	○
P02.11	Magnetic	Setting range: 0.0–100.0%	80.0%	○

Function code	Name	Description	Default	Modify
	saturation coefficient 1 of iron core of AM 1			
P02.12	Magnetic saturation coefficient 2 of iron core of AM 1	Setting range: 0.0–100.0%	68.0%	○
P02.13	Magnetic saturation coefficient 3 of iron core of AM 1	Setting range: 0.0–100.0%	57.0%	○
P02.14	Magnetic saturation coefficient 4 of iron core of AM 1	Setting range: 0.0–100.0%	40.0%	○
P02.15	Rated power of SM 1	Setting range: 0.1–3000.0kW	Model depended	◎
P02.16	Rated frequency of SM 1	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.17	Number of pole pairs of SM 1	Setting range: 1–128	2	◎
P02.18	Rated voltage of SM 1	Setting range: 0–1200V	Model depended	◎
P02.19	Rated current of SM 1	Setting range: 0.8–6000.0A	Model depended	◎
P02.20	Stator resistance of SM 1	Setting range: 0.001–65.535Ω	Model depended	○
P02.21	Direct-axis inductance of SM 1	Setting range: 0.01–655.35mH	Model depended	○
P02.22	Quadrature-axis inductance of SM 1	Setting range: 0.01–655.35mH	Model depended	○
P02.23	Counter-emf constant of SM 1	Setting range: 0–10000	300	○
P02.24	Initial pole position of SM 1	Setting range: 0x0000–0xFFFF **Note:** Supported by software of version V6.xx or later.	0x0000	●
P02.25	Rotation frequency	Setting range: 5.0%–100.0% **Note:** Supported by software of version	60.0%	◎

Function code	Name	Description	Default	Modify
	percentage setting for SM 1 counter-emf identifying	V6.xx or later.		
P02.26	Overload protection selection of motor 1	Setting range: 0–2 0: No protection 1: Common motor protection (with low-speed compensation). As the cooling effect of a common motor is degraded at low speed running, the corresponding electronic 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: Variable-frequency motor protection (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.	2	◎
P02.27	Overload protection coefficient of motor 1	Specifies the motor overload protection coefficient. A small motor overload protection coefficient indicates a great overload multiplication (M). When M=116%, protection is performed after motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M⩾400%, protection is performed immediately. Setting range: 20.0%–150.0%	100.0%	○
P02.28	Power display calibration coefficient of	Used to adjust the power display value of motor 1. However, it does not affect the control performance of the VFD.	1.00	○

Function code	Name	Description	Default	Modify
	motor 1	Setting range: 0.00–3.00		
P02.29	Parameter display selection of motor 1	Setting range: 0–1 0: Display by motor type. In this mode, only parameters related to the present motor type are displayed. 1: Display all. In this mode, all the motor parameters are displayed.	0	○
P02.30	System inertia of motor 1	Setting range: 0.001–30.000kg・m^2	0.001 kg・m^2	○
P02.31	Motor parameter model calculation	Setting range: 0–1 0: Invalid 1: Enable **Note:** Supported by software of version V6.xx or later.	0	◎
P02.32	AM1 power factor setting	Setting range: 0.00–1.00 **Note:** ● Supported by software of version V6.xx or later. ● For AMs, before setting P02.31 to the enabling option, set P02.32 according to the motor nameplate; otherwise, the calculation may have deviation.	0.85	○
P02.33	High word of rated speed of AM 1	Setting range: 0–30(10kRPM) **Note:** Supported by software of version V6.xx or later.	0	◎

Group P03—Vector control of motor 1

Function code	Name	Description	Default	Modify
P03.00	Speed-loop proportional gain 1 of motor 1	Setting range: 0.0–200.0 **Note:** Applicable only to vector control mode.	20.0	○
P03.01	Speed-loop integral time 1 of motor 1	Setting range: 0.000–10.000s **Note:** Applicable only to vector control mode.	0.200s	○
P03.02	Low-point	Setting range: 0.00Hz–P03.05	5.00Hz	○

Function code	Name	Description	Default	Modify
	frequency for speed-loop switching of motor 1	**Note:** Applicable only to vector control mode.		
P03.03	Speed-loop proportional gain 2 of motor 1	Setting range: 0.0–200.0 **Note:** Applicable only to vector control mode.	20.0	○
P03.04	Speed-loop integral time 2 of motor 1	Setting range: 0.000–10.000s **Note:** Applicable only to vector control mode.	0.200s	○
P03.05	High-point frequency for speed-loop switching of motor 1	Setting range: P03.02–P00.03 (Max. output frequency) **Note:** Applicable only to vector control mode.	10.00 Hz	○
P03.06	Speed-loop output filter of motor 1	0–8 (corresponding to 0–2^8/10ms)	0	○
P03.07	Electromotive slip compensation coefficient of vector control for motor 1	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. Setting range: 50–200%	100%	○
P03.08	Braking slip compensation coefficient of vector control for motor 1	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. Setting range: 50–200%	100%	○
P03.09	Current-loop proportional coefficient P of motor 1	Setting range: 0–65535 **Note:** ● The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function	1000	○

Function code	Name	Description	Default	Modify
		codes. ● Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3). ● Supported by software of version V3.xx or earlier.		
P03.10	Current-loop integral coefficient I of motor 1	Setting range: 0–65535 **Note:** ● The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ● Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3). ● Supported by software of version V3.xx or earlier.	1000	○
P03.11	Torque setting method selection	Setting range: 0–12 0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step torque 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card **Note:** 100% corresponds to the motor rated current.	0	○
P03.12	Torque set through keypad	Setting range: -300.0%–300.0% (of the motor rated current)	20.0%	○

Function code	Name	Description	Default	Modify
P03.13	Torque reference filter time	Setting range: 0.000–10.000s	0.010s	○
P03.14	Setting source of forward rotation upper-limit frequency in torque control	Setting range: 0–12 0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12: Reserved **Note:** 100% corresponds to the max. frequency.	0	○
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	Setting range: 0–12 0: Keypad (P03.17) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12: Reserved **Note:** 100% corresponds to the max. frequency.	0	○

Function code	Name	Description	Default	Modify
P03.16	Forward rotation frequency upper limit set through keypad in torque control	Specifies the frequency limit when P03.14=1. Setting range: 0.00Hz–P00.03 (100% corresponding to max. output frequency)	50.00 Hz	○
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control	Specifies the frequency limit when P03.15=1. Setting range: 0.00Hz–P00.03 (100% corresponding to max. output frequency)	50.00 Hz	○
P03.18	Setting source of electromotive torque upper limit	Setting range: 0–11 0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11: Reserved **Note:** 100% corresponds to the motor rated current.	0	○
P03.19	Setting source of braking torque upper limit	Setting range: 0–11 0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication	0	○

Function code	Name	Description	Default	Modify
		8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11: Reserved **Note:** 100% corresponds to the motor rated current.		
P03.20	Electromotive torque upper limit set through keypad	Specifies the torque limit. Setting range: 0.0–300.0% (of the motor rated current)	180.0%	○
P03.21	Braking torque upper limit set through keypad	Specifies the torque limit. Setting range: 0.0–300.0% (of the motor rated current)	180.0%	○
P03.22	Weakening coefficient in constant power zone	Used when the AM is in flux-weakening control. Setting range: 0.1–2.0 **Note:** Supported by software of version V3.xx or earlier.	0.3	○
P03.22	Weakening coefficient in constant power zone	Used when the AM is in flux-weakening control. Setting range: 0.1–2.0 **Note:** Supported by software of version V6.xx or later.	1.0	○
P03.23	Lowest weakening point in constant power zone	Setting range: 10%–100% **Note:** Supported by software of version V3.xx or earlier.	20%	○
P03.23	AM lowest weakening point in constant power zone	Setting range: 5%–100% **Note:** Supported by software of version V6.xx or later.	10%	○
P03.24	Max. voltage limit	Specifies the max. VFD output voltage, which is a percentage of the motor rated voltage. Set the value according to onsite	100.0%	○

Function code	Name	Description	Default	Modify
		conditions. Setting range: 0.0–120.0%		
P03.25	Pre-exciting time	Specifies the pre-exciting time. Pre-exciting is performed for the motor when the VFD starts up. A magnetic field is built up inside the motor to improve the torque performance during the start process. Setting range: 0.000–10.000s **Note:** Pre-excitation can improve the starting capability of AM with loads. For an AM, set 0 to disable the pre-excitation process. For an SM, if P13.01 is set to an enabling option, the pre-excitation process is directly skipped.	0.300s	○
P03.26	Flux-weakening proportional gain	Setting range: 0–8000	1000	○
P03.27	Speed display selection in vector control	Setting range: 0–1 0: Display the actual value 1: Display the set value	0	○
P03.28	Static friction compensation coefficient	Setting range: 0.0–100.0%	0.0%	○
P03.29	Corresponding frequency point of static friction	Setting range: 0.50Hz–P03.31	1.00Hz	○
P03.30	High speed friction compensation coefficient	Setting range: 0.0–100.0%	0.0%	○
P03.31	Corresponding frequency of high speed friction torque	Setting range: P03.29–400.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: P03.29–P00.03(Hz) **Note:** Supported by software of version V6.xx or later.	50.00Hz	○
P03.32	Enabling torque control	Setting range: 0–1 0: Disable	0	○

Function code	Name	Description	Default	Modify
		1: Enable		
P03.33	Flux-weakening integral gain	Setting range: 0–8000 **Note:** Supported by software of version V3.xx or earlier.	1200	○
		Setting range: 0.0–300.0% **Note:** Supported by software of version V6.xx or later.	100.0%	
P03.34	Flux-weakening control mode	Setting range: 0x000–0x112 Ones place: Control mode selection 0: Mode 0 1: Mode 1 2: Mode 2 Tens place: Compensation of inductance saturation coefficient 0: Yes 1: No Hundreds place: Reserved 0: Reserved 1: Reserved **Note:** Supported by software of version V3.xx or earlier.	0x000	○
P03.35	Control mode optimization selection	Setting range: 0x0000–0x1111 Ones place: Torque command selection 0: Torque current reference 1: Torque current reference Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved 0: Reserved 1: Reserved	0x0000	○
P03.36	Speed-loop differential gain of motor 1	Setting range: 0.00–10.00s	0.00s	○

Function code	Name	Description	Default	Modify
P03.37	High-frequency current-loop proportional coefficient of motor 1	Setting range: 0–65535 **Note:** Supported by software of version V3.xx or earlier.	1000	○
P03.38	High-frequency current-loop integral coefficient of motor 1	Setting range: 0–65535 **Note:** Supported by software of version V3.xx or earlier.	1000	○
P03.39	Current-loop high-frequency switching threshold of motor 1	setting range: 0.0–100.0% (of the max. output frequency) **Note:** Supported by software of version V3.xx or earlier.	100.0%	○
P03.40	Enabling inertia compensation	Setting range: 0–1 0: Disable 1: Enable	0	○
P03.41	Upper limit of inertia compensation torque	The max. inertia compensation torque is limited to prevent inertia compensation torque from being too large. Setting range: 0.0–150.0% (of the motor rated torque)	10.0%	○
P03.42	Inertia compensation filter times	Filter times of inertia compensation torque, used to smooth inertia compensation. Setting range: 0–10	7	○
P03.43	Inertia identification torque	Used to set Inertia identification torque. Setting range: 0.0–100.0% (of the motor rated torque)	10.0%	○
P03.44	Enabling motor inertia identification	Setting range: 0–1 0: No operation 1: Enable	0	◎
P03.45	Current-loop proportional coefficient after autotuning	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for SMs, you can set the value of this function code to P03.09. Setting range: 0–65535	0	○

Function code	Name	Description	Default	Modify
		Note: ● Set the value to 0 if motor parameter autotuning is not performed. ● Supported by software of version V3.xx or earlier.		
P03.46	Current-loop integral coefficient after autotuning	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for SMs, you can set the value of this function code to P03.10. Setting range: 0–65535 **Note:** ● Set the value to 0 if motor parameter autotuning is not performed. ● Supported by software of version V3.xx or earlier.	0	○
P03.47	Reserved	-	-	-
P03.48	Speed-loop overshoot suppression gain	Setting range: 0–400 **Note:** Supported by software of version V6.xx or later.	0	◎
P03.49	Closed-loop speed observation band width	Setting range: 1.0–200.0 **Note:** Supported by software of version V6.xx or later.	30.0	○
P03.54	Current-loop band width of motor 1	Setting range: 0–2000 **Note:** ● Smaller current-loop band width indicates slower response but better current waveform. ● Supported by software of version V6.xx or later.	400	○
P03.55	SM max. flux weakening current	Setting range: 0.0–200.0% (of the motor rated current) **Note:** Supported by software of version V6.xx or later.	50.0%	◎
P03.56	Vector control loop optimization	Setting range: 0x00–0x1F Bit 0: Enable voltage feedforward compensation (valid in FVC) Bit 1: Enable axis-d voltage cross decoupling	0x17	◎

Function code	Name	Description	Default	Modify
		(valid in FVC) Bit 2: Enable axis-q voltage cross decoupling (valid in FVC) Bit 3: Enable closed-loop disturbance feedforward compensation Bit 4: Axis-q voltage restriction selection 0: Restricted to 1.2 times the motor rated voltage 1: Restricted to axis-d voltage Bit 5–Bit 15: Reserved **Note:** Supported by software of version V6.xx or later.		

Group P04—V/F control

Function code	Name	Description	Default	Modify
P04.00	V/F curve setting of motor 1	Specifies the V/F curve of motor 1 to meet the needs of different loads. Setting range: 0–5 0: Straight-line V/F curve, applicable to constant torque loads 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) Curves 2 – 4 are applicable to the torque loads such as fans and water pumps. You can adjust according to the characteristics of the loads to achieve best performance. 5: Customized V/F (V/F separation). In this mode, V can be separated from F; and you can change the characteristics of the curve by adjusting F through the frequency setting channel specified by P00.06 or by adjusting V through the voltage setting channel specified by P04.27.	0	◎
P04.01	Torque boost of	Setting range: 0.0%: (Automatic torque	0.0%	○

Function code	Name	Description	Default	Modify
	motor 1	boost), 0.1%–10.0%		
P04.02	Torque boost cut-off of motor 1	Setting range: 0.0%–50.0%	20.0%	○
P04.03	V/F frequency point 1 of motor 1	When P04.00=1 (multi-dot V/F curve), you can set the V/F curve through P04.03–P04.08. Setting range: 0.00Hz–P04.05 **Note:** V1＜V2＜V3, f1＜f2＜f3 Too high voltage for low frequency will cause motor overheat or damage and cause VFD overcurrent stall or overcurrent protection.	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1	Setting range: 0.0%–110.0% (of the rated voltage of motor 1) **Note:** See the description for P04.03.	0.0%	○
P04.05	V/F frequency point 2 of motor 1	Setting range: P04.03–P04.07 **Note:** See the description for P04.03.	0.00Hz	○
P04.06	V/F voltage point 2 of motor 1	Setting range: 0.0%–110.0% (of the rated voltage of motor 1) **Note:** See the description for P04.03.	0.0%	○
P04.07	V/F frequency point 3 of motor 1	Setting range: P04.05–P02.02 (of the rated frequency of AM 1) or P04.05–P02.16 (of the rated frequency of SM 1) **Note:** See the description for P04.03.	0.00Hz	○
P04.08	V/F voltage point 3 of motor 1	Setting range: 0.0%–110.0% (of the rated voltage of motor 1) **Note:** See the description for P04.03.	0.0%	○
P04.09	V/F slip compensation gain of motor 1	Used to compensate for the motor rotating speed change caused by load change in the space voltage vector mode, and thus improve the rigidity of the mechanical characteristics of the motor. Setting range: 0.0–200.0%	100.0%	○
P04.10	Low-frequency oscillation control factor of motor 1	In space voltage vector control mode, the motor, especially the large-power motor, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even VFD	10	○

Function code	Name	Description	Default	Modify
		overcurrent. You can adjust the two function codes properly to eliminate such phenomenon. Setting range: 0–100		
P04.11	High-frequency oscillation control factor of motor 1	Setting range: 0–100	10	○
P04.12	Oscillation control threshold of motor 1	Setting range: 0.00Hz–P00.03 (Max. output frequency)	30.00Hz	○
P04.13	V/F curve setting of motor 2	Specifies the V/F curve of motor 2 to meet the needs of different loads. Setting range: 0–5 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 curve (V/F separation) **Note:** See the description for P04.00.	0	◎
P04.14	Torque boost of motor 2	Setting range: 0.0% (automatic); 0.1% – 10.0%	0.0%	○
P04.15	Torque boost cut-off of motor 2	Setting range: 0.0%–50.0% (of the rated frequency of motor 2)	20.0%	○
P04.16	V/F frequency point 1 of motor 2	Setting range: 0.00Hz–P04.18 **Note:** See the description for P04.03.	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2	Setting range: 0.0%–110.0% (of the rated voltage of motor 2) **Note:** See the description for P04.03.	0.0%	○
P04.18	V/F frequency point 2 of motor 2	Setting range: P04.16–P04.20 **Note:** See the description for P04.03.	0.00Hz	○
P04.19	V/F voltage point 2 of motor 2	Setting range: 0.0%–110.0% (of the rated voltage of motor 2) **Note:** See the description for P04.03.	0.0%	○
P04.20	V/F frequency point 3 of motor 2	Setting range: P04.18–P12.02 (of the rated frequency of AM 2) or P04.18–P12.16 (of the rated frequency of SM 2)	0.00Hz	○

Function code	Name	Description	Default	Modify
		Note: See the description for P04.03.		
P04.21	V/F voltage point 3 of motor 2	Setting range: 0.0%–110.0% (of the rated voltage of motor 2) **Note:** See the description for P04.03.	0.0%	○
P04.22	V/F slip compensation gain of motor 2	Used to compensate for the motor rotating speed change caused by load change in the space voltage vector mode, and thus improve the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: $\triangle f=f_b-n*p/60$ Of which, f_b is the rated frequency of the motor, corresponding to function code P12.02. n is the rated rotating speed of the motor, corresponding to function code P12.03. p is the number of pole pairs of the motor. 100.0% corresponds to the rated slip frequency $\triangle f$ of motor 2. Setting range: 0.0–200.0%	0.0%	○
P04.23	Low-frequency oscillation control factor of motor 2	In space voltage vector control mode, the motor, especially the large-power motor, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even VFD overcurrent. You can adjust the two function codes properly to eliminate such phenomenon. Setting range: 0–100	10	○
P04.24	High-frequency oscillation control factor of motor 2	Setting range: 0–100	10	○
P04.25	Oscillation control threshold of motor 2	Setting range: 0.00Hz–P00.03 (Max. output frequency)	30.00Hz	○
P04.26	Energy-saving run	Setting range: 0–1 0: Disable	0	◎

Function code	Name	Description	Default	Modify
		1: Automatic energy-saving run		
P04.27	Voltage setting channel selection	Setting range: 0–13 0: Keypad (specified by P04.28) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step speed running (The setting is determined by related parameters in P10.) 6: PID 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card 13: Reserved	0	○
P04.28	Voltage set through keypad	The function code is the voltage digital setting when "keypad" is selected as the voltage setting channel. Setting range: 0.0%–100.0%	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed for the VFD to accelerate from min. output voltage to the max. output frequency. Setting range: 0.0–3600.0s	5.0s	○
P04.30	Voltage decrease time	Voltage decrease time means the time needed for the VFD to decelerate from the max. output frequency to min. output voltage. Setting range: 0.0–3600.0s	5.0s	○
P04.31	Max. output voltage	Specifies the upper limit of output voltage. Setting range: P04.32–100.0% (of the motor rated voltage)	100.0%	◎
P04.32	Min. output voltage	Specifies the lower limit of output voltage. Setting range: 0.0%–P04.31	0.0%	◎

<table>
<tr><th>Function code</th><th>Name</th><th colspan="2">Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P04.33</td><td>Weakening coefficient in constant power zone (V/F)</td><td colspan="2">1.00–1.30</td><td>1.00</td><td>○</td></tr>
<tr><td rowspan="2">P04.34</td><td rowspan="2">Pull-in current 1 in SM 1 V/F control</td><td rowspan="2">When the SM VF control mode is enabled, the parameter is used to set the reactive current of the motor when the output frequency is lower than the frequency specified by P04.36.
Setting range: -100.0%–100.0% (of the motor rated current)</td><td>Note: Supported by software of version V3.xx or earlier.</td><td>20.0%</td><td rowspan="2">○</td></tr>
<tr><td>Note: Supported by software of version V6.xx or later.</td><td>30.0%</td></tr>
<tr><td>P04.35</td><td>Pull-in current 2 in SM 1 V/F control</td><td colspan="2">When the SM 1 V/F control mode is enabled, the parameter is used to set the reactive current of the motor when the output frequency is higher than the frequency specified by P04.36.
Setting range: -100.0%–100.0% (of the motor rated current)</td><td>10.0%</td><td>○</td></tr>
<tr><td>P04.36</td><td>V/F control pull-in current frequency switching point for SM 1</td><td colspan="2">When the SM 1 V/F control mode is enabled, the parameter is used to set the frequency threshold for the switching between pull-in current 1 and pull-in current 2.
Setting range: 0.0%–200.0% (of the motor rated current)</td><td>20.0%</td><td>○</td></tr>
<tr><td>P04.37</td><td>V/F control reactive closed-loop proportional coefficient for SM 1</td><td>When the SM 1 V/F control mode is enabled, the parameter is used to set the proportional</td><td>Setting range: 0–3000
Note: Supported by software of version V3.xx or earlier.</td><td>50</td><td>○</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th colspan="2">Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>coefficient of reactive current closed-loop control.</td><td>Setting range: 0–500
✎Note: Supported by software of version V6.xx or later.</td><td></td><td></td></tr>
<tr><td rowspan="2">P04.38</td><td rowspan="2">V/F control reactive current closed-loop integral time for SM 1</td><td rowspan="2">When the SM 1 V/F control mode is enabled, the parameter is used to set the integral coefficient of reactive current closed-loop control.</td><td>Setting range: 0–3000
✎Note: Supported by software of version V3.xx or earlier.</td><td rowspan="2">30</td><td rowspan="2">○</td></tr>
<tr><td>Setting range: 0–300
✎Note: Supported by software of version V6.xx or later.</td></tr>
<tr><td>P04.39</td><td>V/F control reactive closed-loop output limit for SM 1</td><td colspan="2">When the SM V/F control mode is enabled, the parameter is used to set the output limit of the reactive current closed-loop control. A greater value indicates a higher reactive closed-loop compensation voltage and higher output power of the motor. In general, you do not need to modify the function code.
Setting range: 0–16000
✎Note: Supported by software of version V3.xx or earlier.</td><td>8000</td><td>○</td></tr>
<tr><td>P04.40</td><td>Enabling IF mode for AM 1</td><td colspan="2">Setting range: 0–1
0: Disable
1: Enable</td><td>0</td><td>◎</td></tr>
<tr><td>P04.41</td><td>Current setting in IF mode for AM 1</td><td colspan="2">When IF control is adopted for AM 1, the parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor.
Setting range: 0.0–200.0%</td><td>120.0%</td><td>○</td></tr>
<tr><td>P04.42</td><td>Proportional coefficient in IF mode for AM 1</td><td colspan="2">When IF control is adopted for AM 1, the parameter is used to set the proportional coefficient of the output current</td><td>350</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		closed-loop control. Setting range: 0–5000		
P04.43	Integral coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150	○
P04.44	Frequency threshold for switching off IF mode for AM 1	Setting range: 0.00Hz–P04.50	10.00Hz	○
P04.45	Enabling IF mode for AM 2	Setting range: 0–1 0: Invalid 1: Enable	0	◎
P04.46	Current setting in IF mode for AM 2	When IF control is adopted for AM 2, the parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%	○
P04.47	Proportional coefficient in IF mode for AM 2	When IF control is adopted for AM 2, the parameter is used to set the proportional coefficient of output current closed-loop control. Setting range: 0–5000	350	○
P04.48	Integral coefficient in IF mode for AM 2	When IF control is adopted for AM 2, the parameter is used to set the integral coefficient of output current closed-loop control. Setting range: 0–5000	150	○
P04.49	Frequency threshold for switching off IF mode for AM 2	Setting range: 0.00Hz–P04.51	10.00Hz	○
P04.50	End frequency point for switching off IF mode for motor 1	Setting range: P04.44–P00.03	25.00Hz	○

Function code	Name	Description	Default	Modify
P04.51	End frequency point for switching off IF mode for motor 2	Setting range: P04.49–P00.03	25.00Hz	○
P04.52	Pull-in current 1 in SM 2 V/F control	When the SM 2 V/F control mode is enabled, the parameter is used to set the reactive current of the motor when the output frequency is lower than the frequency specified by P04.54. Setting range: -100.0%–100.0% (of the motor rated current) **Note:** Supported by software of version V6.xx or later.	30.0%	○
P04.53	Pull-in current 2 in SM 2 V/F control	When the SM 2 V/F control mode is enabled, the parameter is used to set the reactive current of the motor when the output frequency is higher than the frequency specified by P04.54. Setting range: -100.0%–100.0% (of the motor rated current) **Note:** Supported by software of version V6.xx or later.	10.0%	○
P04.54	V/F control pull-in current frequency switching point for SM 2	When the SM 2 V/F control mode is enabled, the parameter is used to set the frequency threshold for the switching between pull-in current 1 and pull-in current 2. Setting range: 0.0%–200.0% (of the motor rated current) **Note:** Supported by software of version V6.xx or later.	20.0%	○
P04.55	Reactive current closed-loop proportional coefficient in SM 2 V/F control	When the SM 2 V/F control mode is enabled, the parameter is used to set the proportional coefficient of reactive current closed-loop control. Setting range: 0–500 **Note:** Supported by software of version	50	○

Function code	Name	Description	Default	Modify
		V6.xx or later.		
P04.56	V/F control reactive current closed-loop integral time for SM 2	When the SM 2 V/F control mode is enabled, the parameter is used to set the integral coefficient of reactive current closed-loop control. Setting range: 0–300 **Note:** Supported by software of version V6.xx or later.	30	○
P04.57	V/F control energy-saving mode selection for AM 1	Setting range: 0–2 0: Max. efficiency 1: Optimal power factor 2: Max. ratio of torque to current **Note:** Supported by software of version V6.xx or later.	0	○
P04.58	V/F control energy-saving optimization coefficient for AM 1	Setting range: 25.0–400.0% **Note:** Supported by software of version V6.xx or later.	100.0%	○
P04.59	Energy-saving run selection for AM 2	Setting range: 0–1 0: Disable 1: Automatic energy-saving run **Note:** Supported by software of version V6.xx or later.	0	○
P04.60	V/F control energy-saving mode selection for AM 2	Setting range: 0–2 0: Max. efficiency 1: Optimal power factor 2: Max. ratio of torque to current **Note:** Supported by software of version V6.xx or later.	0	○
P04.61	V/F control energy-saving optimization coefficient for AM 2	Setting range: 25.0–400.0% **Note:** Supported by software of version V6.xx or later.	100.0%	○

Group P05—Input terminal functions

Function code	Name	Description	Default	Modify
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00	◎
P05.01	Function of S1	Setting range: 0–95 0: No function 1: Run forward 2: Run reversely 3: Three-wire running control 4: Jog forward 5: Jog reversely 6: Coast to stop 7: Reset faults 8: Pause running 9: External fault input 10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between A setting and B setting 14: Switch between combination setting and A setting 15: Switch between combination setting and B setting 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: ACC/DEC time selection 1 22: ACC/DEC time selection 2 23: Simple PLC stop reset 24: Pause simple PLC	1	◎
P05.02	Function of S2		4	◎
P05.03	Function of S3		7	◎
P05.04	Function of S4		0	◎
P05.05	Function of HDIA		0	◎
P05.06	Function of HDIB		0	◎

Function code	Name	Description	Default	Modify
		25: Pause PID control 26: Pause wobbling frequency 27: Reset wobbling frequency 28: Counter reset 29: Switch between speed control and torque control 30: Disable ACC/DEC 31: Trigger the counter 32: Reserved 33: Clear the frequency increase/decrease setting temporarily 34: DC braking 35: Switch from motor 1 to motor 2 36: Switch the running command channel to keypad 37: Switch the running command channel to terminal 38: Switch the running command channel to communication 39: Pre-exciting command 40: Clear electricity consumption 41: Keep electricity consumption 42: Switch the setting source of braking torque upper limit to keypad 43: Position reference point input (only valid for S2, S3, and S4) 44: Disable spindle orientation 45: Spindle zeroing / Local positioning zeroing 46: Spindle zero position selection 1 47: Spindle zeroing position selection 2 48: Spindle indexing selection 1 49: Spindle indexing selection 2 50: Spindle indexing selection 3 51: Terminal for switching between position control and speed control 52: Disable pulse input 53: Clear position deviation		

Function code	Name	Description	Default	Modify
		54: Switch position proportional gains 55: Enable cyclic digital positioning 56: Emergency stop 57: Motor overtemperature fault input 58: Enable rigid tapping 59: Switch to V/F control 60: Switch to FVC control 61: Switch PID polarities 62: Reserved 63: Enable servo 64: Limit on forward running 65: Limit on reverse running 66: Clear encoder counting 67: Increase pulses 68: Enable pulse superposition 69: Decrease pulses 70: Electronic gear selection 71: Switch to the master 72: Switch to the slave 73: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving 76: Disable roll diameter calculation 77: Clear alarm display 78: Manual braking in tension control 79: Trigger a forcible material feeding interrupt signal 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 82: Trigger fire control 83: Tension PID switchover 84: Pause PID 85: Thickness switchover selection 1 86: Thickness switchover selection 2 87: Clear length 88: Reserved 89: Switch over between open-loop torque mode and closed-loop speed mode 90–95: Reserved		

Function code	Name	Description	Default	Modify
P05.07	Reserved	-	-	-
P05.08	Input terminal polarity	Specifies input terminal polarity. When a bit is 0, the input terminal is positive. when a bit is 1, the input terminal is negative. Range: 0x00–0x3F	0x00	○
P05.09	Digital input filter time	Specifies the sampling filter time of the S1–S8, HDIA, and HDIB terminals. In strong interference cases, increase the value to avoid maloperation. Setting range: 0.000–1.000s	0.010s	○
P05.10	Virtual terminal setting	Setting range: 0x00–0x3F (0: disable; 1: enable) Bit 0: S1 virtual terminal Bit 1: S2 virtual terminal Bit 2: S3 virtual terminal Bit 3: S4 virtual terminal Bit 4: HDIA virtual terminal Bit 5: HDIB virtual terminal	0x00	◎
P05.11	Terminal control mode	Specifies the terminal control mode. Setting range: 0–3 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	◎
P05.12	S1 switch-on delay	Used to specify the delay time corresponding to the electrical level change when a programmable input terminal switches on or switches off. Setting range: 0.000–50.000s **Note:** After a virtual terminal is enabled, the terminal status can be changed only by communication means. The communication address is 0x200A.	0.000s	○
P05.13	S1 switch-off delay		0.000s	○
P05.14	S2 switch-on delay		0.000s	○
P05.15	S2 switch-off delay		0.000s	○
P05.16	S3 switch-on delay		0.000s	○
P05.17	S3 switch-off delay		0.000s	○
P05.18	S4 switch-on delay		0.000s	○

Function code	Name	Description	Default	Modify
P05.19	S4 switch-off delay		0.000s	○
P05.20	HDIA switch-on delay		0.000s	○
P05.21	HDIA switch-off delay		0.000s	○
P05.22	HDIB switch-on delay		0.000s	○
P05.23	HDIB switch-off delay		0.000s	○
P05.24	AI1 lower limit	Setting range: 0.00V–P05.26	0.00V	○
P05.25	Corresponding setting of AI1 lower limit	Setting range: -300.0%–300.0%	0.0%	○
P05.26	AI1 upper limit	Setting range: P05.24–10.00V	10.00V	○
P05.27	Corresponding setting of AI1 upper limit	Setting range: -300.0%–300.0%	100.0%	○
P05.28	AI1 input filter time	Setting range: 0.000–10.000s	0.030s	○
P05.29	AI2 lower limit	Setting range: -10.00V–P05.31	-10.00V	○
P05.30	Corresponding setting of AI2 lower limit	Setting range: -300.0%–300.0%	-100.0%	○
P05.31	AI2 middle value 1	Setting range: P05.29–P05.33	0.00V	○
P05.32	Corresponding setting of AI2 middle value 1	Setting range: -300.0%–300.0%	0.0%	○
P05.33	AI2 middle value 2	Setting range: P05.31–P05.35	0.00V	○
P05.34	Corresponding setting of AI2 middle value 2	Setting range: -300.0%–300.0%	0.0%	○
P05.35	AI2 upper limit	Setting range: P05.33–10.00V	10.00V	○
P05.36	Corresponding setting of AI2 upper limit	Setting range: -300.0%–300.0%	100.0%	○
P05.37	AI2 input filter time	Setting range: 0.000–10.000s	0.030s	○

Function code	Name	Description	Default	Modify
P05.38	HDIA high-speed pulse input function selection	Setting range: 0–2 0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIB	0	◎
P05.39	HDIA frequency lower limit	Setting range: 0.000kHz– P05.41	0.000kHz	○
P05.40	Corresponding setting of HDIA frequency lower limit	Setting range: -300.0%–300.0%	0.0%	○
P05.41	HDIA frequency upper limit	Setting range: P05.39–50.000kHz	50.000 kHz	○
P05.42	Corresponding setting of HDIA upper limit frequency	Setting range: -300.0%–300.0%	100.0%	○
P05.43	HDIA frequency input filter time	Setting range: 0.000–10.000s	0.030s	○
P05.44	HDIB high-speed pulse input function selection	Setting range: 0–2 0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIA	0	◎
P05.45	HDIB frequency lower limit	Setting range: 0.000kHz–P05.47	0.000kHz	○
P05.46	Corresponding setting of HDIB frequency lower limit	Setting range: -300.0%–300.0%	0.0%	○
P05.47	HDIB frequency upper limit	Setting range: P05.45–50.000kHz	50.000 kHz	○
P05.48	Corresponding setting of HDIB upper limit frequency	Setting range: -300.0%–300.0%	100.0%	○
P05.49	HDIB frequency input filter time	Setting range: 0.000–10.000s	0.030s	○

Function code	Name	Description	Default	Modify
P05.50	AI1 input signal type	Setting range: 0–1 0: Voltage 1: Current **Note:** You can set the AI1 input signal type through the corresponding function code.	0	◎
P05.51–P05.52	Reserved	-	-	-

Group P06—Output terminal functions

Function code	Name	Description	Default	Modify
P06.00	HDO output type	Setting range: 0–1 0: Open collector high-speed pulse output. The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For details about the related functions, see P06.02.	0	◎
P06.01	Y1 output	Setting range: 0–63 0: Invalid 1: Running 2: Running forward 3: Running reversely 4: Jogging 5: VFD in fault 6: Frequency level detection FDT1 7: Frequency level detection FDT2 8: Frequency reached 9: Running in zero speed 10: Frequency upper limit reached 11: Frequency lower limit reached 12: Ready for running 13: Pre-exciting 14: Overload pre-alarm 15: Underload pre-alarm	0	○
P06.02	HDO output		0	○
P06.03	RO1 output		1	○
P06.04	Relay output RO2		5	○

Function code	Name	Description	Default	Modify
		16: Simple PLC stage completed 17: Simple PLC cycle completed 18: Set counting value reached 19: Designated counting value reached 20: External fault is valid 21: Reserved 22: Running time reached 23: Modbus/ Modbus TCP communication virtual terminal output 24: PROFIBUS/CANopen/DeviceNet communication virtual terminal output 25: Ethernet communication virtual terminal output 26: DC bus voltage established 27: Z pulse output 28: Superposing pulses 29: STO action 30: Positioning completed 31: Spindle zeroing completed 32: Spindle indexing completed 33: Reserved 34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output 35: Reserved 36: Speed/position control switchover completed 37: Any frequency reached 38–40: Reserved 41: Y1 from the programmable card 42: Y2 from the programmable card 43: HDO from the programmable card 44: RO1 from the programmable card 45: RO2 from the programmable card 46: RO3 from the programmable card 47: RO4 from the programmable card 48: I/O card detected PT100 OH pre-alarm 49: I/O card detected PT1000 OH pre-alarm 50: AIAO detected OT pre-alarm		

Function code	Name	Description	Default	Modify
		51: Stopped or running in zero speed 52: Tension control disconnection 53: Specified roll diameter reached 54: Max. roll diameter reached (Supported by software of version V3.xx or earlier) 54: Min. roll diameter reached (Supported by software of version V3.xx or earlier) 54: Machine stop roll diameter reached (Supported by software of version V6.xx or later) 55: Length reached (Supported by software of version V6.xx or later) 56: Fire mode enabled 57: S1 terminal state (Supported by software of version V3.xx or earlier) 58: S2 terminal state (Supported by software of version V3.xx or earlier) 59: S3 terminal state (Supported by software of version V3.xx or earlier) 60: S4 terminal state (Supported by software of version V3.xx or earlier) 61: HDIA terminal state (Supported by software of version V3.xx or earlier) 62: HDIB terminal state (Supported by software of version V3.xx or earlier) 63: Reserved		
P06.05	Output terminal polarity	Specifies output terminal polarity. Setting range: 0x00–0x0F Bit 0: Y1 Bit 1: HDO Bit 2: RO1 Bit 3: RO2	0x00	○
P06.06	Y1 switch-on delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s	0.000s	○
P06.07	Y1 switch-off delay	Specifies the delay time corresponding to the electrical level change when a	0.000s	○

Function code	Name	Description	Default	Modify
		programmable output terminal switches on or switches off. Setting range: 0.000–50.000s		
P06.08	HDO switch-on delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s **Note:** The function code is valid only when P06.00 is 1.	0.000s	○
P06.09	HDO switch-off delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s **Note:** The function code is valid only when P06.00 is 1.	0.000s	○
P06.10	RO1 switch-on delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s	0.000s	○
P06.11	RO1 switch-off delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s	0.000s	○
P06.12	RO2 switch-on delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s	0.000s	○
P06.13	RO2 switch-off delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. Setting range: 0.000–50.000s	0.000s	○

Function code	Name	Description	Default	Modify
P06.14	AO1 output	Setting range: 0–63	0	○
P06.15	Reserved	0: Running frequency (100% corresponds to max. output frequency) 1: Set frequency (100% corresponds to max. output frequency) 2: Ramp reference frequency (100% corresponds to max. output frequency) 3: Rotational speed (100% corresponds to the speed corresponding to the max. output frequency) 4: Output current (100% corresponds to twice the VFD rated current) 5: Output current (100% corresponds to twice the motor rated current) 6: Output voltage (100% corresponds to 1.5 times the VFD rated voltage) 7: Output power (100% corresponds to twice the motor rated power) 8: Set torque (100% corresponds to twice the motor rated torque) 9: Output torque (Absolute value, 100% corresponds to twice the motor rated torque) 10: AI1 input (0–10V/0–20mA) 11: AI2 input (0–10V) 12: AI3 input (0–10V/0–20mA) 13: HDIA input (0.00–50.00kHz) 14: Value 1 set through Modbus/Modbus TCP communication (0–1000) 15: Value 2 set through Modbus/Modbus TCP communication (0–1000) 16: Value 1 set through PROFIBUS/CANopen/DeviceNet (0–1000) 17: Value 2 set through PROFIBUS/CANopen/DeviceNet (0–1000) 18: Value 1 set through Ethernet communication (0–1000) 19: Value 2 set through Ethernet	0	○
P06.16	HDO high-speed pulse output		0	○

Function code	Name	Description	Default	Modify
		communication (0–1000) 20: HDIB input (0.00–50.00kHz) 21: Value 1 set through EtherCAT/PROFINET/EtherNet IP (0–1000) 22: Torque current (100% corresponds to triple the motor rated current) 23: Exciting current (100% corresponds to triple the motor rated current) 24: Set frequency (bipolar) 25: Ramp reference frequency (bipolar) 26: Rotational speed (bipolar) 27: Value set through EtherCAT/PROFINET/EtherNet IP (0–1000) 28: AO1 from the programmable card (0–1000) 29: AO2 from the programmable card (0–1000) 30: Rotational speed (100% corresponds to twice the motor rated synchronous speed) 31: Output torque (100% corresponds to twice the motor rated torque) 32: AIAO detected temperature output 33: Set tension output (supported by software of version V6.xx or later) 34–63: Reserved		
P06.17	AO1 output lower limit	Setting range: -300.0%–P06.19	0.0%	○
P06.18	AO1 output corresponding to lower limit	Setting range: 0.00–10.00V	0.00V	○
P06.19	AO1 output upper limit	Setting range: P06.17–300.0%	100.0%	○
P06.20	AO1 output corresponding to upper limit	Setting range: 0.00–10.00V	10.00V	○
P06.21	AO1 output filter time	Setting range: 0.000–10.000s	0.000s	○

Function code	Name	Description	Default	Modify
P06.22	Reserved	-	-	-
P06.23	PTC constant current source output current setting	Setting range: 0.000–20.000mA Note: Supported by software of version V3.xx or earlier.	4.000mA	○
P06.24	PTC resistance alarm threshold	Setting range: 0–60000Ω Note: Supported by software of version V3.xx or earlier.	750Ω	○
P06.25	PTC resistance alarm recovery threshold	Setting range: 0–60000Ω Note: Supported by software of version V3.xx or earlier.	150Ω	○
P06.26	Actual PTC resistance	Setting range: 0–60000Ω Note: Supported by software of version V3.xx or earlier.	0Ω	●
P06.22–P06.26	Reserved	-	-	-
P06.27	HDO output lower limit	Setting range: -300.0%–P06.29	0.0%	○
P06.28	HDO output corresponding to lower limit	Setting range: 0.00–50.00kHz	0.00kHz	○
P06.29	HDO output upper limit	Setting range: P06.27–300.0%	100.0%	○
P06.30	HDO output corresponding to upper limit	Setting range: 0.00–50.00kHz	50.00kHz	○
P06.31	HDO output filter time	Setting range: 0.000–10.000s	0.000s	○
P06.32	Reserved	-	-	-
P06.33	Detection value for any frequency reached	Setting range: 0.00Hz–P00.03	1.00Hz	○
P06.34	Detection time for any frequency reached	Setting range: 0.0–3600.0s	0.5s	○

Group P07—Human-machine interface (HMI)

Function code	Name	Description	Default	Modify
P07.00	User password	By default, the user password is not enabled (the default value is 0). When you set the function code to a non-zero number, password protection is enabled. If you set the function code to 00000, the previous user password is cleared and password protection is disabled. After the user password setting takes effect, you need to enter the password to view or edit parameters. Please remember your password and save it in a secure place. After you exit the function code editing interface, the password protection function is enabled within 1 minute. If password protection is enabled,"0.0.0.0.0" is displayed when you press the PRG/ESC key again to enter the function code editing interface. You need to enter the correct user password to enter the interface. Setting range: 0–65535	0	○
P07.01	Reserved	-	-	-
P07.02	Function of QUICK/JOG key	Setting range: 0x00–0x27 Ones place: Function selection of the  key 0: No function 1: Jog 2: Reserved 3: Switch between forward and reverse rotating 4: Clear the UP/DOWN setting 5: Coast to stop	0x01	◎

Function code	Name	Description	Default	Modify
		6: Switch command channels in sequence 7: Reserved Tens place: Reserved		
P07.03	Sequence of switching running-command channels by pressing QUICK/JOG	Specifies the sequence of switching running-command channels by pressing the key when P07.02=6. Setting range: 0–3 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication	0	○
P07.04	Stop function validity of STOP/RST	Used to set the validness selection of the stop function. For fault reset, the key is valid in any conditions. Setting range: 0–3 0: Valid only for keypad control 1: Valid both for keypad and terminal control 2: Valid both for keypad and communication control 3: Valid for all control modes	0	○
P07.05–P07.07	Reserved	-	-	-
P07.08	Frequency display coefficient	Setting range: 0.01–10.00 Display frequency = Running frequency * P07.08	1.00	○
P07.09	Rotational speed display coefficient	Setting range: 0.1–999.9% Mechanical rotation speed = 120 * ×Displayed running frequency× * P07.09/(Number of motor pole pairs)	100.0%	○
P07.10	Linear speed display coefficient	Setting range: 0.1–999.9% Linear speed = (Mechanical rotation speed) × P07.10	1.0%	○
P07.11	Rectifier bridge temperature	Setting range: -20.0–120.0°C	0.0°C	●
P07.12	Inverter module temperature	Setting range: -20.0–120.0°C	0.0°C	●

Function code	Name	Description	Default	Modify
P07.13	Control board software version	Setting range: 1.00–655.35	Version depended	●
P07.14	Local accumulative running time	Setting range: 0–65535h	0h	●
P07.15	VFD electricity consumption high bits	Used to display the electricity consumption of the VFD. VFD electricity consumption = P07.15*1000 + P07.16 Setting range: 0–65535kkWh	0kkWh	●
P07.16	VFD electricity consumption low bits	Used to display the electricity consumption of the VFD. VFD electricity consumption = P07.15*1000 + P07.16 Setting range: 0.0–999.9kWh	0.0kWh	●
P07.17	VFD model	0x0000–0xFFF1 Bit 0–Bit 3: G type or P type 0x0: G type 0x1: P type Bit 4–Bit 11: Chip type and manufacturer 0x00: DSP(TI) 0x01–0x20: Reserved 0x21: MCU(ST) 0x22–0xFF: Reserved Bit 12–Bit15: VFD series 0x0:GD350 0x1:GD350A 0x2:GD350-UL 0x3:GD350 IP55 0x4:GD350N 0x5–0xF: Reserved **Note:** Bit 4–Bit 8 indicate the chip manufacturer (such as TI, ST), while Bit 9–Bit11 indicate the chip type (such as DSP, MCU).	0x0000	●
P07.18	VFD rated power	Setting range: 0.4–3000.0kW	Model depended	●

Function code	Name	Description	Default	Modify
P07.19	VFD rated voltage	Setting range: 50–1200V	Model depended	●
P07.20	VFD rated current	Setting range: 0.1–6000.0A	Model depended	●
P07.21	Factory bar code 1	Setting range: 0x0000–0xFFFF	Model depended	●
P07.22	Factory bar code 2	Setting range: 0x0000–0xFFFF	Model depended	●
P07.23	Factory bar code 3	Setting range: 0x0000–0xFFFF	Model depended	●
P07.24	Factory bar code 4	Setting range: 0x0000–0xFFFF	Model depended	●
P07.25	Factory bar code 5	Setting range: 0x0000–0xFFFF	Model depended	●
P07.26	Factory bar code 6	Setting range: 0x0000–0xFFFF	Model depended	●
P07.27	Present fault type	Setting range: 0–76 0: No fault 1: Inverter unit U-phase protection (OUt1) 2: Inverter unit V-phase protection (OUt2) 3: Inverter unit W-phase protection (OUt3) 4: Overcurrent during ACC (OC1) 5: Overcurrent during DEC (OC2) 6: Overcurrent during constant speed running (OC3) 7: Overvoltage during ACC (OV1) 8: Overvoltage during DEC (OV2) 9: Overvoltage during constant speed running (OV3) 10: Bus undervoltage fault (UV) 11: Motor overload (OL1) 12: VFD overload (OL2) 13: Phase loss on input side (SPI) 14: Phase loss on output side (SPO) 15: Rectifier module overheating (OH1) 16: Inverter module overheating (OH2) 17: External fault (EF)	0	●
P07.28	Last fault type		0	●
P07.29	2nd-last fault type		0	●
P07.30	3rd-last fault type		0	●
P07.31	4th-last fault type		0	●
P07.32	5th-last fault type		0	●

Function code	Name	Description	Default	Modify
		18: Modbus/Modbus TCP communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29: PROFIBUS communication fault (E-DP) 30: Ethernet communication error (E-NET) 31: CANopen communication error (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder disconnection fault (ENC1o) 38: Encoder direction reversal fault (ENC1d) 39: Encoder Z-pulse disconnection fault (ENC1Z) 40: Safe torque off (STO) 41: STO channel 1 safety circuit exception (STL1) 42: STO channel 2 safety circuit exception (STL2) 43: Exception in both STO channels 1 and 2 (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: Programmable card customized fault 1 (P-E1) 46: Programmable card customized fault 2 (P-E2) 47: Programmable card customized fault 3		

Function code	Name	Description	Default	Modify
		(P-E3) 48: Programmable card customized fault 4 (P-E4) 49: Programmable card customized fault 5 (P-E5) 50: Programmable card customized fault 6 (P-E6) 51: Programmable card customized fault 7 (P-E7) 52: Programmable card customized fault 8 (P-E8) 53: Programmable card customized fault 9 (P-E9) 54: Programmable card customized fault 10 (P-E10) 55: Duplicate expansion card type (E-Err) 56: Encoder UVW lost (ENCUV) 57: PROFINET communication fault (E-PN) 58: CAN communication fault (SECAN) 59: Motor overtemperature fault (OT) 60: Failure to identify the card in slot 1 (F1-Er) 61: Failure to identify the card in slot 2 (F2-Er) 62: Failure to identify the card in slot 3 (F3-Er) 63: Communication timeout of the card in slot 1 (C1-Er) 64: Communication timeout of the card in slot 2 (C2-Er) 65: Communication timeout of the card in slot 3 (C3-Er) 66: EtherCAT communication fault (E-CAT) 67: BACnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: CAN slave fault in master/slave synchronization (S-Err)		

Function code	Name	Description	Default	Modify
		70: EC PT100 detected OH (OtE1) 71: EC PT1000 detected OH (OtE2) 72: EtherNet IP communication timeout fault (E-EIP) 73: No upgrade bootload (E-PAO) 74: AI1 disconnection (E-AI1) 75: AI2 disconnection (E-AI2) 76: AI3 disconnection (E-AI3)		
P07.33	Running frequency at present fault	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P07.34	Ramp reference frequency at present fault	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P07.35	Output current at present fault	Setting range: 0–1200V	0V	●
P07.36	Output current at present fault	Setting range: 0.0–6300.0A	0.0A	●
P07.37	Bus voltage at present fault	Setting range: 0.0–2000.0V	0.0V	●
P07.38	Temperature at present fault	Setting range: -20.0–120.0°C	0.0°C	●
P07.39	Input terminal status at present fault	Setting range: 0x0000–0xFFFF	0x0000	●
P07.40	Output terminal state at present fault	Setting range: 0x0000–0xFFFF	0x0000	●
P07.41	Running frequency at last	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier.	0.00Hz	●

Function code	Name	Description	Default	Modify
	fault	Setting range: 0.00Hz–P00.03 Note: Supported by software of version V6.xx or later.		
P07.42	Ramp reference frequency at last fault	Setting range: 0.00–630.00Hz Note: Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 Note: Supported by software of version V6.xx or later.	0.00Hz	●
P07.43	Output voltage at last fault	Setting range: 0–1200V	0V	●
P07.44	Output current at last fault	Setting range: 0.0–6300.0A	0.0A	●
P07.45	Bus voltage at last fault	Setting range: 0.0–2000.0V	0.0V	●
P07.46	Temperature at last fault	Setting range: -20.0–120.0°C	0.0°C	●
P07.47	Input terminal state at last fault	Setting range: 0x0000–0xFFFF	0x0000	●
P07.48	Output terminal state at last fault	Setting range: 0x0000–0xFFFF	0x0000	●
P07.49	Running frequency at 2nd-last fault	Setting range: 0.00–630.00Hz Note: Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 Note: Supported by software of version V6.xx or later.	0.00Hz	●
P07.50	Ramp reference frequency at 2nd-last fault	Setting range: 0.00–630.00Hz Note: Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 Note: Supported by software of version V6.xx or later.	0.00Hz	●
P07.51	Output voltage at 2nd-last fault	Setting range: 0–1200V	0V	●
P07.52	Output current at 2nd-last fault	Setting range: 0.0–6300.0A	0.0A	●

Function code	Name	Description	Default	Modify
P07.53	Bus voltage at 2nd-last fault	Setting range: 0.0–2000.0V	0.0V	●
P07.54	Temperature at 2nd-last fault	Setting range: -20.0–120.0°C	0.0°C	●
P07.55	Input terminal state at 2nd-last fault	Setting range: 0x0000–0xFFFF	0x0000	●
P07.56	Output terminal state at 2nd-last fault	Setting range: 0x0000–0xFFFF	0x0000	●

Group P08—Enhanced functions

Function code	Name	Description	Default	Modify
P08.00	ACC time 2	Setting range: 0.0–3600.0s	Model depended	○
P08.01	DEC time 2	Setting range: 0.0–3600.0s	Model depended	○
P08.02	ACC time 3	Setting range: 0.0–3600.0s	Model depended	○
P08.03	DEC time 3	Setting range: 0.0–3600.0s	Model depended	○
P08.04	ACC time 4	Setting range: 0.0–3600.0s	Model depended	○
P08.05	DEC time 4	Setting range: 0.0–3600.0s	Model depended	○
P08.06	Running frequency of jog	Specifies the reference frequency during jogging. Setting range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	○
P08.07	ACC time for jogging	Specifies the time needed for the VFD to accelerate from 0Hz to the max. output frequency (P00.03). Setting range: 0.0–3600.0s	Model depended	○
P08.08	DEC time for jogging	Specifies the time needed for the VFD to speed down from the max. output frequency (P00.03) to 0Hz.	Model depended	○

Function code	Name	Description	Default	Modify
		Setting range: 0.0–3600.0s		
P08.09	Jump frequency 1	The VFD can avoid mechanical resonance points by setting jump frequencies. When the set frequency is within the range of jump frequency, the VFD runs at the boundary of jump frequency. The VFD supports the setting of three jump frequencies. If the jump frequency points are set to 0, this function is invalid. Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.10	Jump frequency amplitude 1		0.00Hz	○
P08.11	Jump frequency 2		0.00Hz	○
P08.12	Jump frequency amplitude 2		0.00Hz	○
P08.13	Jump frequency 3		0.00Hz	○
P08.14	Jump frequency amplitude 3		0.00Hz	○
P08.15	Amplitude of wobbling frequency	Setting range: 0.0–100.0% (of the set frequency)	0.0%	○
P08.16	Amplitude of sudden jump frequency	Setting range: 0.0–50.0% (of the amplitude of wobbling frequency)	0.0%	○
P08.17	Rise time of wobbling frequency	Setting range: 0.1–3600.0s	5.0s	○
P08.18	Fall time of wobbling frequency	Setting range: 0.1–3600.0s	5.0s	○
P08.19	Switching frequency of ACC/DEC time	Setting range: 0.00–P00.03 (Max. output frequency) 0.00Hz: No switchover If the running frequency is greater than P08.19, switch to ACC/DEC time 2.	0.00Hz	○
P08.20	Frequency threshold of the start of droop control	Setting range: 0.00–50.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	2.00Hz	○
P08.21	Reference frequency of ACC/DEC time	Setting range: 0–2 0: Max. output frequency 1: Set frequency	0	◎

Function code	Name	Description		Default	Modify
		2: 100Hz ✎**Note:** Valid for straight ACC/DEC only.			
P08.22	Output torque display selection	Setting range: 0–1 0: Based on torque current 1: Based on output power		0	○
P08.23	Number of decimal places of frequency	Setting range: 0–1 0: Two 1: One		0	○
P08.24	Number of decimal places of linear speed	Setting range: 0–3 0: None 1: One 2: Two 3: Three		0	○
P08.25	Set counting value	Setting range: P08.26–65535		0	○
P08.26	Designated counting value	Setting range: 0–P08.25		0	○
P08.27	Set running time	Setting range: 0–65535min		0min	○
P08.28	Auto fault reset count	Specifies the number of automatic fault reset times when the VFD uses automatic fault reset. When the number of continuous reset times exceeds the value, the VFD reports a fault and stops. After VFD starts, If no fault occurred within 600s after the VFD starts, the number of automatic fault reset times is cleared. Setting range: 0–10		0	○
P08.29	Auto fault reset interval	Specifies the time interval from when a fault occurred to when automatic fault reset takes effect. Setting range: 0.1–3600.0s		1.0s	○
P08.30	Frequency decrease ratio in droop control	Specifies the variation rate of the VFD output frequency based on the load. It is mainly used in balancing the power when multiple	Setting range: 0.00–50.00Hz ✎**Note:** Supported by software of version V3.xx or earlier.	0.00Hz	○

Function code	Name	Description	Default	Modify
		motors drive the same load. | Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.		
P08.31	Channel for switching between motor 1 and motor 2	Setting range: 0x00–0x14 Ones place: Switchover channel 0: Switch over through terminals 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET/EtherNet IP communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable	0x00	◎
P08.32	FDT1 electrical level detection value	Used to view the FDT1 electrical level detection value. When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level—FDT lagging detection value). Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P08.33	FDT1 lagging detection value	Used to view the FDT1 lagging detection value. When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital	5.0%	○

Function code	Name	Description	Default	Modify
		output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level—FDT lagging detection value). Setting range of: 0.0–100.0% (FDT1 electrical level)		
P08.34	FDT2 electrical level detection value	Used to view the FDT2 electrical level detection value. When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level—FDT lagging detection value). Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P08.35	FDT2 lagging detection value	Used to view the FDT2 lagging detection value. When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level—FDT lagging detection value). Setting range: 0.0–100.0% (FDT2 electrical level)	5.0%	○

Function code	Name	Description	Default	Modify
P08.36	Detection value for frequency being reached	When the output frequency is within the detection range, the multifunction digital output terminal outputs the signal of "Frequency reached". Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.37	Enabling energy-consumption braking	Setting range: 0–1 0: Disable 1: Enable	1	○
P08.38	Energy-consumption braking threshold voltage	Specifies the starting bus voltage of dynamic braking. Adjust this value properly to achieve effective braking for the load. The default value varies depending on the voltage class. Setting range: 200.0–2000.0V	For 220V: 380.0V For 380V: 700.0V For 660V: 1120.0V	○
P08.39	Cooling-fan running mode	Setting range: 0–2 0: Normal mode 1: Permanent running after power-on 2: Run mode 2	0	○
P08.40	PWM selection	Setting range: 0x0000–0x1221 Ones place: PWM mode selection 0: PWM mode 1, 3PH modulation and 2PH modulation 1: PWM mode 2, 3PH modulation Tens place: PWM low-speed carrier frequency limit 0: Low-speed carrier frequency limit mode 1 1: Low-speed carrier frequency limit mode 2 2: No limit on low-speed carrier frequency Hundreds place: Deadzone compensation method 0: Compensation method 1 1: Compensation method 2 (only for vector control) 2: Compensation method 3 (only for vector	0x1101	◎

Function code	Name	Description	Default	Modify
		control) Thousands place: PWM loading mode selection 0: Interruptive loading 1: Normal loading **Note:** Supported by software of version V3.xx or earlier.		
		0x0000–0x1221 Ones place: PWM mode selection 0: Switch from SVPWM to DPWM 1: SPWM overmodulation throughout the entire process Tens place: PWM low-speed carrier frequency limit 0: Low-speed carrier frequency limit mode 1 1: Low-speed carrier frequency limit mode 2 2: No limit on low-speed carrier frequency Hundreds place: Deadzone compensation method 0: Compensation method 1 1: Compensation method 2 (only for vector control) 2: Compensation method 3 (only for vector control) Thousands place: SVPWM mode selection 0: SVPWM using three-order harmonic injection method 1: Traditional SPWM **Note:** Supported by software of version V6.xx or later.		

Function code	Name	Description	Default	Modify
P08.41	Overmodulation selection	Setting range: 0x0000–0x1111 Ones place: Overmodulation enabling 0: Overmoulation is invalid 1: Overmoulation is valid Tens place: Overmodulation mode 0: Deepened overmoulation is invalid 1: Deepened overmodulation is valid Hundreds place: Carrier frequency limit 0: Yes 1: No limit Thousands place: Output voltage compensation selection (supported by software of version V3.xx or earlier) 0: No 1: Yes	0x1001 (supported by software of version V3.xx or earlier) 0x0001 (supported by software of version V6.xx or later)	◎
P08.42	Reserved	-	-	-
P08.43	LED keypad potentiometer integral rate	0.01–10.00s	0.10s	○
P08.44	UP/DOWN terminal control setting	Setting range: 0x000–0x221 Ones place: Whether the setting made through UP/DOWN is valid. 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received	0x000	○

Function code	Name	Description	Default	Modify
P08.45	UP terminal frequency incremental change rate	Setting range: 0.01–50.00Hz/s **Note:** ● The value is also used as the frequency increment or decrement that is made by pressing the UP/DOWN key on the LCD keypad. ● Supported by software of version V3.xx or earlier.	0.50Hz/s	○
		Setting range: 0.01Hz/s–P00.03/s **Note:** ● **Note:** The value is also used as the frequency increment or decrement that is made by pressing the UP/DOWN key on the LCD keypad. ● Supported by software of version V6.xx or later.		
P08.46	DOWN terminal frequency incremental change rate	Setting range: 0.01–50.00Hz/s **Note:** Supported by software of version V3.xx or earlier.	0.50Hz/s	○
		Setting range: 0.01Hz/s–P00.03/s **Note:** Supported by software of version V6.xx or later.		
P08.47	Action selection at power-off during frequency setting	Setting range: 0x000–0x111 Ones place: Action selection at power-off during frequency adjusting through digitals. 0: Save the setting at power-off. 1: Clear the setting at power-off. Tens place: Action selection for power-off in Modbus based frequency setting 0: Save the setting at power-off. 1: Clear the setting at power-off. Hundreds place: Action selection at power-off during frequency adjusting through DP communication methods 0: Save the setting at power-off. 1: Clear the setting at power-off.	0x000	○

Function code	Name	Description	Default	Modify
P08.48	Initial electricity consumption high bit	Specifies the initial electricity consumption. Initial electricity consumption = P08.48×1000+P08.49 Setting range: 0–59999kWh	0kWh	○
P08.49	Initial electricity consumption low bit	Specifies the initial electricity consumption. Initial electricity consumption = P08.48×1000+P08.49 Setting range: 0.0–999.9kWh	0.0kWh	○
P08.50	Magnetic flux braking	Used to enable the magnetic flux braking. Magnetic flux braking can be used for motor stop, as well as for motor rotation speed change. The current of the stator other than the rotor increases during magnetic flux braking. Therefore, the cooling is better. 0: Invalid 100–150: A greater coefficient indicates greater braking strength. Setting range: 0, 100–150	0	○
P08.51	VFD input power factor	Used to adjust the current display value on the AC input side. Setting range: 0.00–1.00	0.56	○
P08.52	STO lock selection	Setting range: 0–1 0: Lock upon STO alarm 1: No lock upon STO alarm	0	○
P08.53	Upper limit frequency bias value in torque control	Setting range: 0.00Hz–P00.03 (Max. output frequency) **Note:** Valid for torque control only.	0.00Hz	○
P08.54	Upper limit frequency ACC/DEC selection in torque control	Setting range: 0–4 0: No limit on acceleration or deceleration 1: ACC/DEC time 1 2: ACC/DEC time 2 3: ACC/DEC time 3 4: ACC/DEC time 4	0	○

Function code	Name	Description	Default	Modify
P08.55	Enabling auto carrier frequency reduction	Setting range: 0–1 0: Disable 1: Enable **Note:** Automatic carrier frequency reduction indicates that the VFD automatically reduces the carrier frequency when detecting the heat sink temperature exceeds the rated temperature. When the temperature decreases to a specified value, the carrier frequency restores to the setting. This function can reduce the VFD overheat alarm reporting chances.	0	○
P08.56	Min. carrier frequency	Setting range: 0.0–15.0kHz	Model depended	●
P08.57	Temperature point of auto carrier frequency reduction	Setting range: 40.0–85.0°C	70.0°C	○
P08.58	Interval of carrier frequency reduction	Setting range: 0–30min	10min	○
P08.59	AI1 disconnection detection threshold	Setting range: 0–100%	0%	○
P08.60	AI2 disconnection detection threshold	Setting range: 0–100%	0%	○
P08.61	AI3 disconnection detection threshold	Setting range: 0–100%	0%	○
P08.62	Output current filter time	Setting range: 0.000–10.000s	0.000s	○
P08.63	Filter count in output torque display	Setting range: 0–8	8	○

Group P09—PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source selection	Specifies the target given channel during the PID process. Setting range: 0–12 0: Setting through P09.01 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step running 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12: Reserved **Note:** The set target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system always calculates a related value (0–100.0%).	0	○
P09.01	PID digital setting	Setting range: -100.0%–100.0%	0.0%	○
P09.02	PID feedback source selection	Specifies the PID feedback channel. Setting range: 0–10 0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/EtherNet IP communication	0	○

Function code	Name	Description	Default	Modify
		9: Programmable card 10: Reserved **Note:** The reference channel and feedback channel cannot be duplicate. Otherwise, effective PID control cannot be achieved.		
P09.03	PID output characteristics selection	Setting range: 0–1 0: PID output is positive. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will decrease to balance the PID. Example: PID control on strain during unwinding. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will increase to balance the PID. Example: PID control on tension during unwinding	0	○
P09.04	Proportional gain (Kp)	Specifies the proportional gain P of PID input. Setting range: 0.00–100.00	1.80	○
P09.05	Integral time (Ti)	Determines the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. Setting range: 0.00–10.00s	0.90s	○
P09.06	Differential time (Td)	Determines the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. Setting range: 0.00–10.00s	0.00s	○
P09.07	Sampling period (T)	Specifies the sampling cycle of feedback. The regulator calculates in each sampling cycle. A longer sampling cycle indicates slower response. Setting range: 0.001–1.000s	0.001s	○

Function code	Name	Description	Default	Modify
P09.08	PID control deviation limit	Specifies the max. deviation allowed by the output of PID system relative to the closed loop reference, which can adjust the accuracy and stability of the PID system. Setting range: 0.0–100.0%	0.0%	○
P09.09	PID output upper limit	Used to set the upper limit of PID regulator output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). Setting range: P09.10–100.0%	100.0%	○
P09.10	PID output lower limit	Specifies the lower limit of PID regulator output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). Setting range: -100.0%–P09.09	0.0%	○
P09.11	Feedback offline detection value	Specifies the PID feedback offline detection value. Setting range: 0.0–100.0%	0.0%	○
P09.12	Feedback offline detection time	Setting range: 0.0–3600.0s	1.0s	○
P09.13	PID control selection	Setting range: 0x0000–0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens place: 0: Same as the main reference direction 1: Contrary to the main reference direction Hundreds place: 0: Limit as per the max. frequency 1: Limit as per A frequency Thousands place: 0: A+B frequency. ACC/DEC of main reference A frequency source buffering is invalid.	0x0001	○

Function code	Name	Description	Default	Modify
		1: A+B frequency. Acceleration/ deceleration of main reference A frequency source precharging is valid. The acceleration/deceleration is determined by P08.04 (acceleration time 4).		
P09.14	Low frequency proportional gain (Kp)	Setting range: 0.00–100.00 Low-frequency switching point: 5.00Hz, high-frequency switching point: 10.00Hz (P09.04 corresponds to high-frequency parameter), and the middle is the linear interpolation between these two points.	1.00	○
P09.15	ACC/DEC time of PID command	Setting range: 0.0–1000.0s	0.0s	○
P09.16	PID output filter time	Setting range: 0.000–10.000s	0.000s	○
P09.17	Reserved	-	-	-
P09.18	Low frequency integral time (Ti)	Setting range: 0.00–10.00s	0.90s	○
P09.19	Low frequency differential time (Td)	Setting range: 0.00–10.00s	0.00s	○
P09.20	Low frequency point for PID parameter switching	Setting range: 0.00Hz–P09.21	5.00Hz	○
P09.21	High frequency point for PID parameter switching	Setting range: P09.20–P00.03	10.00Hz	○
P09.22–P09.28	Reserved	-	-	-

Group P10—Simple PLC and multi-step speed control

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	Setting range: 0–2 0: Stop after running once. The VFD stops	0	○

Function code	Name	Description	Default	Modify
		automatically after running for one cycle, and it can be started only after receiving the running command. 1: Keep running in the final value after running for one cycle. The VFD keeps the running frequency and direction of the last section after a single cycle. 2: Cyclic running. The VFD enters the next cycle after completing one cycle until receiving the stop command.		
P10.01	Simple PLC memory selection	Setting range: 0–1 0: Do not memorize at power outage 1: Memorize at power outage. The PLC memories its running stage and running frequency before power-off.	0	○
P10.02	Multi-step speed 0	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.03	Running time of step 0	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.04	Multi-step speed 1	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.05	Running time of step 1	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.06	Multi-step speed 2	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.07	Running time of step 2	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.08	Multi-step speed 3	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.09	Running time of step 3	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.10	Multi-step speed 4	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds	0.0%	○

Function code	Name	Description	Default	Modify
		to the max. output frequency P00.03.		
P10.11	Running time of step 4	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.12	Multi-step speed 5	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.13	Running time of step 5	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.14	Multi-step speed 6	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.15	Running time of step 6	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.16	Multi-step speed 7	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.17	Running time of step 7	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.18	Multi-step speed 8	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.19	Running time of step 8	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.20	Multi-step speed 9	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.21	Running time of step 9	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.22	Multi-step speed 10	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.23	Running time of step 10	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.24	Multi-step speed 11	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○

Function code	Name	Description	Default	Modify
P10.25	Running time of step 11	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.26	Multi-step speed 12	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.27	Running time of step 12	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.28	Multi-step speed 13	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.29	Running time of step 13	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.30	Multi-step speed 14	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.31	Running time of step 14	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.32	Multi-step speed 15	Setting range: -300.0–300.0% The frequency setting 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.33	Running time of step 15	Setting range: 0.0–6553.5s(min) The time unit is specified by P10.37.	0.0s (min)	○
P10.34	ACC/DEC time of steps 0–7 of simple PLC	Setting range: 0x0000–0xFFFF	0x0000	○
P10.35	ACC/DEC time of steps 8–15 of simple PLC	Setting range: 0x0000–0xFFFF	0x0000	○
P10.36	PLC restart mode	Setting range: 0–1 0: Restart from the step 0, namely if the VFD stops during running (caused by stop command, fault or power off), it will run from the first step after restart. 1: Continue running from the step frequency when interruption occurred, namely if the VFD stops during running (caused by stop command or fault), it will	0	◎

Function code	Name	Description	Default	Modify
		record the running time of current step, and enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.		
P10.37	Multi-step running time unit	Setting range: 0–1 0: second; the running time of each step is counted in seconds 1: minute; the running time of each step is counted in minutes	0	◎

Group P11—Protection parameters

Function code	Name	Description	Default	Modify
P11.00	Protection against phase loss	Setting range: 0x000–0x111 Ones place: 0: Disable software input phase loss protection. 1: Enable software input phase loss protection. Tens place: 0: Disable output phase loss protection. 1: Enable output phase loss protection. Hundreds place: 0: Disable hardware input phase loss protection. 1: Enable hardware input phase loss protection.	0x110 (>2.2kW) 0x011 (2.2kW and lower)	○
P11.01	Frequency drop at transient power-off	Setting range: 0–1 0: Disable 1: Enable	0	○
P11.02	Enabling dynamic braking in standby mode	Setting range: 0–1 0: Enable 1: Disable **Note:** Supported by software of version V3.xx or earlier.	0	◎
		Setting range: 0–1	1	

Function code	Name	Description	Default	Modify
		0: Disable 1: Enable **Note:** Supported by software of version V6.xx or later.		
P11.03	Overvoltage stall protection	Setting range: 0–1 0: Disable 1: Enable	1	○
P11.04	Overvoltage stall protection voltage	120–150% (standard bus voltage) (380V)	136%	○
		120–150% (standard bus voltage) (220V)	120%	
P11.05	Current limit selection	During accelerated running, as the load is too large, the actual acceleration rate of motor is lower than that of output frequency. To prevent the VFD trip due to overcurrent during acceleration, take the current limit measures. Setting range: 0x000–0x111 Ones place: Current limit action selection 0: Invalid 1: Always valid Tens: Action selection upon hardware current limit overload 0: Report a fault and stop 1: Keep running Hundreds place: Indicates whether to enable SM hardware current limit action 0: Disable 1: Enable **Note:** The hundreds place is supported only by software of version V6.xx or later.	0x001	◎
P11.06	Automatic current limit threshold	Setting range: 50.0–200.0% (of the rated VFD output current)	For G type: 160.0% For the P type: 120.0%	◎
P11.07	Frequency drop rate during current limit	Setting range: 0.00–50.00Hz/s **Note:** Supported by software of version V3.xx or earlier.	10.00Hz/s	◎

Function code	Name	Description	Default	Modify
		Setting range: 0.00Hz/s–P00.03/s **Note:** Supported by software of version V6.xx or later.		
P11.08	VFD/motor OL/UL pre-alarm selection	Setting range: 0x0000–0x1134 Ones place: Overload/underload (OL/UL) pre-alarm detection method 0: Motor OL/UL pre-alarm, relative to the motor rated current. 1: VFD OL/UL pre-alarm, relative to the VFD rated current. 2: Motor output torque OL/UL pre-alarm, relative to motor rated torque. 3: Motor OL/UL pre-alarm. The OL is relative to motor rated current, while the UL is relative to the motor rated power. (It is supported by software of version V3.xx or earlier.) 4: VFD OL/UL pre-alarm. The OL is relative to the VFD rated current, while the UL is relative to the VFD rated power. (It is supported by software of version V3.xx or earlier.) Tens place: Action selection after OL/UL fault condition is triggered 0: The VFD continues to work, while keeping the OL/UL pre-alarm. 1: For a UL fault, the VFD continues to work, while keeping the pre-alarm; for an OL fault, it reports the fault and stops. 2: For an OL fault, the VFD continues to work, while keeping the pre-alarm; for a UL fault, it reports the fault and stops. 3: The VFD reports the OL/UL fault and stops. Hundreds place: Detection method 0: Always detect 1: Detect during constant speed running. Thousands place: VFD overload current	0x0000	○

Function code	Name	Description	Default	Modify
		reference selection 0: Related to current calibration coefficient 1: Irrelated to current calibration coefficient		
P11.09	Underload pre-alarm detection threshold	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload pre-alarm detection time (P11.10), overload pre-alarm signal will be outputted. Setting range: P11.11–200% (relative value determined by the ones place of P11.08)	For the G type: 150% For the P type: 120%	○
P11.10	Overload pre-alarm detection time	Setting range: 0.1–3600.0s	1.0s	○
P11.11	Underload pre-alarm detection threshold	Underload pre-alarm signal will be outputted if the output current of the VFD or motor is lower than underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm detection time (P11.12). Setting range: 0–P11.09 (relative value determined by the ones place of P11.08)	50%	○
P11.12	Underload pre-alarm detection time	Underload pre-alarm signal will be outputted if the output current of the VFD or motor is lower than underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm detection time (P11.12). Setting range: 0.1–3600.0s	1.0s	○
P11.13	Fault output terminal action upon fault occurring	Specifies the action of fault output terminals at undervoltage and fault reset. Setting range: 0x00–0x11 Ones place: Action selection for an underload fault 0: Act at undervoltage 1: Do not act at undervoltage Tens place: Action selection during automatic reset 0: Act during automatic reset	0x00	○

<table>
<tr><th>Function code</th><th>Name</th><th colspan="2">Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td colspan="2">1: Do not act during the automatic reset period</td><td></td><td></td></tr>
<tr><td>P11.14</td><td>Speed deviation detection value</td><td colspan="2">Specifies the speed deviation detection value.
Setting range: 0.0–50.0%</td><td>10.0%</td><td>○</td></tr>
<tr><td>P11.15</td><td>Speed deviation detection time</td><td colspan="2">Specifies the speed deviation detection time. If the speed deviation detection time is smaller than the set value, the VFD continues running.
Setting range: 0.0–10.0s
Note: Speed deviation protection is invalid when the value is 0.0.</td><td>2.0s</td><td>○</td></tr>
<tr><td>P11.16</td><td>Automatic frequency-reduction during voltage drop</td><td colspan="2">Setting range: 0–1
0: Invalid
1: Enable</td><td>0</td><td>○</td></tr>
<tr><td rowspan="2">P11.17</td><td rowspan="2">Proportional coefficient of voltage regulator during undervoltage stall</td><td rowspan="2">Specifies the proportional coefficient of the bus voltage regulator during undervoltage stall.</td><td>Setting range: 0–1000
Note: Supported by software of version V3.xx or earlier.</td><td>100</td><td rowspan="2">○</td></tr>
<tr><td>Setting range: 0–127
Note: Supported by software of version V6.xx or later.</td><td>30</td></tr>
<tr><td>P11.18</td><td>Integral coefficient of voltage regulator during undervoltage stall</td><td colspan="2">Specifies the integral coefficient of the bus voltage regulator during undervoltage stall.
Setting range: 0–1000</td><td>40</td><td>○</td></tr>
<tr><td>P11.19</td><td>Proportional coefficient of current regulator during undervoltage stall</td><td colspan="2">Specifies the proportional coefficient of the active current regulator during undervoltage stall.
Setting range: 0–1000</td><td>25</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
P11.20	Integral coefficient of current regulator during undervoltage stall	Specifies the integral coefficient of the active current regulator during undervoltage stall. Setting range: 0–2000	150	○
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	Specifies the proportional coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000 **Note:** Supported by software of version V3.xx or earlier. Setting range: 0–127 **Note:** Supported by software of version V6.xx or later.	60	○
P11.22	Integral coefficient of voltage regulator during overvoltage stall	Specifies the integral coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000 **Note:** Supported by software of version V3.xx or earlier.	10	○
		Note: Supported by software of version V6.xx or later.	5	
P11.23	Proportional coefficient of current regulator during overvoltage stall	Specifies the proportional coefficient of the active current regulator during overvoltage stall. Setting range: 0–1000	60	○
P11.24	Integral coefficient of current regulator during overvoltage stall	Specifies the integral coefficient of the active current regulator during overvoltage stall. Setting range: 0–2000	250	○
P11.25	VFD overload integral enabling	Setting range: 0–1 0: Disable. The overload timing value is reset to zero after the VFD is stopped. In this	0	◎

Function code	Name	Description	Default	Modify
		case, the determination of VFD overload takes more time, and therefore the effective protection over the VFD is weakened. 1: Enable. 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.		
P11.26	Reserved	-	-	-
P11.27	V/F oscillation control method	Setting range: 0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: 0: Reserved 1: Reserved **Note:** Supported by software of version V3.xx or earlier.	0x00	◎
P11.28	SPO switch-on detection delay time	Setting range: 0.0–60.0s **Note:** The SPO detection is started only after the VFD runs for the delay time P11.28 to avoid false alarms caused by the unstable frequency. When the frequency is stable, the delay time will be skipped.	5.0s	○
P11.29	SPO unbalance factor	Setting range: 0–10	6	○
P11.30	Reserved	-	-	-
P11.31	Fault severity group 1	Setting range: 0x0000–0x3333 Thousands place/hundreds place/tens place/ones place: 0: Report a fault 1: Report a fault after deceleration to stop 2: Pre-alarm, with the action executed according to P11.51 3: Screen out fault **Note:** Different fault actions are taken for	0x0000	○
P11.32	Fault severity group 2		0x0000	○
P11.33	Fault severity group 3		0x0000	○
P11.34	Fault severity group 4		0x0000	○

Function code	Name	Description	Default	Modify
P11.35	Fault severity group 5	different fault severities. The first 10 faults are not grouped by severity, but each four of the subsequent faults are grouped by severity in ascending order from right to left in hexadecimal format, that is, from the ones place to the thousands place (for example, the ones place of fault severity group 1 corresponds to fault 11). Group 1: Faults 11–14 (OL1, OL2, SPI, SPO) Group 2: Faults 15–18 (OH1, OH2, EF, CE) Group 3: Faults 19–22 (ItE, tE, EEP, PIDE) Group 4: Faults 23–26 (bCE, END, OL3, PCE) Group 5: Faults 27–30 (UPE, DNE, E-DP, E-NET) Group 6: Faults 31–34 (E-CAN, ETH1, ETH2, dEu) Group 7: Faults 35–38 (Sto, LL, ENC1O, ENC1D) Group 8: Faults 39–42 (ENC1Z, STO, STL1, STL2) Group 9: Faults 43–46 (STL3, CrCE, P-E1, P-E2) Group 10: Faults 47–50 (P-E3, P-E4, P-E5, P-E6) Group 11: Faults 51–54 (P-E7, P-E8, P-E9, P-E10) Group 12: Faults 55–58 (E-Err, ENCU, E-PN, SECAN) Group 13: Faults 59–62 (OT, F1-Er, F2-Er, F3-Er) Group 14: Faults 63–66 (C1-Er, C2-Er, C3-Er, E-CAT) Group 15: Faults 67–70 (E-BAC, E-DEV, S-Err, OtE1) Group 16: Faults 71–74 (OtE2, E-EIP, E-PAO, E-AI1) Group 17: Faults 75–78 (E-AI2, E-AI3,	0x0000	○
P11.36	Fault severity group 6		0x0000	○
P11.37	Fault severity group 7		0x0000	○
P11.38	Fault severity group 8		0x0000	○
P11.39	Fault severity group 9		0x0000	○
P11.40	Fault severity group 10		0x0000	○
P11.41	Fault severity group 11		0x0000	○
P11.42	Fault severity group 12		0x0000	○
P11.43	Fault severity group 13		0x0000	○
P11.44	Fault severity group 14		0x0000	○
P11.45	Fault severity group 15		0x0000	○
P11.46	Fault severity group 16		0x0000	○
P11.47	Fault severity group 17		0x0000	○
P11.48	Fault severity group 18		0x0000	○
P11.49	Fault severity group 19		0x0000	○
P11.50	Fault severity group 20		0x0000	○

Function code	Name	Description	Default	Modify
		Reserved, Reserved) Group 18: Faults 79–82 (Reserved, Reserved, Reserved, Reserved) Group 19: Faults 83–86 (Reserved, Reserved, Reserved, Reserved) Group 20: Faults 87–90 (Reserved, Reserved, Reserved, Reserved) **Note:** Supported by software of version V3.xx or earlier.		
		Setting range of P11.31: 0x0000–0x3313 Setting range of P11.32: 0x0000–0x1333 Setting range of P11.33: 0x0000–0x3333 Setting range of P11.34: 0x0000–0x1133 Setting range of P11.35–P11.50: 0x0000–0x3333 Thousands place/hundreds place/tens place/ones place: 0: Report a fault 1: Report a fault after deceleration to stop 2: Pre-alarm, with the action executed according to P11.51 3: Screen out fault **Note:** Different fault actions are taken for different fault severities. The first 10 faults cannot be grouped by severity, but each four of the subsequent faults are grouped by severity in ascending order from right to left in hexadecimal format. Group 1: Faults 11, 12, 13, 14 (OL1, OL2, SPI, SPO) Group 2: Faults 17, 18, 22, 23 (EF, CE, PIDE, bCE) Group 3: Faults 25, 26, 29, 30 (OL3, PCE, E-DP, E-NET) Group 4: Faults 31, 34, 35, 36 (E-CAN, dEU, STo, LL) Group 5: Faults 37, 38, 39, 45 (ENC1O,		

Function code	Name	Description	Default	Modify
		ENC1D, ENC1Z, P-E1) Group 6: Faults 46, 47, 48, 49 (P-E2, P-E3, P-E4, P-E5) Group 7: Faults 50, 51, 52, 53 (P-E6, P-E7, P-E8, P-E9) Group 8: Faults 54, 55, 56, 57 (P-E10, E-Err, ENCU, E-PN) Group 9: Faults 58, 59, 60, 61 (SECAN, OT, F1-Er, F2-Er) Group 10: Faults 62, 63, 64, 65 (F3-Er, C1-Er, C2-Er, C3-Er) Group 11: Faults 66, 67, 68, 69 (E-CAT, E-BAC, E-DEV, S-Err) Group 12: Faults 70, 71, 72, 73 (OtE1, OtE2, E-EIP, E-PAO) Group 13: Faults 74, 75, 76, Reserved (E-AI1, E-AI2, E-AI3, Reserved) Group 14: Fault=Reserved Group 15: Fault=Reserved Group 16: Fault=Reserved Group 17: Fault=Reserved Group 18: Fault=Reserved Group 19: Fault=Reserved Group 20: Fault=Reserved **Note:** Supported by software of version V6.xx or later.		
P11.51	Action for fault pre-alarm	Setting range: 0–4 0: Run at the set frequency 1: Run at the output frequency at the time of failure 2: Run at the upper limit frequency 3: Run at the lower limit frequency 4: Run at the backup frequency upon exceptions	0	○
P11.52	Backup frequency upon exceptions	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier.	0.00Hz	○

Function code	Name	Description	Default	Modify
		Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.		
P11.53	Fire mode function	Setting range: 0–2 0: Invalid. In this case, the VFD runs in normal mode and stops when encountering a fault. 1: Fire mode 1. If fire mode 1 is selected, the VFD always runs at the speed specified by P11.54, but stops upon any of the following faults: OUT1, OUT2, OUT3, OC1, OC2, OC3, STO, STL1, STL2, STL3, ETH1, ETH2 2: Fire mode 2. If fire mode 2 is selected, the VFD always runs, but stops upon any of the following faults: OUT1, OUT2, OUT3, OC1, OC2, OC3, STO, STL1, STL2, STL3, ETH1, ETH2, tE, OV1, OV2, OV3, SPO **Note:** The fire mode function requires terminal control, where OUT1, OUT2, OUT3, OC1, OC2, OC3, STO, STL1, STL2, STL3, ETH1, and ETH2 are hardware blocking faults. In fire mode, it runs if a fault occurs.	0	◎
P11.54	Running frequency in fire mode	Setting range: 0.00Hz–P00.03	50.00Hz	○
P11.55	Fire mode flag	Setting range: 0–1 **Note:** If the fire mode has lasted 5 minutes, this flag is reset to 1, and no warranty of repair is granted.	0	●
P11.56–P11.58	Reserved	-	-	-
P11.59	Exciting current limit during weakening flux	0.0–100.0% **Note:** Supported by software of version V3.xx or earlier.	50.0%	○
P11.60	CBC current limit coefficient	0.0–100.0% **Note:** A smaller value indicates a smaller number of CBC current limit times.	100.0%	○

Group P12—Parameters of motor 2

Function code	Name	Description	Default	Modify
P12.00	Type of motor 2	Setting range: 0–1 0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P12.01	Rated power of AM 2	Setting range: 0.1–3000.0kW	Model depended	◎
P12.02	Rated frequency of AM 2	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	Rated speed of AM 2	Setting range: 1–60000RPM	Model depended	◎
P12.04	Rated voltage of AM 2	Setting range: 0–1200V	Model depended	◎
P12.05	Rated current of AM 2	Setting range: 0.8–6000.0A	Model depended	◎
P12.06	Stator resistance of AM 2	Setting range: 0.001–65.535Ω	Model depended	○
P12.07	Rotor resistance of AM 2	Setting range: 0.001–65.535Ω	Model depended	○
P12.08	Leakage inductance of AM 2	Setting range: 0.1–6553.5mH	Model depended	○
P12.09	Mutual inductance of AM 2	Setting range: 0.1–6553.5mH	Model depended	○
P12.10	No-load current of AM 2	Setting range: 0.1–6553.5A	Model depended	○
P12.11	Magnetic saturation coefficient 1 of iron core of AM 2	Setting range: 0.0–100.0%	80.0%	○
P12.12	Magnetic saturation coefficient 2 of iron core of AM 2	Setting range: 0.0–100.0%	68.0%	○
P12.13	Magnetic saturation coefficient 3 of iron core of AM 2	Setting range: 0.0–100.0%	57.0%	○

Function code	Name	Description	Default	Modify
P12.14	Magnetic saturation coefficient 4 of iron core of AM 2	Setting range: 0.0–100.0%	40.0%	○
P12.15	Rated power of SM 2	Setting range: 0.1–3000.0kW	Model depended	◎
P12.16	Rated frequency of SM 2	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.17	Number of pole pairs of SM 2	Setting range: 1–128	2	◎
P12.18	Rated voltage of SM 2	Setting range: 0–1200V	Model depended	◎
P12.19	Rated current of SM 2	Setting range: 0.8–6000.0A	Model depended	◎
P12.20	Stator resistance of SM 2	Setting range: 0.001–65.535Ω	Model depended	○
P12.21	Direct-axis inductance of SM 2	Setting range: 0.01–655.35mH	Model depended	○
P12.22	Quadrature-axis inductance of SM 2	Setting range: 0.01–655.35mH	Model depended	○
P12.23	Counter-emf constant of SM 2	Setting range: 0–10000V	300V	○
P12.24	Initial pole position of SM 2	Setting range: 0x0000–0xFFFF **Note:** Supported by software of version V6.xx or later.	0x0000	●
P12.25	Identification current of SM 2	Setting range: 0–50% (of the motor rated current)	10%	●
P12.26	Overload protection selection of motor 2	Setting range: 0–2 0: No protection 1: Common motor (with low-speed compensation) 2: Frequency-variable motor (without low-speed compensation)	2	◎
P12.27	Overload protection coefficient of motor 2	Specifies the motor overload protection coefficient. A small motor overload protection coefficient indicates a great overload multiplication (M).	100.0%	○

Function code	Name	Description	Default	Modify
		When M=116%, protection is performed after motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M⩾400%, protection is performed immediately. Setting range: 20.0%–150.0%		
P12.28	Power display calibration coefficient of motor 2	Setting range: 0.00–3.00	1.00	○
P12.29	Parameter display selection of motor 2	Setting range: 0–1 0: Display by motor type. In this mode, only parameters related to the present motor type are displayed. 1: Display all. In this mode, all the motor parameters are displayed.	0	○
P12.30	System inertia of motor 2	Setting range: 0.001–30.000kg・m^2	0.001 kg・m^2	○
P12.31	Reserved	-	-	-
P12.32	Power factor of AM 2	Setting range: 0.00–1.00 **Note:** Supported by software of version V6.xx or later.	0.85	○
P12.33	High word of rated speed of AM 2	Setting range: 0–30(10kRPM) **Note:** Supported by software of version V6.xx or later.	0	◎

Group P13—SM control

Function code	Name	Description	Default	Modify
P13.00	SM injected-current decrease ratio	Specifies the reduction rate of the input reactive current. When the active current of the synchronous motor increases to some extent, the input reactive current can be	80.0%	○

Function code	Name	Description	Default	Modify
		reduced to improve the power factor of the motor. Setting range: 0.0%–100.0% (of the the motor rated current)		
P13.01	Initial pole detection method	Setting range: 0–2 0: No detection 1: High frequency superposition 2: Pulse superposition	0 (Software of version V3.xx or earlier) 2 (Software of version V6.xx or later)	◎
P13.02	Pull-in current 1	Specifies the pole position orientation current. It is valid within the lower limit of pull-in current switch-over frequency threshold. If you need to increase the start torque, increase the value of this function parameter properly. Setting range: -100.0%–100.0% (of the motor rated current)	20.0% (Software of version V3.xx or earlier) 30.0% (Software of version V6.xx or later)	○
P13.03	Pull-in current 2	Specifies the pole position orientation current. It is valid within the upper limit of pull-in current switching frequency threshold. You do not need to change the value in most cases. Setting range: -100.0%–100.0% (of the motor rated current)	10.0% (Software of version V3.xx or earlier) 0.0% (Software of	○

Function code	Name	Description	Default	Modify
			version V6.xx or later)	
P13.04	Pull-in current switching frequency	Setting range: 0.0–200.0% **Note:** The value is relative to the motor rated frequency.	20.0%	○
P13.05	Reserved	-	-	-
P13.06	High-frequency superposition voltage	Specifies the pulse current threshold when the initial magnetic pole position is detected in the pulse mode. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–300% (of the motor rated voltage)	100.0% (Software of version V3.xx or earlier) 80.0% (Software of version V6.xx or later)	◎
P13.07	Control parameter 0	Setting range: 0.0–400.0	0.0	○
P13.08	Control parameter 1	Setting range: 0x0000–0xFFFF	0x0000	○
	Vector control optimization mode	Setting range: 0x0000–0xFFFF Bit 0: Enable counter-emf self-adaptation (only applicable to PM-SVC1) Bit 1: Enable SM weakening flux optimization (working with P03.22 to adjust the compensation) Bit 2: Enable current loop parameter optimization Bit 3: Enable SM counter-emf identifying optimization Bit 4: Enable SM MTPA Bit 5: Reserved Bit 6: Stator resistance online regulation Bit 7: Initial position identifying		

Function code	Name	Description	Default	Modify
		optimization Bits 8–15: Reserved **Note:** Supported by software of version V6.xx or later.		
P13.09	Frequency threshold of phase-lock loop switch-in	Used to set the frequency threshold for enabling the counter-electromotive force phase-locked loop in SVC 0. When the running frequency is lower than the value of the function code, the phase-locked loop is disabled; and when the running frequency is higher than that, the phase-locked loop is enabled. Setting range: 0.00–655.35 **Note:** Supported by software of version V3.xx or earlier.	2.00	○
P13.10	Initial compensation angle of SM	0.0–359.9	0.0	○
P13.11	Mal-adjustment detection time	Used to adjust the responsiveness of anti-maladjustment function. If the load inertia is large, increase the value of this parameter properly, however, the responsiveness may slow down accordingly. Setting range: 0.0–10.0s	0.5s	○
P13.12	SM high-frequency compensation coefficient	Valid when the motor speed exceeds the rated speed. If oscillation occurred to the motor, adjust this parameter properly. Setting range: 0.0–100.0% **Note:** Supported by software of version V3.xx or earlier.	0.0%	○
P13.13	High-frequency injection current	Setting range: 0.0–300.0% (of the rated VFD output current)	20.0%	◎
P13.14	SVC speed feedback bandwidth	Setting range: 10.0–200.0rad/s **Note:** Supported by software of version V6.xx or later.	62.5 rad/s	◎

Function code	Name	Description	Default	Modify
P13.15	SM counter-emf adaptation bandwidth	Setting range: 1–100 **Note:** Supported by software of version V6.xx or later.	1	○

Group P14—Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	Setting range: 1–247 When the master writes the slave communication address to 0 indicating a broadcast address in a frame, all the salves on the Modbus bus receive the frame but do not respond to it. The communication addresses on the communication network are unique, which is the basis of the point-to-point communication. **Note:** The slave address cannot be set to 0.	1	○
P14.01	Communication baud rate setting	Specifies the data transmission speed between the host controller and the VFD. Setting range: 0–7 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 115200 bps **Note:** The baud rate set on the VFD must be consistent with that on the host controller. Otherwise, the communication fails. A greater baud rate indicates faster communication.	4	○
P14.02	Data bit check	Setting range: 0–5	1	○

Function code	Name	Description	Default	Modify
		0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU **Note:** The data format set on the VFD must be consistent with that on the host controller. Otherwise, the communication fails.		
P14.03	Communication response delay	Setting range: 0–200ms	5ms	○
P14.04	485 communication timeout period	Setting range: 0.0 (invalid)–60.0s	0.0s	○
P14.05	Transmission fault processing	Setting range: 0–3 0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0	○
P14.06	Modbus communication processing action selection	Setting range: 0x000–0x111 Ones place: 0: Respond to write operations 1: Not respond to write operations Tens place: 0: Communication password protection is invalid. 1: Communication password protection is valid. Hundreds place: 0: User-defined addresses specified by P14.07 and P14.08 are invalid. 1: User-defined addresses specified by P14.07 and P14.08 are valid.	0x000	○

Function code	Name	Description	Default	Modify
P14.07	User-defined running command address	Setting range: 0x0000–0xFFFF	0x2000	○
P14.08	User-defined frequency setting address	Setting range: 0x0000–0xFFFF	0x2001	○
P14.09	Modbus TCP communication timeout time	Setting range: 0.0–60.0s	5.0s	○
P14.10	Enabling 485 upgrade program	Setting range: 0–1 0: Disable 1: Enable	0	◎
P14.11	Bootload software version	Setting range: 0.00–655.35	0.00	●
P14.12	Display of no upgrade bootload fault	Setting range: 0–1 0: Display 1: Do not display	0	○
P14.13–P14.47	Reserved	-	-	-
P14.48	Channel selection for mapping between PZDs and function codes	Setting range: 0x00–0x12 Ones place: Channel for mapping function codes to PZDs 0: Reserved 1: Group P15 2: Group P16 Tens place: Save function at power off 0: Disable 1: Enable	0x12	○
P14.49	Mapped function code of received PZD2	Setting range: 0x0000–0xFFFF	0x0000	○
P14.50	Mapped function code of received PZD3	Setting range: 0x0000–0xFFFF	0x0000	○
P14.51	Mapped function code of received PZD4	Setting range: 0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
P14.52	Mapped function code of received PZD5	Setting range: 0x0000–0xFFFF	0x0000	○
P14.53	Mapped function code of received PZD6	Setting range: 0x0000–0xFFFF	0x0000	○
P14.54	Mapped function code of received PZD7	Setting range: 0x0000–0xFFFF	0x0000	○
P14.55	Mapped function code of received PZD8	Setting range: 0x0000–0xFFFF	0x0000	○
P14.56	Mapped function code of received PZD9	Setting range: 0x0000–0xFFFF	0x0000	○
P14.57	Mapped function code of received PZD10	Setting range: 0x0000–0xFFFF	0x0000	○
P14.58	Mapped function code of received PZD11	Setting range: 0x0000–0xFFFF	0x0000	○
P14.59	Mapped function code of received PZD12	Setting range: 0x0000–0xFFFF	0x0000	○
P14.60	Mapped function code of sent PZD2	Setting range: 0x0000–0xFFFF	0x0000	○
P14.61	Mapped function code of sent PZD3	Setting range: 0x0000–0xFFFF	0x0000	○
P14.62	Mapped function code of sent PZD4	Setting range: 0x0000–0xFFFF	0x0000	○
P14.63	Mapped function code of sent PZD5	Setting range: 0x0000–0xFFFF	0x0000	○
P14.64	Mapped function code of sent PZD6	Setting range: 0x0000–0xFFFF	0x0000	○
P14.65	Mapped function code of sent PZD7	Setting range: 0x0000–0xFFFF	0x0000	○
P14.66	Mapped function code of sent PZD8	Setting range: 0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
P14.67	Mapped function code of sent PZD9	Setting range: 0x0000–0xFFFF	0x0000	○
P14.68	Mapped function code of sent PZD10	Setting range: 0x0000–0xFFFF	0x0000	○
P14.69	Mapped function code of sent PZD11	Setting range: 0x0000–0xFFFF	0x0000	○
P14.70	Mapped function code of sent PZD12	Setting range: 0x0000–0xFFFF	0x0000	○

Group P15—Functions of communication expansion card 1

Function code	Name	Description	Default	Modify
P15.00	Reserved	-	-	-
P15.01	Module address	Setting range: 0–127	2	◎
P15.02	Received PZD2	Setting range: 0–31 0: Invalid 1: Set frequency (0–Fmax, unit: 0.01Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current) 8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current)	0	○
P15.03	Received PZD3		0	○
P15.04	Received PZD4		0	○
P15.05	Received PZD5		0	○
P15.06	Received PZD6		0	○
P15.07	Received PZD7		0	○
P15.08	Received PZD8		0	○
P15.09	Received PZD9		0	○
P15.10	Received PZD10		0	○
P15.11	Received PZD11		0	○
P15.12	Received PZD12		0	○

Function code	Name	Description	Default	Modify
		9. Virtual input terminal command (range: 0x000–0x3FF, corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1) 10: Virtual output terminal command (range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1) 11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: High bit of position reference (signed) 15: Low bit of position reference (unsigned) 16: High bit of position feedback (signed) 17: Low bit of position feedback (unsigned) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20–31: Reserved		
P15.13	Sent PZD2	Setting range: 0–31 0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotation speed of running (×1, RPM) 9: Linear speed of running (×1, m/s) 10: Ramp reference frequency 11: Fault code	0	○
P15.14	Sent PZD3		0	○
P15.15	Sent PZD4		0	○
P15.16	Sent PZD5		0	○
P15.17	Sent PZD6		0	○
P15.18	Sent PZD7		0	○
P15.19	Sent PZD8		0	○
P15.20	Sent PZD9		0	○
P15.21	Sent PZD10		0	○
P15.22	Sent PZD11		0	○
P15.23	Sent PZD12		0	○

Function code	Name	Description	Default	Modify
		12: AI1 input (×100, V) 13: AI2 input (×100, V) 14: AI3 input (× 100, V) 15: HDIA frequency value (×100, kHz) 16: Terminal input status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: High bit of position reference (signed) 22: Low bit of position reference (unsigned) 23: High bit of position feedback (signed) 24: Low bit of position feedback (unsigned) 25: Status word 26: HDIB frequency value (×100, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit 29: PG card pulse reference count MSB 30: PG card pulse reference count LSB 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)		
P15.24	Reserved	-	-	-
P15.25	DP communication timeout time	Setting range: 0.0 (invalid)–60.0s	5.0s	○
P15.26	CANopen communication timeout time	Setting range: 0.0 (invalid)–60.0s	5.0s	○
P15.27	CANopen communication baud rate	Setting range: 0–7 0: 1000kbps 1: 800kbps 2: 500kbps 3: 250kbps 4: 125kbps 5: 100kbps 6: 50kbps 7: 20kbps	3	◎

Function code	Name	Description	Default	Modify
P15.28	CAN communication address	Setting range: 0–127	1	◎
P15.29	CAN communication baud rate	Setting range: 0–5 0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 1Mbps	2	◎
P15.30	Master/slave CAN communication timeout period	Setting range: 0.0 (invalid)–60.0s	5.0s	○
P15.31	Reserved	-	-	-
P15.32	Display node baud rate	Setting range: 0–65535 **Note:** Supported by software of version V6.xx or later.	0	●
P15.33–P15.42	Reserved	-	-	-
P15.43	Communication control word expression format	Setting range: 0–1 0: Decimal format 1: Binary format **Note:** Supported by software of version V6.xx or later.	0	◎

Group P16—Functions of communication expansion card 2

Function code	Name	Description	Default	Modify
P16.00–P16.01	Reserved	-	-	-
P16.02	Ethernet monitoring card IP address 1	Setting range: 0–255	192	◎
P16.03	Ethernet monitoring card IP address 2	Setting range: 0–255	168	◎

Function code	Name	Description	Default	Modify
P16.04	Ethernet monitoring card IP address 3	Setting range: 0–255	0	◎
P16.05	Ethernet monitoring card IP address 4	Setting range: 0–255	1	◎
P16.06	Ethernet monitoring card subnet mask 1	Setting range: 0–255	255	◎
P16.07	Ethernet monitoring card subnet mask 2	Setting range: 0–255	255	◎
P16.08	Ethernet monitoring card subnet mask 3	Setting range: 0–255	255	◎
P16.09	Ethernet monitoring card subnet mask 4	Setting range: 0–255	0	◎
P16.10	Ethernet monitoring card gateway 1	Setting range: 0–255	192	◎
P16.11	Ethernet monitoring card gateway 2	Setting range: 0–255	168	◎
P16.12	Ethernet monitoring card gateway 3	Setting range: 0–255	0	◎
P16.13	Ethernet monitoring card gateway 4	Setting range: 0–255	1	◎
P16.14	Ethernet card monitoring variable address 1	Setting range: 0x0000–0xFFFF	0x0000	○
P16.15	Ethernet card monitoring variable address 2	Setting range: 0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
P16.16	Ethernet card monitoring variable address 3	Setting range: 0x0000–0xFFFF	0x0000	○
P16.17	Ethernet card monitoring variable address 4	Setting range: 0x0000–0xFFFF	0x0000	○
P16.18–P16.23	Reserved	-	-	-
P16.24	Identification time for the expansion card in card slot 1	Setting range: 0.0–600.0s **Note:** The value 0.0 indicates that an identification fault will not be detected.	0.0s	○
P16.25	Identification time for the expansion card in card slot 2	Setting range: 0.0–600.0s **Note:** The value 0.0 indicates that an identification fault will not be detected.	0.0s	○
P16.26	Identification time for the expansion card in card slot 3	Setting range: 0.0–600.0s **Note:** The value 0.0 indicates that an identification fault will not be detected.	0.0s	○
P16.27	Communication timeout time of expansion card in card slot 1	Setting range: 0.0–600.0s **Note:** The value 0.0 indicates that an offline fault will not be detected.	0.0s	○
P16.28	Communication timeout time of expansion card in card slot 2	Setting range: 0.0–600.0s **Note:** The value 0.0 indicates that an offline fault will not be detected.	0.0s	○
P16.29	Communication timeout time of expansion card in card slot 3	Setting range: 0.0–600.0s **Note:** The value 0.0 indicates that an offline fault will not be detected.	0.0s	○
P16.30	Reserved	-	-	-
P16.31	PROFINET communication timeout time	Setting range: 0.0 (invalid)–60.0s	5.0s	○
P16.32	Received PZD2	Setting range: 0–31	0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P16.33</td><td>Received PZD3</td><td rowspan="10">0: Invalid
1: Set frequency (0–Fmax, unit: 0.01Hz)
2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%)
3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%)
4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current)
5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz)
6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz)
7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current)
9. Virtual input terminal command (range: 0x000–0x3FF, corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1)
10: Virtual output terminal command (range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1)
11: Voltage setting (special for V/F separation)

(0–1000, in which 1000 corresponds to 100% of the motor rated voltage)
12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%)
13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%)
14: High bit of position reference (signed)
15: Low bit of position reference (unsigned)
16: High bit of position feedback (signed)
17: Low bit of position feedback (unsigned)</td><td>0</td><td>○</td></tr>
<tr><td>P16.34</td><td>Received PZD4</td><td>0</td><td>○</td></tr>
<tr><td>P16.35</td><td>Received PZD5</td><td>0</td><td>○</td></tr>
<tr><td>P16.36</td><td>Received PZD6</td><td>0</td><td>○</td></tr>
<tr><td>P16.37</td><td>Received PZD7</td><td>0</td><td>○</td></tr>
<tr><td>P16.38</td><td>Received PZD8</td><td>0</td><td>○</td></tr>
<tr><td>P16.39</td><td>Received PZD9</td><td>0</td><td>○</td></tr>
<tr><td>P16.40</td><td>Received PZD10</td><td>0</td><td>○</td></tr>
<tr><td>P16.41</td><td>Received PZD11</td><td>0</td><td>○</td></tr>
<tr><td>P16.42</td><td>Received PZD12</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20–31: Reserved		
P16.43	Sent PZD2	Setting range: 0–31 0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotation speed of running (×1, RPM) 9: Linear speed of running (×1, m/s) 10: Ramp reference frequency 11: Fault code 12: AI1 input (×100, V) 13: AI2 input (×100, V) 14: AI3 input (× 100, V) 15: HDIA frequency value (×100, kHz) 16: Terminal input status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: High bit of position reference (signed) 22: Low bit of position reference (unsigned) 23: High bit of position feedback (signed) 24: Low bit of position feedback (unsigned) 25: Status word 26: HDIB frequency value (×100, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit 29: PG card pulse reference count MSB 30: PG card pulse reference count LSB	0	○
P16.44	Sent PZD3		0	○
P16.45	Sent PZD4		0	○
P16.46	Sent PZD5		0	○
P16.47	Sent PZD6		0	○
P16.48	Sent PZD7		0	○
P16.49	Sent PZD8		0	○
P16.50	Sent PZD9		0	○
P16.51	Sent PZD10		0	○
P16.52	Sent PZD11		0	○
P16.53	Sent PZD12		0	○

Function code	Name	Description	Default	Modify
		31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)		
P16.54	EtherNet IP communication timeout time	Setting range: 0.0–60.0s	5.0s	○
P16.55	EtherNet IP communication rate	Setting range: 0–4 0: Self adaptive 1: 100 M full duplex 2: 100 M half duplex 3: 10 M full duplex 4: 10 M half duplex	0	◎
P16.56	Bluetooth pairing code	Setting range: 0–65535	0	●
P16.57	Bluetooth host type	Setting range: 0–65535 0: No host connection 1: Mobile App 2: Bluetooth box 3–65535: Reserved	0	●
P16.58	Industrial Ethernet communication card IP address 1	Setting range: 0–255	192	◎
P16.59	Industrial Ethernet communication card IP address 2	Setting range: 0–255	168	◎
P16.60	Industrial Ethernet communication card IP address 3	Setting range: 0–255	0	◎
P16.61	Industrial Ethernet communication card IP address 4	Setting range: 0–255	20	◎
P16.62	Industrial Ethernet communication card subnet mask 1	Setting range: 0–255	255	◎

Function code	Name	Description	Default	Modify
P16.63	Industrial Ethernet communication card subnet mask 2	Setting range: 0–255	255	◎
P16.64	Industrial Ethernet communication card subnet mask 3	Setting range: 0–255	255	◎
P16.65	Industrial Ethernet communication card subnet mask 4	Setting range: 0–255	0	◎
P16.66	Industrial Ethernet communication card gateway 1	Setting range: 0–255	192	◎
P16.67	Industrial Ethernet communication card gateway 2	Setting range: 0–255	168	◎
P16.68	Industrial Ethernet communication card gateway 3	Setting range: 0–255	0	◎
P16.69	Industrial Ethernet communication card gateway 4	Setting range: 0–255	1	◎

Group P17—Status viewing

Function code	Name	Description	Default	Modify
P17.00	Set frequency	Displays the present set frequency of the VFD. Setting range: 0.00Hz–P00.03	0.00Hz	●
P17.01	Output frequency	Displays the present output frequency of the VFD. Setting range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp reference frequency	Displays the present ramp reference frequency of the VFD.	0.00Hz	●

Function code	Name	Description	Default	Modify
		Setting range: 0.00Hz–P00.03		
P17.03	Output voltage	Displays the present output voltage of the VFD. Setting range: 0–1200V	0V	●
P17.04	Output current	Displays the valid value of present output current of the VFD. Setting range: 0.0–5000.0A	0.0A	●
P17.05	Motor rotation speed	Displays the present motor rotation speed. Setting range: 0–65535RPM	0RPM	●
P17.06	Torque current	Displays the present torque current of the VFD. Setting range: -3000.0–3000.0A	0.0A	●
P17.07	Exciting current	Displays the present exciting current of the VFD. Setting range: -3000.0–3000.0A	0.0A	●
P17.08	Motor power	Displays the present motor power. 100% corresponds to the motor rated power. Setting range: -300.0–300.0% (of the motor rated power)	0.0%	●
P17.09	Motor output torque	Displays the present output torque of the VFD. 100% corresponds to the motor rated torque. Setting range: -250.0–250.0%	0.0%	●
P17.10	Estimated motor frequency	Used to indicate the estimated motor rotor frequency under the open-loop vector condition. Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Used to indicate the estimated motor rotor frequency under the open-loop vector condition. Setting range: 0.00–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P17.11	DC bus voltage	Displays the present DC bus voltage of the VFD.	0.0V	●

Function code	Name	Description	Default	Modify
		Setting range: 0.0–2000.0V		
P17.12	Digital input terminal state	Displays the present digital input terminal state of the VFD. Setting range: 0x00–0x3F Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively.	0x00	●
P17.13	Digital output terminal state	Displays the present digital output terminal state of the VFD. Setting range: 0x00–0x0F The bits correspond to RO2, RO1, HDO, and Y1 respectively.	0x00	●
P17.14	Digital adjustment value	Used to display the adjustment on the VFD through the UP/DOWN terminal. Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Used to display the adjustment on the VFD through the UP/DOWN terminal. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P17.15	Torque reference value	Indicates the percentage of the rated torque of the present motor, displaying the torque reference. Setting range: -300.0%–300.0% (of the motor rated current)	0.0%	●
P17.16	Linear speed	0–65535	0	●
P17.17	Reserved	-	-	-
P17.18	Count value	0–65535	0	●
P17.19	AI1 input voltage	Displays the AI1 input signal. Setting range: 0.00–10.00V	0.00V	●
P17.20	AI2 input voltage	Used to display the AI2 input signal. Setting range: -10.00V–10.00V	0.00V	●
P17.21	HDIA input frequency	Displays the HDIA input frequency. Setting range: 0.000–50.000kHz	0.000 kHz	●
P17.22	HDIB input frequency	Displays the HDIB input frequency. Setting range: 0.000–50.000kHz	0.000kHz	●
P17.23	PID reference value	Displays the PID reference value. Setting range: -100.0–100.0%	0.0%	●

Function code	Name	Description	Default	Modify
P17.24	PID feedback value	Displays the PID feedback value. Setting range: -100.0–100.0%	0.0%	●
P17.25	Motor power factor	Displays the power factor of the present motor. Setting range: -1.00–1.00	0.00	●
P17.26	Duration of this run	Displays the duration of this run of the VFD. Setting range: 0–65535min	0min	●
P17.27	Present step of simple PLC	Displays the present step of the simple PLC function. Setting range: 0–15	0	●
P17.28	Motor ASR controller output	Displays the ASR controller output value as a percentage relative to the rated motor torque under the vector control mode. Setting range: -300.0%–300.0% (of the motor rated current)	0.0%	●
P17.29	Pole angle of open-loop SM	Displays the initial identification angle of SM. Setting range: 0.0–360.0°	0.0°	●
P17.30	Phase compensation of SM	Displays the phase compensation of SM. Setting range: -180.0–180.0	0.0	●
P17.31	High-frequency superposition current of SM	0.0%–200.0% (of the motor rated current)	0.0%	●
P17.32	Motor flux linkage	0.0%–200.0%	0.0%	●
P17.33	Exciting current reference	Displays the exciting current reference value under the vector control mode. Setting range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Displays the torque current reference value under the vector control mode. Setting range: -3000.0–3000.0A	0.0A	●
P17.35	AC incoming current	Used to display the valid value of incoming current on AC side. Setting range: 0.0–5000.0A	0.0A	●
P17.36	Output torque	Displays the output torque value. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running,	0.0Nm	●

Function code	Name	Description	Default	Modify
		the positive value is the generating state while the negative value is the motoring state. Setting range: -3000.0Nm–3000.0Nm		
P17.37	Motor overload count value	Setting range: 0–65535	0	●
P17.38	Process PID output	Setting range: -100.0%–100.0%	0.0%	●
P17.39	Function code in parameter download error	Setting range: 0.00–99.99	0.00	●
P17.40	Motor control mode	Setting range: 0x000–0x123 Ones place: Control mode 0: Vector 0 1: Vector 1 2: V/F control 3: Closed-loop vector control Tens place: Control status 0: Speed control 1: Torque control 2: Position control Hundreds place: Motor number 0: Motor 1 1: Motor 2	0x000	●
P17.41	Electromotive torque upper limit	Setting range: 0.0%–300.0% (of the motor rated current)	0.0%	●
P17.42	Braking torque upper limit	Setting range: 0.0%–300.0% (of the motor rated current)	0.0%	●
P17.43	Forward rotation upper-limit frequency in torque control	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P17.44	Reverse rotation upper-limit frequency in torque control	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03	0.00Hz	●

Function code	Name	Description	Default	Modify
		Note: Supported by software of version V6.xx or later.		
P17.45	Inertia compensation torque	Setting range: -100.0%–100.0%	0.0%	●
P17.46	Friction compensation torque	Setting range: -100.0%–100.0%	0.0%	●
P17.47	Motor pole pairs	Setting range: 0–65535	0	●
P17.48	VFD overload count value	Setting range: 0–65535	0	●
P17.49	Frequency set by A source	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P17.50	Frequency set by B source	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	●
P17.51	PID proportional output	Setting range: -100.0%–100.0%	0.0%	●
P17.52	PID integral output	Setting range: -100.0%–100.0%	0.0%	●
P17.53	PID differential output	Setting range: -100.0%–100.0%	0.0%	●
P17.54	PID present proportional gain	Setting range: 0.00–100.00	0.00	●
P17.55	PID present integral gain	Setting range: 0.00–10.00s	0.00s	●
P17.56	PID present differential time	Setting range: 0.00–10.00s	0.00s	●
P17.57	Reserved	-	-	-

Function code	Name	Description	Default	Modify
P17.58	Actual carrier frequency	Setting range: 0.000–15.000kHz **Note:** Supported by software of version V6.xx or later.	0.000kHz	●
P17.59	SM signal to noise ratio	Setting range: 0.0–1000.0 **Note:** Supported by software of version V6.xx or later.	0.0	●
P17.60	Counter-emf of SM	Setting range: 0–1200V **Note:** Supported by software of version V6.xx or later.	0V	●
P17.61	Motor rotation speed high word	Setting range: 0–30(10kRPM) **Note:** Supported by software of version V6.xx or later.	0	●
P17.62–P17.63	Reserved	-	-	-
P17.64	VFD status word 3	Setting range: 0x0000–0xFFFF Bit 0: Running protection flag Bit 1: Running Bit 2: Running direction (1=REV, 0=FWD) Bit 3: Jogging Bit 4: Pre-alarming Bit 5: In fault Bit 6: Running paused Bit 7: In sleep Bit 8: In PoFF state Bit 9: Undervoltage due to transient power loss Bit 10: Overvoltage stall Bit 11: Pre-exciting Bit 12: DC braking Bit 13: Identifying parameters Bit 14: Flux weakening (reserved) Bit 15: Reserved **Note:** Supported by software of version V6.xx or later.	0x0000	●

Group P18—Status viewing in closed-loop control

Function code	Name	Description	Default	Modify
P18.00	Actual frequency of encoder	Used to indicate the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative. Setting range: -999.9–3276.7Hz	0.0Hz	●
P18.01	Encoder position count value	Used to indicate the encoder count value, quadruple frequency. Setting range: 0–65535	0	●
P18.02	Encoder Z pulse count value	Used to indicate the count value of the encoder Z pulse. Setting range: 0–65535	0	●
P18.03	High bit of position reference value	Used to indicate the MSB of position reference value. It is cleared after stop. Setting range: 0–30000	0	●
P18.04	Low bit of position reference value	Used to indicate the LSB of position reference value. It is cleared after stop. Setting range: 0–65535	0	●
P18.05	High bit of position feedback value	Used to indicate the MSB of position feedback value. It is cleared after stop. Setting range: 0–30000	0	●
P18.06	Low bit of position feedback value	Used to indicate the LSB of position feedback value. It is cleared after stop. Setting range: 0–65535	0	●
P18.07	Position deviation	Used to indicate the deviation between the reference position and actual running position. Setting range: -32768–32767	0	●
P18.08	Position of position reference point	Z-pulse reference point position of spindle accurate stop. Setting range: 0–65535	0	●
P18.09	Spindle present position setting	Present position setting of spindle accurate stop. Setting range: 0–359.99	0.00	●
P18.10	Present position of spindle accurate stop	Present position of spindle accurate stop. Setting range: 0–65535	0	●

Function code	Name	Description	Default	Modify
P18.11	Encoder Z pulse direction	Z pulse direction display. During spindle accurate stop, there may be a few pulses of error in the stop positions of the forward and reverse directions, which can be eliminated by adjusting Z pulse direction of P20.02 or swapping the encoder A/B phases. Setting range: 0–1 0: Forward 1: Reverse	0	●
P18.12	Encoder Z pulse angle	Reserved. Setting range: 0.00–359.99	0.00	●
P18.13	Encoder Z pulse error times	Reserved. Setting range: 0–65535	0	●
P18.14	PG card pulse feedback count high bit	Used to indicate the encoder pulse count value. The count value is accumulated only if the VFD is powered on. Setting range: 0–65535	0	●
P18.15	PG card pulse feedback count low bit	Used to indicate the encoder pulse count value. The count value is accumulated only if the VFD is powered on. Setting range: 0–65535	0	●
P18.16	Speed measured by main control board	Setting range: -3276.8–3276.7Hz	0.0Hz	●
P18.17	Pulse command frequency	The pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Setting range: -3276.8–3276.7Hz	0.0Hz	●
P18.18	Pulse command feedforward	The pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Setting range: -3276.8–3276.7Hz	0.0Hz	●
P18.19	Position regulator output	Setting range: -327.68–327.67Hz	0.00Hz	●

Function code	Name	Description	Default	Modify
P18.20	Count value of resolver	Used to indicate the count value of the resolver. Setting range: 0–65535	0	●
P18.21	Resolver angle	Used to indicate the pole position angle read by the resolver-type encoder. Setting range: 0.00–359.99	0.00	●
P18.22	Pole angle of closed-loop SM	Used to indicate the present pole position. Setting range: 0.00–359.99	0.00	●
P18.23	SW 2	Setting range: 0x0000–0xFFFF **Note:** Supported by software of version V3.xx or earlier.	0x0000	●
		Setting range: 0–65535 **Note:** Supported by software of version V6.xx or later.	0	
P18.24	PG card pulse reference count high bit	Indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on. Setting range: 0–65535	0	●
P18.25	PG card pulse reference count low bit	Indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on. Setting range: 0–65535	0	●
P18.26	PG card detected speed	Setting range: -3276.8–3276.7Hz	0.0Hz	●
P18.27	Encoder UVW sectors	Setting range: 0–7	0	●
P18.28	Encoder PPR display	Setting range: 0–65535	0	●
P18.29	Angle compensation value of SM	Setting range: -180.0–180.0°	0.0°	●
P18.30	Z pulse angle of SM	Setting range: 0.00–655.35° **Note:** Supported by software of version V6.xx or later.	0.00°	●
P18.31	Z pulse value of pulse reference	Setting range: 0–65535	0	●

Function code	Name	Description	Default	Modify
P18.32	Main control board measured value of pulse reference	Setting range: -3276.8–3276.7Hz	0.0Hz	●
P18.33	PG card measured value of pulse reference	Setting range: -3276.8–3276.7Hz	0.0Hz	●
P18.34	Present encoder filter width	Setting range: 0–63	0	●
P18.35	CPU load rate	Setting range: 0.0–100.0% **Note:** Supported by software of version V6.xx or later.	0.0%	●

Group P19—Expansion card status viewing

Function code	Name	Description	Default	Modify
P19.00	Type of expansion card in slot 1	Setting range: 0–65535 0: No card 1: PLC card 2: I/O card 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card 6: DP communication card 7: Bluetooth card 8: Resolver PG card 9: CANopen communication card 10: WiFi card 11: PROFINET communication card 12: Sine-cosine PG card without CD signals 13: Sine-cosine PG card with CD signals 14: Absolute encoder PG card 15: CAN master/slave communication card 16: Modbus TCP communication card 17: EtherCAT communication card 18: BACnet communication card	0	●
P19.01	Type of expansion card in slot 2		0	●
P19.02	Type of expansion card in slot 3		0	●

Function code	Name	Description	Default	Modify
		19: DeviceNet communication card 20: PT100/PT1000 temperature detection card 21: EtherNet IP card 22: MECHATROLINK communication card 23–65535: Reserved		
P19.03	Software version of expansion card at slot 1	Setting range: 0.00–655.35	0.00	●
P19.04	Software version of expansion card at slot 2	Setting range: 0.00–655.35	0.00	●
P19.05	Software version of expansion card at slot 3	Setting range: 0.00–655.35	0.00	●
P19.06	Terminal input status of I/O card	Setting range: 0x0000–0xFFFF	0x0000	●
P19.07	Terminal output status of I/O card	Setting range: 0x0000–0xFFFF	0x0000	●
P19.08	Reserved	-	-	-
P19.09	AI3 input voltage of I/O card	Setting range: 0.00–10.00V	0.00V	●
P19.10	EC PT100 detected temperature	Setting range: -50.0–150.0°C	0.0°C	●
P19.11	EC PT100 detected digital	Setting range: 0–4096	0	●
P19.12	EC PT1000 detected temperature	Setting range: -50.0–150.0°C	0.0°C	●
P19.13	EC PT1000 detected digital	Setting range: 0–4096	0	●
P19.14	Alarm display value	Setting range: 0–4 0: None 1: EC PT100 detected OT alarm 2: EC PT1000 detected OT alarm 3: EC PT100 disconnection alarm	0	●

Function code	Name	Description	Default	Modify
		4: EC PT1000 disconnection alarm		
P19.15	VFD communication control word	Setting range: 0x0000–0xFFFF	0x0000	●
P19.16	VFD communication status word	Setting range: 0x0000–0xFFFF	0x0000	●
P19.17	Ethernet monitoring variable 1	Setting range: 0–65535	0	●
P19.18	Ethernet monitoring variable 2	Setting range: 0–65535	0	●
P19.19	Ethernet monitoring variable 3	Setting range: 0–65535	0	●
P19.20	Ethernet monitoring variable 4	Setting range: 0–65535	0	●
P19.21	AI/AO detected temperature	Setting range: -20.0–200.0°C	0.0°C	●
P19.22–P19.23	Reserved	-	-	-
P19.24	Function version	Setting range: 0.00–655.35 **Note:** Supported by software of version V6.xx or later.	0.00	●
P19.25	Performance version	Setting range: 0.00–655.35 **Note:** Supported by software of version V6.xx or later.	0.00	●

Group P20—Encoder of motor 1

Function code	Name	Description	Default	Modify
P20.00	Encoder type display	Setting range: 0–3 0: Incremental encoder 1: Resolver-type encoder	0	●

Function code	Name	Description	Default	Modify
		2: Sin/Cos encoder 3: Reserved		
P20.01	Encoder pulse count	Used to indicate the number of pulses generated when the encoder revolves for one circle. Setting range: 0–16000	1024	◎
P20.02	Encoder direction	Setting range: 0x000–0x111 Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P20.03	Encoder disconnection fault detection time	Setting range: 0.0–10.0s	2.0s	○
P20.04	Encoder reversal fault detection time	Setting range: 0.0–100.0s	0.8s	○
P20.05	Filter times of encoder detection	Setting range: 0x00–0x99 Ones place: Low-speed filter times, corresponding to 2^(0–9)×125μs Tens place: High-speed filter times, corresponding to 2^(0–9)×125μs	0x33	○
P20.06	Speed ratio between encoder mounting shaft and motor	You need to set the function parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.000–65.535	1.000	○
P20.07	Control parameters of SM	Setting range: 0x0000–0xFFFF Bit 0: Enable Z pulse calibration Bit 1: Enable encoder angle calibration Bit 2: Enable SVC speed measurement Bit 3: Reserved Bit 4: Reserved	0x0003 **Note:** Supported by software of	○

Function code	Name	Description	Default	Modify
		Bit 5: Reserved Bit 6: Enable the CD signal calibration Bit 7: Reserved Bit 8: Do not detect encoder faults during autotuning Bit 9: Enable Z pulse detection optimization Bit 10: Enable the initial Z pulse calibration optimization Bit 11: Update the initial angle (Software of version V6.xx or later) Bit 12: Clear the Z pulse arrival signal after stop Bit 13: Enable encoder direction identifying (Software of version V6.xx or later) Bit 14: Detect Z pulse after one rotation Bit 15: Reserved	version V3.xx or earlier. 0x2003 **Note:** Supported by software of version V6.xx or later.	
P20.08	Enable Z pulse offline detection	Setting range: 0x00–0x11 Ones place: Z pulse detection 0: No detection 1: Enable Tens place: UVW pulse detection (for SM) 0: Disable 1: Enable	0x10	○
P20.09	Initial angle of Z pulse	Relative electric angle between the encoder Z pulse and the motor pole position. Setting range: 0.00–359.99	0.00	○
P20.10	Pole initial angle	Relative electric angle between the encoder position and the motor pole position. Setting range: 0.00–359.99	0.00	○
P20.11	Initial pole position autotuning	Setting range: 0–3 0: No operation 1: Rotary autotuning (DC braking) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning 2 (initial angle identification)	0	◎

Function code	Name	Description	Default	Modify
P20.12	Speed measurement optimization selection	Setting range: 0–3 0: No optimization 1: Optimization mode 1 2: Optimization mode 2 3: Optimization mode 3 (observing disturbance) (supported by software of version V6.xx or later)	1	◎
P20.13	CD signal zero offset gain	Setting range: 0–65535	0	○
P20.14	Encoder type selection	Setting range: 0x00–0x11 Ones place: Incremental encoder 0: Without UVW 1: With UVW Tens place: Sin/Cos encoder 0: without CD signal 1: with CD signal	0x00	◎
P20.15	Speed measurement mode	Setting range: 0–1 0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.	0	◎
P20.16	Frequency division coefficient	Setting range: 0–255 When the function parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P20.17	Pulse filter handling selection	Setting range: 0x0000–0xFFFF Bit 0: Indicates whether to enable encoder P-channel input filter 0: Do not filter 1: Filter Bit 1: Encoder P-channel input filter method 0: Self-adaptive filter 1: Use P20.18 as the filter parameter Bit 2: Indicates whether to enable encoder P-channel frequency-division output filter 0: Do not filter 1: Filter Bit 3: Indicates whether to enable filter for	0x0033	○

Function code	Name	Description	Default	Modify
		pulse reference F-channel frequency-division output 0: Do not filter 1: Filter Bit 4: Indicates whether to enable pulse reference F-channel filter 0: Do not filter 1: Filter Bit 5: Pulse reference F-channel filter method 0: Self-adaptive filter 1: Use P20.19 as the filter parameter Bit 6: Frequency-divided output source selection (valid only for incremental encoders) 0: Encoder 1: Pulse reference Bit7–15: Reserved		
P20.18	Encoder P-channel filter width	Setting range: 0–63 The filter time is P20.18×0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P20.19	Pulse reference F-channel filter width	Setting range: 0–63 The filter time is P20.19×0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P20.20	Pulse reference F-channel pulse count	Setting range: 0–16000	1024	◎
P20.21	Enabling SM angle compensation	Setting range: 0–1	1	○
P20.22	Frequency point of speed measurement mode switchover	Setting range: 0.00–630.00Hz **Note:** ● Valid only when P20.12=0. ● Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** ● Valid only when P20.12=0.	1.00Hz	○

Function code	Name	Description	Default	Modify
		● Supported by software of version V6.xx or later.		
P20.23	Angle compensation coefficient	Setting range: -200.0–200.0%	100.0%	○
P20.24	Motor rotation turns in initial pole angle autotuning	Setting range: 1–128	2	◎

Group P21—Position control

Function code	Name	Description	Default	Modify
P21.00	Positioning mode	Setting range: 0x0000–0x7121 Ones place: Control mode selection (only for closed-loop vector control) 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train. The pulse giving signals from PG card terminals A2 and B2 are used for position control. 1: Digital position. The setting of P21.17 is used for positioning, while the positioning mode can be set through P21.16. 2: Positioning of photoelectric switch during stop. When a terminal receives a photoelectric switch signal (terminal function 43 selected), the VFD starts positioning for stop, and the stop distance can be set through P21.17. Hundred place: Position feedback source 0: PG1 1: PG2 Thousands place: Servo mode (Reserved) 0: Disable servo, without position deviation	0x0000	○

Function code	Name	Description	Default	Modify
		1: Disable servo, with position deviation 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved		
P21.01	Pulse command mode	Setting range: 0x0000–0x3133 Ones place: Pulse mode 0: A/B quadrature pulse; A precedes B 1: A is PULSE and B is SIGN If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A is positive PULSE Channel A is positive pulse; channel B needs no wiring 3: A/B dual-channel pulse; channel A pulse edge counts up, channel B pulse edge counts down Tens place: Pulse direction 0: Pulse direction setting: forward 1: Pulse direction setting: reverse 2: Pulse direction set by running direction 3: Pulse direction set by running direction Hundreds place: Frequency multiplication selection for pulse +direction (reserved) 0: No frequency multiplication 1: Frequency multiplication Thousands place: Pulse control selection 0: Inertia filter, without overspeed control 1: Average moving filter, without overspeed control 2: Inertia filter, with overspeed control 3: Average moving filter, with overspeed control	0x0000	◎
P21.02	Position-loop gain 1	The two position-loop gains are switched based on the switching mode set through P21.04. When the spindle accurate stop function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running,	20.0	○

Function code	Name	Description	Default	Modify
		and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0		
P21.03	Position-loop gain 2	The two position-loop gains are switched based on the switching mode set through P21.04. When the spindle accurate stop function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0	30.0	○
P21.04	Position-loop gain switchover mode	Setting range: 0–5 0: No switchover 1: Torque command 2: Speed command 3–5: Reserved	0	○
P21.05	Position gain switchover threshold in torque command	Setting range: 0.0–100.0% (of the motor rated torque)	10.0%	○
P21.06	Position gain switchover threshold in speed command	Setting range: 0.0–100.0% (of the motor rated speed)	10.0%	○
P21.07	Smooth filter coefficient for gain switchover	Used to indicate the smooth filter coefficient for APR gain switchover. Setting range: 0–15	5	○
P21.08	Output limit of position controller	Setting range: 0.0–100.0% (of max. output frequency P00.03)	20.0%	○
P21.09	Positioning completion zone	Setting range: 0–1000	10	○
P21.10	Detection time for positioning completion	Setting range: 0.0–1000.0ms	10.0ms	○
P21.11	Numerator of position command ratio	Setting range: 1–65535	1000	○

Function code	Name	Description	Default	Modify
P21.12	Denominator of position command ratio	Setting range: 1–65535	1000	○
P21.13	Position feedforward gain	Setting range: 0.00–120.0% For pulse string reference only (position control)	100.00%	○
P21.14	Position feedforward filter time constant	Setting range: 0.0–3200.0ms For pulse string reference only (position control)	3.0ms	○
P21.15	Position command filter time constant	Setting range: 0.0–3200.0ms	0.0ms	◎
P21.16	Digital positioning mode	Setting range: 0x0000–0xFFFF Bit 0: Positioning mode 0: Relative position 1: Absolute position (Origin mode. This function is reserved.) Bit 1: Positioning cycle selection 0: Terminal-based cyclic positioning 1: Automatic cyclic positioning Bit 2: Cyclic mode 0: Continuous 1: Reciprocating (support the automatic cyclic positioning) Bit 3: P21.17 digital setting mode 0: Incremental 1: Position type (do not support the continuous mode) Bit 4: Origin searching mode. This function is reserved. 0: Search for the origin only for once 1: Search for the origin in every time of running Bit 5: Origin calibration mode. This function is reserved. 0: Calibration in real time 1: One-time calibration Bit 6: Positioning completion signal	0x0000	○

Function code	Name	Description	Default	Modify
		selection 0: Valid in the positioning completion signal holding time (P21.25) 1: Always valid Bit 7: Initial positioning selection 0: Invalid 1: Enable Bit 8: Positioning enable signal selection 0: Pulse signal 1: Electrical level signal Bit 9: Position source 0: Setting of P21.17 1: PROFIBUS/CANopen setting Bit 10: Indicates whether to save encoder pulse count value at power-off 0: No 1: Yes Bit 11: Reserved Bit 12: Positioning curve setting (reserved) 0: Straight line 1: S curve		
P21.17	Position set in digital mode	Used for digital positioning. Actual position = P21.17×P21.11/P21.12 Setting range: 0–65535	0	○
P21.18	Positioning speed setting selection	Setting range: 0–5 0: Setting of P21.19 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB	0	○
P21.19	Positioning speed set in digital mode	Setting range: 0.0–100.0% (of the max. output frequency)	20.0%	○
P21.20	Positioning ACC time	Used to set the ACC/DEC time in the positioning process. Positioning ACC time means the time needed if the VFD speeds up from 0Hz to	3.00s	○

Function code	Name	Description	Default	Modify
		the max. output frequency (P00.03). Setting range: 0.00–300.00s		
P21.21	Positioning DEC time	Used to set the ACC/DEC time in the positioning process. Positioning DEC time means the time needed if the VFD speeds down from the max. output frequency (P00.03) to 0Hz. Setting range: 0.00–300.00s	3.00s	○
P21.22	Positioning holding time	Used to set the holding time after the destination position is reached. Setting range: 0.000–60.000s	0.100s	○
P21.23	Origin searching speed	Setting range: 0.00–50.00Hz	2.00Hz	○
P21.24	Origin bias	Setting range: 0–65535	0	○
P21.25	Positioning completion signal holding time	Time for holding the positioning completion signal. This parameter is also valid for the positioning completion signal of spindle accurate stop. Setting range: 0.000–60.000s	0.200s	○
P21.26	Pulse superposition	The function is valid in the pulse speed reference (P00.06=12) or pulse position mode (P21.00=1). 1. Input terminal function 68 (Enable the pulse superimposition) When the rising edge of the terminal is detected, add the value set in P21.26 to the set pulse value, and compensate to the pulse reference channel based on the pulse superposition speed set in P21.27. 2. Input terminal function 67 (pulse increase) When the terminal is valid, superpose the pulse value to the pulse reference channel based on the pulse superposition speed set in P21.27. **Note:** Terminal filter P05.09 may affect the actual superposed value.	0	○

Function code	Name	Description	Default	Modify
		3. Input terminal function 69 (pulse decrease) The time sequence of this function is same as the above. The difference is that this terminal is the pulse number that is superposed degressively. **Note:** The pulses mentioned above are superposed to A2 and B2 of pulse reference channel. Functions such as filtering and electronic gear are still valid for superposed pulses. 4. Output terminal function 28 (during pulse superposition) During the pulse superposition, the output terminal is valid. After the pulse superposition is completed, the output terminal is invalid. Setting range: 0–65535		
P21.27	Pulse superposition rate	Setting range: 0.0–6553.5pulse/ms	8.0 pulse/ms	○
P21.28	ACC/DEC time after pulse inhibition	Setting range: 0.0–3000.0s	5.0s	○
P21.29	Speed feedforward filtering time constant (pulse string-based speed mode)	Filter time constant detected by the pulse string when the speed reference source is set to the pulse train (P00.06=12 or P00.07=12). Setting range: 0.0–3200.0ms	10.0ms	○
P21.30	Numerator of the 2nd command ratio	Setting range: 1–65535	1000	○
P21.31	Speed measuring method of pulse reference	Setting range: 0–2 0: By main control board 1: By PG card 2: Hybrid method	0	○
P21.32	Pulse reference feedforward source	Setting range: 0x0–0x1	0x0	◎

Function code	Name	Description	Default	Modify
P21.33	Clear encoder counting Setting	Setting range: 0–65535	0	◎

Group P22—Spindle positioning

Function code	Name	Description	Default	Modify
P22.00	Spindle positioning mode selection	Setting range: 0x0000–0xFFFF Bit0: Indicates whether to enable spindle accurate stop when spindle positioning is enabled. 0: Disable 1: Enable Bit1: Spindle positioning reference point selection. Select the encoder Z pulse or the photoelectric switch (set to function 43) as the spindle accurate stop reference point. 0: Z pulse input 1: S2/S3/S4 terminal input Bit2: Reference point search selection. Choose whether to search for the reference point for every run. 0: Search only once 1: Search every time Bit 3: Indicates whether to enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1. Select the set direction or the nearest direction to perform spindle accurate stop. 0: Set direction positioning 1: Nearest direction positioning Bit5: Positioning mode selection 2. It is valid when bit4 is set to 0. 0: Forward positioning 1: Reverse positioning	0x0000	○

Function code	Name	Description	Default	Modify
		Bit 6: Zeroing command selection 0: Electric level mode. The positioning (zeroing and indexing) command can be executed only when there is a run command. 1: Pulse mode. Executing the positioning (zeroing and indexing) command does not need a running command. If there is a run command, it will automatically switch back to the speed mode. Bit 7: Reference point calibration mode 0: Calibrate at the first time 1: Calibration in real time Bit 8: Action selection after zeroing signal (electric level type) cancellation 0: Switch to speed mode 1: Position lock mode Bit 9: Positioning completion signal selection 0: Electrical level signal 1: Pulse signal Bit 10: Z pulse signal source 0: Motor 1: Spindle Bit11–15: Reserved		
P22.01	Speed of spindle accurate stop	Used to indicate the speed of searching for the accurate-stop start position during spindle accurate stop. After finding the accurate-stop start position, switch to position control mode for an accurate stop. Setting range: 0.00–100.00Hz	10.00Hz	○
P22.02	DEC time of spindle accurate stop	Used to indicate the DEC time of spindle accurate stop. The DEC time of spindle accurate stop indicates the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. Setting range: 0.1–100.0s	3.0s	○

Function code	Name	Description	Default	Modify
P22.03	Spindle zeroing position 0	You can select four spindle zeroing positions by terminals (functions 46 and 47). Setting range: 0–65535	0	○
P22.04	Spindle zeroing position 1	Setting range: 0–65535	0	○
P22.05	Spindle zeroing position 2	Setting range: 0–65535	0	○
P22.06	Spindle zeroing position 3	Setting range: 0–65535	0	○
P22.07	Spindle indexing angle 1	You can select seven spindle indexing angles by terminals (functions 48, 49, and 50). Setting range: 0.00–359.99	15.00	○
P22.08	Spindle indexing angle 2	Setting range: 0.00–359.99	30.00	○
P22.09	Spindle indexing angle 3	Setting range: 0.00–359.99	45.00	○
P22.10	Spindle indexing angle 4	Setting range: 0.00–359.99	60.00	○
P22.11	Spindle indexing angle 5	Setting range: 0.00–359.99	90.00	○
P22.12	Spindle indexing angle 6	Setting range: 0.00–359.99	120.00	○
P22.13	Spindle indexing angle 7	Setting range: 0.00–359.99	180.00	○
P22.14	Spindle drive ratio	Used to set the reduction ratio of the spindle and the mounting shaft of the encoder. Setting range: 0.001–30.000	1.000	○
P22.15	Spindle zero-point communication setting	Used to set spindle zero-point offset. If the selected spindle zero point is P22.03, the final spindle zero point is the sum of P22.03 and P22.15. Setting range: 0–39999	0	○
P22.16	Reserved	-	-	-
P22.17	Reserved	-	-	-

Function code	Name	Description	Default	Modify
P22.18	Rigid tapping selection	Setting range: 0x00–0x31 Ones place: Enabling selection 0: Disable (This function can be enabled through a terminal (configured with function 58) 1: Enable (internally) Tens place: Analog input port selection 0: Invalid 1: AI1 2: AI2 3: AI3	0x00	◎
P22.19	Analog filter time of rigid tapping	Setting range: 0.0–1000.0ms	1.0ms	○
P22.20	Max. frequency of rigid tapping	Setting range: 0.00–400.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	50.00Hz	○
P22.21	Corresponding frequency of analog zero drift of rigid tapping	Setting range: 0.00–10.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	0.00Hz	○
P22.22–P22.24	Reserved	-	-	-

Group P23—Vector control of motor 2

Function code	Name	Description	Default	Modify
P23.00	Speed-loop proportional gain 1 of motor 2	Setting range: 0.0–200.0	20.0	○

Function code	Name	Description	Default	Modify
P23.01	Speed-loop integral time 1 of motor 2	Setting range: 0.000–10.000s	0.200s	○
P23.02	Low-point frequency for speed-loop switching of motor 2	Setting range: 0.00Hz–P23.05	5.00Hz	○
P23.03	Speed-loop proportional gain 2 of motor 2	Setting range: 0.0–200.0	20.0	○
P23.04	Speed-loop integral time 2 of motor 2	Setting range: 0.000–10.000s	0.200s	○
P23.05	High-point frequency for speed-loop switching of motor 2	Setting range: P23.02–P00.03 (Max. output frequency)	10.00Hz	○
P23.06	Speed-loop output filter of motor 2	Setting range: 0–8 (corresponding to 0–2^8/10ms)	0	○
P23.07	Electromotive slip compensation coefficient of vector control for motor 2	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. Setting range: 50–200%	100%	○
P23.08	Braking slip compensation coefficient of vector control for motor 2	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. Setting range: 50–200%	100%	○

Function code	Name	Description	Default	Modify
P23.09	Current-loop proportional coefficient P of motor 2	Setting range: 0–65535 **Note:** ● The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ● Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3). ● Supported by software of version V3.xx or earlier.	1000	○
P23.10	Current-loop integral coefficient I of motor 2	Setting range: 0–65535 **Note:** ● The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ● Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3). ● Supported by software of version V3.xx or earlier.	1000	○
P23.11	Speed-loop differential gain of motor 2	Setting range: 0.00–10.00	0.00	○
P23.12	High-frequency current-loop proportional coefficient of motor 2	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P23.14), the current-loop PI parameters are P23.09 and P23.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P23.12 and P23.13. Setting range: 0–65535	1000	○
P23.13	High-frequency current-loop integral coefficient of motor 2		1000	○

Function code	Name	Description	Default	Modify
		Note: Supported by software of version V3.xx or earlier.		
P23.14	Current-loop high-frequency switching threshold of motor 2	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P23.14), the current-loop PI parameters are P23.09 and P23.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P23.12 and P23.13. setting range: 0.0–100.0% (of the max. output frequency) **Note:** Supported by software of version V3.xx or earlier.	100.0%	○
P23.15	Current-loop band width of motor 2	Setting range: 0–2000 **Note:** Supported by software of version V6.xx or later.	400	○
P23.16–P23.19	Reserved	-	-	-

Group P24—Encoder functions of motor 2

Function code	Name	Description	Default	Modify
P24.00	Encoder type display	Setting range: 0–3 0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Reserved	0	●
P24.01	Encoder pulse count	Used to indicate the number of pulses generated when the encoder revolves for one circle. Setting range: 0–16000	1024	◎
P24.02	Encoder direction	Setting range: 0x000–0x111 Ones place: AB direction	0x000	◎

Function code	Name	Description	Default	Modify
		0: Forward 1: Reverse Tens place: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse		
P24.03	Encoder disconnection fault detection time	Setting range: 0.0–10.0s	2.0s	○
P24.04	Encoder reversal fault detection time	Setting range: 0.0–100.0s	0.8s	○
P24.05	Filter times of encoder detection	Setting range: 0x00–0x99 Ones place: Low-speed filter times, corresponding to 2^(0–9)×125μs Tens place: High-speed filter times, corresponding to 2^(0–9)×125μs	0x33	○
P24.06	Speed ratio between encoder mounting shaft and motor	You need to set the function parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.000–65.535	1.000	○
P24.07	Control parameters of SM	Setting range: 0x0000–0xFFFF Bit 0: Enable Z pulse calibration Bit 1: Enable encoder angle calibration Bit 2: Enable SVC speed measurement Bit 3: Reserved Bit 4: Reserved Bit 5: Reserved Bit 6: Enable the CD signal calibration Bit 7: Reserved Bit 8: Do not detect encoder faults during autotuning Bit 9: Enable Z pulse detection optimization Bit 10: Enable the initial Z pulse calibration	0x0003	○

Function code	Name	Description	Default	Modify
		optimization Bit 11: Reserved Bit 12: Clear the Z pulse arrival signal after stop Bit 13: Reserved Bit 14: Detect Z pulse after one rotation Bit 15: Reserved		
P24.08	Enable Z pulse offline detection	Setting range: 0x00–0x11 Ones place: Z pulse detection 0: No detection 1: Enable Tens place: UVW pulse detection (for SM) 0: No detection 1: Enable	0x10	○
P24.09	Initial angle of Z pulse	Relative electric angle between the encoder Z pulse and the motor pole position. Setting range: 0.00–359.99	0.00	○
P24.10	Pole initial angle	Relative electric angle between the encoder position and the motor pole position. Setting range: 0.00–359.99	0.00	○
P24.11	Initial pole position autotuning	Setting range: 0–3 0: No operation 1: Rotary autotuning (DC braking) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning 2 (initial angle identification) The pole initial angle obtained through rotary autotuning 1 is accurate. Rotary autotuning 1 is recommended in most cases, in which the motor needs to be decoupled from the load or the motor load is light.	0	◎
P24.12	Speed measurement optimization selection	Setting range: 0–2 0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎

Function code	Name	Description	Default	Modify
P24.13	CD signal zero offset gain	Setting range: 0–65535	0	○
P24.14	Encoder type selection	Setting range: 0x00–0x11 Ones place: Incremental encoder 0: Without UVW 1: With UVW Tens place: Sin/Cos encoder 0: without CD signal 1: with CD signal	0x00	◎
P24.15	Speed measurement mode	Setting range: 0–1 0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.	0	◎
P24.16	Frequency division coefficient	Setting range: 0–255 **Note:** When the function parameter is set to 0 or 1, the frequency division of 1:1 is implemented.	0	○
P24.17	Pulse filter handling selection	Setting range: 0x0000–0xFFFF Bit 0: Indicates whether to enable encoder P-channel input filter 0: Do not filter 1: Filter Bit 1: Encoder P-channel input filter method 0: Self-adaptive filter 1: Use P24.18 as the filter parameter Bit 2: Indicates whether to enable encoder P-channel frequency-division output filter 0: Do not filter 1: Filter Bit 3: Indicates whether to enable filter for pulse reference F-channel frequency-division output 0: Do not filter 1: Filter Bit 4: Indicates whether to enable pulse reference F-channel filter 0: Do not filter 1: Filter	0x0033	○

Function code	Name	Description	Default	Modify
		Bit 5: Pulse reference F-channel filter method 0: Self-adaptive filter 1: Use P24.19 as the filter parameter Bit 6: Frequency-divided output source selection (only for incremental PG cards) 0: Encoder input channel 1: Pulse giving channel Bit 7–Bit 15: Reserved		
P24.18	Encoder P-channel filter width	Setting range: 0–63 The filter time is P24.18×0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P24.19	Pulse reference F-channel filter width	Setting range: 0–63 The filter time is P24.19×0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P24.20	Pulse reference F-channel pulse count	Setting range: 0–16000	1024	◎
P24.21	Enabling SM angle compensation	Setting range: 0–1	1	○
P24.22	Frequency point of speed measurement mode switchover	Setting range: 0.00–630.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	1.00Hz	○
P24.23	Angle compensation coefficient	Setting range: -200.0–200.0%	100.0%	○
P24.24	Motor pole pairs in initial pole angle autotuning	Setting range: 1–128	2	◎

Group P25—I/O card input functions

Function code	Name	Description	Default	Modify
P25.00	HDI3 input type	Setting range: 0–1	0	◎

Function code	Name	Description	Default	Modify
		0: HDI3 is high-speed pulse input 1: HDI3 is digital input		
P25.01	Function of S5	Same as the description for P05.01	0	◎
P25.02	Function of S6		0	◎
P25.03	Function of S7		0	◎
P25.04	Function of S8		0	◎
P25.05	Function of S9		0	◎
P25.06	Function of S10		0	◎
P25.07	Function of HDI3		0	◎
P25.08	Expansion card input terminal polarity	Setting range: 0x00–0x7F Bit0: S5 Bit1: S6 Bit2: S7 Bit3: S8 Bit4: S9 Bit5: S10 Bit6: HDI3	0x00	○
P25.09	Expansion card virtual terminal setting	Setting range: 0x00–0x7F (0: disable; 1: enable) Bit0: S5 Bit1: S6 Bit2: S7 Bit3: S8 Bit4: S9 Bit5: S10 Bit6: HDI3	0x00	◎
P25.10	HDI3 switch-on delay	Used to define the delay time corresponding to the electrical level changes when the programmable input terminals switch on or switch off. Setting range: 0.000–50.000s	0.000s	○
P25.11	HDI3 switch-off delay		0.000s	○
P25.12	S5 switch-on delay		0.000s	○
P25.13	S5 switch-off delay		0.000s	○
P25.14	S6 switch-on delay		0.000s	○
P25.15	S6 switch-off delay		0.000s	○

Function code	Name	Description	Default	Modify
P25.16	S7 switch-on delay		0.000s	○
P25.17	S7 switch-off delay		0.000s	○
P25.18	S8 switch-on delay		0.000s	○
P25.19	S8 switch-off delay		0.000s	○
P25.20	S9 switch-on delay		0.000s	○
P25.21	S9 switch-off delay		0.000s	○
P25.22	S10 switch-on delay		0.000s	○
P25.23	S10 switch-off delay		0.000s	○
P25.24	AI3 lower limit	Setting range: 0.00V–P25.26	0.00V	○
P25.25	Corresponding setting of AI3 lower limit	Setting range: -300.0%–300.0%	0.0%	○
P25.26	AI3 upper limit	Setting range: P25.24–10.00V	10.00V	○
P25.27	Corresponding setting of AI3 upper limit	Setting range: -300.0%–300.0%	100.0%	○
P25.28	AI3 input filter time	Setting range: 0.000–10.000s	0.030s	○
P25.29	AI4 lower limit	Setting range: 0.00V–P25.31	0.00V	○
P25.30	Corresponding setting of AI4 lower limit	Setting range: -300.0%–300.0%	0.0%	○
P25.31	AI4 upper limit	Setting range: P25.29–10.00V	10.00V	○
P25.32	Corresponding setting of AI4 upper limit	Setting range: -300.0%–300.0%	100.0%	○
P25.33	AI4 input filter time	Used to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but	0.030s	○

Function code	Name	Description	Default	Modify
		may reduce the sensitivity of analog input. Setting range: 0.000–10.000s		
P25.34	HDI3 high-speed pulse input function selection	Setting range: 0–1 0: Input set through frequency 1: Counting	0	◎
P25.35	HDI3 lower limit frequency	Setting range: 0.000kHz– P25.37	0.000kHz	○
P25.36	Corresponding setting of HDI3 lower limit frequency	Setting range: -300.0%–300.0%	0.0%	○
P25.37	HDI3 upper limit frequency	Setting range: P25.35–50.000kHz	50.000 kHz	○
P25.38	Corresponding setting of HDI3 upper limit frequency	Setting range: -300.0%–300.0%	100.0%	○
P25.39	HDI3 frequency input filter time	Setting range: 0.000–10.000s	0.030s	○
P25.40	AI3 input signal type selection	Setting range: 0–1 0: Voltage 1: Current	0	○
P25.41	AI4 input signal type selection	Setting range: 0–1 0: Voltage 1: Current	0	○
P25.42–P25.45	Reserved	-	-	-

Group P26—I/O card output functions

Function code	Name	Description	Default	Modify
P26.00	HDO2 output type	Setting range: 0–1 0: Open collector high-speed pulse output 1: Open collector output	0	◎
P26.01	HDO2 output type	Same as the description for P06.01	0	○
P26.02	Y2 output		0	○

Function code	Name	Description	Default	Modify
P26.03	Y3 output		0	○
P26.04	RO3 output		0	○
P26.05	RO4 output		0	○
P26.06	RO5 output		0	○
P26.07	RO6 output		0	○
P26.08	RO7 output		0	○
P26.09	RO8 output		0	○
P26.10	RO9 output		0	○
P26.11	RO10 output		0	○
P26.12	Expansion card output terminal polarity	Setting range: 0x0000–0x1FFF Bit0: Y2 Bit1: Y3 Bit2: HDO2 Bit3: RO3 Bit4: RO4 Bit5: RO5 Bit6: RO6 Bit7: RO7 Bit8: RO8 Bit9: RO9 Bit10: RO10 Bit11: RO11 Bit12: RO12	0x0000	○
P26.13	HDO2 switch-on delay	Used to define the delay time corresponding to the electrical level changes when the programmable output terminals switch on or switch off. Setting range: 0.000–50.000s **Note:** P26.13 and P26.14 are valid only when P26.00=1.	0.000s	○
P26.14	HDO2 switch-off delay		0.000s	○
P26.15	Y2 switch-on delay	Used to define the delay time corresponding to the electrical level changes when the programmable output terminals switch on or switch off. Setting range: 0.000–50.000s	0.000s	○
P26.16	Y2 switch-off delay		0.000s	○
P26.17	Y3 switch-on delay		0.000s	○
P26.18	Y3 switch-off delay		0.000s	○

Function code	Name	Description	Default	Modify
P26.19	RO3 switch-on delay		0.000s	○
P26.20	RO3 switch-off delay		0.000s	○
P26.21	RO4 switch-on delay		0.000s	○
P26.22	RO4 switch-off delay		0.000s	○
P26.23	RO5 switch-on delay		0.000s	○
P26.24	RO5 switch-off delay		0.000s	○
P26.25	RO6 switch-on delay		0.000s	○
P26.26	RO6 switch-off delay		0.000s	○
P26.27	RO7 switch-on delay		0.000s	○
P26.28	RO7 switch-off delay		0.000s	○
P26.29	RO8 switch-on delay		0.000s	○
P26.30	RO8 switch-off delay		0.000s	○
P26.31	RO9 switch-on delay		0.000s	○
P26.32	RO9 switch-off delay		0.000s	○
P26.33	RO10 switch-on delay		0.000s	○
P26.34	RO10 switch-off delay		0.000s	○
P26.35	AO2 output	Same as the description for P06.14	0	○
P26.36	AO3 output		0	○
P26.37	Reserved	-	-	-
P26.38	AO2 output lower limit	Setting range: -300.0%–P26.40	0.0%	○

Function code	Name	Description	Default	Modify
P26.39	AO2 output corresponding to lower limit	Setting range: 0.00V–10.00V	0.00V	○
P26.40	AO2 output upper limit	Setting range: P26.38–100.0%	100.0%	○
P26.41	AO2 output corresponding to upper limit	Setting range: 0.00V–10.00V	10.00V	○
P26.42	AO2 output filter time	Setting range: 0.000–10.000s	0.000s	○
P26.43	AO3 output lower limit	Setting range: -300.0%–P26.45	0.0%	○
P26.44	AO3 output corresponding to lower limit	Setting range: 0.00V–10.00V	0.00V	○
P26.45	AO3 output upper limit	Setting range: P26.43–300.0%	100.0%	○
P26.46	AO3 output corresponding to upper limit	Setting range: 0.00V–10.00V	10.00V	○
P26.47	AO3 output filter time	Setting range: 0.000–10.000s	0.000s	○
P26.48–P26.52	Reserved	-	-	-

Group P27—Programmable card functions

Function code	Name	Description	Default	Modify
P27.00	Enabling programmable card functions	Setting range: 0–1 Used to enable the programmable card function. This function is reserved.	0	◎
P27.01	C_WrP1	Setting range: 0–65535 Value that the VFD writes to WrP1 on the programmable card.	0	○
P27.02	C_WrP2	Setting range: 0–65535 Value that the VFD writes to WrP2 on the programmable card.	0	○

Function code	Name	Description	Default	Modify
P27.03	C_WrP3	Setting range: 0–65535 Value that the VFD writes to WrP3 on the programmable card.	0	○
P27.04	C_WrP4	Setting range: 0–65535 Value that the VFD writes to WrP4 on the programmable card.	0	○
P27.05	C_WrP5	Setting range: 0–65535 Value that the VFD writes to WrP5 on the programmable card.	0	○
P27.06	C_WrP6	Setting range: 0–65535 Value that the VFD writes to WrP6 on the programmable card.	0	○
P27.07	C_WrP7	Setting range: 0–65535 Value that the VFD writes to WrP7 on the programmable card.	0	○
P27.08	C_WrP8	Setting range: 0–65535 Value that the VFD writes to WrP8 on the programmable card.	0	○
P27.09	C_WrP9	Setting range: -9999–32767 Value that the VFD writes to WrP9 on the programmable card.	0	○
P27.10	C_WrP10	Setting range: -9999–32767 Value that the VFD writes to WrP10 on the programmable card.	0	○
P27.11	Programmable card status	Used to display the status of the programmable card. Setting range: 0–1 0: Stop 1: Run	0	●
P27.12	C_MoP1	Setting range: 0–65535 Used for the VFD to monitor/view the MoP1 value of the programmable card.	0	●
P27.13	C_MoP2	Setting range: 0–65535 Used for the VFD to monitor/view the MoP2 value of the programmable card.	0	●
P27.14	C_MoP3	Setting range: 0–65535 Used for the VFD to monitor/view the MoP3	0	●

Function code	Name	Description	Default	Modify
		value of the programmable card.		
P27.15	C_MoP4	Setting range: 0–65535 Used for the VFD to monitor/view the MoP4 value of the programmable card.	0	●
P27.16	C_MoP5	Setting range: 0–65535 Used for the VFD to monitor/view the MoP5 value of the programmable card.	0	●
P27.17	C_MoP6	Setting range: 0–65535 Used for the VFD to monitor/view the MoP6 value of the programmable card.	0	●
P27.18	C_MoP7	Setting range: 0–65535 Used for the VFD to monitor/view the MoP7 value of the programmable card.	0	●
P27.19	C_MoP8	Setting range: 0–65535 Used for the VFD to monitor/view the MoP8 value of the programmable card.	0	●
P27.20	C_MoP9	Setting range: -9999–32767 Used for the VFD to monitor/view the MoP9 value of the programmable card.	0	●
P27.21	C_MoP10	Setting range: -9999–32767 Used for the VFD to monitor/view the MoP10 value of the programmable card.	0	●
P27.22	Digital input terminal status of programmable card	Setting range: 0x00–0x3F Input terminal status on the programmable card. Bit5–Bit0 indicate PS6–PS1.	0x00	●
P27.23	Digital output terminal status of programmable card	Setting range: 0x0–0x3 Output terminal status on the programmable card. Bit0 indicates PRO1, and Bit1 indicates PRO2.	0x0	●
P27.24	AI1 from programmable card	0–65535	0	●
P27.25	AO1 from programmable card	0–65535	0	●

Function code	Name	Description	Default	Modify
P27.26	Length of data sent by programmable card and PZD communication object	Setting range: 0x00–0x28 Ones place: Quantity of data sent from the programmable card and VFD (that is, quantity of data sent from the programmable card + from VFD sending table 1 + from VFD sending table 2) 0: 0+24+60 1: 12+24+60 2: 24+24+60 3: 36+24+60 4: 48+24+60 5: 60+48+60 6: 72+24+60 7: 84+24+60 8: 96+96+96 Tens place: Card that communicates with the programmable card through PZD (valid only when the ones place of P27.26 is 5) 0: DP card 1: CANopen card 2: PN card **Note:** P27.26 can be changed at any time, but the change will only take effect after the re-power on.	0x03	○
P27.27	Programmable card save function at power off	Setting range: 0–1 0: Disable 1: Enable	1	◎

Group P28—Master/slave control

Function code	Name	Description	Default	Modify
P28.00	Master/slave mode	Setting range: 0–2 0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	0	◎
P28.01	Master/slave communication data selection	Setting range: 0–1 0: CAN 1: Reserved	0	◎

Function code	Name	Description	Default	Modify
P28.02	Master/slave control mode	Setting range: 0x000–0x112 Ones place: Master/slave running mode selection 0: Master/slave mode 0 The master and slave use speed control, with power balanced through droop control. 1: Master/slave mode 1 (The master and slave must be in the same type of vector control. When the master is in speed control, the slave is forced into torque control.) 2: Master/slave mode 2 The slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point. Tens place: Slave start command source 0: Master 1: Determined by P00.01 Hundreds place: Whether to enable master/slave to send/receive data 0: Enable 1: Disable	0x001	◎
P28.03	Slave speed gain	Setting range: 0.0–500.0%	100.0%	○
P28.04	Slave torque gain	Setting range: 0.0–500.0%	100.0%	○
P28.05	Speed/torque mode switching frequency point in master/slave mode 2	Setting range: 0.00–10.00Hz **Note:** Supported by software of version V3.xx or earlier. Setting range: 0.00Hz–P00.03 **Note:** Supported by software of version V6.xx or later.	5.00Hz	○
P28.06	Number of slaves	Setting range: 0–15	1	◎
P28.07–P28.08	Reserved	-	-	-
P28.09	CAN slave torque offset	Setting range: -100.0–100.0%	0.0%	○

Function code	Name	Description	Default	Modify
P28.10	Enabling EC PT100/PT1000 to detect temperature	Setting range: 0x00–0x11 Ones place: PT100 temperature detection 0: Disable 1: Enable Tens place: PT1000 temperature detection 0: Disable 1: Enable	0x00	◎
P28.11	EC PT100 detected OT protection threshold	Setting range: 0.0–150.0°C	120.0°C	○
P28.12	EC PT100 detected OT pre-alarm threshold	Setting range: 0.0–150.0°C	100.0°C	○
P28.13	EC PT100 detected temperature calibration upper limit	Setting range: 50.0–150.0°C	120.0°C	○
P28.14	EC PT100 detected temperature calibration lower limit	Setting range: -20.0–50.0°C	10.0°C	○
P28.15	EC PT100 calibration upper limit digital	Setting range: 0–4096	2950	○
P28.16	EC PT100 calibration lower limit digital	Setting range: 0–4096	1270	○
P28.17	EC PT100 detected OT protection threshold	Setting range: 0.0–150.0°C	120.0°C	○
P28.18	EC PT100 detected OT pre-alarm threshold	Setting range: 0.0–150.0°C	100.0°C	○

Function code	Name	Description	Default	Modify
P28.19	EC PT1000 detected temperature calibration upper limit	Setting range: 50.0–150.0°C	120.0°C	○
P28.20	EC PT1000 detected temperature calibration lower limit	Setting range: -20.0–50.0°C	10.0°C	○
P28.21	EC PT1000 calibration upper limit digital	Setting range: 0–4096	3100	○
P28.22	EC PT1000 calibration lower limit digital	Setting range: 0–4096	1100	○
P28.23	Detecting for PT100/PT1000 disconnection from EC	Setting range: 0x00–0x11 Ones place: PT100 disconnection detection 0: Disable 1: Enable Tens place: PT1000 disconnection detection 0: Disable 1: Enable	0x00	◎
P28.24	Enabling digital calibration in EC PT100/PT1000 temperature detection	Setting range: 0–4 0: Invalid 1: Enable PT100 lower limit digital calibration 2: Enable PT100 upper limit digital calibration 3: Enable PT1000 lower limit digital calibration 4: Enable PT1000 upper limit digital calibration	0	○
P28.25	Type of sensor for AIAO to detect motor temperature	Setting range: 0–4 0: No temperature sensor 1: PT100 2: PT1000	0	◎

Function code	Name	Description	Default	Modify
		3: KTY84 4: PTC (measuring resistance only) (supported by software of version V3.xx or earlier) **Note:** Motor temperature is displayed through P19.21. To measure temperature, switch the output of AO1 to current, and connect one end of the temperature resistor to AI1 and AO1, and the other end to GND.		
P28.26	AIAO detected motor OT protection threshold	Setting range: 0.0–200.0°C **Note:** When the motor temperature exceeds the threshold, the VFD releases the OT alarm.	110.0°C	○
P28.27	AIAO detected motor OT pre-alarm threshold	Setting range: 0.0–200.0°C **Note:** When the motor temperature exceeds the value, the DO terminal with function 48 (AI detected motor OT pre-alarm) outputs a valid signal.	90.0°C	○

Group P90—Speed mode functions for tension control (supported by software of version V3.xx or earlier)

Function code	Name	Description	Default	Modify
P90.00	Tension control mode	Setting range: 0–3 0: Invalid 1: Tension speed control 2: Open-loop tension torque control 3: Closed-loop tension torque control **Note:** The value 0 indicates tension control is invalid. Select a non-zero value to enable the tension control function.	0	◎
P90.01	Winding/ unwinding mode	Setting range: 0–1 0: Winding 1: Unwinding **Note:** The motor forward rotation direction is the winding direction. When	0	○

Function code	Name	Description	Default	Modify
		using the tension control mode, check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the unwinding mode by setting P90.01 to 1 or changing the winding/unwinding switchover terminals.		
P90.02	Reel mechanical transmission rate	=Motor rotation speed/reel rotation speed=Reel diameter/motor shaft diameter Setting range: 0.01–600.0	1.00	○
P90.03	Max. linear speed	Setting range: 0.0–6000.0m/min	1000.0 m/ min	○
P90.04	Linear speed input source selection	Setting range: 0–5 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Main traction encoder frequency-division input	0	◎
P90.05	Linear speed set through keypad	Setting range: 0.0–100.0%	20.0%	○
P90.06	Main traction diameter	Setting range: 0.0–6000.0mm	99.0mm	○
P90.07	Main traction drive ratio	Setting range: 0.000–60.000	1.000	○
P90.08	Linear speed ACC time	Setting range: 0.00–600.00s	0.00s	○
P90.09	Linear speed DEC time	Setting range: 0.00–600.00s	0.00s	○
P90.10	Tension setting source selection	Setting range: 0x00–0x14 Ones place: Tension setting source selection 0: Keypad digital 1: AI1 2: AI2	0x00	◎

Function code	Name	Description	Default	Modify
		3: AI3 4: High-speed pulse HDI Tens place: Multiplier selection of max. tension P90.12 0: 1 times 1: 10 times		
P90.11	Tension set through keypad	Setting range: 0.0–100.0%	10.0%	○
P90.12	Max. tension	Setting range: 0–60000 (N, P90.10 tens place=0) or 0–60000 (10N, tens place of P90.10=1)	1000	○
P90.13	Roll diameter calculation method selection	Setting range: 0–7 0: No calculation 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Linear speed calculation method 6: Thickness (of wire) 7: Thickness (of strip)	0	◎
P90.14	Roll diameter calculation delay time	Setting range: 0.0–100.0s	1.0s	○
P90.15	Min. roll diameter	Setting range: 0.0mm–P90.16	50.0mm	○
P90.16	Max. roll diameter	Setting range: P90.15–5000.0mm	1000.0 mm	○
P90.17	Initial roll diameter 1	Setting range: P90.15–P90.16	100.0 mm	○
P90.18	Initial roll diameter 2	Setting range: P90.15–P90.16	100.0 mm	○
P90.19	Initial roll diameter 3	Setting range: P90.15–P90.16	100.0 mm	○
P90.20	Linear speed roll diameter calculation filter time	Setting range: 0.000–60.000s	2.000s	○

Function code	Name	Description	Default	Modify
P90.21	Linear speed roll diameter calculation restriction	Setting range: 0x00–0x11 Ones place: 0: No limit 1: Restrict changes in reverse direction Tens place: 0: No limit 1: Automatic restriction according to running frequency and material thickness	0x00	○
P90.22	Material thickness	Setting range: 0.001–65.535mm	0.010 mm	○
P90.23	Number of coils per layer	Setting range: 1–10000	1	◎
P90.24	Revolution counting function selection	Setting range: 0–2 0: Digital terminal input 1: PG card input (applicable to thickness calculation method) 2: Running frequency (no input automatic revolution counting)	0	◎
P90.25	PPR count	Setting range: 1–60	1	◎
P90.26	Roll diameter set value	Setting range: 0.0–100.0%	80.0%	○
P90.27	Roll diameter reset setting	Setting range: 0x0000–0x1111 Ones place: During stop 0: Remain the present roll diameter 1: Restore to the initial roll diameter Tens place: Power failure at running 0: Remain the present roll diameter 1: Restore to the initial roll diameter Hundreds place: Roll diameter set value reached 0: Remain the present roll diameter 1: Restore to the initial roll diameter after stop Thousands place: Terminal reset restriction 0: Roll diameter reset allowed at running	0x1000	○

Function code	Name	Description	Default	Modify
		1: Roll diameter reset only allowed during stop		
P90.28	Tension PID output reference	Setting range: 0–1 0: Max. value 1: Given value	0	○
P90.29	Tension PID parameter source	Setting range: 0–5 0: Fixed to the first group of in P90. 1: Roll diameter (max. roll diameter) 2: Main reference frequency (max. frequency) 3: Running linear speed (max. linear speed) 4: Deviation (Reference 100%) 5: Terminal	0	○
P90.30	Proportional gain of group 1	Setting range: 0.000–30.000	0.030	○
P90.31	Integral time of group 1	Setting range: 0.00–30.00s	5.00s	○
P90.32	Differential time of group 1	Setting range: 0.00–10.00s	0.00s	○
P90.33	Proportional gain of group 2	Setting range: 0.000–30.000	0.030	○
P90.34	Integral time of group 2	Setting range: 0.00–30.00s	5.00s	○
P90.35	Differential time of group 2	Setting range: 0.00–10.00s	0.00s	○
P90.36	PID parameter adjustment reference point 1	Setting range: 0.0%– P90.37	10.0%	○
P90.37	PID parameter adjustment reference point 2	Setting range: P90.36–100.0%	50.0%	○
P90.38	Min. frequency for roll diameter calculation	Setting range: 0.00–50.00Hz **Note:** It is valid only for roll diameter calculation based on the linear speed.	0.30Hz	○
P90.39	Min. linear speed for roll diameter calculation	Setting range: 0.0–100.0% **Note:** Relative to the max. linear speed. It is valid only for roll diameter calculation based on the linear speed.	3.0%	○

Group P90—Torque mode functions for tension control (supported by software of version V3.xx or earlier)

Function code	Name	Description	Default	Modify
P91.00	Tension control zero speed reference	Setting range: 0–1 0: Max. linear speed 1: Max. frequency	0	◎
P91.01	Tension control zero speed threshold	Setting range: 0.0–50.0%	0.5%	○
P91.02	Zero speed offset	Setting range: 0.0–50.0%	2.0%	○
P91.03	Upper-limit frequency source of torque control	Setting range: 0–3 0: Set by P03.14 and P03.15 1: Forward rotation limit set by linear speed 2: Reverse rotation limit set by linear speed 3: Forward/reverse rotation limit set by linear speed	3	◎
P91.04	Running frequency upper limit offset of tension control	Setting range: 0.0–100.0%	5.0%	○
P91.05	Differential separation threshold	Setting range: 0.0–100.0%	5.0%	○
P91.06	PID restricts reverse limit at zero speed	Setting range: 0–1 0: Allow active reverse material tightening by PID at zero speed. 1: Do not allow active reverse material tightening by PID at zero speed.	0	◎
P91.07	Torque compensation selection	Setting range: 0x000–0x111 Ones place: Frictional torque compensation 0: No 1: Yes Tens place: Inertia compensation 0: No 1: Yes Hundreds place: Compensation direction 0: Consistent with the torque direction	0x000	◎

Function code	Name	Description	Default	Modify
		1: Opposite to the torque direction		
P91.08	System mechanical parameter identification	Setting range: 0–2 0: No operation 1: Enable system mechanical inertia identification 2: Enable mechanical friction torque identification	0	◎
P91.09	Static friction torque compensation coefficient	Setting range: 0.0–100.0%	0.0%	○
P91.10	Sliding friction torque compensation coefficient 1	Setting range: 0.0–100.0%	0.0%	○
P91.11	Sliding friction torque compensation coefficient 2	Setting range: 0.0–100.0%	0.0%	○
P91.12	Sliding friction torque compensation coefficient 3	Setting range: 0.0–100.0%	0.0%	○
P91.13	High speed torque compensation coefficient	Setting range: 0.0–100.0%	0.0%	○
P91.14	Compensation frequency point of static friction torque	Setting range: 0.0%– P91.15	1.0%	○
P91.15	Compensation frequency point of sliding friction torque 1	Setting range: P91.14–P91.16	20.0%	○
P91.16	Compensation frequency point of sliding friction torque 2	Setting range: P91.15–P91.17	50.0%	○

Function code	Name	Description	Default	Modify
P91.17	Compensation frequency point of sliding friction torque 3	Setting range: P91.16–P91.18	80.0%	○
P91.18	High-speed friction torque compensation frequency point	Setting range: P91.17 –100.0%	100.0%	○
P91.19	ACC/DEC frequency source	Setting range: 0–1 0: Linear speed 1: Running frequency	0	◎
P91.20	Material density	Setting range: 0–30000kg/m³	0kg/m³	○
P91.21	Reel width	Setting range: 0.000–60.000m	0.000m	○
P91.22	ACC inertia compensation coefficient	Setting range: 0.0–100.0%	10.0%	○
P91.23	DEC inertia compensation coefficient	Setting range: 0.0–100.0%	10.0%	○
P91.24	Tension taper coefficient source	Setting range: 0–4 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI	0	◎
P91.25	Tension taper set through keypad	Setting range: 0.0–100.0%	30.0%	○
P91.26	Tension taper compensation correction	Setting range: 0.0–5000.0mm	0.0mm	○
P91.27	Tension taper curve selection	Setting range: 0–1 0: Inverse proportional curve 1: Multi-point polyline	0	◎
P91.28	Roll diameter value 1	Setting range: 0.0–5000.0mm	200.0 mm	○
P91.29	Tension taper coefficient for roll diameter value 1	Setting range: 0.0–50.0%	3.0%	○

Function code	Name	Description	Default	Modify
P91.30	Roll diameter value 2	Setting range: 0.0–5000.0mm	500.0 mm	○
P91.31	Tension taper coefficient for roll diameter value 2	Setting range: 0.0–50.0%	7.0%	○
P91.32	Tension offset value at zero speed	Setting range: 0.0–300.0%	0.0%	○
P91.33	Present roll diameter setting	Setting range: 0.0–5000.0mm	0.0mm	◎

Group P92—Optimization functions for tension control (supported by software of version V3.xx or earlier)

Function code	Name	Description	Default	Modify
P92.00	Pre-drive speed gain	Setting range: 0.0–100.0%	100.0%	○
P92.01	Pre-drive torque limit	Setting range: 0–2 0: Set based on P03.20 and P03.21 1: Set based on P93.02 2: Set based on the set tension	2	○
P92.02	Pre-drive torque limit setting	Setting range: 0.0–200.0%	100.0%	○
P92.03	Zero bit conversion enabling	Setting range: 0–1 0: Invalid 1: Enable	0	◎
P92.04	Initial zero bit	Setting range: 0.0–100.0%	10.0%	○
P92.05	Final zero bit	Setting range: 0.0–100.0%	50.0%	○
P92.06	Conversion time from initial zero bit to final zero bit	Setting range: 0.00–60.00s	5.00s	○
P92.07	Conversion time from final zero bit to initial zero bit	Setting range: 0.00–60.00s	5.00s	○
P92.08	Feeding interrupt detection mode	Setting range: 0–3 0: No detection	0	○

Function code	Name	Description	Default	Modify
		1: Detect based on digital value 2: Detect based on roll diameter calculation value 3: Detect based on feedback position		
P92.09	Feeding interrupt detection start delay time	Setting range: 0.0–200.0s	20.0s	○
P92.10	Frequency lower limit of feeding interrupt detection	Setting range: 0.00–300.00Hz	10.00Hz	○
P92.11	Error range of feeding interrupt detection	Setting range: 0.1–50.0%	10.0%	○
P92.12	Determination delay time of feeding interrupt detection	Setting range: 0.1–60.0s	1.0s	○
P92.13	Handling mode of feeding interrupt	Setting range: 0x000–0x111 Ones place: Stop mode 0: Decelerate to stop in emergency manner 1: Coast to stop Tens place: Alarm mode 0: Stop in the ones-place specified mode without reporting alarms 1: Report an alarm and coast to stop Hundreds place: Roll diameter memory function of feeding interrupt 0: Do not memorize 1: Memorize	0x000	◎
P92.14	Stop braking frequency	Setting range: 0.00–300.00Hz	1.50Hz	○
P92.15	Stop braking time	Setting range: 0.0–600.0s	0.0s	○

Group P93—Tension control status viewing (supported by software of version V3.xx or earlier)

Function code	Name	Description	Default	Modify
P93.00	Actual control mode	Setting range: 0–3 0: Tension control is invalid 1: Closed-loop tension speed control 2: Open-loop tension torque control 3: Closed-loop tension torque control	0	●
P93.01	Actual winding/unwinding mode	Setting range: 0–1 0: Winding 1: Unwinding	0	●
P93.02	Initial roll diameter	Setting range: 0.0–5000.0mm	0.0mm	●
P93.03	Reset roll diameter	Setting range: 0.0–5000.0mm	0.0mm	●
P93.04	Roll diameter change rate	Setting range: 0.00–655.35mm/s	0.00 mm/s	●
P93.05	Present roll diameter	Setting range: 0.0–5000.0mm	0.0mm	●
P93.06	Roll diameter for linear speed calculation	Setting range: 0.0–5000.0mm	0.0mm	●
P93.07	Set linear speed	Setting range: 0.0–6000.0m/min	0.0 m/min	●
P93.08	Present linear speed	Setting range: 0.0–6000.0m/min	0.0 m/min	●
P93.09	Main reference frequency	Setting range: 0.00–600.00Hz	0.00Hz	●
P93.10	Actual proportional gain	Setting range: 0.00–30.00	0.00	●
P93.11	Actual integral time	Setting range: 0.00–30.00s	0.00s	●
P93.12	Proportional output value	Setting range: 0–65535	0	●
P93.13	Integral output value	Setting range: 0–65535	0	●
P93.14	PID upper limit	Setting range: -100.0–100.0%	0.0%	●

Function code	Name	Description	Default	Modify
P93.15	PID lower limit	Setting range: -100.0–100.0%	0.0%	●
P93.16	PID output frequency	Setting range: -99.99–99.99Hz	0.00Hz	●
P93.17	Main traction running frequency	Setting range: -300.0–300.0Hz	0.0Hz	●
P93.18	Set tension	Setting range: 0–30000N	0N	●
P93.19	Tension taper coefficient	Setting range: 0.0–100.0%	0.0%	●
P93.20	Actually set tension	Setting range: 0–30000N	0N	●
P93.21	Basic torque reference value	Setting range: -300.0–300.0%	0.0%	●
P93.22	Friction compensation torque value	Setting range: -300.0–300.0%	0.0%	●
P93.23	System rotational inertia	Setting range: 0.00–655.35kg・m^2	0.00 kg・m^2	●
P93.24	Frequency change rate	Setting range: -99.99–327.67Hz/s	0.00Hz/s	●
P93.25	Torque compensation value of system rotational inertia	Setting range: -300.0–300.0%	0.0%	●
P93.26	Reference value after torque compensation	Setting range: -300.0–300.0%	0.0%	●
P93.27	PID output torque	Setting range: -300.0–300.0%	0.0%	●
P93.28	Final output torque	Setting range: -300.0–300.0%	0.0%	●
P93.29	Detected tension	Setting range: 0–30000N	0N	●
P93.30	Number of material turns on the reel	Setting range: -100–32767	0	●
P93.31	Length of material on reel	Setting range: 0–65535m	0m	●
P93.32	Length increment	Setting range: 0.0–6553.5m	0.0m	●

Group P90—Basic parameters for tension control (supported by software version V6.xx or later)

Function code	Name	Description	Default	Modify
P90.00	Tension control mode	Setting range: 0–8 0: Standard model 1: Open-loop torque mode 2: Closed-loop speed mode 3: Closed-loop torque mode 4: Constant linear speed mode (reserved) 5: Traction mode 6: Standard winding/unwinding mode 7: Direct speed torque mode (inertia/friction compensation required) 8: Cable routing mode (reserved) **Note:** The value 0 indicates the VFD enables general-purpose functions. A non-zero value indicates the VFD enables the tension control function.	0	◎
P90.01	Winding/unwinding mode	Setting range: 0–1 0: Winding 1: Unwinding **Note:** The motor forward rotation direction is the winding direction. When using the tension control mode, check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the unwinding mode by setting P90.01 to 1 or changing the winding/unwinding switchover terminals.	0	◎
P90.02	Frequency upper limit of winding	Setting range: 0.00Hz–P00.03	50.00Hz	◎
P90.03	Frequency upper limit of unwinding	Setting range: 0.00Hz–P00.03	1.00Hz	◎
P90.04	Frequency upper limit channel	Setting range: 0–6 0: Keypad	0	◎

Function code	Name	Description	Default	Modify
		1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB 6: Automatic upper limit frequency (actual frequency for winding)		
P90.05	Actual frequency upper limit	Setting range: 0.01Hz–P00.03	0.00Hz	●
P90.06	Reel mechanical transmission rate	Setting range: 0.01–300.00	1.00	◎
P90.07	Torque reference in debug mode	Setting range: 0.0–300.0%	0.0%	○
P90.08	Static friction torque compensation	Setting range: 0.0–100.0%	0.0%	○
P90.09	Dynamic friction torque compensation	Setting range: 0.0–100.0%	0.0%	○
P90.10	Torque compensation corresponding to max. linear speed	Setting range: 0.0–100.0%	0.0%	○
P90.11	Static friction frequency threshold	Setting range: 0.01Hz–P00.03	1.00Hz	○
P90.12	Dynamic friction frequency threshold	Setting range: 0.01Hz–P00.03	5.00Hz	○
P90.13	Linear speed input method	Setting range: 0–8 0: Linear speed=0 1: AI1 2: AI2 3: AI3 4: HDIA 5: HDIB 6: Communication	0	◎

Function code	Name	Description	Default	Modify
		7: Max. linear speed 8: Based on master pulses (encoder pulse train)		
P90.14	Max. linear speed	Setting range: 0.0–3000.0m/min	300.0 m/min	◎
P90.15	Real-time linear speed	Setting range: 0.0m/min–P90.14	0.0 m/min	●
P90.16	Roll diameter calculation method	Setting range: 0–10 0: No calculation 1: Linear speed calculation method 2: PG thickness accumulation method 3: HDIA 4: HDIB (Only one from HDIA and HDIB can be selected) 5: Reserved 6: AI1 calibration method 7: AI2 calibration method 8: AI3 calibration method 9: SVC evaluation method 10: Automatic identifying	0	◎
P90.17	Max. roll diameter	Setting range: 1–10000mm **Note:** The set min. value should be greater than P90.18–P90.25.	1200mm	◎
P90.18	Initial roll diameter 0 of winding	Setting range: 1mm–P90.17	80mm	◎
P90.19	Initial roll diameter 1 of winding	Setting range: 1mm–P90.17	100mm	◎
P90.20	Initial roll diameter 2 of winding	Setting range: 1mm–P90.17	120mm	◎
P90.21	Initial roll diameter 3 of winding	Setting range: 1mm–P90.17	150mm	◎
P90.22	Initial roll diameter 0 of unwinding	Setting range: 1mm–P90.17	800mm	◎

Function code	Name	Description	Default	Modify
P90.23	Initial roll diameter 1 of unwinding	Setting range: 1mm–P90.17	900mm	◎
P90.24	Initial roll diameter 2 of unwinding	Setting range: 1mm–P90.17	1000mm	◎
P90.25	Initial roll diameter 3 of unwinding	Setting range: 1mm–P90.17	1200mm	◎
P90.26	Roll diameter change rate 2	Setting range: 0.01–10.00mm/T	1.00 mm/T	◎
P90.27	Roll diameter reset method selection	Setting range: 0–2 0: Terminal 1: Stop 2: Communication reset (set to 2, auto changed to 0, reset once)	0	◎
P90.28	Min. linear speed for roll diameter calculation	Setting range: 0.1–300.0m/min	15.0 m/min	◎
P90.29	Roll diameter calculation interval time	Setting range: 0.000–30.000s	1.000s	○
P90.30	Roll diameter calculation monotonicity selection	Setting range: 0–1 0: No requirement 1: Increasing only for winding, and decreasing only for unwinding	1	◎
P90.31	Roll diameter change rate 1	0.00mm/T–P90.26	0.10 mm/T	◎
P90.32	Material type	Setting range: 0–1 0: Wire 1: Strip	1	◎
P90.33	I-wheel width	Setting range: 1–10000mm	1000mm	◎
P90.34	Wire diameter 0 or strip thickness 0	Setting range: 0.001–60.000m	0.100 mm	◎
P90.35	Wire diameter 1 or strip thickness 1	Setting range: 0.001–60.000m	0.150 mm	◎

Function code	Name	Description	Default	Modify
P90.36	Wire diameter 2 or strip thickness 2	Setting range: 0.001–60.000m	0.200 mm	◎
P90.37	Wire diameter 3 or strip thickness 3	Setting range: 0.001–60.000m	0.250 mm	◎
P90.38	Real-time material diameter or thickness	Setting range: 0.000–60.000m	0.000 mm	●
P90.39	PPR of device axis	Setting range: 0–65535	600	◎
P90.40	Real-time pulse count	Setting range: 0–65535 **Note:** When 65535 is exceeded, it changes to 0.	0	/●
P90.41	Roll diameter calculation filter time	Setting range: 0.000–10.000s	3.000s	○
P90.42	Real-time roll diameter	Setting range: 0mm–P90.17	0mm	◎
P90.43	Real-time roll diameter	Setting range: 0mm–P90.17	0mm	/●
P90.44	Actual working mode	Setting range: 0x00–0x1F	0x00	●
P90.45	Material density	Setting range: 0–60000kg/m^3	0kg/m^3	◎
P90.46	Material inertia	Setting range: 0.00–300.00kg·m^2	0.00 kg·m^2	○
P90.47	Mechanical inertia	Setting range: 0.00–300.00kg·m^2	0.00 kg·m^2	○
P90.48	Traction machine ACC time	Setting range: 0.00–300.00s **Note:** The value 0 indicates automatic calculation.	15.00s	◎
P90.49	Traction machine DEC time	Setting range: 0.00–300.00s	15.00s	◎
P90.50	Inertia compensation torque value	Setting range: 0.0–300.0%	0.0%	●
P90.51	Linear ACC	Setting range: -99.00–99.00m/s^2	0.00 m/s^2	●
P90.52	Inertia compensation ACC/DEC time	Setting range: 0.000–10.000s	0.100s	◎

Function code	Name	Description	Default	Modify
P90.53	Device PPR (* 100)	Setting range: 0–65535	0	●
P90.54	Reserved	-	-	-
P90.55	Tension giving method selection	Setting range: 0–7 0: Digital 1: AI1 2: AI2 3: AI3 4: HDIA 5: HDIB 6: Communication 7: Torque	0	◎
P90.56	Reference tension setting through digital	Setting range: 0N–P90.57	0N	○
P90.57	Max. tension	Setting range: 0N–60000N	10000N	◎
P90.58	Tension giving change time	Setting range: 0.00–60.00s	0.00s	○
P90.59	Tension taper input method	Setting range: 0–6 0: Digital 1: AI1 (relative to digital tension taper value) 2: AI2 3: AI3 4: HDIA 5: HDIB 6: Communication (reserved)	0	◎
P90.60	Digital tension taper	Setting range: 0.00–100.00%	0.00	○
P90.61	Tension taper type	Setting range: 0–3 0: Curve type 1: Single-segment line type (denominator 1000) 2: Two-segment line type (interpolation) 3: 20-segment line type (interpolation)	1	◎
P90.62	Tension taper compensation value	Setting range: 0–10000mm	1mm	○
P90.63	Middle roll diameter	Setting range: P90.18–P90.22	500	○

Function code	Name	Description	Default	Modify
P90.64	Middle tension	Setting range: 0.00–100.00%	80.00%	○
P90.65	Tension of max. roll diameter	Setting range: 0.00–100.00%	50.00%	○
P90.66–P90.68	Reserved	-	-	-
P90.69	Set tension value	Setting range: 0–30000N	0N	●
P90.70	Taper tension value	Setting range: 0–30000N	0N	●
P90.71	Output frequency filter time	Setting range: 0.000–10.000s	0.010s	○
P90.72	Output frequency for roll diameter calculation	Setting range: 0.00Hz–P00.03	0.00Hz	●
P90.73	Linear speed stablization time	Setting range: 0–60s	20s	○
P90.74	Set roll diameter	Setting range: 0mm–P90.17	0mm	○
P90.75	Roll diameter of stop	Setting range: 0mm–P90.17	0mm	○
P90.76	Min. roll diameter	Setting range: 0mm–P90.17	96mm	○
P90.77	Winding/unwinding reversal selection	Setting range: 0–1 0: Normal 1: Directional	0	◎
P90.78	Traction wheel roll diameter	Setting range: 1–10000mm	500mm	◎
P90.79	Traction wheel transmission ratio	Setting range: 0.01–300.00	1.00	◎
P90.80	Traction motor PPR count	Setting range: 1–10000	1024	◎
P90.81	Linear speed sampling time	Setting range: 1–200ms	25ms	◎
P90.82	Sampling-time pulse count L	Setting range: 0–65535	0	●
P90.83	Linear speed filter time	Setting range: 0.000–10.000s	0.000s	○
P90.84–P90.87	Reserved	-	-	-
P90.88	HDIA pulse count	Setting range: 0–65535	0	●

Function code	Name	Description	Default	Modify
P90.89	HDIB pulse count	Setting range: 0–65535	0	●
P90.90	HDIA percentage	Setting range: 0.00–100.00%	0.00%	●
P90.91	HDIB percentage	Setting range: 0.00–100.00%	0.00%	●
P90.92	Actual length	Setting range: 0–65535m	0m	●
P90.93–P90.95	Reserved	-	-	-

Group P91—PID parameters for tension control (supported by software version V6.xx or later)

Function code	Name	Description	Default	Modify
P91.00	PID giving method	Setting range: 0–7 0: Position given by pendulum 1: Tension 2: AI1 3: AI2 4: AI3 5: HDIA reference 6: HDIB reference 7: Communication (2002H:0.00–100.00%)	0	◎
P91.01	Pendulum position reference	Setting range: 0.00–10.00V **Note:** 0–10V corresponds to 0.00%–100.00%.	5.00V	○
P91.02	Position reference ACC time	Setting range: 0.000–20.000s	0.000s	○
P91.03	Position reference DEC time	Setting range: 0.000–20.000s	0.000s	○
P91.04	Start position selection of position reference	Setting range: 0–1 0: Feedback position 1: Actual position	0	◎
P91.05	Pendulum/tension feedback selection	Setting range: 0–6 0: AI1 1: AI2 2: AI3 3: HDIA	1	◎

Function code	Name	Description	Default	Modify
		4: HDIB 5: Output torque (200.0% for calibration) 6: Communication (2003H:0.00–100.00%)		
P91.06	PID control function selection	Setting range: 0–1 0: Positive 1: Negative **Note:** When the PID automatically completes the winding/unwinding switchover, it functions as domain switchover.	0	◎
P91.07	PID output control selection	Setting range: 0–4 0: Max. frequency 1: Base given frequency A 2: Max. tension 3: Tension 4: Base given frequency B	0	◎
P91.08	Reserved	-	-	-
P91.09	PID control parameter selection	Setting range: 0–5 0: Use the first group of parameter 1: Control based on roll diameter (winding/unwinding initial roll diameter has linear change) 2: Control based on frequency 3: Control based on linear speed 4: Control based on deviation 5: Switch over through terminals **Note:** P90.00=6, 4 (winding); 2 (unwinding)	0	◎
P91.10	Proportional gain 1	Setting range: 0.000–30.000 **Note:** P90.00=6, 0.060 (winding); 0.300 (unwinding)	0.200	○
P91.11	Integral time 1	Setting range: 0.00–30.00s	0.00s	○
P91.12	Differential time 1	Setting range: 0.000–30.000s	0.000s	○
P91.13	Proportional gain 2	Setting range: 0.000–30.000 **Note:** P90.00=6,0.100 (winding); 0.400 (unwinding)	0.200	○
P91.14	Integral time 2	Setting range: 0.00–30.00s	0.00s	○

Function code	Name	Description	Default	Modify
P91.15	Differential time 2	Setting range: 0.000–30.000s	0.000s	○
P91.16	PID1 switchover point	Setting range: 0.00–100.00%	4.00%	○
P91.17	PID2 switchover point	Setting range: 0.00–100.00% **Note:** P90.00=6,45 (winding); 90 (unwinding)	45.00%	○
P91.18	PID deviation limit	Setting range: 0.00–100.00%	0.00%	○
P91.19	PID integral separation	Setting range: 0.00–100.00% **Note:** When it is set to 100%, integral separation is invalid.	100.00%	○
P91.20	PID differential limit	Setting range: 0.00–100.00%	0.00%	○
P91.21	PID output upper limit	Setting range: 0.00–100.00%	100.00%	○
P91.22	PID output lower limit	Setting range: 0.00–100.00% **Note:** P90.00=6,100 (winding); 50 (unwinding)	100.00%	○
P91.23	PID calculation cycle	Setting range: 1–1000ms	1ms	○
P91.24	Reserved	-	-	-
P91.25	PID start delay	Setting range: 0.000–10.000s	0.000s	○
P91.26	PID output filter time	Setting range: 0.000–10.000s	0.000s	○
P91.27	PID reference value	Setting range: 0.00–100.00%	0.00%	●
P91.28	PID feedback value	Setting range: 0.00–100.00%	0.00%	●
P91.29	PID deviation	Setting range: -100.00–100.00%	0.00%	●
P91.30–P91.32	-	-	-	-
P91.33	Deviation 0	Setting range: 0.00%–P91.34	4.00%	○
P91.34	Deviation 1	Setting range: P91.33– P91.35(%)	12.00%	○
P91.35	Deviation 2	Setting range: P91.34– P91.36(%)	22.00%	○
P91.36	Deviation 3	Setting range: P91.35– P91.37(%)	37.00%	○
P91.37	Deviation 4	Setting range: P91.36– P91.38(%)	52.00%	○
P91.38	Deviation 5	Setting range: P91.37–100.00%	72.00%	○

Function code	Name	Description	Default	Modify
P91.39	Soft start integral time	Setting range: 0.0–1000.0s **Note:** 167.0 (winding); 143.0 (unwinding)	167.0s	○
P91.40	Integral time 1	Setting range: 0.0–1000.0s **Note:** 909.0 (winding); 555.0 (unwinding)	909.0s	○
P91.41	Integral time 2	Setting range: 0.0–1000.0s **Note:** 333.0 (winding); 200.0 (unwinding)	333.0s	○
P91.42	Integral time 3	Setting range: 0.0–1000.0s **Note:** 133.0 (winding); 77.0 (unwinding)	133.0s	○
P91.43	Integral time 4	Setting range: 0.0–1000.0s **Note:** 67.0 (winding); 36.0 (unwinding)	67.0s	○
P91.44	Integral time 5	Setting range: 0.0–1000.0s **Note:** 25.0 (winding); 13.5 (unwinding)	25.0s	○
P91.45	Integral time 6	Setting range: 0.0–1000.0s **Note:** 9.0 (winding); 5.0 (unwinding)	9.0s	○
P91.46	Deviation integral actual value	Setting range: 0.00–500.00%	0.00%	●
P91.47	Deviation integral action channel selection	Setting range: 0–4 0: Feedforward gain * AI1 1: Feedforward gain * AI1 2: Feedforward gain * 10V 3: HDIA 4: HDIB **Note:** 0 or 1 (winding); 2 (unwinding)	0	◎
P91.48	Deviation integral range selection	Setting range: 0–2 0: Feedforward gain unchanged 1: 0–Feedforward gain upper limit 2: Negative feedforward gain upper limit – Positive feedforward gain upper limit **Note:** 1 (winding); 2 (unwinding)	1	◎
P91.49	Deviation integral upper limit	Setting range: 0.00–500.00% **Note:** 500.00 (winding); 100.00 (unwinding)	500.00%	◎
P91.50	Deviation integral gain	Setting range: 0.00–500.00% **Note:** 50.00 (winding); 0.00 (unwinding)	50.00%	◎
P91.51	Deviation integral power-failure memory selection	Setting range: 0x00–0x11 Ones place: 0: Automatic reset	0x10	◎

Function code	Name	Description	Default	Modify
		1: Terminal based reset (sharing the roll diameter reset terminal) Tens place: 0: Save at power failure 1: Not save at power failure		
P91.52	Low-speed PID output limit	Setting range: 0.00–100.00%	0.00%	◎
P91.53	Low-speed PID range	Setting range: 0.00–100.00%	2.00%	◎
P91.54	Low-speed PID re-effective time	Setting range: 0.000–60.000s	0.000s	○
P91.55	Reverse rotation control	Setting range: 0–2 0: Enable 1: Disable 1 2: Disable 2 (Reverse rotation, frequency reference is 0)	0	◎
P91.56	Zero speed control	Setting range: 0–1 0: Zero speed run (Reverse rotation, frequency reference is 0) 1: Self-adaptive run (Reverse rotation, PID action feedforward does not work any more)	0	◎
P91.57	Reserved	-	-	-
P91.58	Feeding interrupt detection upper limit	Setting range: 0.00–10.00V **Note:** The value 0 indicates the detection low limit.	0.00V	◎
P91.59	Disconnection detection lower limit	Setting range: 0.00–10.00V **Note:** The value 0 indicates the detection upper limit.	0.00V	◎
P91.60	Feeding interrupt detection filter time	Setting range: 0–10000ms	500ms	○
P91.61	Feeding interrupt detection start delay time	Setting range: 0.0–10.0s **Note:** The time 0.0 indicates feeding interrupt detection is disabled.	6.0s	○
P91.62	Continuous run time upon feeding interrupt	Setting range: 0.0–60.0s	10.0s	○

Function code	Name	Description	Default	Modify
P91.63	Reserved	-	-	-
P91.64	Disconnection detection method	Setting range: 0–1 0: Automatic 1: External terminal signal	0	◎
P91.65	Fault handling method	Setting range: 0–1 0: Decelerate to stop and report the fault 1: VFD fault	0	◎
P91.66–P91.74	Reserved	-	-	-

Group P92—Optimization functions for tension control (supported by software of version V6.xx or later)

Function code	Name	Description	Default	Modify
P92.00	Frequency gain of winding pre-drive frequency	Setting range: 50.00–200.0%	105.00%	◎
P92.01	Frequency gain of unwinding pre-drive frequency	Setting range: 50.00–200.0%	95.00%	◎
P92.02	Pre-drive control delay	Setting range: 0.0–60.0s **Note:** During pre-drive process, roll diameter calculation stops.	1.0s	○
P92.03	Setting of fixed length	Setting range: 0–65535m	10000m	◎
P92.04	Pulses per meter	Setting range: 0.01–655.35	1.00	◎
P92.05–P92.06	Reserved	-	-	-
P92.07	Output control of fixed length	Setting range: 0–1 0: Do not output when length reached 1: Output when length reached	1	◎
P92.08	Setting of segmented roll diameter 1	Setting range: 0–P92.09	100	○

Function code	Name	Description	Default	Modify
P92.09	Setting of segmented roll diameter 2	Setting range: P92.08–P92.10	150	○
P92.10	Setting of segmented roll diameter 3	Setting range: P92.09–P92.11	200	○
P92.11	Setting of segmented roll diameter 4	Setting range: P92.10–P92.12	230	○
P92.12	Setting of segmented roll diameter 5	Setting range: P92.11–P92.13	280	○
P92.13	Setting of segmented roll diameter 6	Setting range: P92.12–P92.14	320	○
P92.14	Setting of segmented roll diameter 7	Setting range: P92.13–P92.15	350	○
P92.15	Setting of segmented roll diameter 8	Setting range: P92.14–P92.16	380	○
P92.16	Setting of segmented roll diameter 9	Setting range: P92.15–P92.17	400	○
P92.17	Setting of segmented roll diameter 10	Setting range: P92.16–P92.18	420	○
P92.18	Setting of segmented roll diameter 11	Setting range: P92.17–P92.19	450	○
P92.19	Setting of segmented roll diameter 12	Setting range: P92.18–P92.20	460	○
P92.20	Setting of segmented roll diameter 13	Setting range: P92.19–P92.21	470	○

Function code	Name	Description	Default	Modify
P92.21	Setting of segmented roll diameter 14	Setting range: P92.20–P92.22	480	○
P92.22	Setting of segmented roll diameter 15	Setting range: P92.21–P92.23	500	○
P92.23	Setting of segmented roll diameter 16	Setting range: P92.22–P92.24	520	○
P92.24	Setting of segmented roll diameter 17	Setting range: P92.23–P92.25	560	○
P92.25	Setting of segmented roll diameter 18	Setting range: P92.24–P92.26	600	○
P92.26	Setting of segmented roll diameter 19	Setting range: P92.25–P92.27	620	○
P92.27	Setting of segmented roll diameter 20	Setting range: P92.26–P90.17	680	○
P92.28	Taper 1	Setting range: 0.00–100.00%	1.00%	○
P92.29	Taper 2	Setting range: 0.00–100.00%	3.00%	○
P92.30	Taper 3	Setting range: 0.00–100.00%	5.00%	○
P92.31	Taper 4	Setting range: 0.00–100.00%	10.00%	○
P92.32	Taper 5	Setting range: 0.00–100.00%	15.00%	○
P92.33	Taper 6	Setting range: 0.00–100.00%	20.00%	○
P92.34	Taper 7	Setting range: 0.00–100.00%	25.00%	○
P92.35	Taper 8	Setting range: 0.00–100.00%	30.00%	○
P92.36	Taper 9	Setting range: 0.00–100.00%	32.00%	○
P92.37	Taper 10	Setting range: 0.00–100.00%	35.00%	○
P92.38	Taper 11	Setting range: 0.00–100.00%	38.00%	○
P92.39	Taper 12	Setting range: 0.00–100.00%	40.00%	○
P92.40	Taper 13	Setting range: 0.00–100.00%	42.00%	○
P92.41	Taper 14	Setting range: 0.00–100.00%	44.00%	○
P92.42	Taper 15	Setting range: 0.00–100.00%	46.00%	○
P92.43	Taper 16	Setting range: 0.00–100.00%	48.00%	○

Function code	Name	Description	Default	Modify
P92.44	Taper 17	Setting range: 0.00–100.00%	50.00%	○
P92.45	Taper 18	Setting range: 0.00–100.00%	52.00%	○
P92.46	Taper 19	Setting range: 0.00–100.00%	54.00%	○
P92.47	Taper 20	Setting range: 0.00–100.00%	56.00%	○
P92.48–P92.50	Reserved	-	-	-

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