Operation Manual

Goodrive350-19 Series
VFD for Hoisting

SHENZHEN INVT ELECTRIC CO., LTD.

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1.	First release	V1.0	March 2020

Preface

Thank you for choosing Goodrive350-19 series variable-frequency drives (VFDs) for hoisting.

Goodrive350-19 series VFDs are the new generation of VFDs that INVT develops for hoisting machinery by using advanced control technologies based on more than ten-year accumulative hoisting-industry experience. The VFDs achieve excellent torque performance by integrating various special functions, including brake control, zero servo, quick stop, master/slave control, switchover between three sets of motor parameters, pre-magnetizing, light-load speed acceleration, rope detection, and travel limit, to ensure the safety, reliability, and high efficiency of the machinery. The VFDs can be widely used to drive the mechanisms such as about lifting, tilting, luffing, running, slewing, and grabbing in hoisting machinery.

In order to meet diversified customer demands, Goodrive350-19 series VFDs are compatible with abundant extension cards including hoisting process cards, PG cards, communication cards, and I/O extension cards to achieve various functions as needed. Each VFD can be configured with up to three extension cards.

PG cards support common encoders such as incremental encoders, resolver-type encoders, and sine-cosine encoders, but also support pulse reference and frequency-division output. PG cards improve EMC performance for the use of digital filter technology and thus realize stable receiving of encoder signal over long distance. PG cards also have the encoder disconnection detection function, which relieves the impact of system faults.

Goodrive350-19 series VFDs support mainstream bus and control automation communication modes, including Modbus, CANopen, Profibus-DP, Profinet, and EtherCAT, and thus can be seamlessly interconnected with various hoist control systems. The VFDs can be connected to the internet with wireless communication cards, allowing you to monitor VFD status on mobile APP anytime anywhere.

Goodrive350-19 series VFDs use high power density design. The VFDs in some power ranges carry built-in DC reactors and braking units, saving installation space. The VFDs can satisfy the low noise and low electromagnetic interference requirements for the overall EMC design. In addition, the VFDs can withstand challenging grid, temperature, humidity, and dust conditions, greatly enhancing product reliability.

This operation manual instructs you how to install, wire, set parameters for, diagnose and remove faults for, and maintain Goodrive350-19 series VFDs, and also lists related precautions. Before installing a Goodrive350-19 VFD, read through this manual carefully to ensure the proper installation and running with the excellent performance and powerful functions into full play.

If the product is ultimately used for military affairs or manufacture of weapons, it will be listed on the export control formulated by the *Foreign Trade Law of the People's Republic of China*. Rigorous review and necessary export formalities are needed when the product is exported.

INVT reserves the right to update the manual information without prior notice.

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1 Safety precautions

1.1 What this chapter contains

Read the manual carefully before moving, installing, running and servicing the VFD, and follow all safety precautions contained. Otherwise, device damage or personal injury or even death can result.

We are not liable or responsible for any device damage or personal injury or death caused by you or your customers due to your ignorance of the safety precautions.

1.2 Safety definition

Danger: Severe personal injury or even death can result if related requirements are not followed.

Warning: Personal injury or device damage can result if related requirements are not followed.

Note: Actions taken to ensure proper running.

Qualified electricians: People working on 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.

1.3 Warning symbols

Warnings caution you about conditions that can result in severe injury or death and/or device damage and advice on how to prevent dangers. The following table lists the warning symbols in this manual.

Symbol	Name	Description	Abbreviation
Danger	Danger	Severe personal injury or even death can result if related requirements are not followed.	
Warning	Warning	Personal injury or device damage can result if related requirements are not followed.	
Do not	Electrostatic sensitive	PCBA board damage can result if related requirements are not followed.	
Hot sides	Hot sides	The VFD base may be hot. Do not touch.	
5 min	Electric shock	High voltage may be present in bus capacitors after power off. To prevent electric shock, wait at least 5 or 15 or 25 minutes (depending on the VFD warning symbol) before operating the VFD that is just powered off.	5 min
	Read manual	Read the manual before operating.	
Note	Note	Actions to ensure proper running.	**Note**

1.4 Safety guidelines

✧ Only trained and qualified electricians can operate the VFD.

✧ Do not perform any wiring, inspection, or component changing when power is applied. Ensure all input power supplies are disconnected before wiring or checking, and always wait at least the time designated on the VFD or until the DC bus voltage is less than 36V. The following table lists the waiting time.

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

✧ Do not refit the VFD unless authorized; otherwise, fire, electric shock or other injuries may result.

✧ The heat sink base may become hot during running. Do not touch it; otherwise, burns may result.

✧ The electronic components inside the VFD are electrostatic sensitive. Take measurements to avoid electrostatic discharge during related operation.

1.4.1 Delivery and installation

✧ Install the VFD on fire-retardant material and keep the VFD away from combustible materials.

✧ Connect the optional braking parts (braking resistors, braking units or feedback units) according to the wiring diagram.

✧ Do not run a damaged or incomplete VFD.

✧ Do not touch the VFD with wet items or body parts; otherwise, electric shock may result.

Note:

- Select appropriate tools for delivery and installation to ensure proper VFD running and prevent accidents. To ensure physical safety, take mechanical protective measures such as wearing safety shoes and working uniforms.
- Prevent the VFD from physical shock or vibration during delivery and installation.
- Do not carry the VFD only by its front cover as the cover may fall off.
- Install the VFD far away from children and other public places.
- Use the VFD in proper environments. (For details, see the installation environment.)
- Prevent screws, cables and other conductive parts from falling into the VFD.

- As the leakage current during VFD 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 output terminals for motors. Connect the input power cables and motor cables properly; otherwise, VFD damage may result.

1.4.2 Commissioning and running

	✧ Disconnect all power sources applied to the VFD before terminal wiring, and wait at least the time designated on the VFD after disconnecting the power sources. ✧ High voltage presents inside the VFD during running. Do not carry out any operation on the VFD during running except for keypad setup. For 3PH AC 660V VFD models, the control terminals form extra-low voltage circuits. Therefore, you need to prevent the control terminals from connecting to accessible terminals of other devices. ✧ The VFD may start up by itself when P01.21 is set to 1 (restart after power cut). Do not get close to the VFD and motor. ✧ The VFD cannot be used as "Emergency-stop device". ✧ The VFD cannot act as an emergency brake for the motor; it is a must to install mechanical brake device. ✧ During driving a permanent-magnet synchronous motor, besides above-mentioned items, the following work must be done before installation and maintenance. a) Disconnect all the input power sources including main power and control power. b) Ensure the permanent-magnet synchronous motor has been stopped, and the voltage on output end of the VFD is lower than 36V. c) After the permanent-magnet synchronous motor is stopped, wait at least the time designated on the VFD, and ensure the voltage between "+" and "-" is lower than 36V. d) During operation, it is a must to ensure the permanent-magnet synchronous motor cannot run again by the action of external load; it is recommended to install effective external brake devices or disconnect the direct electrical connection between permanent-magnet synchronous motor and the VFD.

Note:

- Do not switch on or switch off input power sources of the VFD frequently.
- If the VFD has been stored without use for a long time, perform capacitor reforming (described in Maintenance), inspection and pilot run for the VFD before using the VFD.
- Close the front cover before VFD running; otherwise, electric shock may occur.

1.4.3 Maintenance and component replacement

	✧ Only well-trained and qualified professionals are allowed to perform maintenance, inspection, and component replacement on the VFD. ✧ Disconnect all the power sources applied to the VFD before terminal wiring, and wait at least the time designated on the VFD after disconnecting the power sources. ✧ Take measures to prevent screws, cables and other conductive matters from falling into the VFD during maintenance and component replacement.

Note:

- Use proper torque to tighten the screws. (For details, see "Recommended cable sizes".)
- Keep the VFD and its parts and components away from combustible materials during maintenance and component replacement.
- Do not carry out insulation voltage-endurance test on the VFD, or measure the control circuits of the VFD with megameter.
- Take proper anti-static measures on the VFD and its internal parts during maintenance and component replacement.

1.4.4 Disposal of a scrap VFD

	✧ The VFD contains heavy metal. Dispose of a scrap VFD as industrial waste.
	✧ When the life cycle ends, the VFD should enter the recycling system. Dispose of it separately at an appropriate collection point instead of placing it in the normal waste stream.

2 Quick startup

2.1 What this chapter contains

This chapter introduces the basic installation and commissioning rules that you need to follow to realize quick installation and commissioning.

2.2 Unpacking inspection

Check the following after receiving the product.

● Whether the packing box is damaged or dampened.
● Whether the model identifier on the exterior surface of the packing box is consistent with the purchased model.
● Whether the interior surface of the packing box is abnormal, for example, in wet condition, or whether the enclosure of the VFD is damaged or cracked.
● Whether the VFD nameplate is consistent with the model identifier on the exterior surface of the packing box.
● Whether the accessories (including the manual, control keypad, and extension card) inside the packing box are complete.

If any problems are found, contact the local dealer or INVT office.

2.3 Checking before use

Check the following before using the VFD.

● Mechanical type of the load to be driven by the VFD. Check whether the VFD will be overloaded in actual running and whether the VFD power class needs to be increased.
● The actual running current of the loaded motor is less than the rated current of the VFD.
● The control accuracy required by actual load is the same as that provided by the VFD.
● The grid voltage is consistent with the rated voltage of the VFD.
● Whether required functions can only be implemented with extension card configuration.

2.4 Environment checking

Check the following before installing the VFD. Note that the ambient temperature of a cabinet-built VFD is the air temperature inside the cabinet.

● Whether the ambient temperature in the application is higher than 40°C. If yes, derate the current by 2% for every 1°C temperature increase. Do not use the VFD in environments where the temperature is higher than 50°C.
● Whether the ambient temperature is lower than -10°C. If yes, configure a heating device.
● Whether the VFD installation altitude is higher than 1000 meters. If yes, derate the current by 1% for every increased 100 meters.
● Whether the ambient humidity is higher than 90% or condensation occurs. If yes, take more protective measures.

● Whether there is direct sunlight or biological invasion in the environment where the VFD is to be used. If yes, take more protective measures.
● Whether there is dust or inflammable and explosive gas in the environment where the VFD is to be used. If yes, take more protective measures.

2.5 Checking after installation

Check the following after the VFD installation is complete.

● Whether the input power cables and motor cables meet the current-carrying capacity requirements of the actual load.
● Whether the peripheral accessories are correctly selected and properly installed, and whether the installation cables meet the current-carrying capacity requirements of these accessories, including the input reactor, input filter, output reactor, output filter, DC reactor, braking unit, and braking resistor.
● Whether the VFD is installed on flame-retardant materials, and whether its accessories (such as the reactors and braking resistor) that generate heat are kept away from flammable materials.
● Whether all the control cables and power cables are separately wired and whether EMC specification requirements are taken into full account during the wiring.
● Whether all the grounding systems are properly grounded.
● Whether all VFD installation clearances of the meet the requirements stated in the manual.
● The installation mode of the VFD complies with the requirements in the manual. Vertical installation is recommended whenever possible.
● Whether the external wiring terminals are tightened, and whether the torque meets the requirements.
● Take protective measures to ensure that no screws, cables, or other conductive objects drop into the VFD.

2.6 Basic commissioning

Do as follows to complete basic commissioning before the use:

1. Select the motor type, set motor parameters and select VFD control modes according to actual motor parameters.
2. Check whether autotuning is needed. If possible, disconnect the motor load to perform dynamic parameter autotuning. If the load cannot be disconnected, perform static autotuning.
3. Adjust the acceleration and deceleration time based on actual load working conditions.
4. Perform jogging to carry out device commissioning. Check whether the motor rotational direction is consistent with the required direction. If no, you are advised to change the motor rotational direction by exchanging the motor wiring of any two phases.
5. Set all the control parameters, and carry out actual running.

3 Product overview

3.1 What this chapter contains

This chapter introduces the VFD running principles, features, layout, nameplate, and model instructions.

3.2 Basic principle

Goodrive350-19 series VFDs are used to control asynchronous AC induction motors and permanent-magnet synchronous motors. The following lists the main circuit diagrams of the VFDs. The rectifier converts 3PH AC voltage into DC voltage, and the capacitor bank of intermediate circuit stabilizes the DC voltage. The inverter converts DC voltage into the AC voltage used by an AC motor. When the circuit voltage exceeds the upper limit, the external braking resistor is connected to the intermediate DC circuit to consume the feedback energy.

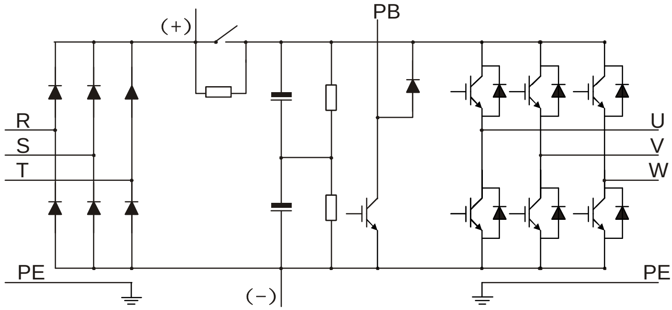


Figure 3.1 Main circuit diagram for 380V 15kW or lower VFD models

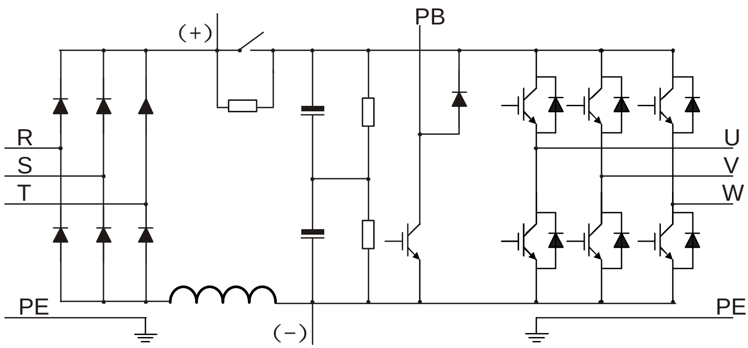


Figure 3.2 Main circuit diagram for 380V 18.5kW–110kW VFD models

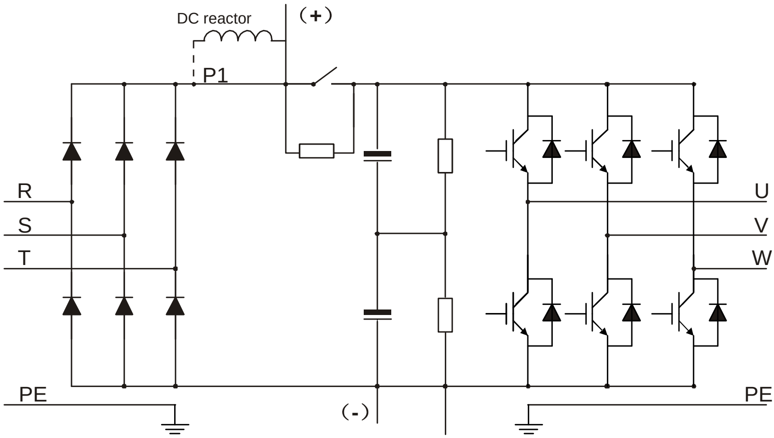


Figure 3.3 Main circuit diagram for 380V 132kW or higher VFD models

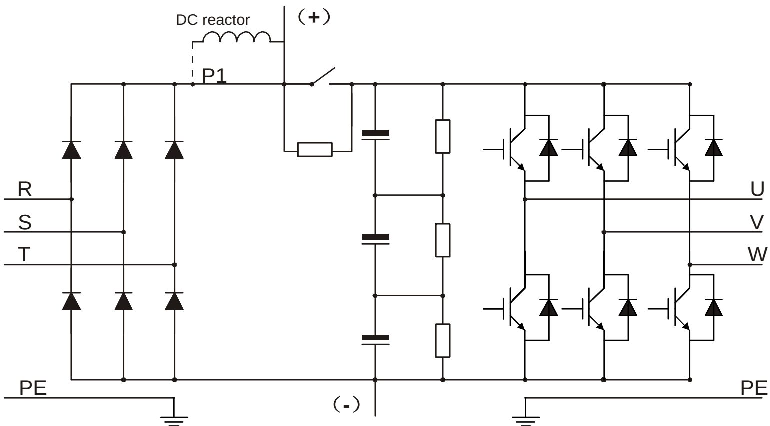


Figure 3.4 Main circuit diagram for 660V VFD models

Note:

- The 132kW or higher VFD models support connection to external DC reactors, but before the connection, you must remove the short-connection copper bar between P1 and (+). The 132kW or higher VFD models also support connection to external braking units. Both DC reactor and braking unit are optional parts.
- DC reactors have been built in the 18.5kW–110kW VFD models.
- Braking units have been built in the 110kW and lower VFD models. The VFD models with built-in

braking units support connection to external braking resistors. Braking resistors are optional parts.

- All the 660V VFD models support connection to external DC reactors, but before the connection, you must remove the short-connection copper bar between P1 and (+). The 660V VFD models also support connection to external braking units. Both DC reactor and braking unit are optional parts.

3.3 Product specifications

Table 3.1 Product specifications

Function		Specification
Power 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 "Product ratings".
	Input frequency (Hz)	50Hz or 60Hz, allowable range: 47–63Hz
	Input power factor	30–110kW≥0.9
Power output	Output voltage (V)	0–Input voltage
	Output current (A)	See "Product ratings".
	Output power (kW)	See "Product ratings".
	Output frequency (Hz)	0–150Hz
Technical control performance	Control mode	SVPWM control, SVC, and VC
	Motor type	Asynchronous motor (AM) and permanent magnetic synchronous motor (SM)
	Speed ratio	1: 200 (SVC) 1: 1000 (VC)
	Speed control accuracy	±0.2% (SVC) ±0.02% (VC)
	Speed fluctuation	± 0.3% (SVC) ± 0.02% (VC)
	Torque response	<20ms (SVC) <10ms (VC)
	Torque control accuracy	10% (SVC) 5% (VC)
	Starting torque	For AMs: 0.25Hz/150% (SVC) For SMs: 2.5 Hz/150% (SVC) 0Hz/200% (VC)
	Overload capacity	150% for 1 minute, 180% for 10 seconds, and 200% for 1

Function		Specification
		second.
	Braking capacity	100% for long time, 120% for 1 minute, and 170% for 10 seconds
Running control performance	Frequency setting method	Settings can be implemented through digital, analog, pulse frequency, multi-step speed running, graded multi-step speed reference, simple PLC, PID, MODBUS communication, PROFIBUS communication and so on. Settings can be combined and the setting channels can be switched.
	Automatic voltage regulation	The output voltage can be kept constant although the grid voltage changes.
	Fault protection	More than 30 protection functions, such as protection against overcurrent, overvoltage, undervoltage, overtemperature, phase loss, and overload.
Special purpose functions	Braking protection	The 30–110 kW VFD models provide the function of protecting against braking resistor short connection, braking unit short connection, and PB-PE short connection.
	Brake control	Embedded with hoisting-oriented brake logic, and integrated with the torque verifying, brake feedback, zero position detection, restart after braking functions, which meet the industrial standards on the VFDs for hoisting.
	Conical motor control	Special V/F curves are used to adjust voltage. During startup, the magnetic flow is increased to release the brake. During stop, the magnetic flow is decreased to close the brake.
	Light load speed boost	In closed-loop mode, the speed can be boosted and limited at constant power status, and the speed is limited in stepped way. In open-loop mode, if the simplified speed boost way is used, the speed boosts to the set frequency in light load status; if the speed is boosted or limited in constant power status, the speed is limited in stepped way.
	Zero servo	In closed-loop mode, if the VFD detects load downward slip, the VFD automatically enters the zero servo state and outputs a brake failure alarm. When a level-2 fault occurs, if load downward slip occurs, the VFD automatically resets the fault, enters the zero servo state, and outputs a brake failure alarm.
	Loose rope protection (only in closed-loop	Upward loose rope protection: If the speed limiting in loose rope state is detected, the speed limiting is cancelled when timeout occurs or load is held.

Function		Specification
	mode)	Downward loose rope protection: If the loose rope state is detected, the VFD reports a fault or alarm.
	Upward or downward position limit	The function is used to limit the hoist to run within the specified range. The VFD enables emergency stop and reports an alarm once the range is exceeded.
	Upward or downward DEC position	When the deceleration signal is valid, the running speed of the hoist is limited once the hoist runs within the slow speed area. The function also features uni-directional speed limit. For example, only the upward running speed is limited when the hoist runs within the upward slow speed area.
	Load position	In closed-loop mode, the encoder is used to obtain load position information.
	Master/slave control	Including power balance and speed synchronization between the master and slave.
	Hoisting application macro	Including lifting, horizontal moving, construction hoist, and tower crane rotating, and user-defined application macros.
	Lifting and horizontal moving switchover	Three groups of motor parameters, control modes, and application macros can be switched.
	Frequency derating with voltage	When the bus voltage is continuously low, the reference frequency is decreased to keep the normal output torque of VFD.
	Low voltage protection	When the bus voltage decrease transiently or the VFD quickly stops due to power outage, the function is used to ensure the hook does not slip. The low voltage protection function is automatically disabled once the bus voltage restores to the normal state.
	Low-speed running protection	The VFD reports the low-speed running protection fault when the low-speed running time exceeds the allowed time. The prevents the axial cooling motor from being damaged due to overheating caused by long-time running.
	Overload protection	In closed-loop mode, when overload occurs, upward lifting is restricted.
	Turbulence control	HDO outputs PWM waves to directly control turbulence.
	Brake feedback	When the brake control signal is inconsistent with the brake feedback signal, the VFD handles the inconsistency according to the brake status to ensure safety.

Function		Specification
	Zero position detection	The zero position signal and running signal are mutually exclusive.
	Torque verification	The VFD verifies the current or torque before brake release. The VFD performs brake release when the verification succeeds, and the VFD reports the verification fault when the verification fails.
	One key open/closed loop switchover	The closed-loop control mode can be switched to the open-loop control mode through terminals. When the encoder is faulty, the open-loop control mode can be used. The switchover can get response only in stopped state but not in running state.
	Jogging	After receiving a jogging command, the VFD can automatically start, run, and stop at the preset running frequency and time according to the settings. During the process, the brake can be normally opened or closed under the control of VFD, ensuring the stability without hook slip or exception when the crane starts or stops.
	Smooth lifting	In high-speed lifting mode, the high speed is limited at the moment of steel rope straightening, reducing the impact caused by the sudden load to the hoist at the lifting start.
	Set frequency exception protection	If the set frequency is lower than the threshold after the brake is opened, the VFD reports the set frequency exception, which prevents slip caused by insufficient force at low speed.
	Motor overheat protection	The I/O extension card can receive motor temperature sensor input (PT100, PT1000 and PTC).
Peripheral interface	Terminal analog input resolution	No greater than 20mV
	Terminal digital input resolution	No greater than 2ms
	Analog input	Two inputs, 0–10V/0–20mA for AI1, -10–10V for AI2
	Analog output	One output: AO1; range: 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 terminal

<table>
<tr><th colspan="2">Function</th><th>Specification</th></tr>
<tr><td rowspan="2"></td><td></td><td>RO2A NO, RO2B NC, RO2C common terminal
Contact capacity: 3A/250VAC, 1A/30VDC</td></tr>
<tr><td>Extension interface</td><td>Three extension interfaces: SLOT1, SLOT2, SLOT3
Extensible PG card, programmable extension card, communication card, I/O card, and so on
Note:
· You can install extension cards (optional) for 1.5–5.5kW VFD models and you are recommended to install them at slot 2.
· I/O extension card 2 has been installed at slot 3 for 7.5kW and higher VFD models as standard configuration.</td></tr>
<tr><td rowspan="4">I/O extension card 2</td><td>Relay output</td><td>Two programmable relay outputs
RO3A NO, RO3C common terminal
RO4A NO, RO4C common terminal
Contact capacity: 3A/250VAC, 1A/30VDC</td></tr>
<tr><td>Digital input</td><td>Four regular inputs, supporting PTC input during DC power supply, and the PTC acting at 2.5kΩ, but not supporting PTC input during AC power supply;
Internal impedance: 6.6kΩ;
Max. input frequency: 1kHz;
Supporting the internal power 24V;
Supporting the voltage input of external power (-20%)24–48VDC(+10%) and (-10%)24–48VAC(+10%);
Bidirectional input terminals, simultaneously supporting NPN and PNP connection methods</td></tr>
<tr><td>PT100 input</td><td rowspan="2">Independent PT100 and PT1000 input:
Resolution: 1°C
Range: -20°C–150°C
Detection precision: ±3°C
Supporting offline protection</td></tr>
<tr><td>PT1000 input</td></tr>
<tr><td rowspan="4">Other</td><td>Installation method</td><td>Wall mounting, floor mounting, or flange mounting</td></tr>
<tr><td>Temperature of running environment</td><td>-10–50°C
Derating is required if the ambient temperature exceeds 40°C.</td></tr>
<tr><td>IP rating</td><td>IP20</td></tr>
<tr><td>Pollution degree</td><td>Degree 2</td></tr>
</table>

Function		Specification
	Cooling method	Forced air cooling
	DC reactor	DC reactors have been built in 380V 18.5–110kW VFD models as standard configuration. DC reactors are optional parts for 380V 132kW and higher models and for 660V models and can be externally connected.
	Braking unit	Braking units have been built in 380V 110kW and lower VFD models as standard configuration. Braking units are optional parts for 660V models and can be externally connected.
	EMC filter	C3 filters are optional parts and can be built in VFDs. If C3 filters are required, connect the jumper J10. After C3 filters are configured, the VFDs can meet IEC61800-3 C3 requirements. External filters can be configured to meet IEC61800-3 C2 requirements.

Table 3.2 Dedicated functions

Function			Control method		
Dedicated function	Mode		V/F	SVC	VC
	Brake control	Brake control	√	√	√
		Restart after braking	√	√	√
		Brake feedback	√	√	√
		Zero position detection	√	√	√
		Current verification	√		
		Torque verification		√	√
		Brake slip verification			√
		Speed deviation detection	√	√	√
		Jogging	√	√	√
		Set frequency exception protection	√	√	√
	Torque control	Torque control		√	√
		Pre torque		√	√
	Conical motor	Conical motor control	√		
	Light load speed boost	Simplified speed boost mode	√	√	
		Constant power speed boost			√
		Constant power speed limit			√
		Stepped speed limit			√
	Safety function	STO	√	√	√

Function			Control method		
		Zero servo			√
		Loose rope protection			√
		Stable lifting protection			√
		Upward and downward limit	√	√	√
		Upward and downward DEC limit	√	√	√
		Overload protection			√
	Master/slave control	Speed synchronization	√	√	√
		Power balance	√	√	√
		Position synchronization			√
	Other	Load position			√
		Motor parameter switchover	√	√	√
		Turbulence control	√	√	√
		Motor temperature protection	√	√	√
		CVCF function	√		

3.4 Product nameplate

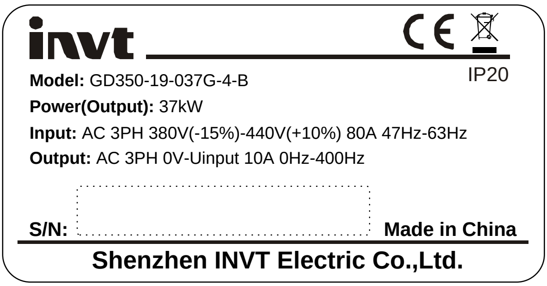


Figure 3.5 Product nameplate

Note: This is a nameplate example for standard Goodrive350-19 VFD models. The markings such as "CE" and "IP20" on the nameplate vary depending on actual certification status.

3.5 Model designation code

A model designation code contains product information. You can find the model designation code on the VFD nameplate and simplified nameplate.

GD350-19-037G-4-B

① ② ③ ④

Figure 3.6 Model description

No.	Description	Example
①	Abbreviation of product series	GD350-19: Goodrive350-19 series VFD for hoisting
②	Power range + load type	037: 37kW G: Constant torque load
③	Voltage class	4: AC 3PH 380V(-15%)–440V(+10%) 6: AC 3PH 520V(-15%)–690V(+10%)
④	Built-in braking unit	B: Built-in braking unit Empty: No built-in braking unit

3.6 Product ratings

Table 3.3 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Output power (kW)	Input current (A)	Output current (A)
GD350-19-1R5G-4-B	1.5	5.0	3.7
GD350-19-2R2G-4-B	2.2	5.8	5
GD350-19-004G-4-B	4	13.5	9.5
GD350-19-5R5G-4-B	5.5	19.5	14
GD350-19-7R5G-4-B	7.5	25	18.5
GD350-19-011G-4-B	11	32	25
GD350-19-015G-4-B	15	40	32
GD350-19-018G-4-B	18.5	41	38
GD350-19-022G-4-B	22	48	45
GD350-19-030G-4-B	30	58	60
GD350-19-037G-4-B	37	72	75
GD350-19-045G-4-B	45	88	92
GD350-19-055G-4-B	55	106	115
GD350-19-075G-4-B	75	139	150
GD350-19-090G-4-B	90	168	180
GD350-19-110G-4-B	110	201	215
GD350-19-132G-4	132	265	260
GD350-19-160G-4	160	310	305
GD350-19-185G-4	185	345	340
GD350-19-200G-4	200	385	380
GD350-19-220G-4	220	430	425
GD350-19-250G-4	250	485	480
GD350-19-280G-4	280	545	530
GD350-19-315G-4	315	610	600
GD350-19-355G-4	355	625	650
GD350-19-400G-4	400	715	720
GD350-19-450G-4	450	840	820
GD350-19-500G-4	500	890	860

Note:

- The input current of 1.5–500kW VFD models is measured in cases where the input voltage is 380V without an additional reactor.
- The rated output current is the output current corresponding to 380V output voltage.
- Within the allowable input voltage range, the output current and power cannot exceed the rated output current and power.

Table 3.4 AC 3PH 520V (-15%) – 690V (+10%)

VFD model	Output power (kW)	Input current (A)	Output current (A)
GD350-19-022G-6	22	35	27
GD350-19-030G-6	30	40	35
GD350-19-037G-6	37	47	45
GD350-19-045G-6	45	52	52
GD350-19-055G-6	55	65	62
GD350-19-075G-6	75	85	86
GD350-19-090G-6	90	95	98
GD350-19-110G-6	110	118	120
GD350-19-132G-6	132	145	150
GD350-19-160G-6	160	165	175
GD350-19-185G-6	185	190	200
GD350-19-200G-6	200	210	220
GD350-19-220G-6	220	230	240
GD350-19-250G-6	250	255	270
GD350-19-280G-6	280	286	300
GD350-19-315G-6	315	334	350
GD350-19-355G-6	355	360	380
GD350-19-400G-6	400	411	430
GD350-19-450G-6	450	445	465
GD350-19-500G-6	500	518	540
GD350-19-560G-6	560	578	600
GD350-19-630G-6	630	655	680

Note:

- The input current of 22–350kW VFD models is measured in cases where the input voltage is 660V without DC reactors or input or output reactors.
- The input current of 400–630kW VFD models is measured in cases where the input voltage is 660V with input reactors.
- The rated output current is the output current corresponding to 660V output voltage.

- Within the allowable input voltage range, the output current and power cannot exceed the rated output current and power.

3.7 Structural diagram

The VFD structure is shown in the following figure (using the 380V 30kW VFD as an example):

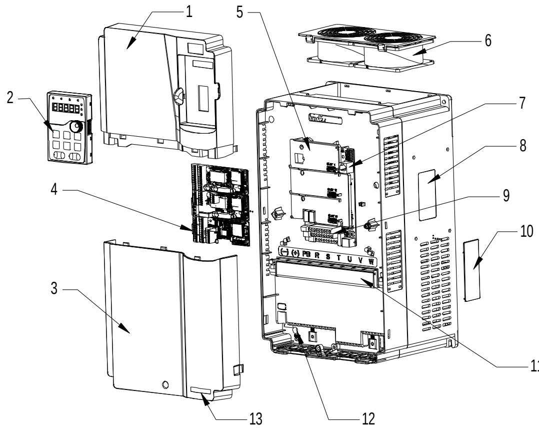


Figure 3.7 Structural diagram

No.	Part	Description
1	Upper cover	Used to protect internal components.
2	Keypad	For details, see "Keypad".
3	Lower cover	Used to protect internal components.
4	Extension card	Optional. For details, see "Extension cards".
5	Control board baffle	Used to protect the control board and install extension cards.
6	Cooling fan	For details, see "Maintenance".
7	Keypad interface	Used to connect the keypad.
8	Nameplate	For details, see "Product nameplate".
9	Control terminals	For details, see "Installing".
10	Ventilation hole cover	Optional. Using the ventilation hole cover can enhance the protection rating but also increase the internal temperature, which requires derating.
11	Main circuit terminals	For details, see "Installing".
12	POWER indicator	Indicator of the power supply.
13	GD350-19 product series label	For details, see "Model designation code".

4 Installing

4.1 What this chapter contains

This chapter introduces the mechanical and electrical installations of the VFD.

✧ Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Perform operations following the instructions presented in Safety precautions. Ignoring the safety precautions may result in device damage or injury or even death.

✧ Ensure the VFD power is disconnected before installation. If the VFD has been powered on, disconnect the VFD from the power, wait at least the time specified on the VFD, and ensure the POWER indicator is off. It is recommended that a multimeter should be used to check and ensure the VFD DC bus voltage is lower than 36V.

✧ VFD installation must be designed and performed according to applicable local laws and regulations. INVT is not liable or responsible for any installation that breaches local laws and regulations. If recommendations given by INVT are not followed, the VFD may experience problems that the warranty does not cover.

4.2 Mechanical installation

4.2.1 Installation environment

The VFD installation environment is essential for the VFD to run with best performance in long terms. Install the VFD in an environment compliant with the following requirements.

Environment	Condition
Installation site	Indoor
Ambient temperature	✧ -10–+50°C ✧ When the ambient temperature exceeds 40°C, derate by 1% for every temperature increase of 1°C. ✧ It is not recommended that the VFD be used when the ambient temperature exceeds 50°C. ✧ In order to ensure reliability, do not use the VFD in cases where the temperature changes rapidly. ✧ When the VFD is used in closed space such as a control cabinet, use the cooling fan or air conditioner to prevent the internal temperature from exceeding the allowed temperature. ✧ When the temperature is too low, install an external heating device before running the VFD that has been powered off for a long time, which eliminates the freeze inside the VFD. Otherwise, the VFD may be damaged.
Humidity	✧ The relative humidity (RH) of the air is less than 90%. ✧ Condensation is not allowed.

Environment	Condition
	✧ The max. RH cannot exceed 60% in the environment with corrosive gases.
Storage temperature	-30–+60°C
Running environment	The installation site must be: ✧ Away from electromagnetic radiation sources. ✧ Away from oil mist, corrosive gases and combustible gases. ✧ Protective from foreign materials such as metal powder, dust, oil, and water so that the foreign materials will not fall into the VFD. (Do not install the VFD on inflammables such as wood.) ✧ Away from radioactive substances and combustible objects. ✧ Away from harmful gases and liquids. ✧ With a low salt content density. ✧ No direct sunlight.
Altitude	✧ Lower than 1000m. ✧ When the altitude exceeds 1000m, derate by 1% for every increase of 100m. ✧ When the altitude exceeds 3000m, consult the local INVT dealer or local INVT office for details.
Vibration	The max. vibration amplitude cannot exceed 5.8m/s^2 (0.6g).
Installation direction	Install the VFD vertically to ensure good heat dissipation effect.

Note:

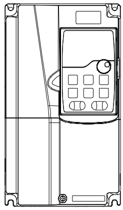
- GD350-19 series VFDs need to be installed in a clean and well-ventilated environment based on the enclosure IP rating.
- The cooling air must be clean enough and free from corrosive gases and conductive dust.

4.2.2 Installation direction

The VFD can be installed on the wall or in a cabinet.

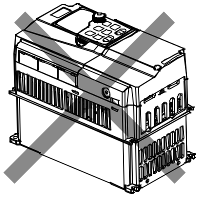
The VFD must be installed vertically. Check the installation position according to following requirements. For details about outline dimensions, see "Dimensional drawings".

OK



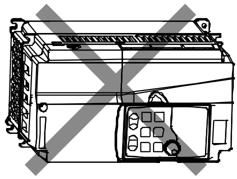
a. Vertical installation

NG



b. Horizontal installation

NG



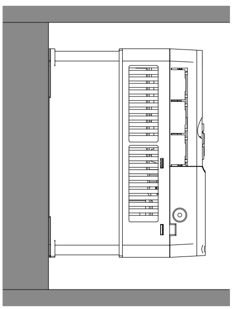
c. Lateral installation

Figure 4.1 VFD installation direction

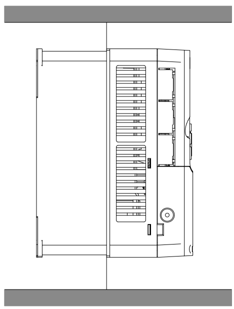
4.2.3 Installation methods

There are three installation methods by VFD outline dimensions:

- Wall mounting: applicable to the 380V 315kW and lower VFD models and the 660V 355kW and lower models.
- Flange mounting: applicable to the 380V 200kW and lower VFD models and the 660V 220kW and lower VFD models.
- Floor mounting: applicable to the 380V 220–500kW VFD models and the 660V 250–630kW VFD models.



Wall mounting



Flange mounting

Figure 4.2 Installation methods

Step 1 Mark the positions of the installation holes. For details about the positions, see the VFD outline dimension drawings in Appendix C.

Step 2 Mount the screws or bolts onto the marked positions.

Step 3 Place the VFD against the wall.

Step 4 Fasten the screws on the wall.

Note:

- When the flange mounting method is used, the (optional part) flange mounting plate is required for the 380V 1.5–75kW VFD models but not required for the 380V 90–200kW and 660V 22–220kW VFD models.
- The 380V 220–315kW and 660V 250–355kW VFD models support the (optional part) installation base, which can house an input AC reactor (or DC reactor) and an output AC reactor.

4.2.4 Installing one VFD

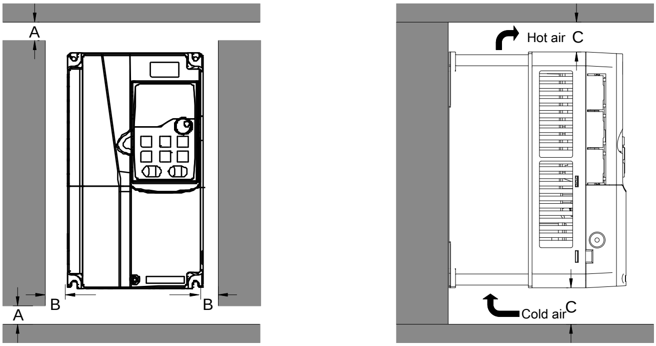


Figure 4.3 Installing one VFD

Note: For clearances B and C, each must be 100mm at least.

4.2.5 Installing multiple VFDs

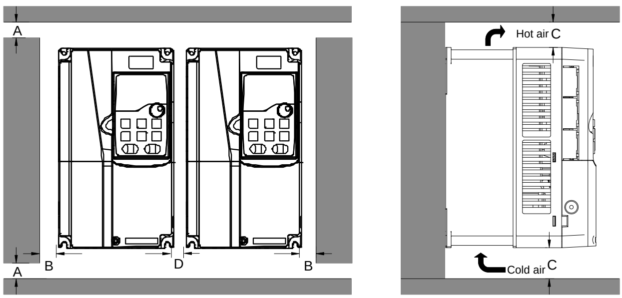


Figure 4.4 Installing multiple VFDs side by side

Note:

- If the VFDs are in different sizes, align the top of the VFDs for installation, which facilitates maintenance.
- For clearances B, D, and C, each must be 100mm at least.

4.2.6 Vertical installation

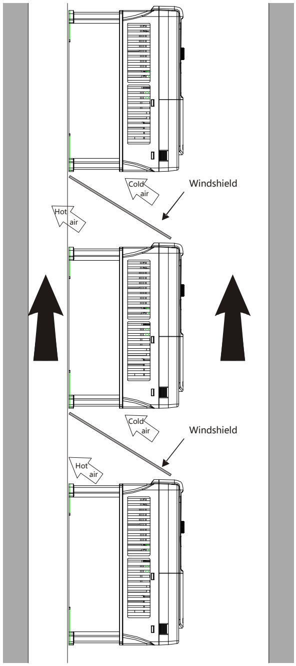


Figure 4.5 Vertical installation

Note: Windshields must be used for vertical installation. Otherwise, the VFDs experience mutual interference, degrading the heat dissipation performance.

4.2.7 Tilted installation

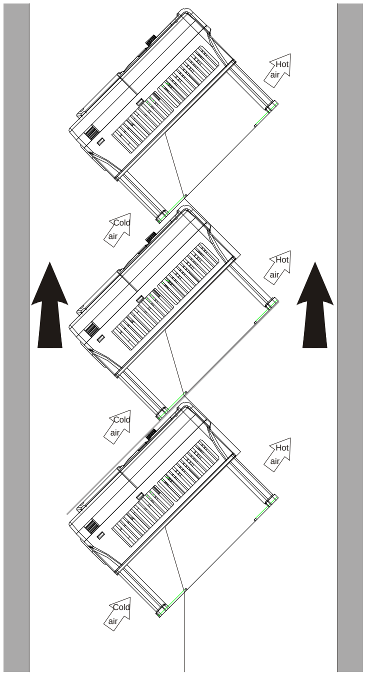


Figure 4.6 Tilted installation

Note: To prevent mutual interference in tilted installation, separate the air inlet ducts of the VFDs from the air outlet ducts of the VFDs.

4.3 Main circuit standard wiring

4.3.1 Main circuit wiring diagram

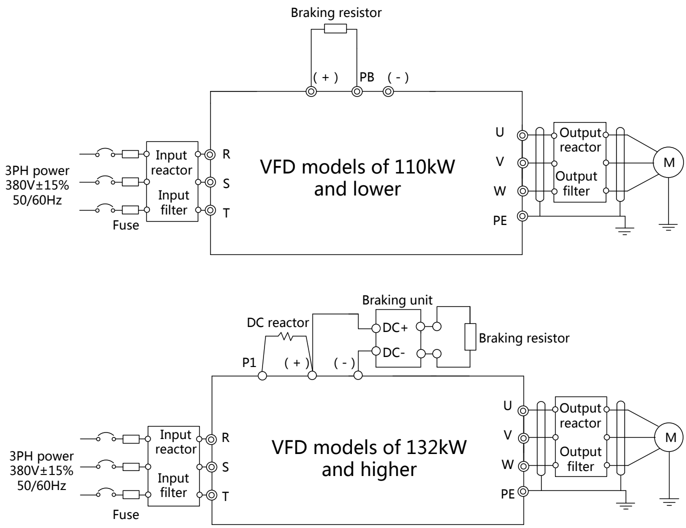


Figure 4.7 Main circuit wiring diagram for the VFD models of AC 3PH 380V(-15%)–440V(+10%)

Note:

- The fuse, DC reactor, braking unit, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. For details, see "Optional peripheral accessories".
- P1 and (+) have been short connected by default for the 380V 132kW and higher VFD models. If the VFD needs to connect to an external DC reactor, remove the short connector between P1 and (+).
- When the braking resistor needs to be connected, remove the yellow warning labels marked with PB, (+) and (-) from the terminal block before connecting the braking resistor wire. Otherwise, poor contact may result.

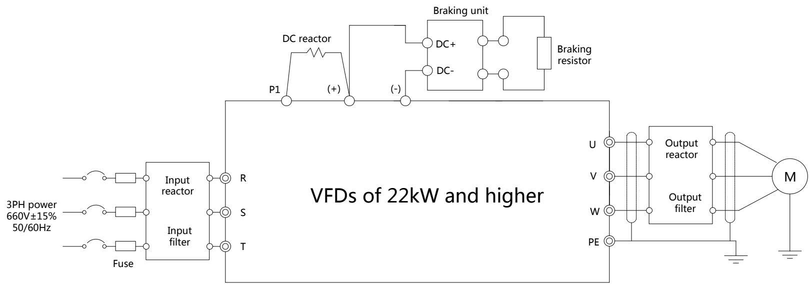


Figure 4.8 Main circuit wiring diagram for the VFD models of AC 3PH 520V(-15%)–690V(+10%)

Note:

- The fuse, DC reactor, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. For details, see "Optional peripheral accessories".
- P1 and (+) have been short connected by default. If the VFD needs to connect to an external DC reactor, remove the short connector between P1 and (+).
- When the braking resistor needs to be connected, remove the yellow warning labels marked with (+) and (-) from the terminal block before connecting the braking resistor wire. Otherwise, poor contact may result.

4.3.2 Main circuit terminal diagram

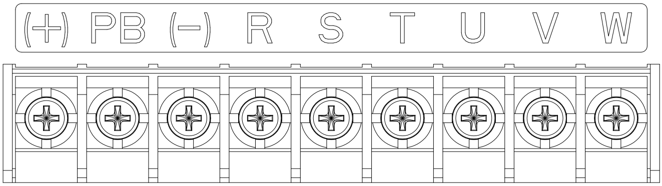


Figure 4.9 Main circuit terminal diagram for 3PH 380V 22kW and lower VFD models

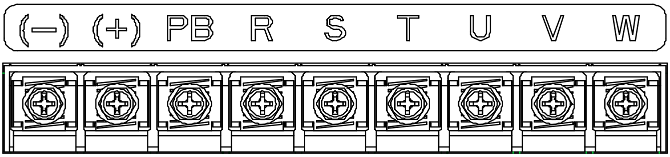


Figure 4.10 Main circuit terminal diagram for 3PH 380V 30–37kW VFD models

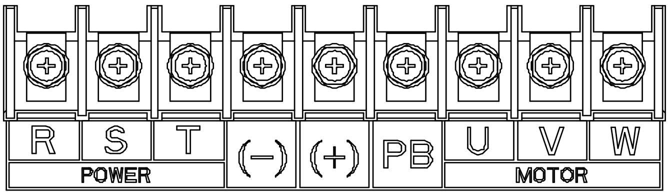


Figure 4.11 Main circuit terminal diagram for 3PH 380V 45–110kW VFD models

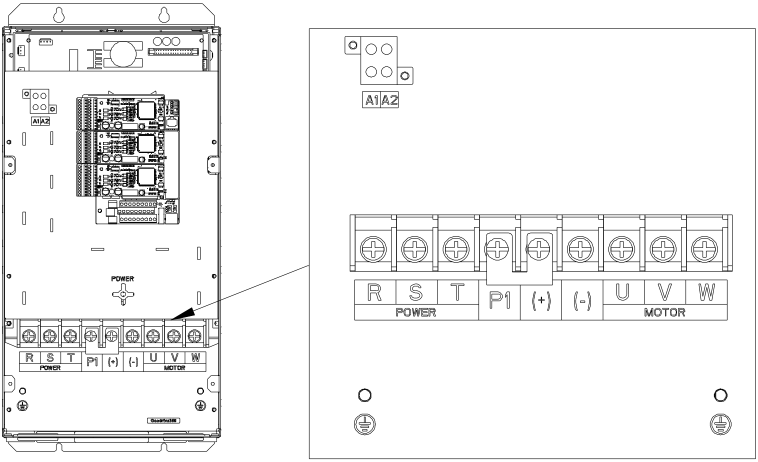


Figure 4.12 Main circuit terminal diagram for 660V 22–45kW VFD models

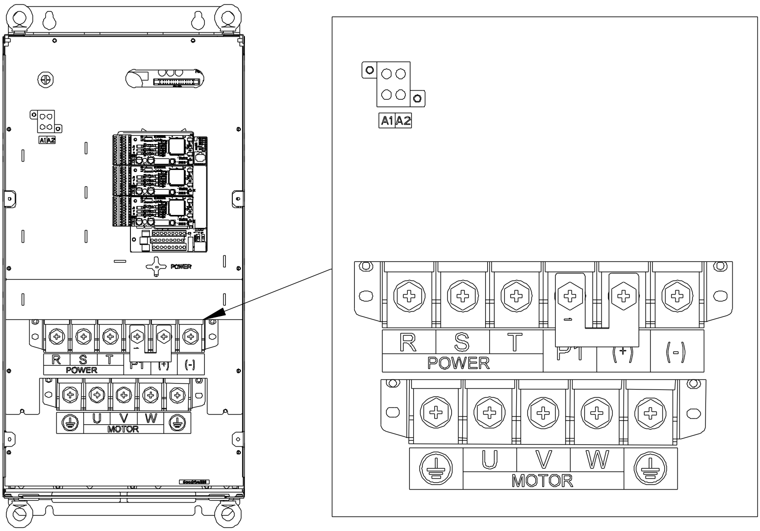


Figure 4.13 Main circuit terminal diagram for 660V 55–132kW VFD models

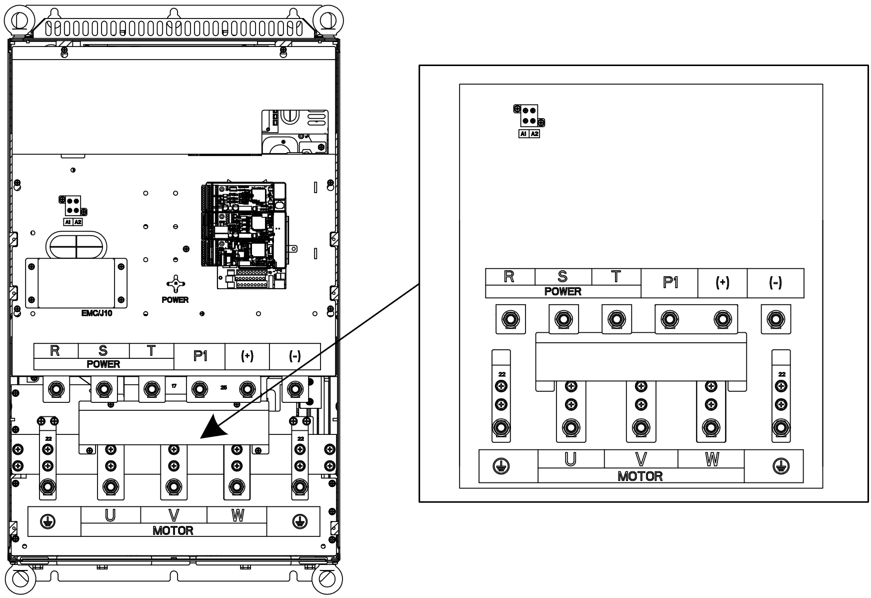


Figure 4.14 Main circuit terminal diagram for 380V 132–200kW and 660V 160–220kW VFD models

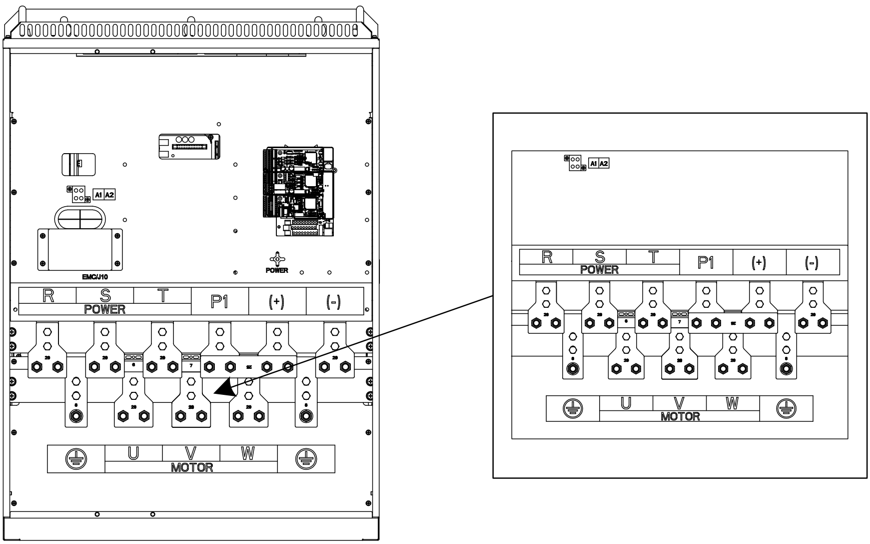


Figure 4.15 Main circuit terminal diagram for 380V 220–315kW and 660V 250–355kW VFD models

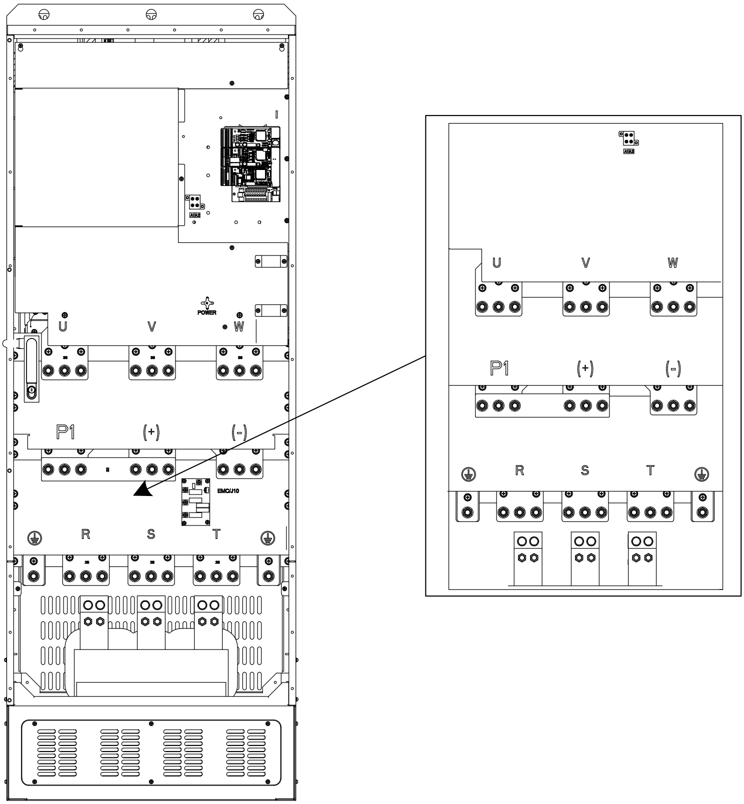


Figure 4.16 Main circuit terminal diagram for 380V 355–500kW and 660V 400–630kW VFD models

Sign	Terminal		Function description
	380V 110kW and lower	380V 132kW and higher 660V all series	
R, S, T	Main circuit power input		3PH AC input terminal, connected to the grid.
U, V, W	VFD output		3PH AC output terminal, connected to the motor in most cases.
P1	Not available	DC reactor terminal 1	P1 and (+) connect to external DC reactor terminals. (+) and (-) connect to external
(+)	Braking resistor terminal 1	DC reactor terminal 2 Braking unit terminal 1	
(-)	/	Braking unit terminal 2	

Sign	Terminal		Function description
	380V 110kW and lower	380V 132kW and higher 660V all series	
PB	Braking resistor terminal 2	Not available	braking unit terminals. PB and (+) connect to external braking resistor terminals.
PE	Grounding resistor less than 10Ω		Grounding terminal for safe protection; each machine must carry two PE terminals and proper grounding is required.

Note:

- Do not 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.
- Route the motor cable, input power cable and control cables separately.
- "Not available" means this terminal is not for external connection.

4.3.3 Wiring procedure of the main circuit terminals

1. Connect the ground wire of the input power cable to the PE terminal of the VFD, connect the 3PH input cable to the R, S and T terminals, and tighten up.
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.
3. Connect optional parts such as the braking resistor that carries cables to designated positions.
4. Fasten all the cables outside the VFD mechanically if allowed.

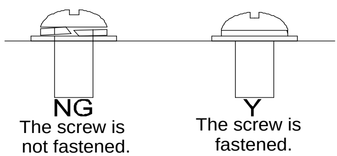


Figure 4.17 Screw installation diagram

4.4 Standard wiring of control circuit

4.4.1 Wiring diagram of basic control circuit

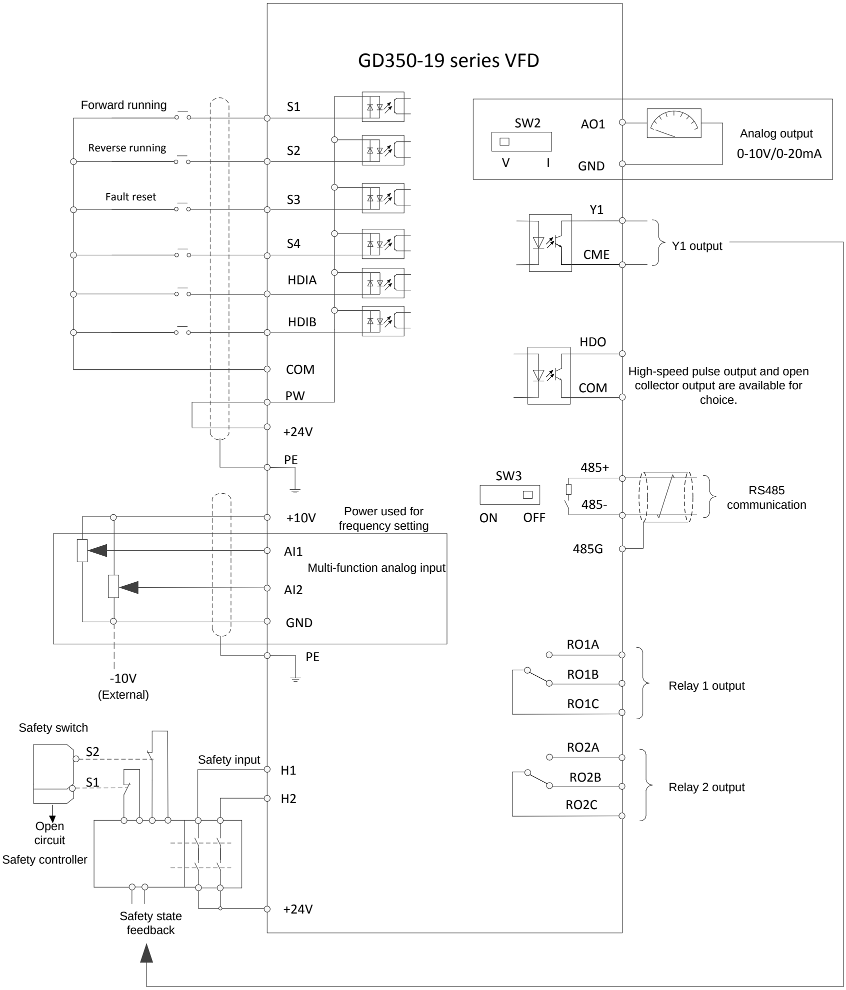


Figure 4.18 Wiring diagram of control circuit

Terminal name	Instruction
+10V	Locally provided +10.5V power supply
AI1	1. Input range: AI1 voltage/current can choose 0–10V / 0–20mA; AI2: -10V – +10V; 2. Input impedance: 20kΩ during voltage input; 250Ω during current input;
AI2	

<table>
<tr><th>Terminal name</th><th colspan="2">Instruction</th></tr>
<tr><td></td><td colspan="2">3. Whether the input is voltage or current is set through P05.50;
4. Resolution ratio: When 10V corresponds to 50Hz, the min. resolution ratio is 5mV;
5. Deviation: ±0.5% at 25°C, when input is above 5V/10mA.</td></tr>
<tr><td>GND</td><td colspan="2">+10.5V reference zero potential</td></tr>
<tr><td>AO1</td><td colspan="2">1. Output range: 0–10V or 0–20mA
2. Whether the output is voltage or current is set through the switch SW2
3. Deviation: ±0.5% at 25°C, when input is above 5V/10mA.</td></tr>
<tr><td>RO1A</td><td colspan="2" rowspan="3">RO1 relay output; RO1A is NO, RO1B is NC, RO1C is common terminal
Contact capacity: 3A/AC250V, 1A/DC30V</td></tr>
<tr><td>RO1B</td></tr>
<tr><td>RO1C</td></tr>
<tr><td>RO2A</td><td colspan="2" rowspan="3">RO2 relay output; RO2A is NO, RO2B is NC, RO2C is common terminal
Contact capacity: 3A/AC250V, 1A/DC30V</td></tr>
<tr><td>RO2B</td></tr>
<tr><td>RO2C</td></tr>
<tr><td>HDO</td><td colspan="2">1. Switch capacity: 200mA/30V
2. Range of output frequency: 0–50kHz
3. Duty ratio: 50%</td></tr>
<tr><td>COM</td><td colspan="2">Common terminal of +24V</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: 200mA/30V
Range of output frequency: 0–1kHz</td></tr>
<tr><td>485+</td><td colspan="2" rowspan="2">RS485 communication port, RS485 differential signal port and standard RS485 communication port must use twisted shielded pair; the 120ohm 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">Use to provide input digital working power from the external to the internal.
Voltage range: 12–30V</td></tr>
<tr><td>+24V</td><td colspan="2">User power provided by the VFD, maximum output current 200mA.</td></tr>
<tr><td>COM</td><td colspan="2">Common terminal of +24V</td></tr>
<tr><td>S1</td><td>Digital input 1</td><td rowspan="4">1. Internal impedance: 3.3kΩ
2. Accept 12–30V voltage input
3. Bi-directional input terminal, supporting NPN/PNP connection modes
4. Max. input frequency: 1kHz
5. All are programmable digital input terminals, the functions of which be set through function codes</td></tr>
<tr><td>S2</td><td>Digital input 2</td></tr>
<tr><td>S3</td><td>Digital input 3</td></tr>
<tr><td>S4</td><td>Digital input 4</td></tr>
<tr><td>HDIA</td><td colspan="2" rowspan="2">Besides S1–S4 functions, the terminals can also act as high frequency pulse input channels
Max. input frequency: 50kHz;
Duty ratio: 30%–70%;
Supporting quadrature encoder input; 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">1. Safe torque off (STO) redundant input, connected to the external NC contact. When the contact opens, STO acts and the VFD stops output;
2. Safety input signal wires use shielded wires whose length is within 25m;
3. The H1 and H2 terminals are short connected to +24V by default. Remove the short connectors from the terminals before using STO function.</td></tr>
<tr><td>+24V—H2</td><td>STO input 2</td></tr>
</table>

4.4.2 Input/output signal connection diagram

You can select the NPN/PNP mode and internal/external power through the U-type short connector. NPN internal mode is adopted by default.

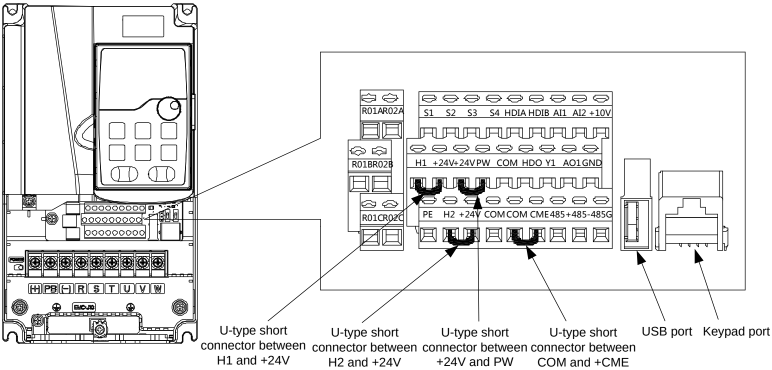
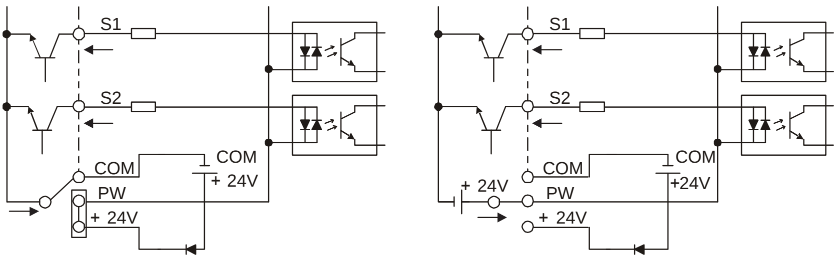


Figure 4.19 Position of U-type short connector

Note: As shown in Figure 4.19, 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 keypad of the VFD is used.

If input signal comes from NPN transistors, set the U-type short connector between +24V and PW based on the power used according to the following figure.



Internal power（NPN mode） External power（NPN mode）

Figure 4.20 NPN mode

If input signal comes from PNP transistor, set the U-type short connector based on the power used according to the following figure.

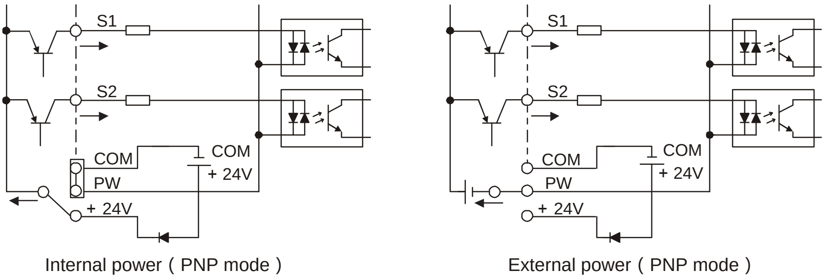


Figure 4.21 PNP mode

4.4.3 Control circuit wiring of I/O extension card 2

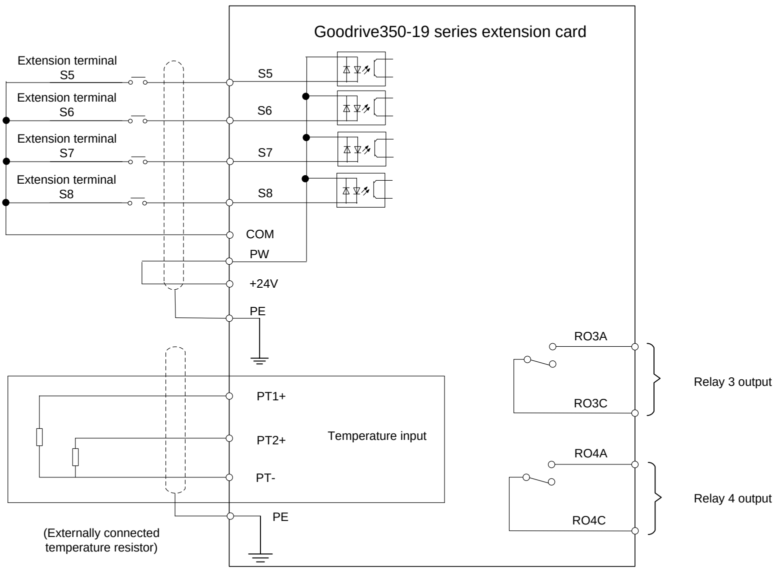


Figure 4.22 Control circuit wiring of I/O extension card 2

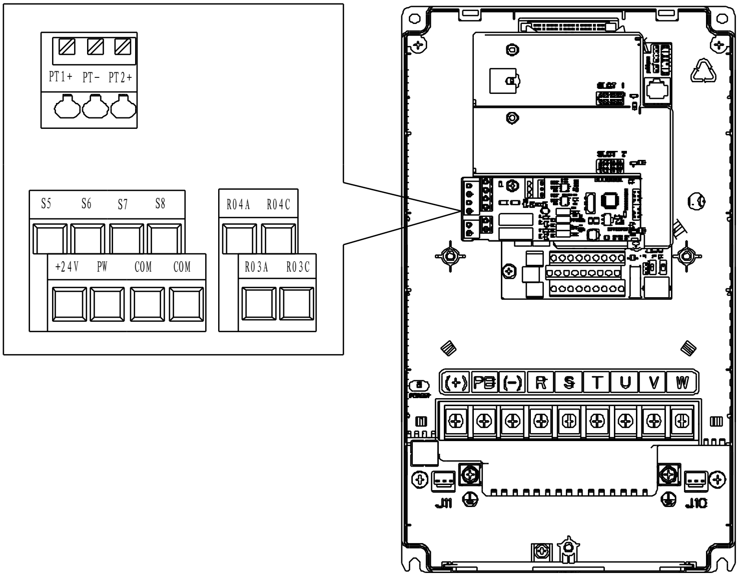


Figure 4.23 Terminal layout of I/O extension card 2

Terminal	Description
PT1+	Independent PT100 and PT1000 inputs: PT1+ connects to PT100 resistor, while PT2+ connects to PT1000 resistor 1. Resolution: 1°C 2. Range: -20°C–150°C 3. Detection precision: 3°C 4. Supporting disconnection protection
PT2+	
PT-	Reference zero potential of PT100/PT1000
RO3A	RO3 relay output; RO3A is NO, RO3C is common terminal Contact capacity: 3A/AC250V, 1A/DC30V
RO3C	
RO4A	RO4 relay output; RO4A is NO, RO4C is common terminal Contact capacity: 3A/AC250V, 1A/DC30V
RO4C	
PW	Used to provide input digital working power from the external to the internal Voltage range: 24(-20%)–48VDC(+10%), 24(-10%)–48VAC(+10%) voltage input
+24V	User power provided by the VFD; maximum output current 200mA
COM	Common terminal of +24V

Terminal		Description
S5	Digital input 5	1. Internal impedance: 6.6kΩ 2. Supporting the voltage input from external power supply (-20%)24–48VDC(+10%), (-10%)24–48VAC(+10%) 3. Supporting the 24V internal power supply 4. Bi-directional input terminal, supporting NPN/PNP connection modes 5. Max. input frequency: 1kHz 6. All are programmable digital input terminals, the functions of which can be set through function codes 7. Supporting PTC overtemperature protection during DC power supply, and the PTC acting at 2.5kΩ (internal power 24V is recommended), but not supporting PTC overtemperature protection during AC power supply
S6	Digital input 6	
S7	Digital input 7	
S8	Digital input 8	

Note:

- You can install extension cards (optional) for 1.5–5.5kW VFD models and you are recommended to install them at slot 2.
- I/O extension card 2 has been installed at slot 3 for 7.5kW and higher VFD models as standard configuration.

4.5 Wiring protection

4.5.1 Protecting the VFD and input power cable in short circuit

The VFD and input power cable can be protected during short-circuit to avoid thermal overload.

Carry out protective measures according to the following requirements.

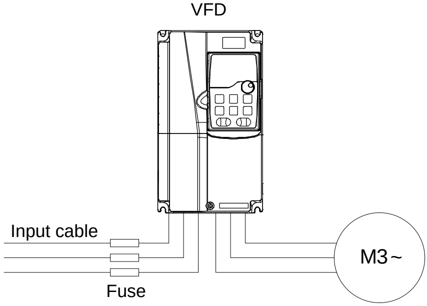


Figure 4.24 Fuse configuration

Note: Select the fuse according to operation manual. During short-circuit, the fuse will protect input power cables to avoid damage to the VFD; when internal short-circuit occurred to the VFD, it can protect neighboring equipment from being damaged.

4.5.2 Protecting the motor and motor cable in short circuit

If the motor cable is selected according to the VFD rated current, the VFD can perform short-circuit protection for the motor and motor cable, without the use of other protective devices.

	✧ If the VFD is connected to multiple motors, an additional thermal overload switch or breaker must be used to protect the motor and motor cable. Such a device may use the fuse to cut off the short-circuit current.

4.5.3 Protecting the motor from thermal overload

According to the requirements, the motor must be protected to prevent thermal overload. Once overload is detected, you must cut off the current. The VFD is equipped with motor thermal overload protection function, which will block output and cut off the current (if necessary) to protect the motor.

4.5.4 Bypass connection

In critical occasions, power-variable frequency conversion circuit is necessary to ensure proper operation of the system when VFD fault occurs. In some special cases, for example, only soft startup is needed, it will convert to power-frequency operation directly after soft startup, corresponding bypass link is also needed.

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

If frequent switchover is needed, you can use the switch/contactor which carries mechanical interlock to ensure motor terminals are not connected to input power cables and VFD output ends simultaneously.

5 Commissioning

5.1 Commissioning lifting in open-loop vector control

5.1.1 Wiring

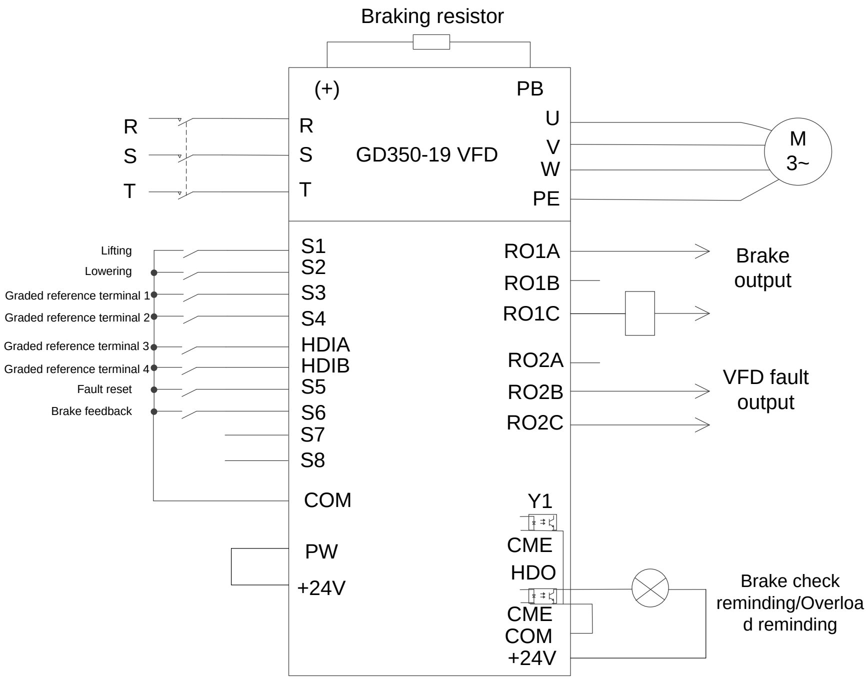


Figure 5.1 Wiring for lifting in open-loop vector control

Note: If the wiring is performed according to Figure 5.1, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting the open-loop vector controlled lifting application macro.

5.1.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.
3. Set P02 motor parameters.
4. Set P00.15=2. The keypad displays "-ΓUN-". Press the RUN key to perform static autotuning.
5. Set P90.00=1 to select the open-loop vector controlled lifting function macro.
6. Perform low-speed trial running.

Note: In closed-loop mode, when the encoder is abnormal, set **P90.00=1** to switch to the open-loop vector control mode. The two modes are different in the brake timing sequence logic, and therefore you need to adjust P01 and P90 parameters accordingly.

5.1.3 Macro parameters (P90.00=1)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	1	SVC mode 1
P00.01	Command running channel	1	Terminal
P00.03	Max. output frequency	100.00Hz	
P00.04	Upper limit of running frequency	90.00Hz	
P00.06	Setting channel of A frequency command	15	Graded multi-step speed
P00.11	ACC time 1	8.0s	
P00.12	DEC time 1	4.0s	
P00.14	Carrier frequency setting	1.5kHz	
P01.01	Starting frequency of direct start	1.00Hz	
P01.15	Stop speed	1.50 Hz	
P01.24	Stop speed delay	0.4s	
P05.00	HDI input type	0x11	HDIA is digital input HDIB is digital input
P05.03	Function of S3 terminal	77	Graded reference terminal 1
P05.04	Function of S4 terminal	78	Graded reference terminal 2
P05.05	Function of HDIA terminal	79	Graded reference terminal 3
P05.06	Function of HDIB terminal	80	Graded reference terminal 4
P06.00	HDO output type	1	Open collector output
P06.02	HDO output selection	56	Brake detection reminding
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P11.08	VFD or motor overload/underload alarm	0x021	Underload protection is enabled to enhance equipment safety
P11.11	Underload pre-alarm detection level	15%	
P25.01	Function of S5 terminal	7	Fault reset
P25.02	Function of S6 terminal	75	Brake feedback signal
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.

Function code	Name	Setting	Remarks
P90.06	Graded multi-step speed reference 0	10.0%	Corresponding to the max. frequency
P90.07	Graded multi-step speed reference 1	30.0%	Corresponding to the max. frequency
P90.08	Graded multi-step speed reference 2	50.0%	Corresponding to the max. frequency
P90.09	Graded multi-step speed reference 3	70.0%	Corresponding to the max. frequency
P90.10	Graded multi-step speed reference 4	90.0%	Corresponding to the max. frequency
P90.14	Forward brake release torque	50.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	30.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	3.00Hz	
P90.17	Reverse brake release frequency	3.00Hz	
P90.18	Forward brake closing frequency	3.00Hz	
P90.19	Reverse brake closing frequency	3.50Hz	
P90.20	Delay before forward brake release	0.000s	
P90.22	Delay after forward brake release	0.500s	
P90.24	Delay before forward brake closing	0.000s	
P90.26	Delay after forward brake closing	0.100s	
P90.30	Torque verification fault detection time	2.000s	
P90.31	Enabling the monitoring on brake status	1	Enable the brake current monitoring (and brake feedback detection)
P91.08	Light load speed boost function selection	2	Constant power speed limit

Note: The macro parameter table does not contain some parameters that are factory default parameters.

5.1.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If you perform empty-load commissioning, set P90.00 to 1 (Lifting in open-loop vector control), set P11.08 to 0x000 to disable underload protection, and set P90.14 and P90.15 to 0 to prevent the torque verification fault reporting caused by empty load. In addition, if no external braking resistor is connected, you need to increase the ACC/DEC time to prevent the bus overvoltage fault reporting caused by too fast stop.
- If there is a brake feedback signal, set P25.02 to 75, and the macro has been set by default. In addition, set P90.31 to 1. If there is no brake feedback signal, set P90.31 to 0 to prevent the misreporting of a brake feedback fault.
- During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the load lifting/lowering direction, adjust any two phase sequences of VFD output terminals U, V, and W.
- If PLC control is used, speed signal and other input and output signal functions need to be adjusted according to the actual control logic.
- This macro can meet the requirements of most lifting application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.2 Commissioning lifting in closed-loop vector control

5.2.1 Wiring

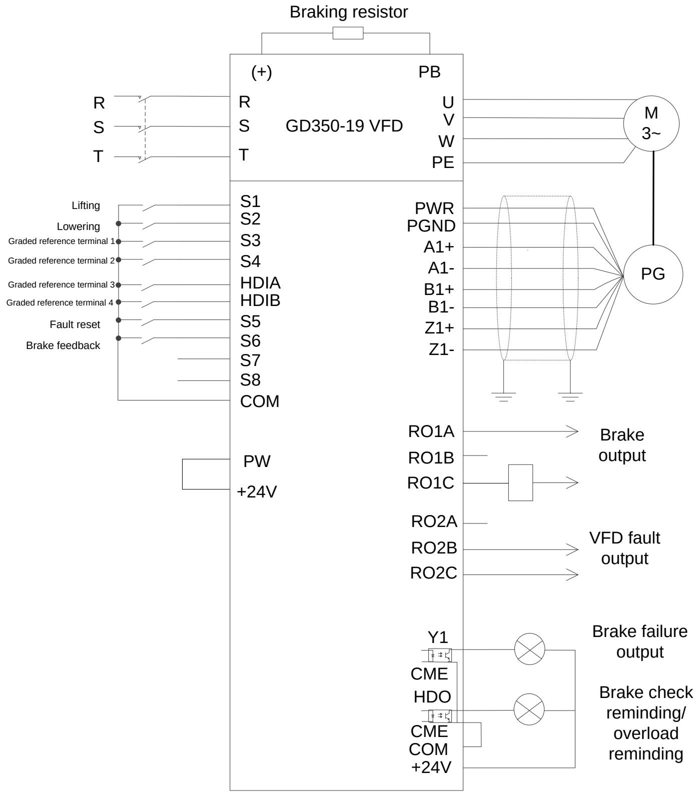


Figure 5.2 Wiring for lifting in closed-loop vector control

Note: If the wiring is performed according to Figure 5.2, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting the closed-loop vector controlled lifting application macro.

5.2.2 Commissioning procedure for hoisting-up closed-loop vector control

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.
3. Set motor nameplate parameters in P02.
4. Set P00.15=2. The keypad displays "-ΓUN-". Press the RUN key to perform static autotuning.
5. Set P90.00=1, set the encoder type parameter P20.00, set the pulse per resolution (PPR)

parameter P20.01. Perform low-speed upward running. Check the value of P18.00. If the value is negative, the encoder direction is reversed. Then you only need to set P20.02=0x001.

6. Set P90.00=2 to select the lifting closed-loop vector application macro.
7. Perform low-speed trial running.

5.2.3 Macro parameters (P90.00=2)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	3	Closed-loop vector control mode
P00.01	Command running channel	1	Terminal
P00.03	Max. output frequency	100.00Hz	
P00.04	Upper limit of running frequency	90.00Hz	
P00.06	Setting channel of A frequency command	15	Graded multi-step speed
P00.11	ACC time 1	8.0s	
P00.12	DEC time 1	4.0s	
P00.14	Carrier frequency setting	1.5kHz	
P01.01	Starting frequency of direct start	0.00Hz	
P01.02	Hold time of starting frequency	0.3s	
P03.10	Current loop integral coefficient I	3500	
P05.00	HDI input type	0x11	HDIA is digital input HDIB is digital input
P05.03	Function of S3 terminal	77	Graded reference terminal 1
P05.04	Function of S4 terminal	78	Graded reference terminal 2
P05.05	Function of HDIA terminal	79	Graded reference terminal 3
P05.06	Function of HDIB terminal	80	Graded reference terminal 4
P06.00	HDO output type	1	Open collector output
P06.01	Y output selection	57	Brake failure alarm
P06.02	HDO output selection	56	Brake detection reminding
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P11.08	VFD or motor overload/underload alarm	0x021	Underload protection is enabled to enhance equipment safety
P11.11	Underload pre-alarm	10%	

Function code	Name	Setting	Remarks
	detection level		
P11.14	Speed deviation detection value	20.0%	
P11.15	Speed deviation detection time	2.0s	Speed deviation protection can be performed.
P25.01	Function of S5 terminal	7	Fault reset
P25.02	Function of S6 terminal	75	Brake feedback signal
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.06	Graded multi-step speed reference 0	10.0%	Corresponding to the max. frequency
P90.07	Graded multi-step speed reference 1	30.0%	Corresponding to the max. frequency
P90.08	Graded multi-step speed reference 2	50.0%	Corresponding to the max. frequency
P90.09	Graded multi-step speed reference 3	70.0%	Corresponding to the max. frequency
P90.10	Graded multi-step speed reference 4	90.0%	Corresponding to the max. frequency
P90.14	Forward brake release torque	50.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	30.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	0.20Hz	
P90.17	Reverse brake release frequency	0.20Hz	
P90.18	Forward brake closing frequency	0.50Hz	
P90.19	Reverse brake closing frequency	1.00Hz	
P90.20	Delay before forward brake release	0.000s	
P90.22	Delay after forward brake release	0.500s	
P90.24	Delay before forward brake closing	0.000s	

Function code	Name	Setting	Remarks
P90.26	Delay after forward brake closing	0.100s	
P90.30	Torque verification fault detection time	2.000s	
P90.31	Enabling the monitoring on brake status	1	Enable the brake current monitoring (and brake feedback detection)
P91.08	Light load speed boost function selection	2	Constant power speed limit
P93.02	Zero servo protection mode	1	Zero servo input slows down

Note: The macro parameter table does not contain some parameters that are factory default parameters.

5.2.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If you perform empty-load commissioning, set P90.00 to 2 (Lifting in closed-loop vector control) first, set P11.08 to 0x000 to disable underload protection, and set P90.14 and P90.15 to 0 to prevent the torque verification fault reporting caused by empty load. In addition, if no external braking resistor is connected, you need to increase the ACC/DEC time to prevent the bus overvoltage fault reporting caused by too fast stop.
- If there is a brake feedback signal, set P25.02 to 75, and the macro has been set by default. In addition, set P90.31 to 1. Since the closed-loop mode is used, the brake current monitoring function is automatically enabled after the setting, and you can set P90.34 to set whether the reference speed is used if the brake status is incorrect. If there is no brake feedback signal, set P90.31 to 0 to prevent the misreporting of a brake feedback fault.
- In closed-loop mode, brake slip verifying is enabled by default. If you need to check the running status of the VFD without a brake, set P93.01 to 0 to disable brake slip verifying.
- During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the hook lifting/lowering, swap any two phase wires of VFD output terminals U, V, and W.
- If PLC control is used, speed signal and other input and output signal functions need to be adjusted according to the actual control logic.
- This macro can meet the requirements of most tower crane lifting application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.3 Commissioning horizontal moving

5.3.1 Wiring

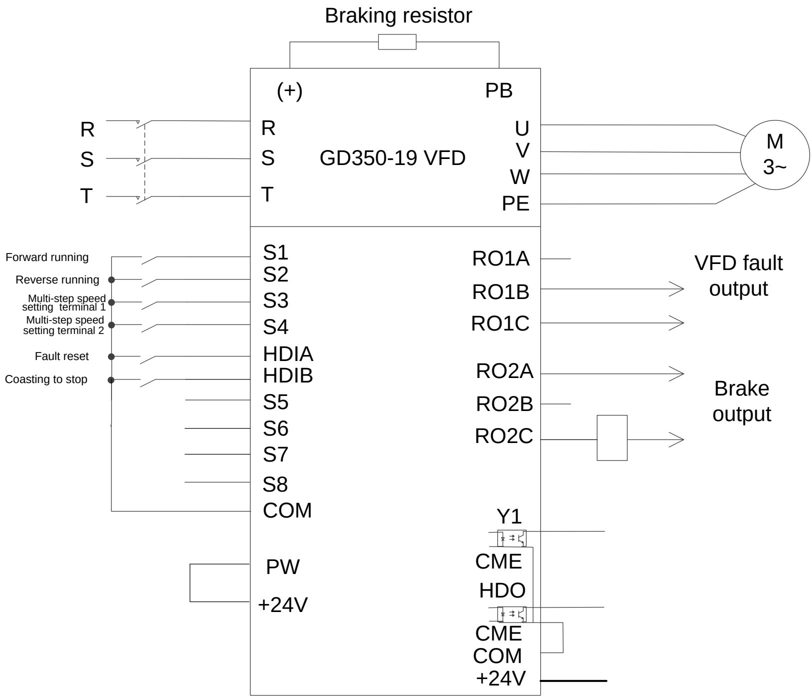


Figure 5.3 Wiring for horizontal moving

Note: If the wiring is performed according to Figure 5.3, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting the horizontal moving application macro.

5.3.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.
3. Set motor nameplate parameters in P02.
4. Set P90.00=3 to select the horizontal moving function macro.
5. Perform low-speed trial running.

5.3.3 Macro parameters (P90.00=3)

Function code	Name	Setting	Remarks
P00.01	Command running channel	1	Terminal
P00.03	Max. output frequency	100.00Hz	
P00.04	Upper limit of running frequency	60.00Hz	
P00.06	Setting channel of A frequency command	6	Multi-step speed running
P00.11	ACC time 1	5.0s	
P00.12	DEC time 1	4.0s	
P01.01	Starting frequency of direct start	0.20Hz	
P01.15	Stop speed	0.10 Hz	
P05.00	HDI input type	0x11	HDIA is digital input HDIB is digital input
P05.03	Function of S3 terminal	16	Multi-step speed setting terminal 1
P05.04	Function of S4 terminal	17	Multi-step speed setting terminal 2
P05.05	Function of HDIA terminal	7	Fault reset
P05.06	Function of HDIB terminal	6	Coasting to stop
P06.03	RO1 output selection	5	VFD fault
P06.04	RO2 output selection	49	Brake output
P10.02	Multi-step speed 0	10.0%	Corresponding to the max. frequency
P10.04	Multi-step speed 1	30.0%	Corresponding to the max. frequency
P10.06	Multi-step speed 2	60.0%	Corresponding to the max. frequency
P11.05	Current limit selection	0x11	Enable software and hardware current limit.
P11.26	Enabling special functions	1	
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.12	Forward brake release current	50.0%	Corresponding to the motor rated current
P90.13	Reverse brake release current	50.0%	Corresponding to the motor rated current

Note: The macro parameter table does not contain some parameters that are factory default parameters.

5.3.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).

- If you perform empty-load commissioning, set P90.00 to 3 (Horizontal moving function macro), set P11.08 to 0x000 to disable underload protection, and set P90.12 and P90.13 to 0 to prevent the torque verification fault reporting caused by empty load.
- During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the hook lifting/lowering, swap any two phase wires of VFD output terminals U, V, and W.
- This macro can meet the requirements of most horizontal moving application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.4 Commissioning tower crane rotating

5.4.1 Wiring

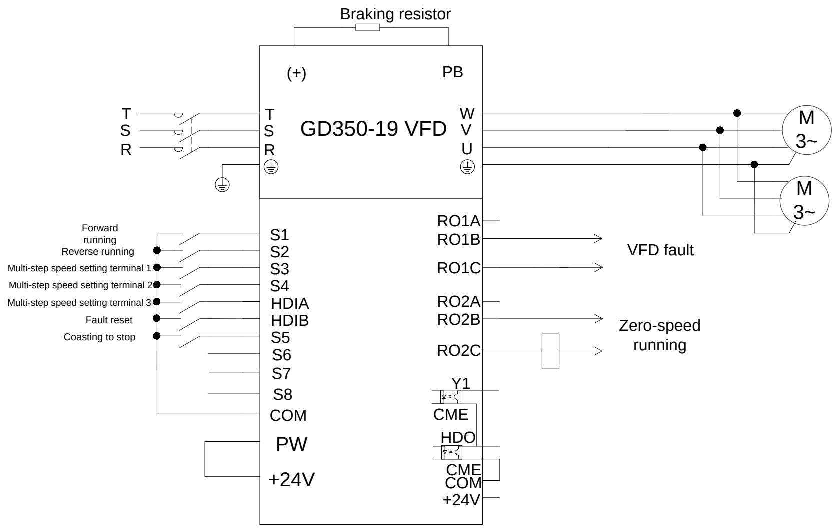


Figure 5.4 Wiring for tower crane rotating

Note: If the wiring is performed according to Figure 5.4, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting the tower crane rotating application macro.

5.4.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.

3. Set motor nameplate parameters in P02.
4. Set P90.00=4 to select the tower crane rotating function macro.
5. Perform low-speed trial running.

5.4.3 Macro parameters (P90.00=4)

Function code	Name	Setting	Remarks
P00.01	Command running channel	1	Terminal
P00.06	Setting channel of A frequency command	6	Multi-step speed running
P00.11	ACC time 1	10.0s	Low-frequency ACC time
P00.12	DEC time 1	18.0s	Low-frequency DEC time
P01.01	Starting frequency of direct start	1.50Hz	
P01.15	Stop speed	1.00Hz	
P05.00	HDI input type	0x11	HDIA is digital input HDIB is digital input
P05.03	Function of S3 terminal	16	Multi-step speed setting terminal 1
P05.04	Function of S4 terminal	17	Multi-step speed setting terminal 2
P05.05	Function of HDIA terminal	18	Multi-step speed setting terminal 3
P05.06	Function of HDIB terminal	7	Fault reset
P06.03	RO1 output selection	5	VFD fault
P06.04	RO2 output selection	9	Running in zero speed
P06.05	Output terminal polarity selection	0X04	The polarity of RO1 is reversed.
P08.00	ACC time 2	15.0s	High-frequency ACC time
P08.01	DEC time 2	13.0s	High-frequency DEC time
P08.19	Switching frequency of ACC/DEC time	16.00Hz	ACC/DEC time 2 is used when P08.19 is exceeded.
P10.04	Multi-step speed 1	16.0%	Corresponding to the max. frequency
P10.06	Multi-step speed 2	36.0%	Corresponding to the max. frequency
P10.08	Multi-step speed 3	60.0%	Corresponding to the max. frequency
P10.10	Multi-step speed 4	100.0%	Corresponding to the max. frequency
P25.01	Function of S5 terminal	6	Coasting to stop
P25.10	Extension card input terminal polarity	0x01	The S5 terminal polarity is negative.

Note: The macro parameter table does not contain some parameters that are factory default parameters.

5.4.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If you perform empty-load commissioning, set P90.00 to 4 (Tower crane rotating function macro), and set P11.08 to 0x000 to disable underload protection.
- During onsite commissioning, if the VFD terminal signal forward/reverse running command is inconsistent with the load running direction, adjust any two phase sequences of VFD output terminals U, V, and W.
- This macro can meet the requirements of most tower crane rotating application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.5 Commissioning the conical motor function

5.5.1 Wiring

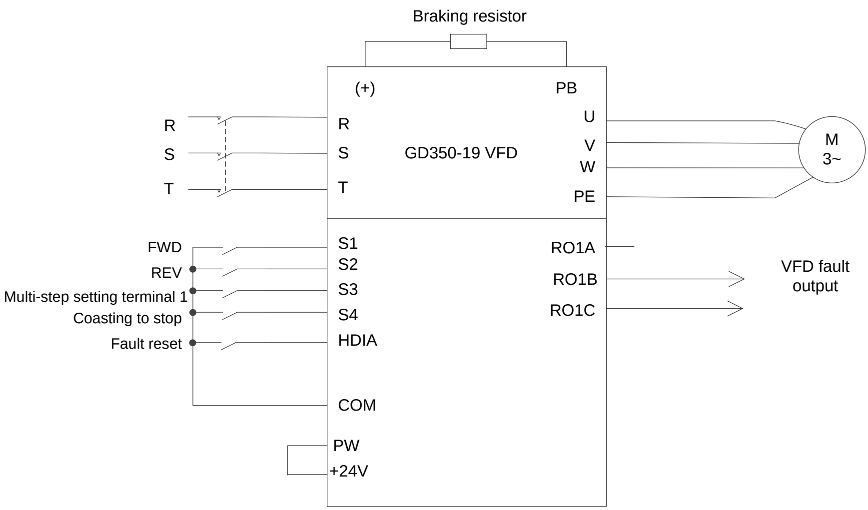


Figure 5.5 Wiring for the conical motor

Note: If the wiring is performed according to Figure 5.5, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting the conical motor application macro.

5.5.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.
3. Set motor nameplate parameters in P02.

4. Set P90.00=5 to select the conical motor function macro.
5. Perform low-speed trial running.

5.5.3 Macro parameters (P90.00=5)

Table 5.1 Parameter settings

Function code	Name	Setting	Remarks
P00.01	Command running channel	1	Terminal
P00.06	Setting channel of A frequency command	6	Multi-step speed running
P00.11	ACC time 1	3	Time taken to accelerate from 0Hz to the max. frequency.
P00.12	DEC time 1	2	Time taken to decelerate from the max. frequency to 0Hz.
P01.01	Starting frequency of direct start	2.00	2.00Hz
P05.00	HDI input type	0x11	HDIA is digital input HDIB is digital input
P05.03	Function of S3 terminal	16	Multi-step speed setting terminal
P05.04	Function of S4 terminal	6	Coasting to stop
P05.05	Function of HDIA terminal	7	Fault reset
P06.03	RO1 output selection	5	Fault output
P10.02	Multi-step speed 0	50.0%	50% of the max. output frequency P00.03
P10.04	Multi-step speed 1	100.0%	100% of the max. output frequency P00.03
P91.00	Enabling the conical motor function	1	Enable the conical motor function

5.5.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If the direction is incorrect when the heavy load runs upward during lifting in forward running mode, adjust any two phase sequences of VFD output terminals U, V, and W but not change the value of P00.13.
- The starting frequency cannot be set too low. During onsite commissioning, ensure the starting frequency is set properly so that the brake can be turned on, and ensure the brake has been turned on before running.
- The lifting ACC time can be 3s at most. If the ACC time is too long, the brake may not be opened.
- The rated voltage must be at least 380V. If the grid rated voltage is too low (lower than 85% Ue), the brake cannot be opened; if the voltage is too low, the speed cannot be boosted.

- When the conical motor performs constant-power variable-frequency speed regulation (boost), the max. rotational speed cannot exceed 1.2 times the rated speed (60Hz). Otherwise, the motor cannot run properly since the pressure spring cannot be pushed due to the axial magnetic pull force reduce, and therefore the VFD encounters the current limit or overcurrent fault.

5.6 Commissioning lifting in space voltage vector control

5.6.1 Wiring

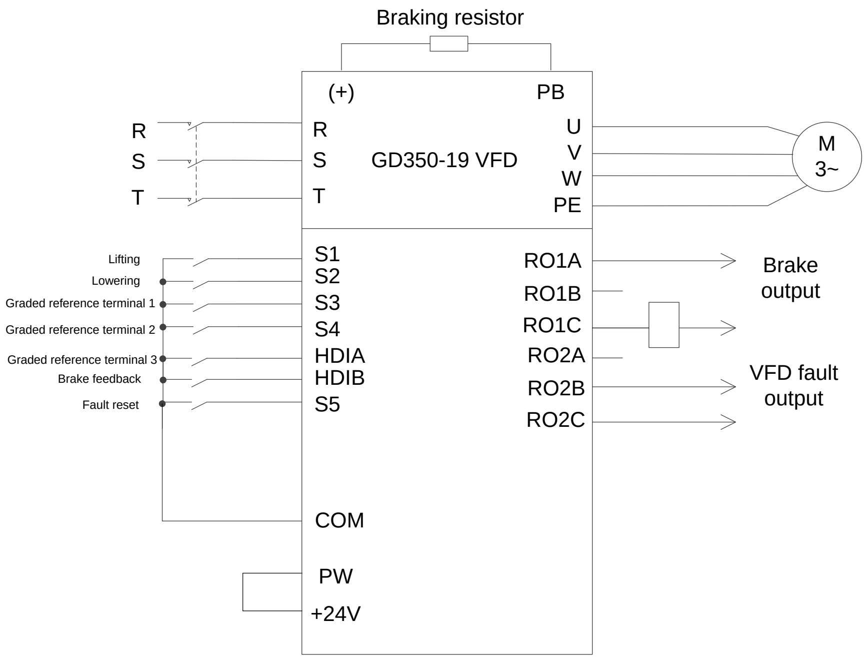


Figure 5.6 Wiring for lifting in space voltage vector control

Note: If the wiring is performed according to Figure 5.2, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting the space voltage vector controlled lifting application macro.

5.6.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1 to restore to the factory settings.
3. Set P02 motor parameters.
4. Set P90.00=9 to select the space voltage vector controlled lifting function macro.
5. Perform low-speed trial running.

Note: In closed-loop mode, when the encoder is abnormal, set **P90.00=9** to switch to the space voltage vector control mode. The two modes are different in the brake timing sequence logic, and therefore you need to adjust P01, P04, and P90 parameters accordingly.

5.6.3 Macro parameters (P90.00=9)

Function code	Name	Setting	Remarks
P00.01	Command running channel	1	Terminal
P00.03	Max. output frequency	100.00Hz	
P00.04	Upper limit of running frequency	90.00Hz	
P00.06	Setting channel of A frequency command	15	Graded multi-step speed
P00.11	ACC time 1	8.0s	
P00.12	DEC time 1	8.0s	
P04.01	Torque boost of motor 1	0.1%	Disable automatic torque boost.
P04.02	Torque boost cut-off of motor 1	0.1%	
P04.40	Enabling I/F mode for asynchronous motor 1	1	Enable the I/F mode.
P05.00	HDI input type	0x11	HDIA is digital input HDIB is digital input
P05.03	Function of S3 terminal	77	Graded reference terminal 1
P05.04	Function of S4 terminal	78	Graded reference terminal 2
P05.05	Function of HDIA terminal	79	Graded reference terminal 3
P05.06	Function of HDIB terminal	75	Brake feedback
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P11.08	VFD or motor overload/underload alarm	0x021	Underload protection is enabled to enhance equipment safety
P11.11	Underload pre-alarm detection level	15%	
P25.01	Function of S5 terminal	7	Fault reset
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.06	Graded multi-step speed reference 0	10.0%	Corresponding to the max. frequency

Function code	Name	Setting	Remarks
P90.07	Graded multi-step speed reference 1	30.0%	Corresponding to the max. frequency
P90.08	Graded multi-step speed reference 2	50.0%	Corresponding to the max. frequency
P90.09	Graded multi-step speed reference 3	70.0%	Corresponding to the max. frequency
P90.12	Forward brake release current	50.0%	Corresponding to the motor rated current
P90.13	Reverse brake release current	50.0%	Corresponding to the motor rated current
P90.16	Forward brake release frequency	1.50Hz	
P90.17	Reverse brake release frequency	1.50Hz	
P90.18	Forward brake closing frequency	1.50Hz	
P90.19	Reverse brake closing frequency	1.50Hz	
P90.31	Enabling the monitoring on brake status	1	Enable the brake current monitoring (and brake feedback detection)

Note: The macro parameter table does not contain some parameters that are factory default parameters.

5.6.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If you perform empty-load commissioning, set P90.00 to 9 (Lifting in space voltage vector control), set P11.08 to 0x000 to disable underload protection, and set P90.12 and P90.13 to 0 to prevent the torque verification fault reporting caused by empty load. In addition, if no external braking resistor is connected, you need to increase the ACC/DEC time to prevent the bus overvoltage fault reporting caused by too fast stop.
- If there is a brake feedback signal, set P05.06 to 75, and the macro has been set by default. In addition, set P90.31 to 1. If there is no brake feedback signal, set P90.31 to 0 to prevent the misreporting of a brake feedback fault.
- During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the load lifting/lowering direction, adjust any two phase sequences of VFD output terminals U, V, and W.

- If PLC control is used, speed signal and other input and output signal functions need to be adjusted according to the actual control logic.
- This macro can meet the requirements of most lifting application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.7 Commissioning winching in closed-loop vector control (applicable to lifting in mineral wells and winches)

5.7.1 Wiring

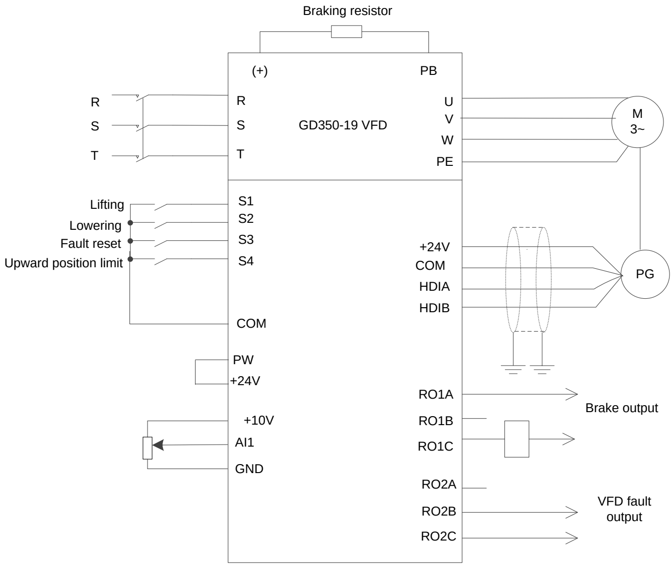


Figure 5.7 Wiring for winching in closed-loop vector control (recommended analog reference 0V–10V)

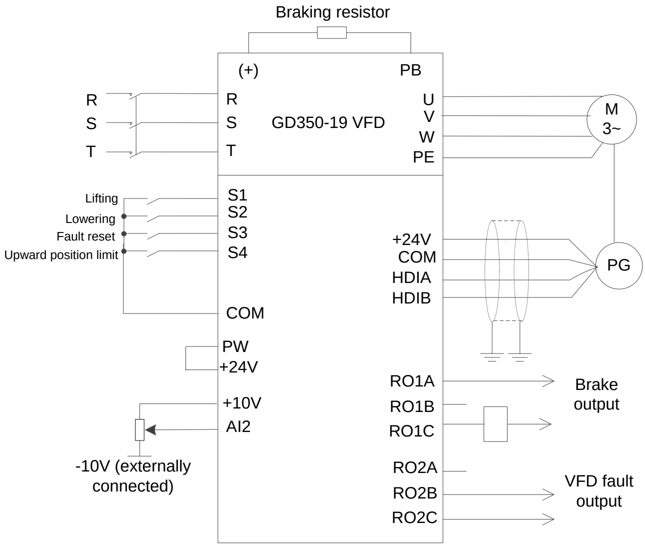


Figure 5.8 Wiring for winching in closed-loop vector control (using analog reference -10V–10V)

5.7.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.
3. Set motor nameplate parameters in P02.
4. Set P00.15=2. The keypad displays "-ΓUN-". Press the RUN key to perform static autotuning.
5. Set P90.00=11 to select the closed-loop controlled winching function macro.
6. Perform low-speed trial running.

5.7.3 Macro parameters (P90.00=11)

Table 5.2 Parameter settings for the closed-loop vector controlled winching application macro (recommended analog reference 0V–10V)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	3	Closed-loop vector control mode
P00.01	Command running channel	1	Terminal
P00.06	Setting channel of A frequency command	1	AI1
P00.07	Setting channel of B frequency command	0	Keypad

Function code	Name	Setting	Remarks
P00.11	ACC time 1	10.0s	
P00.12	DEC time 1	5.0s	
P05.03	Function of S3 terminal	64	Upward position limit
P05.04	Function of S4 terminal	5	Fault reset
P05.24	Lower limit value of AI1	0.20V	0.00V–P05.26. Adjust the value according to the actual situation.
P05.28	Input filter time of AI1	0.100s	0.000s–10.000s
P05.38	HDIA high-speed pulse input function	2	Input through the encoder
P05.44	HDIB high-speed pulse input function	2	Input through the encoder
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P20.15	Speed measuring mode	1	Measuring the speed through HDIA and HDIB
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.05	Enabling forward torque for reverse-running start/stop	0x01	Enable forward torque for reverse-running start/stop
P90.14	Forward brake release torque	50.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	50.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	1.00Hz	
P90.17	Reverse brake release frequency	1.00Hz	
P90.18	Forward brake closing frequency	1.00Hz	
P90.19	Reverse brake closing frequency	1.00Hz	

Table 5.3 Parameter settings for the closed-loop vector controlled winching application macro (using analog reference -10V–10V)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	3	Closed-loop vector control mode
P00.01	Command running channel	1	Terminal
P00.06	Setting channel of A frequency command	2	AI2
P00.07	Setting channel of B frequency command	0	Keypad
P00.11	ACC time 1	10.0s	
P00.12	DEC time 1	5.0s	
P05.03	Function of S3 terminal	64	Upward position limit
P05.04	Function of S4 terminal	5	Fault reset
P05.29	Lower limit value of AI2	-10.00V	-10.00V–P05.31
P05.30	Corresponding setting of lower limit of AI2	100.0%	-300.0%–300.0%
P05.31	Intermediate value 1 of AI2	-0.10V	P05.29–P05.33
P05.32	Corresponding setting of intermediate value 1 of AI2	0.0%	-300.0%–300.0%
P05.33	Intermediate value 2 of AI2	0.10V	P05.31–P05.35
P05.34	Corresponding setting of intermediate value 2 of AI2	0.0%	-300.0%–300.0%
P05.35	Upper limit value of AI2	10.00V	P05.33–10.00V
P05.36	Corresponding setting of upper limit of AI2	100.0%	-300.0%–300.0%
P05.37	Input filter time of AI2	0.100s	0.000s–10.000s
P05.38	HDIA high-speed pulse input function	2	Input through the encoder
P05.44	HDIB high-speed pulse input function	2	Input through the encoder
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P20.15	Speed measuring mode	1	Measuring the speed through HDIA

Function code	Name	Setting	Remarks
			and HDIB
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.05	Enabling forward torque for reverse-running start/stop	0x01	Enable forward torque for reverse-running start/stop
P90.14	Forward brake release torque	50.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	50.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	1.00Hz	
P90.17	Reverse brake release frequency	1.00Hz	
P90.18	Forward brake closing frequency	1.00Hz	
P90.19	Reverse brake closing frequency	1.00Hz	

5.7.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If you perform empty-load commissioning, set P90.00 to 11, and set P90.14 and P90.15 to 0, preventing the VFD from reporting the torque verification fault tPF due to empty load. If no braking resistor is externally connected, increase the ACC/DEC time, preventing the VFD from reporting the bus overvoltage fault due to fast stop.
- During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the load lifting/lowering direction, adjust any two phase sequences of VFD output terminals U, V, and W.
- This macro can meet the requirements of most closed-loop vector controlled winching application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.8 Commissioning winching in open-loop vector control (applicable to lifting in mineral wells and winches)

5.8.1 Wiring

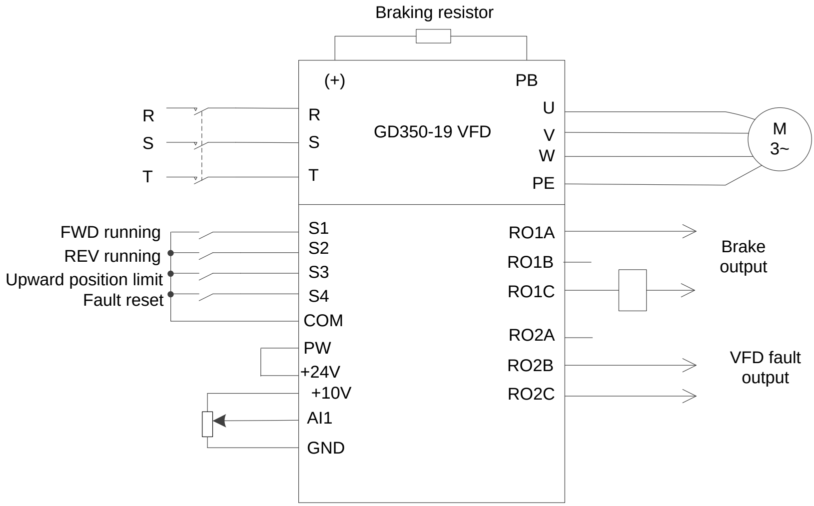


Figure 5.9 Wiring for winching in open-loop vector control (recommended analog reference 0V–10V)

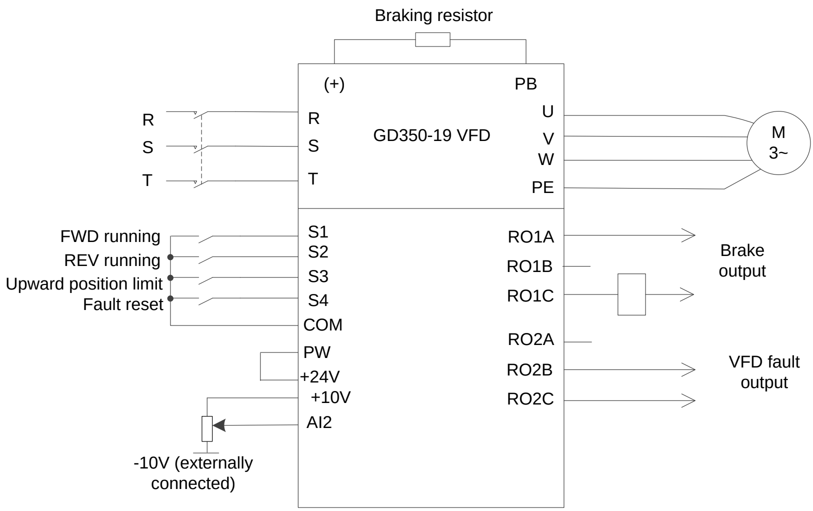


Figure 5.10 Wiring for winching in open-loop vector control (using analog reference -10V–10V)

Note: If the onsite function terminals are inconsistent with the terminals shown in the wiring diagrams, select the open-loop vector controlled winching function macro and adjust the input and output terminal functions according to the actual wiring. The recommended analog reference is 0V–10V.

5.8.2 Commissioning procedure

1. Check the wiring and ensure the wiring is proper.
2. Set P00.18=1.
3. Set motor nameplate parameters in P02.
4. Set P00.15=2. The keypad displays "-ΓUN-". Press the RUN key to perform static autotuning.
5. Set P90.00=12 to select the open-loop controlled winching function macro.
6. Perform low-speed trial running.

5.8.3 Macro parameters (P90.00=12)

Table 5.4 Parameter settings for the open-loop vector controlled winching application macro (recommended analog reference 0V–10V)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	1	SVC 1
P00.01	Command running channel	1	Terminal
P00.06	Setting channel of A frequency command	1	AI1
P00.07	Setting channel of B frequency command	0	Keypad
P00.11	ACC time 1	10.0s	
P00.12	DEC time 1	5.0s	
P05.03	Function of S3 terminal	64	Upward position limit
P05.04	Function of S4 terminal	5	Fault reset
P05.24	Lower limit value of AI1	0.20V	0.00V–P05.26. Adjust the value according to the actual situation.
P05.28	Input filter time of AI1	0.100s	0.000s–10.000s
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.05	Enabling forward torque for reverse-running start/stop	0x01	Enable forward torque for reverse-running start/stop
P90.14	Forward brake release torque	50.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release	50.0%	Corresponding to the motor rated

Function code	Name	Setting	Remarks
	torque		torque
P90.16	Forward brake release frequency	2.00Hz	
P90.17	Reverse brake release frequency	2.00Hz	
P90.18	Forward brake closing frequency	2.00Hz	
P90.19	Reverse brake closing frequency	2.00Hz	

Table 5.5 Parameter settings for the open-loop vector controlled winching application macro (using analog reference -10V–10V)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	1	SVC 1
P00.01	Command running channel	1	Terminal
P00.06	Setting channel of A frequency command	2	AI2
P00.07	Setting channel of B frequency command	0	Keypad
P00.11	ACC time 1	10.0s	
P00.12	DEC time 1	5.0s	
P05.03	Function of S3 terminal	64	Upward position limit
P05.04	Function of S4 terminal	5	Fault reset
P05.29	Lower limit value of AI2	-10.00V	-10.00V–P05.31
P05.30	Corresponding setting of lower limit of AI2	100.0%	-300.0%–300.0%
P05.31	Intermediate value 1 of AI2	-0.10V	P05.29–P05.33
P05.32	Corresponding setting of intermediate value 1 of AI2	0.0%	-300.0%–300.0%
P05.33	Intermediate value 2 of AI2	0.10V	P05.31–P05.35
P05.34	Corresponding setting of intermediate value 2 of	0.0%	-300.0%–300.0%

Function code	Name	Setting	Remarks
	AI2		
P05.35	Upper limit value of AI2	10.00V	P05.33–10.00V
P05.36	Corresponding setting of upper limit of AI2	100.0%	-300.0%–300.0%
P05.37	Input filter time of AI2	0.100s	0.000s–10.000s
P06.03	RO1 output selection	49	Brake output
P06.04	RO2 output selection	5	VFD fault
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.05	Enabling forward torque for reverse-running start/stop	0x01	Enable forward torque for reverse-running start/stop
P90.14	Forward brake release torque	50.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	50.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	2.00Hz	
P90.17	Reverse brake release frequency	2.00Hz	
P90.18	Forward brake closing frequency	2.00Hz	
P90.19	Reverse brake closing frequency	2.00Hz	

5.8.4 Points for attention

- If you only want to check whether the VFD runs properly, set P90.00=0(Common mode).
- If you perform empty-load commissioning, set P90.00 to 12, and set P90.14 and P90.15 to 0, preventing the VFD from reporting the torque verification fault tPF due to empty load. If no braking resistor is externally connected, increase the ACC/DEC time, preventing the VFD from reporting the bus overvoltage fault due to fast stop.
- During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the load lifting/lowering direction, adjust any two phase sequences of VFD output terminals U, V, and W.
- This macro can meet the requirements of most open-loop vector controlled winching application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact

the technical support.

5.9 Commissioning the brake function

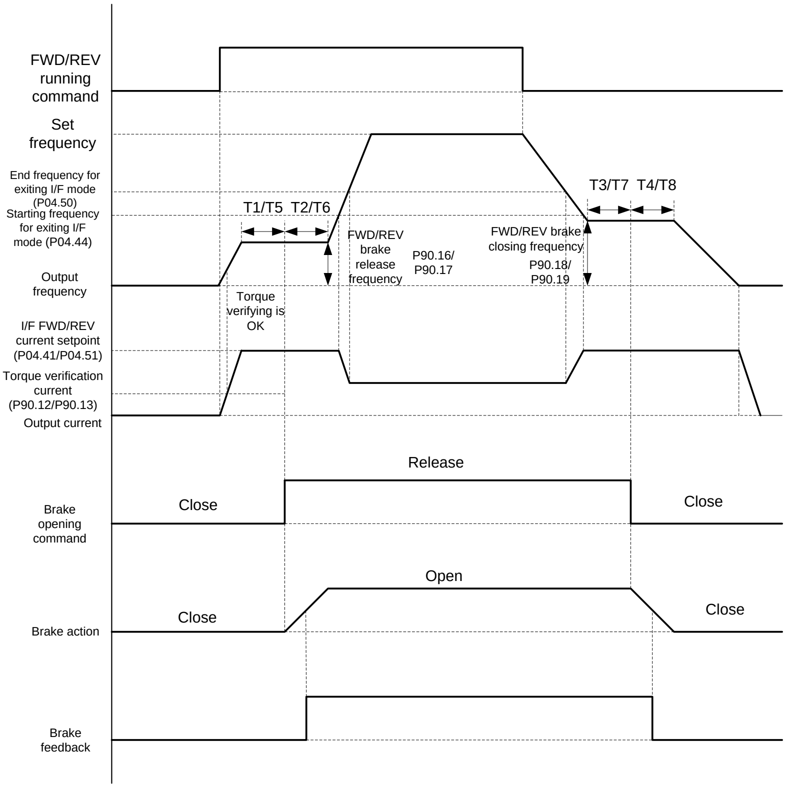
5.9.1 Commissioning brake in space voltage vector control

1. Set P90.04 to 1 to enable the brake function.
2. Set relay brake output. If RO2 is connected to the braking contactor, set P06.04 to 49.
3. If the brake contactor has the feedback function, connect the brake feedback wire to an input terminal, for example, S3. Then set P05.03 to 75 indicating brake feedback signal. Set P90.31 to 1 to enable brake feedback detection.
4. In lifting application, enable the I/F function, set P04.40 to 1, set P04.41, and set P04.52. In horizontal moving application, you can choose whether to enable the I/F function.
5. Set P90.12 (Forward brake release current) and P90.13 (Reverse brake release current) to ensure there is enough torque before the brake is opened.
6. Set the brake timing sequence, including the forward/reverse brake release frequency, forward/reverse brake closing frequency, delay before forward brake release (T1), delay before reverse brake release (T5), delay after forward brake release (T2), delay after reverse brake release (T6), delay before forward brake closing (T3), delay before reverse brake closing (T7), delay after forward brake closing (T4), and delay after reverse brake closing (T8).

Note: If delay before reverse brake release (T5), delay after reverse brake release (T6), delay before reverse brake closing (T7), and delay after reverse brake closing (T8) are set to 0, the delay parameters for forwarding running are used.

7. Perform trial running and check whether the brake timing sequence is correct.

Space voltage vector control mode

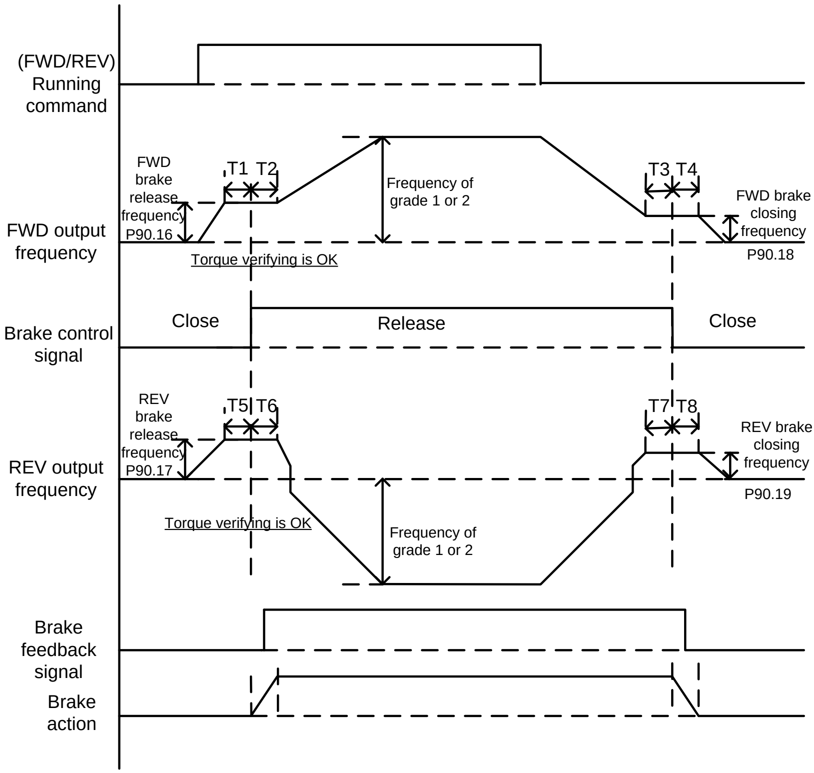


T1: Delay before forward brake release P90.20 T3: Delay before forward brake closing P90.24
T2: Delay after forward brake release P90.22 T4: Delay after forward brake closing P90.26
T5: Delay before reverse brake release P90.21 T7: Delay before reverse brake closing P90.25
T6: Delay after reverse brake release P90.23 T8: Delay after reverse brake closing P90.27

8. Adjust braking comfortability, which can be implemented by using the following methods.

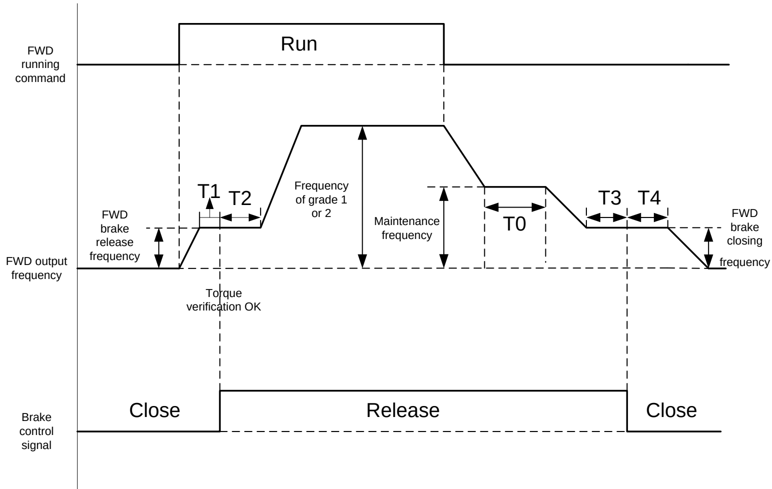
A. In I/F mode, you can decrease the brake release frequency and brake closing frequency and adjust the T1–T8 delay parameters in the timing sequence so that the impact is reduced. Note that the brake release frequency and brake closing frequency are greater than P01.01 (Starting frequency) and P01.15 (Stop speed) in most cases.

B. During the reverse-running stop, you can apply the forward torque, that is, for reverse-running start, you can perform forward brake release and then perform reverse running; for reverse-running stop, you can switch reverse running to forward running, close the brake, and then perform forward-running stop. This ensures there is no slip is felt during reverse start or stop. Forward torque is enabled by setting P90.05. The timing sequence is as follows:



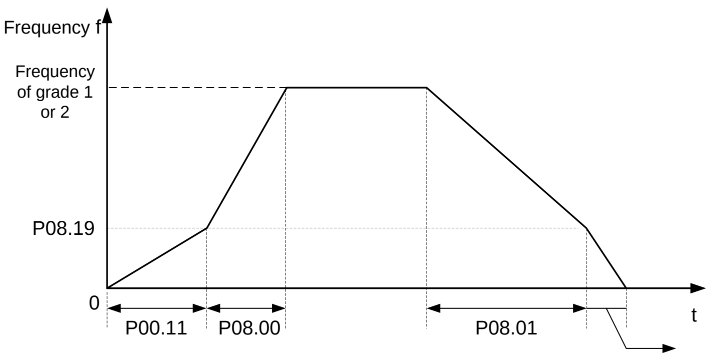
T1: Delay before forward brake release P90.20 T3: Delay before forward brake closing P90.24
T2: Delay after forward brake release P90.22 T4: Delay after forward brake closing P90.26
T5: Delay before reverse brake release P90.21 T7: Delay before reverse brake closing P90.25
T6: Delay after reverse brake release P90.23 T8: Delay after reverse brake closing P90.27

C. During the stop process, you can enable the maintenance frequency so that the device runs at a low speed within a small period of time before the stop, since impact may be caused if the device directly stops at a high speed. The maintenance frequency for stop can be enabled by setting P90.29 to a value greater than 0. You can set the maintenance frequency through P90.30. The timing sequence is as follows:



T1: Delay before forward brake release P90.20 T3: Delay before forward brake closing P90.24
T2: Delay after forward brake release P90.22 T4: Delay after forward brake closing P90.26
T0: Maintenance frequency hold time for DEC stop P90.29
Maintenance frequency: Maintenance frequency for DEC stop P90.28
FWD brake release/closing frequency: P90.16/P90.18

D. If two segments of ACC/DEC time are used, you can increase ACC/DEC time at low frequency running to ensure smoothness at low-frequency start or stop. You can set P08.19 (Switching frequency of ACC/DEC time) to a value greater than 0 to enable two segments of ACC/DEC time and then the ACC/DEC time 1 (P00.11 and P00.12) and ACC/DEC time 2 (P08.00 and P08.01) are used.

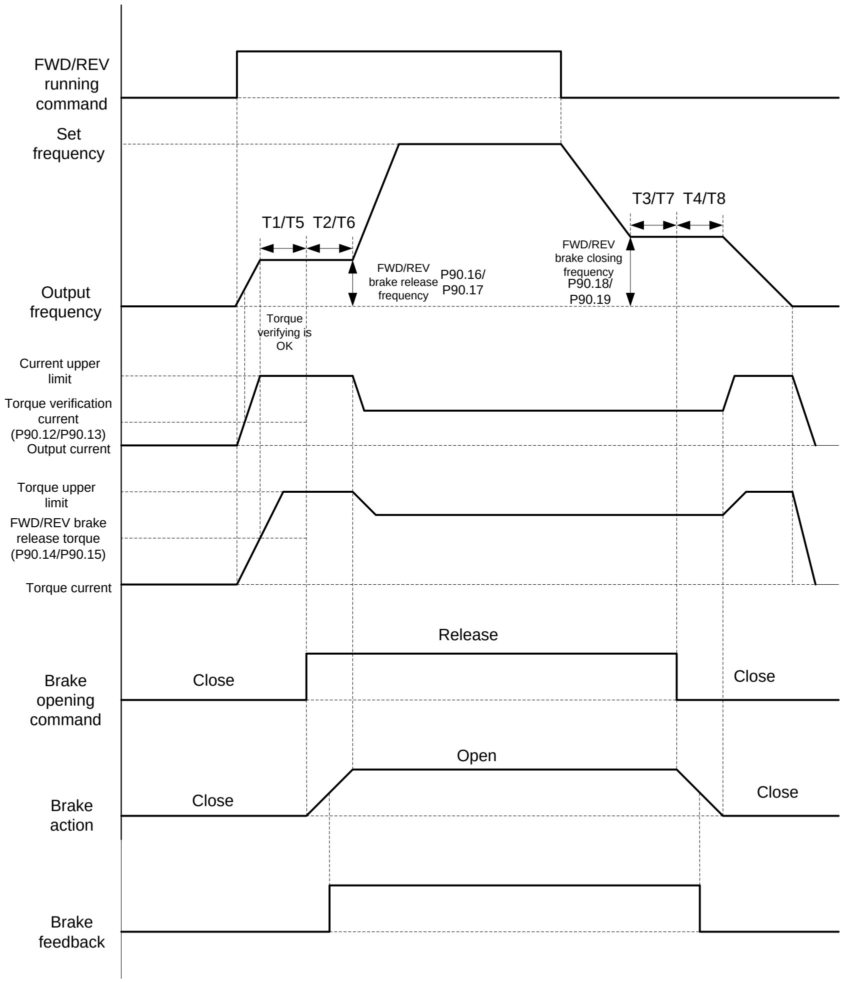


P00.11: ACC time 1 P00.12: DEC time 1
P08.00: ACC time 2 P08.01: DEC time 2
P08.19: ACC/DEC time switchover frequency point

5.9.2 Commissioning brake in open/closed-loop vector control

1. Set P90.04 to 1 to enable the brake function.
2. Set relay brake output. If RO1 is connected to the brake contactor, set P06.03 to 49.
3. If the brake contactor has the feedback function, connect the brake feedback wire to an input terminal, for example, S6. Then set P25.02 to 75 indicating brake feedback signal. Set P90.31 to 1 to enable brake feedback detection. In closed-loop mode, the brake current monitoring function is enabled automatically. If a brake exception occurs, a protection method is applied depending on the present current and the value of P90.34. Skip this step if the braking contactor has no feedback function.
4. Set P90.14 (Forward brake release torque) and P90.13 (Reverse brake release torque) to ensure there is enough torque before the brake is opened. You do not need to set P90.12 and P90.13. In closed-loop mode, you can set P93.00 (Brake slip speed threshold) to check whether the braking torque is enough.
5. Set the brake timing sequence, including the forward/reverse brake release frequency, forward/reverse brake closing frequency, delay before forward brake release (T1), delay before reverse brake release (T5), delay after forward brake release (T2), delay after reverse brake release (T6), delay before forward brake closing (T3), delay before reverse brake closing (T7), delay after forward brake closing (T4), and delay after reverse brake closing (T8).
6. In closed-loop mode, you can decrease the brake release frequency and brake closing frequency and adjust the T1–T8 delay parameters in the timing sequence.
7. Perform trial running and check whether the brake timing sequence is correct.

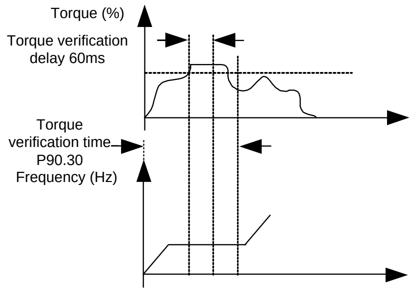
Open/closed loop vector control mode



T1: Delay before forward brake release P90.20
T2: Delay after forward brake release P90.22
T5: Delay before reverse brake release P90.21
T6: Delay after reverse brake release P90.23
T3: Delay before forward brake closing P90.24
T4: Delay after forward brake closing P90.26
T7: Delay before reverse brake closing P90.25
T8: Delay after reverse brake closing P90.27

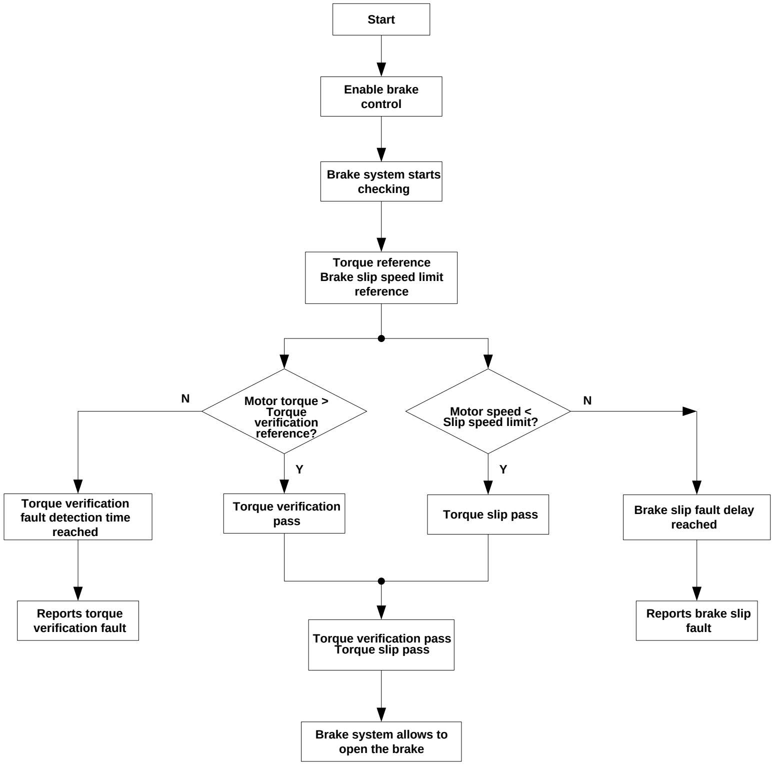
5.9.3 Description about torque verification and brake slip

After the VFD runs, the VFD output current or torque is checked before the brake release. If the VFD output current or torque is greater than the output current or torque setting (P90.12 or P90.15) and the situation lasts 60ms, torque verification succeeds. If torque verification does not pass after the torque verification time P90.30 is reached, the torque verification fault tPF is reported.



In closed-loop mode, if the brake slip fault delay P93.01 is greater than 0, the brake slip detection function is enabled. During torque verification, if the motor (encoder) speed exceeds the set brake slip speed threshold P93.00 and the situation duration exceeds P93.01, the brake failure fault bE is reported.

The torque verification and brake slip flowchart is as follows:



5.9.4 Commissioning parameters

Function code	Name	Description	Default
P90.04	Enabling brake-oriented logic	0–1 0: The brake is controlled by an external controller. 1: The brake is controlled by the VFD.	0
P90.05	Enabling forward torque for reverse-running start/stop	0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The reverse-running start direction complies with the command.) 1: Enable	0x00

Function code	Name	Description	Default
		(The reverse-running start direction is always the forward-running direction.) Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The reverse-running stop direction complies with the command.) 1: Enable (The reverse-running stop direction is always the forward-running direction.)	
P90.12	Forward brake release current	0.0–200.0% (of the motor rated current)	0.0%
P90.13	Reverse brake release current	0.0–200.0% (of the motor rated current)	0.0%
P90.14	Forward brake release torque	0.0–200.0% (of the motor rated torque)	0.0%
P90.15	Reverse brake release torque	0.0–200.0% (of the motor rated torque)	0.0%
P90.16	Forward brake release frequency	0.00–20.00Hz	3.00Hz
P90.17	Reverse brake release frequency	0.00–20.00Hz	3.00Hz
P90.18	Forward brake closing frequency	0.00–20.00Hz	3.00Hz
P90.19	Reverse brake closing frequency	0.00–20.00Hz	3.00Hz
P90.20	Delay before forward brake release	0.000–5.000s	0.300s
P90.21	Delay before reverse brake release	0.000–5.000s The value 0 indicates the delay before forward brake release is used.	0.000s
P90.22	Delay after forward brake release	0.000–5.000s	0.300s
P90.23	Delay after reverse brake	0.000–5.000s	0.000s

Function code	Name	Description	Default
	release	The value 0 indicates the delay after forward brake release is used.	
P90.24	Delay before forward brake closing	0.000–5.000s	0.300s
P90.25	Delay before reverse brake closing	0.000–5.000s The value 0 indicates the delay before forward brake closing is used.	0.000s
P90.26	Delay after forward brake closing	0.000–5.000s	0.300s
P90.27	Delay after reverse brake closing	0.000–5.000s The value 0 indicates the delay after forward brake closing is used.	0.000s
P90.28	Maintenance frequency for stop	0.00–50.00Hz	5.00Hz
P90.29	Maintenance frequency hold time for stop	0.00–5.000S	0.000s
P90.30	Torque verification fault detection time	0.00–10.000S	3.000s
P90.31	Enabling the monitoring on brake status	0–1 0: Disable 1: Enable the brake current monitoring (and brake feedback detection) After the brake is enabled, the brake status monitoring function can be enabled. In open-loop mode: If a brake feedback exception occurs, a fault is reported after the brake feedback exception delay P90.32. In closed-loop mode: During the stop, if a brake feedback exception occurs, a fault is reported after the brake feedback exception delay P90.32. During running, if a brake feedback exception occurs, the current is monitored after the brake feedback exception delay P90.32. If the present current is less than the	0

Function code	Name	Description	Default
		monitored current, it is considered that the brake is not closed, and the action specified by P90.34 is performed. If the present current is greater than the brake monitoring current threshold, an action is performed depending on the actual frequency. If the actual frequency is lower than the forward braking frequency in forward running or the actual frequency is lower than the reverse braking frequency, it is considered that the brake has been closed, and a fault needs to be reported.	
P90.32	Brake feedback exception delay (brake feedback detection time)	0.00–20.000S	1.000s
P90.33	Brake monitoring current	0.0%–200.0% 100.0% corresponding to the motor rated current	100.0%
P90.34	Enabling speed reference under brake status error	0–1 0: Disable (Report the brake feedback fault directly) 1: Enable (Report the brake feedback alarm simultaneously)	0
P90.35	Speed reference under brake status error	0.00–50.00Hz	5.00Hz
P90.37	Brake selection for forward/reverse switchover	0–1 0: Perform switchover without braking 1: Perform switchover with braking	0
P93.00	Brake slip speed threshold	1.00–5.00Hz	1.00Hz
P93.01	Brake slip	0.000–5.000s The value 0 indicates brake slip is not detected, while a non-zero value indicates brake slip is detected.	0.500s

5.10 Commissioning the master/slave function

5.10.1 Master/slave function description

Master/slave control is classified into power balance and speed synchronization.

1. Master/slave power balance

Master/slave power balance is a control method that distributes the load between two or more motors to achieve even balance. When a transmission device is driven by two or more motors, and two or more motor shafts are coupled with each other through gears, chains or conveyor belts, it is necessary to distribute the load between the motors through the master/slave control method to meet the control accuracy requirements.

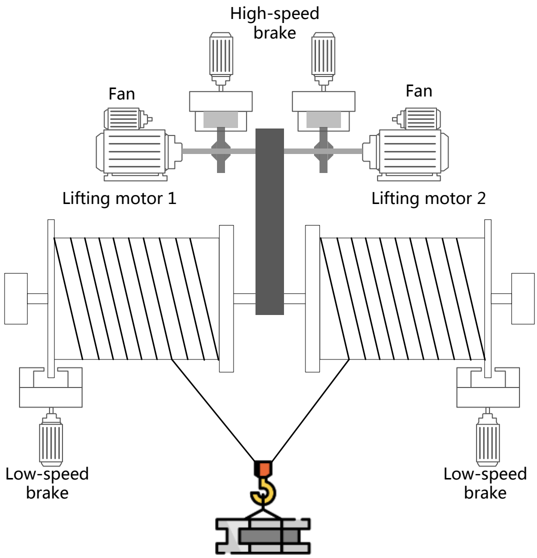


Figure 5.11 Mechanical structure diagram 1

In general, if multiple VFDs control multiple motors through belt connection, it is considered as flexible connection (or soft connection). When flexible connection is applied, generally, the slave adopts the speed control mode, and then the droop function is used to achieve better power balance performance. Therefore, in the terminal master/slave mode, master/slave mode a is recommended; in the CAN communication master/slave mode, master/slave mode 0 is recommended.

In general, if multiple VFDs control multiple motors through shaft, gear, or chain connection, it is considered as rigid connection (or hard connection). When rigid connection is applied, generally, the slave adopts the torque control mode for better power balance performance. Therefore, in the terminal master/slave mode, master/slave mode b is recommended; in the CAN communication master/slave mode, master/slave mode 1 is recommended.

2. Master/slave speed synchronization

Master/slave speed synchronization is used for the speed synchronization between two motors. Using the function requires that both motors have the encoder installed, and the VFD has the encoder pulse counting function. The mechanical structure is shown in the following figure:

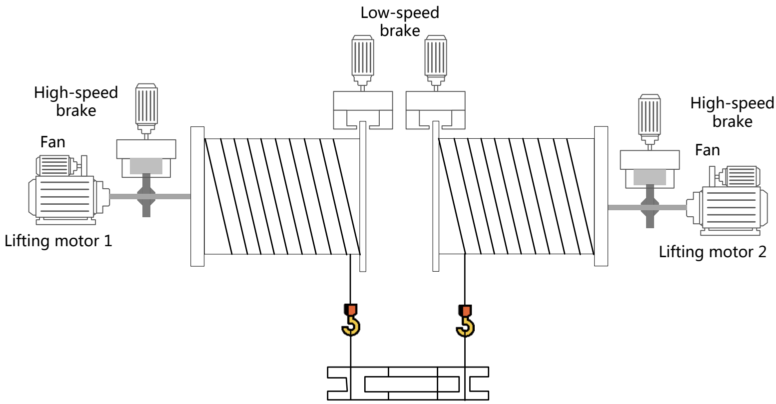


Figure 5.12 Mechanical structure diagram 2

Since master/slave speed synchronization requires speed consistency, the VFD must use the closed-loop mode. Therefore, only master/slave mode 4 in the CAN communication master/slave mode can be used.

5.10.2 Terminal master/slave function

A. Using the VFD high-speed pulse input terminal HDIA and high-speed pulse output terminal HDO to implement simplified master/slave control

The wiring diagram is as follows:

1. Terminal master/slave mode a

The master adopts the speed control mode and sends the ramp frequency to the slave HDIA terminal through the HDO terminal. The slave adopts the speed control mode and the frequency reference is set by the HDIA terminal. Then, adjust reduction ratio of droop control P08.30 of the salve to meet power balance.

Master setting parameters:

Function code	Name	Description	Setting
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0
P06.16	HDO high-speed pulse output	0–47 2: Ramp reference frequency	2

Slave setting parameters:

Function code	Name	Description	Setting
P00.06	Setting channel of A frequency command	0–15 4: High speed pulse HDIA	4
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P08.30	Reduction ratio of droop control	0.00–50.00Hz	1.00hz

2. Terminal master/slave mode b

The master adopts the speed control mode and sends the torque current to the slave HDIA terminal through the HDO terminal. The slave adopts the torque control mode and the torque reference is set by the HDIA terminal.

Master setting parameters:

Function code	Name	Description	Setting
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0
P06.16	HDO high-speed pulse output	0–47 22: Torque current (relative to three times the motor rated current)	22

Slave setting parameters:

Function code	Name	Description	Setting
P03.11	Torque setting mode selection	0–12 5: Set through HDIA	5
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00

B. Using the VFD analog input terminal (for example, AI1) and analog output terminal (for example, AO1) to implement simplified master/slave control

The wiring diagram is as follows:

1. Terminal master/slave mode a

The master adopts the speed control mode and sends the ramp frequency to the slave AI1 terminal through the AO1 terminal. The slave adopts the speed control mode and the frequency reference is set by the AI1 terminal. Then, adjust reduction ratio of droop control P08.30 of the salve to meet power balance.

Master parameters:

Function code	Name	Description	Setting
P06.14	AO1 output selection	0–47 2: Ramp reference frequency	2

Slave parameters:

Function code	Name	Description	Setting
P00.06	Setting channel of A frequency command	0–15 1: AI1	1
P08.30	Reduction ratio of droop control	0.00–50.00Hz	1.00hz

2. Terminal master/slave mode b

The master adopts the speed control mode and sends the torque current to the slave AI1 terminal through the AO1 terminal. The slave adopts the torque control mode and the torque reference is set by the AI1 terminal.

Master parameters:

Function code	Name	Description	Setting
P06.14	AO1 output selection	0–47 22: Torque current (relative to three times the motor rated current)	22

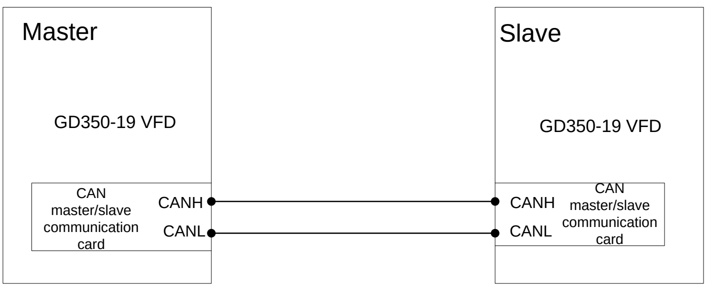
Slave parameters:

Function code	Name	Description	Setting
P03.11	Torque setting mode selection	0–12 2: AI1	2

Note: When the terminal master/slave function is used, commissioning is unrelated to P28.

5.10.3 Communication master/slave function

The VFDs can implement the master/slave function by using the CAN master/slave communication card. The wiring diagram is as follows:



The specific CAN communication master/slave modes are: master/slave mode 0–2 are master/slave power balance modes, master/slave mode 4 is the master/slave speed synchronization mode, and master/slave mode 3 is reserved. Master/slave mode 0 and master/slave mode 1 are used often.

1. Master/slave mode 0 (P28.02 ones place=0)

Basic principle: Both the master and slave adopt the speed control mode, and the power balance is achieved by the droop control.

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 0 both for the master and slave to select master/slave mode 0, and adjust P28.03 for the slave based on the actual situation.

The master sends the running command and speed to the slave through CAN communication. The slave starts according to the command given by the master and runs according to the speed given by the master. At this time, adjust the droop frequency of the slave P08.30 to meet the power balance requirement.

2. Master/slave mode 1 (P28.02 ones place=1)

Basic principle: The master and slave must use the vector control mode of the same type, the master uses speed control, and the slave will be forced to use the torque control mode.

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 1 both for the master and slave to select master/slave mode 1, and adjust P28.04 for the slave based on the actual situation. The slave will be switched to torque mode automatically, and therefore P03 parameters do not need to be adjusted.

The master sends the running command and speed to the slave through CAN communication. The slave starts according to the command given by the master and runs according to the torque given by the master.

3. Master/slave mode 2 (Combined mode, P28.02 ones place=2)

Basic principle: The slave starts in the speed control mode (master/slave mode 0) and then switches to the torque mode (master/slave mode 1) at a certain frequency point.

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 2 both for the master and slave to select master/slave mode 2, and adjust P28.03 and P28.04 for the slave based on the actual situation. In addition, set P28.05.

The master sends the running command, speed and torque to the slave through CAN communication. The slave starts according to the command given by the master and runs according to the speed given by the master if the switching frequency point is not reached but runs according to the torque given by the master if the switching frequency point is reached.

4. Master/slave mode 3 (Reserved)

5. Master/slave mode 4 (Closed-loop master/slave mode, speed synchronization mode)

Basic principle: In the position synchronization mode, speed synchronization means to compare the position pulse counts of the master and slave and correct the position pulse error at the slave side so as to reduce the error to 0. The master and slave must be equipped with encoders. The master and slave adopt speed control, using position pulse difference for speed correction.

Commissioning method:

Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, and set the ones place of P28.02 to 4 both for the master and slave to select master/slave mode 4.

If there is a transmission ratio between the slave and master, set the P28.07, P28.08 and P28.09. When the pulse difference between the slave and master is greater than P28.09, a fault is reported directly. When the pulse difference between the slave and master is less than P28.08, speed correction is not performed. When the pulse difference between the slave and master is greater than P28.08 but less than P28.09, speed correction is performed, and adjust P28.12, P28.13, and P28.14 when necessary. In addition, you can set P28.10.

The master sends the running command, speed, and position pulse to the slave through CAN communication. The slave performs speed correction by comparing the local position pulse with the position pulse sent from the master.

Note: Open-loop vector control is applicable only to master/slave modes 0–3, while closed-loop vector control is applicable to all the master/slave mode.

Function code	Name	Description	Default
P28.00	Master/slave mode selection	0: The master/slave control is invalid 1: This machine is a master 2: This machine is a slave	0
P28.01	Master/slave communication selection	0: CAN 1: Reserved	0
P28.02	Master/slave control mode	Ones: Master/slave running mode selection 0: Master/slave mode 0 (The master and slave adopt speed control and maintains the power balance by droop control) 1: Master/slave mode 1 (The master and slave must be in the same type of vector control mode. The master is speed control, and the slave will be forced to be in the torque control mode.) 2: Master/slave mode 2 The slave starts in the speed mode	0x001

Function code	Name	Description	Default
		(master/slave mode 0) first and then switches to the torque mode at a certain frequency point (master/slave mode 1). 3: Master/slave mode 3 (Reserved) (Both the master and slave adopt speed control, and the slave performs power balance depending on the speed loop integral result of the master.) 4: Master/slave mode 4 (Closed-loop master/slave mode) The master and slave must be equipped with encoders. The master and slave adopt speed control, using position pulse difference for speed correction. Tens: Slave start command source selection 0: Follow the master to start 1: Determined by P00.01 Hundreds: indicates whether to enable slave transmitting/master receiving 0: Enable 1: Disable	
P28.03	Slave speed gain	0.0–500.0%	100.0%
P28.04	Slave torque gain	0.0–500.0%	100.0%
P28.05	Speed/torque mode switching frequency point of master/slave mode 2	0.00–10.00Hz	5.00
P28.06	Number of slaves	0–15	1
P28.07	Master/slave transmission unit pulse ratio for position synchronization	0.00–100.00	1.00
P28.08	Position synchronization deviation deadzone	0–50000 When the position difference is greater than P28.08, correction on the slave is valid.	50

Function code	Name	Description	Default
	setting		
P28.09	Position synchronization deviation threshold	0–50000 When the position difference is greater than P28.09, a master/slave position fault is reported.	1000
P28.10	Position synchronization regulator output limit	0.0–100.0%	5.0%
P28.11	Position synchronization pulse count reset method	0–1 0: Automatic During stop, the position synchronization pulse count is automatically reset. 1: Terminal based If the input terminal selects the position synchronization pulse count reset function, the pulse count is automatically reset when there is signal input.	0
P28.12	Position synchronization proportional coefficient	0.000–10.000	0.005
P28.13	Position synchronization integral time	0.01–80.00s	8.00s
P28.14	Position synchronization filtering time	0.00–10.00s	0.05s

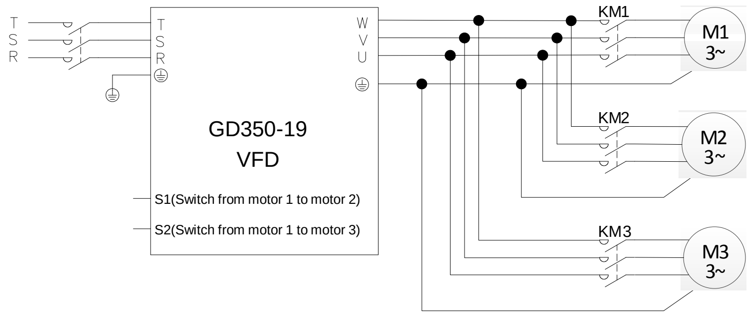
5.11 Motor and macro switchover

5.11.1 Switchover description

The VFD provides three sets of motor parameters, and you can switch between motors through the terminal switching function. First, you need to set the ones place of P08.31 to 0, and then use input terminal function 35 (switching motor 1 to motor 2) and input terminal function 88 (switching to motor 3) to perform motor switchover.

In addition, application macros can be switched. Set P90.03 to set the terminal-based method of switching application macros, and set P90.00 and P90.01 to select application macros. After the corresponding motor is switched, the application macro is switched accordingly.

The wiring diagram for motor switching is as follows (you can see the example in section 5.11.2 for the VFD reference terminals):



Note:

- Switching from motor 1 to motor 2 takes priority over switching from motor 1 to motor 3. That is, the signal for switching from motor 1 to motor 3 is detected only after no signal for switching from motor 1 to motor 2 is detected.
- The motor parameters for motor 2 are separate from those for motor 3. Group P12 and group P29 contain motor parameters for motor 2 and motor parameters for motor 3. However, motor 2 and motor 3 use similar parameters for control modes, such as VF and vector control parameters.
- During motor switching, the terminals to which application macros have assigned values cannot be used for switching. Otherwise, if an application macro changes the value assigned to a terminal, the value is overwritten, resulting in switching failure.

5.11.2 Description about switching from motor 2 to motor 3

The terminal input function does not contain the ability to switch from motor 2 to motor 3. To switch from motor 2 to motor 3, remove the signal for switching from motor 1 to motor 2, and then input the signal for switching from motor 1 to motor 3. If the signal for switching from motor 1 to motor 2 and switching from motor 1 to motor 3 are given simultaneously, the signal for switching from motor 1 to motor 2 is affected since the switching from motor 1 to motor 2 has higher priority (as mentioned earlier), and motor 2 is used automatically.

Example:

If S1 is set to have terminal function 35 (for switching from motor 1 to motor 2) and S2 is set to have terminal function 88 (for switching from motor 1 to motor 3), there are four types of combination:

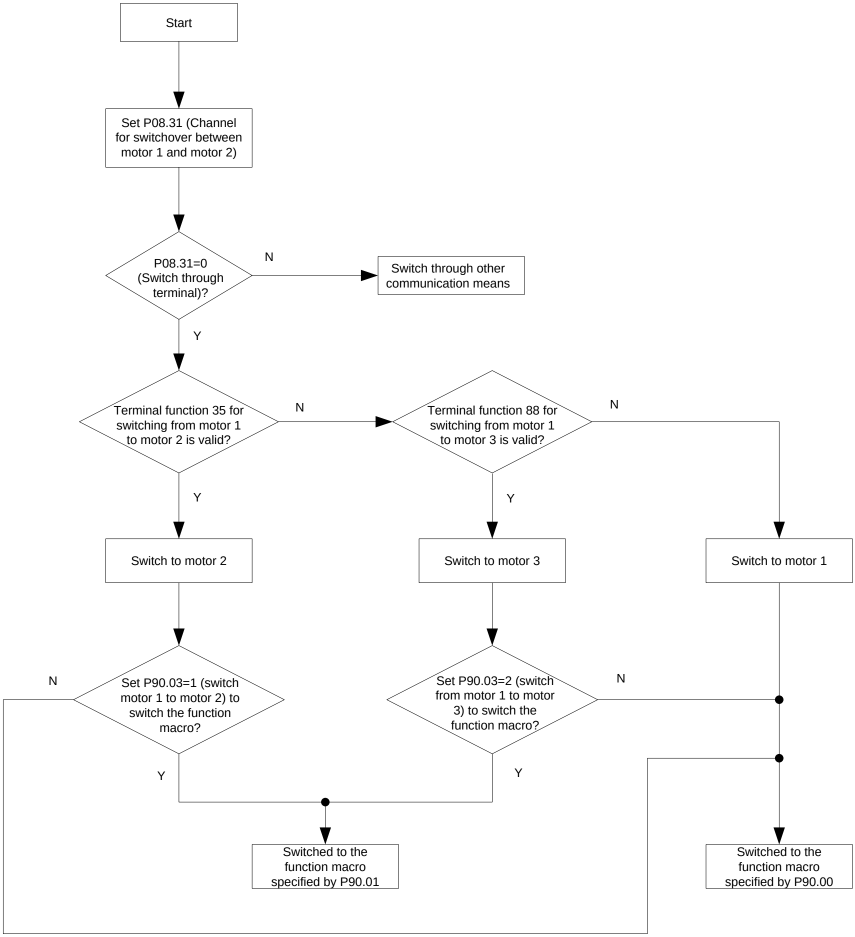
S1 status	S2 status	Current motor status	Contactor switch status
OFF	OFF	Switching to motor 1	KM1 closed, KM2 opened, KM3 opened
ON	OFF	Switching to motor 2	KM1 opened, KM2 closed, KM3 opened
OFF	ON	Switching to motor 3	KM1 opened, KM2 opened, KM3 closed
ON	ON	Switching to motor 2	KM1 opened, KM2 closed, KM3 opened

5.11.3 Motor and macro switchover parameters

Function code	Name	Description	Default
P08.31	Switchover between motor 1 and motor 2	0x00–0x14 Ones: Switchover channel 0: Terminal 1: MODBUS communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCat/Profinet communication Tens: Whether to allow switchover during running 0: Disallow 1: Allow	0x00
P90.00	Hoisting function macro setting	0–12 0: Common application mode 1: Lifting mode 1 (in open-loop vector control) 2: Lifting mode 2 (in closed-loop vector control) 3: Horizontal moving mode (in space voltage vector control) 4: Tower crane rotating mode 5: Conical motor application mode 6: User-defined function macro 1 7: User-defined function macro 2 8: User-defined function macro 3 9: Lifting mode 3 (in space voltage vector control) 10: Construction hoist mode 11: Closed-loop winching (for lifting in mineral wells and winches) 12: Open-loop winching (for lifting in mineral wells and winches)	0
P90.01	Terminal-switched function macro setting	0–12 The switched function macro is determined by P90.03. 0: Common application mode	0

Function code	Name	Description	Default
		1: Lifting mode 1 (in open-loop vector control) 2: Lifting mode 2 (in closed-loop vector control) 3: Horizontal moving mode (in space voltage vector control) 4: Tower crane rotating mode 5: Conical motor application mode 6: User-defined function macro 1 7: User-defined function macro 2 8: User-defined function macro 3 9: Lifting mode 3 (in space voltage vector control) 10: Construction hoist mode 11: Closed-loop winching (for lifting in mineral wells and winches) 12: Open-loop winching (for lifting in mineral wells and winches)	
P90.02	User-defined function macro setting	0–3 0: None 1: Enter the settings of user-defined function macro 1 2: Enter the settings of user-defined function macro 2 3: Enter the settings of user-defined function macro 3	0
P90.03	Method for terminals to switch function macros	0–4 0: No function macro switchover 1: Switch from motor 1 to motor 2 2: Switch from motor 1 to motor 3 3: Switch from the master to the slave 4: Switch from the slave to the master 5: Switch to SVC1 control (open-loop vector control 1)	0

5.11.4 Motor and macro switchover flowchart



5.11.5 User-defined macros

You can enter user-defined function macro settings through P90.02.

Function code	Name	Description	Default
P90.02	User-defined function macro setting	0–3 0: None 1: Enter the settings of user-defined function macro 1 2: Enter the settings of user-defined function macro 2 3: Enter the settings of user-defined function macro 3	0

When P90.02=1, you will automatically enter A80.00–A80.41 to set related function codes.

When P90.02=2, you will automatically enter A81.00–A81.41 to set related function codes.

When P90.02=3, you will automatically enter A82.00–A82.41 to set related function codes.

Currently, there are 42 common function codes available for you to define macros. The three user-defined macro tables are the same. The following lists A80.00–A80.41.

User-defined function list	Related function code	Name	Description	Setting range	Default
A80.00	P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: V/F control mode 3: Closed-loop vector control mode	0–3	2
A80.01	P00.01	Command running channel	0: Keypad 1: Terminal 2: Communication	0–2	0
A80.02	P00.06	Setting channel of A frequency command	0: Keypad 1–14: See chapter 7. 15: Graded multi-step speed	0–15	0
A80.03	P00.11	ACC time 1	0.0–3600.0s	0.0–3600.0	10.0s
A80.04	P00.12	DEC time 1	0.0–3600.0s	0.0–3600.0	10.0s
A80.05	P01.05	ACC/DEC mode	0: Straight line 1: S curve	0–1	0
A80.06	P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1	0

User-defined function list	Related function code	Name	Description	Setting range	Default
A80.07	P04.40	Enabling I/F mode for asynchronous motor 1	0–1	0–1	0
A80.08	P04.41	Forward current setting in I/F mode for asynchronous motor 1	0.0–200.0%	0.0–200.0%	120.0%
A80.09	P04.52	Reverse current setting in I/F mode for asynchronous motor 1	0.0–200.0%	0.0–200.0%	120.0%
A80.10	P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00–0x11	0
A80.11	P05.03	Function of S3 terminal	0: No function 1: Forward running 2: Reverse running 3–89: See chapter 7.	0–89	0
A80.12	P05.04	Function of S4 terminal		0–89	0
A80.13	P05.05	Function of HDIA terminal		0–89	0
A80.14	P06.01	Y output selection	0: Invalid 1: In running 2: In forward running 3: In reverse running 4–64: See chapter 7.	0–66	0
A80.15	P06.03	RO1 output selection		0–66	0
A80.16	P06.04	RO2 output selection		0–66	0
A80.17	P10.02	Multi-step speed 0	0.0–100.0%	0.0–100.0	0.0%
A80.18	P10.04	Multi-step speed 1	0.0–100.0%	0.0–100.0	0.0%

User-defined function list	Related function code	Name	Description	Setting range	Default
A80.19	P10.06	Multi-step speed 2	0.0–100.0%	0.0–100.0	0.0%
A80.20	P10.08	Multi-step speed 3	0.0–100.0%	0.0–100.0	0.0%
A80.21	P10.10	Multi-step speed 4	0.0–100.0%	0.0–100.0	0.0%
A80.22	P25.01	Function of S5 terminal	Same as group P05.	0–89	0
A80.23	P25.02	Function of S6 terminal		0–89	0
A80.24	P90.04	Enabling brake-oriented logic	0–1 0: The brake is controlled by an external controller. 1: The brake is controlled by the VFD.	0–1	0
A80.25	P90.05	Enabling forward torque for reverse-running start/stop	0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The reverse-running start direction complies with the command.) 1: Enable (The reverse-running start direction is always the forward-running direction.) Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The reverse-running stop direction complies with the command.) 1: Enable (The reverse-running stop direction is always the	0x00–0x11	0x00

User-defined function list	Related function code	Name	Description	Setting range	Default
			forward-running direction.)		
A80.26	P90.06	Graded multi-step speed reference 0	0.0–100.0%	0.0–100.0	0.0%
A80.27	P90.07	Graded multi-step speed reference 1	0.0–100.0%	0.0–100.0	0.0%
A80.28	P90.08	Graded multi-step speed reference 2	0.0–100.0%	0.0–100.0	0.0%
A80.29	P90.09	Graded multi-step speed reference 3	0.0–100.0%	0.0–100.0	0.0%
A80.30	P90.10	Graded multi-step speed reference 4	0.0–100.0%	0.0–100.0	0.0%
A80.31	P90.12	Forward brake release current	0.0–200.0% (of the motor rated current)	0.0–200.0	0.0%
A80.32	P90.13	Reverse brake release current	0.0–200.0% (of the motor rated current)	0.0–200.0	0.0%
A80.33	P90.16	Forward brake release frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A80.34	P90.17	Reverse brake release frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A80.35	P90.18	Forward brake closing frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A80.36	P90.19	Reverse brake closing frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A80.37	P90.20	Delay before forward brake release	0.000–5.000s	0.000–5.000	0.300s
A80.38	P90.22	Delay after forward brake release	0.000–5.000s	0.000–5.000	0.300s
A80.39	P90.24	Delay before forward brake closing	0.000–5.000s	0.000–5.000	0.300s
A80.40	P90.26	Delay after forward brake closing	0.000–5.000s	0.000–5.000	0.300s
A80.41	P90.31	Enabling the monitoring on brake status	0–1 0: Disable 1: Enable (brake feedback detection)	0–1	0

User-defined function list	Related function code	Name	Description	Setting range	Default
A81.00–A81.41	Same as A80.00–A80.41				
A82.00–A82.41	Same as A80.00–A80.41				

5.12 Measuring heights

5.12.1 Commissioning description

1. Internal measuring (Motor encoder)

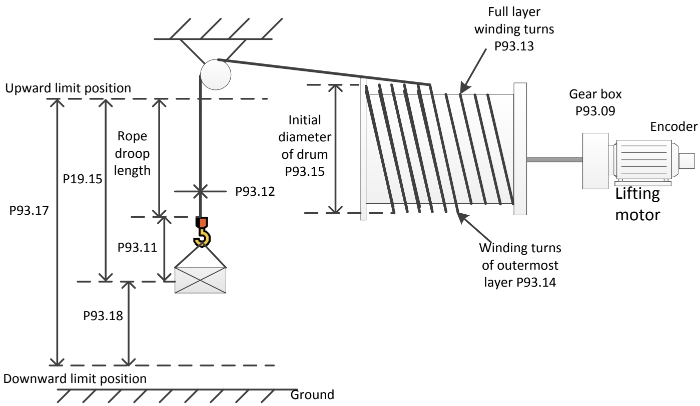


Figure 5.13 Internal measuring (motor encoder), using pulleys

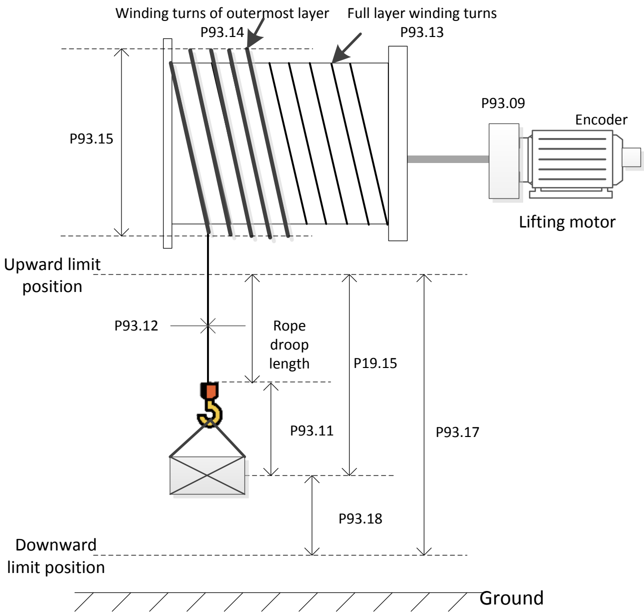


Figure 5.14 Internal measuring (motor encoder), without pulleys

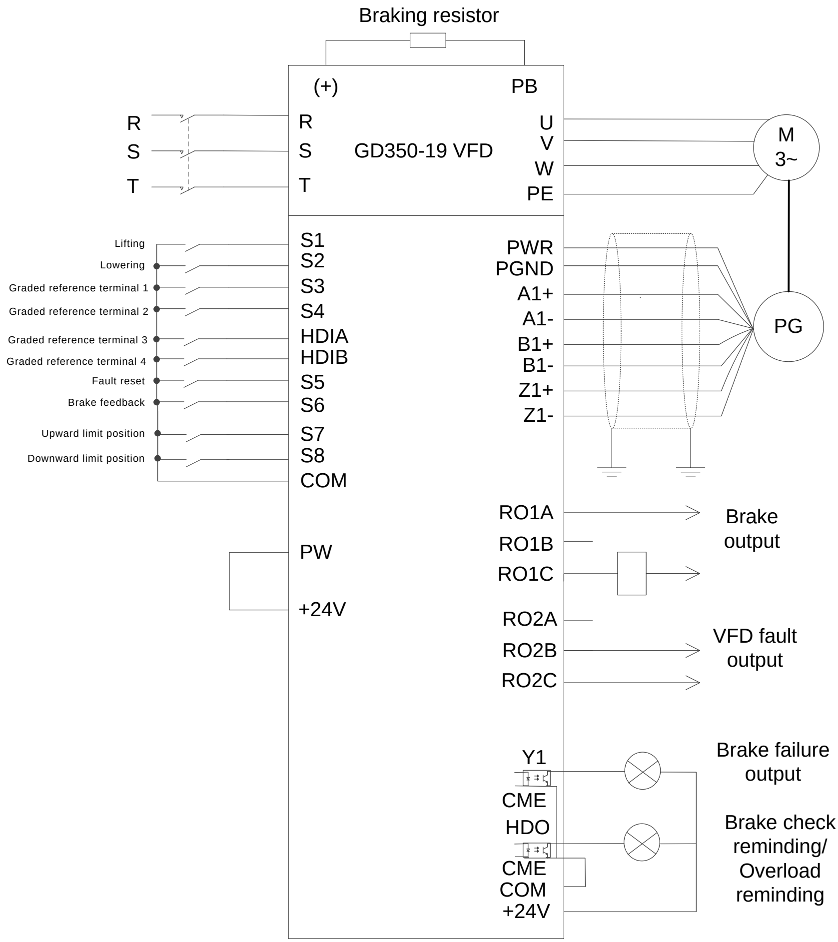


Figure 5.15 Wiring for internal measuring (motor encoder)

According to figure 5.15, you need to set the suspension ratio P93.10 when pulleys are used, so that the height can be correctly measured in the closed-loop mode. Then the measured encoder pulse count is used to calculate the actual running distance of the motor. During the first running, the upper limit needs to be calibrated. You need to use a PG card to connect the encoder (see Appendix A.6 for specific connection method), set P00.00=3 (Closed-loop control mode), P93.08=1 to enable internal measuring (motor encoder), and then set winding drum and cable parameters such as P93.09, P93.10, P93.11, P93.12, P93.13, P93.14 and P93.15.

The procedure for first running is as follows:

1. Set the upward limit terminal. For example, set P25.03=64, which indicates the S7 terminal is used as for upper limit input.
2. Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration.
3. Record the values of P93.12 and P93.13 and reset P19.15, P19.16, and P19.17.
4. After the calibration, send the running command through the S2 terminal to run downward. Check the values of P19.15, P19.16, and P19.17.

If the downward limit position needs to be used as the reference point, the procedure for first running is as follows:

1. Set the upward and downward limit terminals S7 and S8. For example, set P25.03=64 and P25.04=65.
2. Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration.
3. Record the values of P93.12 and P93.13 and reset P19.15, P19.16, and P19.17.
4. Send the running command through the S2 terminal to run downward only if the downward limit terminal S8 is valid. P93.17 displays the height from the upward limit position to the downward limit position and P93.18 displays 0.
5. The calibration is completed, which indicates proper running. P93.17 displays the height from the downward limit position to the upward limit position, P93.18 displays the height using the downward limit position as the reference point (the height is 0 at the downward limit position, the height is positive when it is above the downward limit position, the height is negative when it is under the downward limit position), and P19.15 displays the height using the upward limit position as the reference point (the height is 0 at the upward limit position, and only downward running is allowed when the upward limit position is reached, and P19.15 indicates the rope droop length when the upward limit position is not reached).

2. External measuring (HDI)

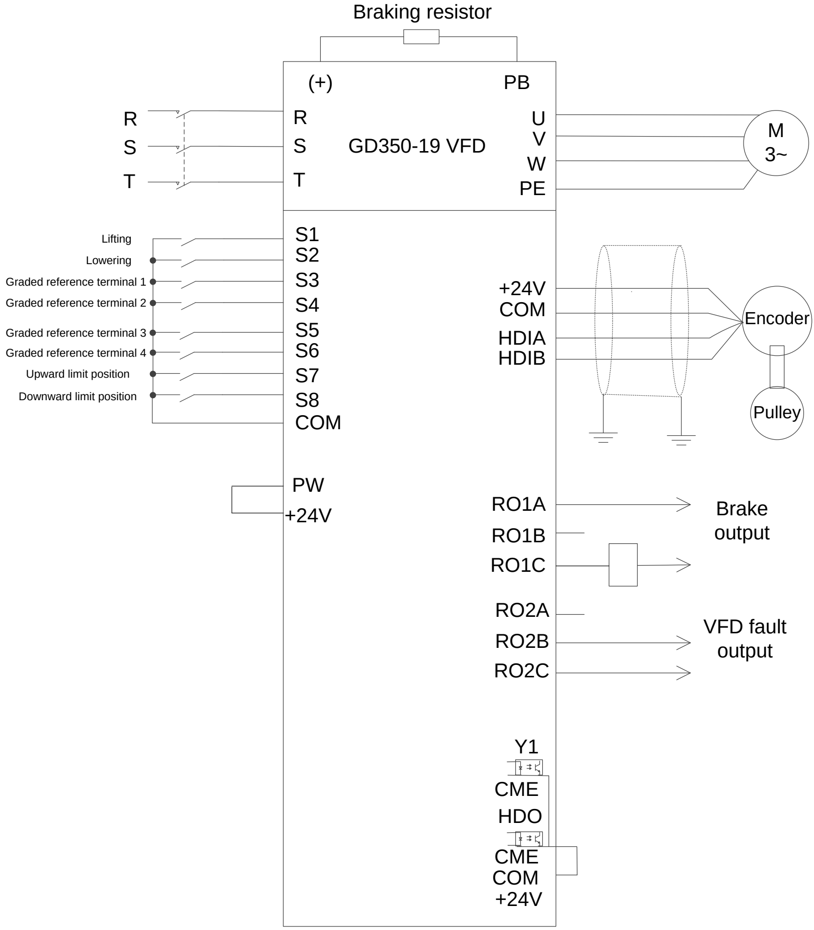


Figure 5.16 Wiring for external measuring (HDI) (In open-loop mode)

Note: During external measuring (HDI), only 24V incremental encoders can be used to measure pulley rotational speeds.

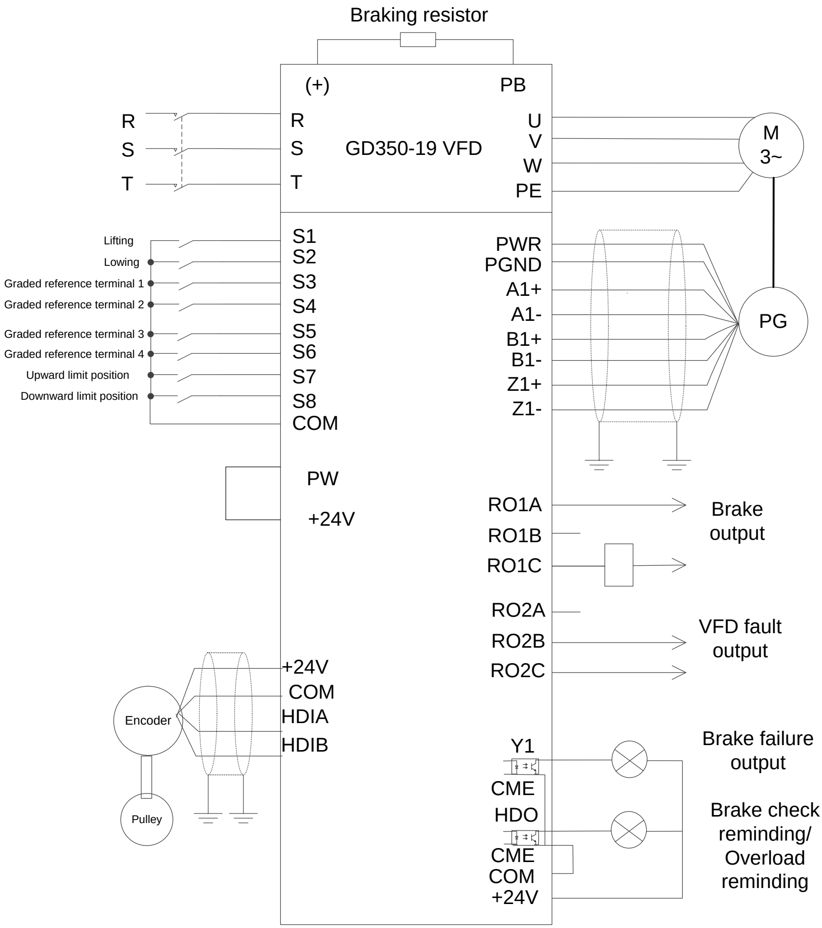


Figure 5.17 Wiring for external measuring (HDI) (In closed-loop mode)

Note: During external measuring (HDI), only 24V incremental encoders can be used to measure pulley rotational speeds.

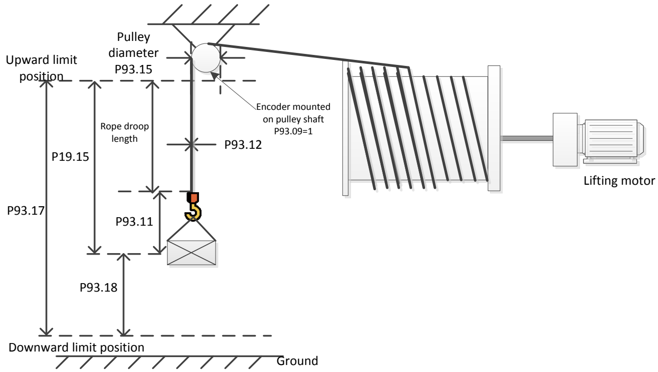


Figure 5.18 External measuring (HDI)

You need to set P05.38=2 and P05.44=2 to connect the encoder to HDIA and HDIB. In open/closed-loop mode, the encoder measures the encoder pulse count at the pulley side to calculate the actual cable running distance of pulley. Before first running, perform upward limit calibration.

The procedure for first running is as follows:

1. Set the upward limit terminal. For example, set P25.03=64, which indicates the S7 terminal is used as for upper limit input.
2. Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration. Reset P19.15, P19.16, and P19.17.
3. After the calibration, send the running command through the S2 terminal to run downward. Check the values of P19.15, P19.16, and P19.17.

If the downward limit position needs to be used as the reference point, the procedure for first running is as follows:

1. Set the upward and downward limit terminals S7 and S8. For example, set P25.03=64 and P25.04=65.
2. Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration. Reset P19.15, P19.16, and P19.17.
3. Send the running command through the S2 terminal to run downward only if the downward limit terminal S8 is valid. P93.17 displays the height from the upward limit position to the downward limit position and P93.18 displays 0.
4. The calibration is completed, which indicates proper running. P93.17 displays the height from the downward limit position to the upward limit position, P93.18 displays the height using the downward limit position as the reference point (the height is 0 at the downward limit position, the height is positive when it is above the downward limit position, the height is negative when it is under the downward limit position), and P19.15 displays the

height using the upward limit position as the reference point (the height is 0 at the upward limit position, and only downward running is allowed when the upward limit position is reached, and P19.15 indicates the rope droop length when the upward limit position is not reached).

Note: During external measuring (HDI) (for the encoder to measuring the pulley rotational speed), P93.09 indicates the transmission ratio between the encoder and pulley, while P93.15 indicates the pulley diameter.

5.12.2 Parameter about height measuring

Table 5.6 Parameters about internal measuring (motor encoder)

Function code	Name	Description	Setting
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Closed-loop vector control mode **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	3
P00.01	Command running channel	0: Keypad 1: Terminal 2: Communication	1
P05.01	Function of S1 terminal	1: Forward running	1
P05.02	Function of S2 terminal	2: Reverse running	2
P25.03	Function of S7 terminal	64: Limit of forward run (upward)	64
P25.04	Function of S8 terminal	65: Limit of reverse run (downward)	65
P20.15	Speed measuring mode	0: Speed measuring by PG card/height measuring on local	0
P93.08	Enabling height measuring	0–1 0: Disable 1: Enable internal measuring (motor encoder) (in closed-loop mode, the encoder measures speeds and heights) 2: Enable external measuring (HDI) (in open/closed-loop mode, the pulley encoder measures heights) **Note:** When P93.08=2 and P20.15=0, HDI is used	1

Function code	Name	Description	Setting
		to measure heights.	
P93.09	Mechanical transmission ratio	0.01–300.00	10.00
P93.10	Suspension ratio	1–4	1
P93.11	Rope length compensation	0.00m–50.00	0.00
P93.12	Cable diameter	0.1–100.0mm	10.0mm
P93.13	Per-layer turns of drum winding	1–200	30
P93.14	Initial turns of drum winding	0–P93.11 (Winding turns of the outermost layer in upward limit)	0
P93.15	Initial diameter of drum	100.0–2000.0mm (Max. drum diameter in upward limit, including cable thickness)	600.0mm
P93.16	Enabling upward/downward limit position check	0x00–0x11 Ones place: 0: The upward limit position is not reached. 1: The upward limit position is reached. Tens place: 0: The downward limit position is not reached. 1: The downward limit position is reached. **Note:** It is used to measure heights when there is no upward/downward limit devices.	0x00
Height status check			
P93.17	Total height measured	0.00–655.35m (Total height measured from the upward limit position to the downward limit position)	0.00m
P93.18	Measured height 1	-50.00m –655.35m (Using the downward limit position as the reference point)	0.00m
P19.15	Measured height	0.00–655.35m (Hook lowering distance using the upward limit position as the reference point)	0.00m
P19.16	MSB of measured height	0–65535	0
P19.17	LSB of measured height	0–65535	0

Table 5.7 Parameters about external measuring (HDI)

Function code	Name	Description	Setting
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Closed-loop vector control mode **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2
P00.01	Command running channel	0: Keypad 1: Terminal 2: Communication	1
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.01	Function of S1 terminal	1: Forward running	1
P05.02	Function of S2 terminal	2: Reverse running	2
P20.15	Speed measuring mode	0: Speed measuring by PG card/height measuring on local	0
P25.03	Function of S7 terminal	64: Limit of forward run (upward)	64
P25.04	Function of S8 terminal	65: Limit of reverse run (downward)	65
P05.38	HDIA high-speed pulse input function	2: Input through the encoder, used in combination with HDIB	2
P05.44	HDIB high-speed pulse input function	2: Input through the encoder, used in combination with HDIA	2
P93.08	Enabling height measuring	0–1 0: Disable 1: Enable internal measuring (motor encoder) (in closed-loop mode, the encoder measures	2

Function code	Name	Description	Setting
		speeds and heights) 2: Enable external measuring (HDI) (in open/closed-loop mode, the pulley encoder measures heights) **Note:** When P93.08=2 and P20.15=0, HDI is used to measure heights.	
P93.09	Mechanical transmission ratio	0.01–300.00	1.00
P93.10	Suspension ratio	1–4	1
P93.11	Rope length compensation	0.00m–50.00	0.00
P93.12	Cable diameter	0.1–100.0mm	10.0mm
P93.15	Pulley diameter	100.0–2000.0mm	600.0mm
Height status check			
P93.17	Total height measured	0.00–655.35m (Total height measured from the upward limit position to the downward limit position)	0.00m
P93.18	Measured height 1	-50.00m–655.35m (Using the downward limit position as the reference point)	0.00m
P19.15	Measured height	0.00–655.35m (Hook lowering distance)	0.00m
P19.16	MSB of measured height	0–65535	0
P19.17	LSB of measured height	0–65535	0

6 Operating

6.1 What this chapter contains

This chapter describes how to operate the VFD by the keypad.

6.2 Keypad

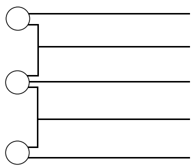
The keypad is used to control GD350-19 VFD, read the status data, and set the parameters.

Figure 6.1 Keypad diagram

Note:

- The LED keypad is a standard configuration for the VFD. In addition, if you need, the LCD keypad (an optional part) can be provided. The LCD keypad supports multiple languages, parameter copying function, and ten-row high-definition display. The installation size of the LCD is compatible with the LED keypad.
- If you need install the keypad on another position rather than on the VFD, use M3 screws or a keypad installation bracket. The installation bracket is an optional part for the 380V 1.5–30kW and 500V 4–18.5kW VFD models, but it is a standard part for the 380V 37–500kW, 500V 22–75kW, and 660V VFD models.

No.	Item	Description	
1	Status indicator	RUN/TUNE	VFD running status indicator. LED off: The VFD is stopped. LED blinking: The VFD is autotuning parameters. LED on: The VFD is running.
		FWD/REV	Forward or reverse running indicator. LED off: The VFD is running forward. LED on: The VFD is running reversely.
		LOCAL/REMOT	Indicates whether the VFD is controlled

No.	Item	Description		
2				through the keypad, terminals, or communication. LED off: The VFD is controlled through the keypad. LED blinking: The VFD is controlled through terminals. LED on: The VFD is controlled through remote communication.
		TRIP		Fault indicator. LED on: in fault state LED off: in normal state LED blinking: in pre-alarm state
2	Unit indicator	Unit displayed currently		
			Hz	Frequency unit
			RPM	Rotational speed unit
			A	Current unit
			%	Percentage
			V	Voltage unit
3	Digital display zone	Five-digit LED displays various monitoring data and alarm codes such as the set frequency and output frequency.		
4	Digital potentiometer	Tuning frequency. For details, see the description of P08.41.		
5	Buttons		Programming key	Press it to enter or exit level-1 menus or delete a parameter.

Display	Means	Display	Means	Display	Means
0	0	1	1	2	2
3	3	4	4	5	5
6	6	7	7	8	8
9	9	A.	A	b.	B
C.	C	d	d	E.	E
F.	F	H.	H	I.	I
L.	L	n.	N	n	n
0	o	P.	P	r	r
S.	S	t	t	U.	U
u	v	.	.	-	-

No.	Item	Description		
			Entry key	Press it to enter menus in cascading mode or confirm the setting of a parameter.
			Up	Press it to increase data or move upward.
			Down	Press it to decrease data or move downward.
			Right-shifting	Press it to select display parameters rightward in the interface for the device in stopped or running state or to select digits to change during parameter setting.
			Run	Press it to run the device when using the keypad for control.
			Stop/Reset	Press it to stop the device that is running. The function of this key is restricted by P07.05. In fault alarm state, this key can be used for reset in any control modes.
			Multifunctional shortcut key	The function is determined by P07.04.

6.3 Keypad display

The display state of GD350-19 series keypad is divided into stop parameter display state, running parameter display state and fault alarm display state.

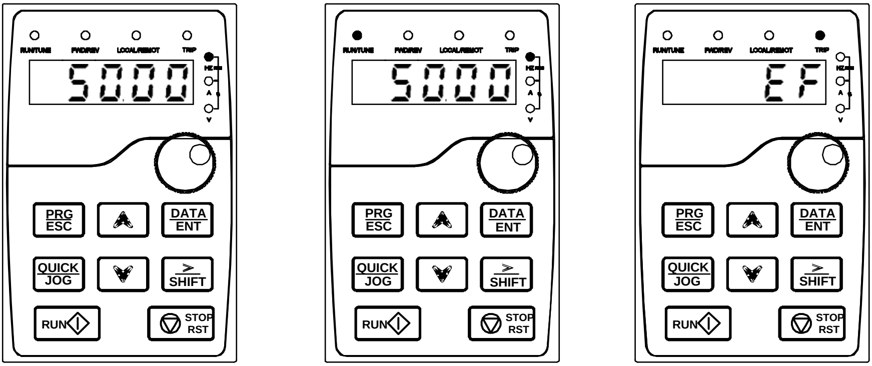
6.3.1 Displaying fault information

After detecting a fault signal, the VFD enters the fault alarm state immediately, the fault code blinks on the keypad, and the TRIP indicator is on. You can perform fault reset by using the STOP/RST key, control terminals, or communication commands.

If the fault still persists, the fault code is continuously displayed.

6.3.2 Editing function codes

You can press the PRG/ESC key to enter the editing mode in stopped, running, or fault alarm state (if a user password is used, see the description of P07.00). The editing mode contains two levels of menus in the following sequence: Function code group or function code number → Function parameter. You can press the DATA/ENT key to enter the function parameter display interface. On the function parameter display interface, you can press the DATA/ENT key to save parameter settings or press the PRG/ESC key to exit the parameter display interface.



Parameters displayed in stopped state

Parameters displayed in running state

Information displayed in faulty state

Figure 6.2 Keypad display

6.4 Operations on keypad

You can perform various operations on the rectifier by using a keypad. For details about the structure of the function codes, see the function code list.

6.4.1 Modifying function codes

The VFD has three levels menu, which are:

1. Group number of function code (first-level menu)

2. Tab of function code (second-level menu)

3. Set value of function code (third-level menu)

Remarks: Press both the PRG/ESC and the DATA/ENT can return to the second-level menu from the third-level menu. The difference is: pressing DATA/ENT will save the set parameters into the control panel, and then return to the second-level menu with shifting to the next function code automatically; while pressing PRG/ESC will directly return to the second-level menu without saving the parameters, and keep staying at the current function code.

Under the third-level menu, if the parameter has no flickering bit, it means the function code cannot be modified. The possible reasons could be:

1) This function code is not modifiable parameter, such as actual detected parameter, operation records and so on;

2) This function code is not modifiable in running state, but modifiable in stop state.

Example: Set function code P00.01 from 0 to 1.

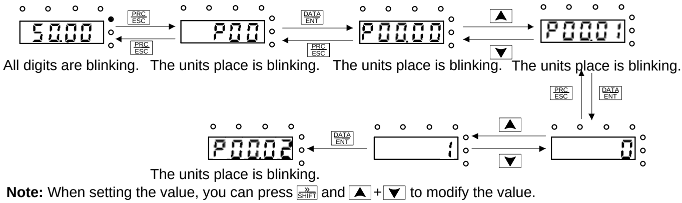


Figure 6.3 Sketch map of modifying parameters

6.4.2 How to set the password of the VFD

Goodrive350-19 VFDs provide password protection function. Set P07.00 to gain the password and the password protection becomes valid instantly after quitting from the function code editing state. Press PRG/ESC again to the function code editing state, "0.0.0.0.0" will be displayed. Unless using the correct password, you cannot enter it.

Set P07.00 to 0 to cancel password protection function.

The password protection becomes effective instantly after retreating form the function code editing state. Press PRG/ESC again to the function code editing state, "0.0.0.0.0" will be displayed. Unless using the correct password, the operators cannot enter it.

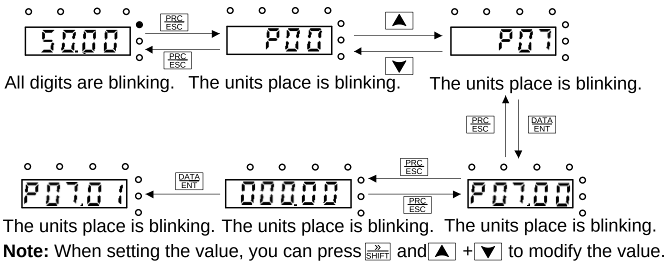


Figure 6.4 Sketch map of password setting

6.4.3 How to view the VFD state through function codes

Goodrive350-19 series VFDs provide group P17 as the state inspection group. You can enter P17 directly to view the state.

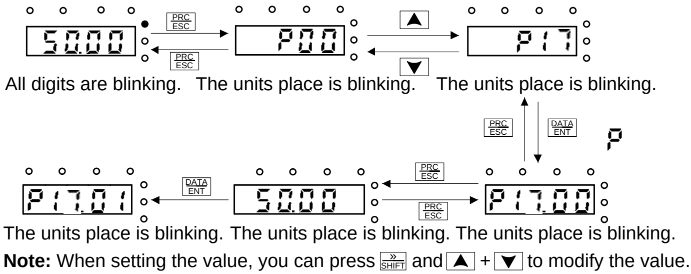


Figure 6.5 Sketch map of state viewing

6.5 Basic operation instruction

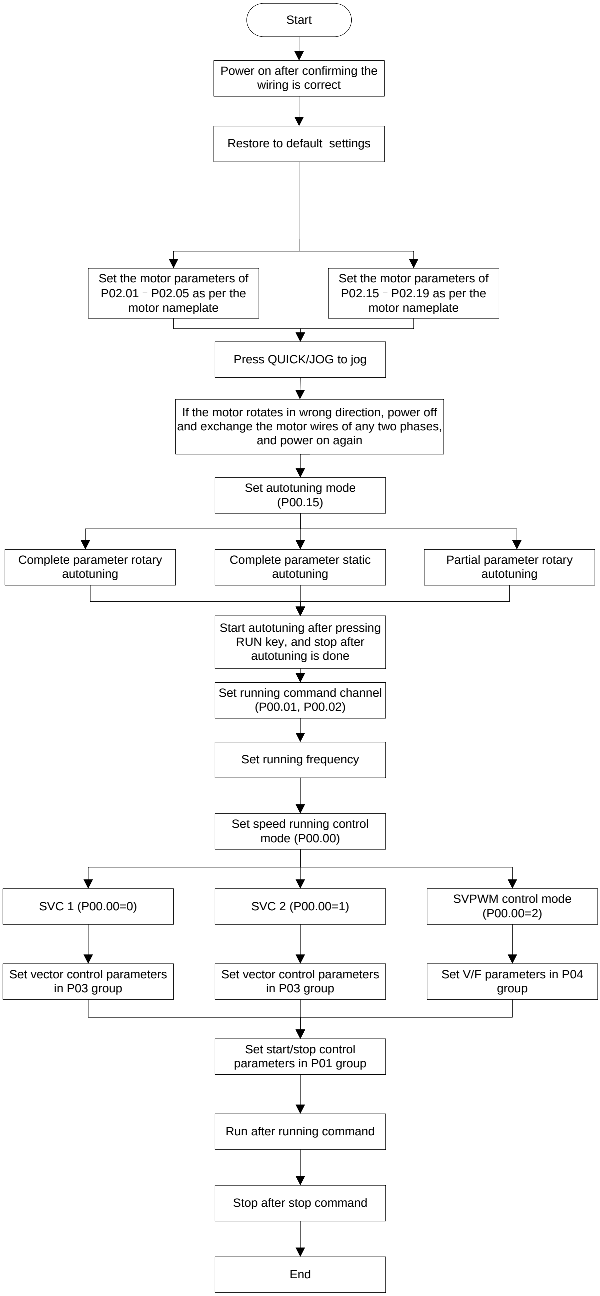
6.5.1 What this section contains

This section introduces the function modules inside the VFD.

	✧ Ensure all the terminals are fixed and tightened firmly. ✧ Ensure the motor matches with the VFD power.

6.5.2 Common commissioning procedure

The common operation procedure is shown as follows (taking motor 1 as an example).


Start
Power on after confirming the wiring is correct
Restore to default settings
Set the motor parameters of P02.01－P02.05 as per the motor nameplate
Set the motor parameters of P02.15－P02.19 as per the motor nameplate
Press QUICK/JOG to jog
If the motor rotates in wrong direction, power off and exchange the motor wires of any two phases, and power on again
Set autotuning mode (P00.15)
Complete parameter rotary autotuning
Complete parameter static autotuning
Partial parameter rotary autotuning
Start autotuning after pressing RUN key, and stop after autotuning is done
Set running command channel (P00.01, P00.02)
Set running frequency
Set speed running control mode (P00.00)
SVC 1 (P00.00=0)
SVC 2 (P00.00=1)
SVPWM control mode (P00.00=2)
Set vector control parameters in P03 group
Set vector control parameters in P03 group
Set V/F parameters in P04 group
Set start/stop control parameters in P01 group
Run after running command
Stop after stop command
End

Note: If a fault occurred, find out the fault cause according to "fault tracking".

The running command channel can be set by terminal commands besides P00.01 and P00.02.

Current running command channel P00.01	Multi-function terminal function (36) Command switches to keypad	Multi-function terminal function (37) Command switches to terminal	Multi-function terminal function (38) Command switches to communication
Keypad	/	Terminal	Communication
Terminal	Keypad	/	Communication
Communication	Keypad	Terminal	/

Note: "/" means this multi-function terminal is valid under current reference channel.

Related parameter list:

Function code	Name	Description	Default value
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0
P00.02	Communication running command channel	0:MODBUS 1:PROFIBUS/CANopen/Devicenet 2:Ethernet 3:EtherCat/Profinet 4:PLC programmable card 5:Bluetooth card	0
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high	0

Function code	Name	Description	Default value
		control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned.	
P00.18	Function parameter restoration	0: No operation 1: Restore to default value 2: Clear fault history **Note:** After the selected function operations are done, this function code will be restored to 0 automatically. Restoration to default value will clear the user password. Exercise caution before using this function.	0
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P02.01	Rated power of asynchronous motor 1	0.1–3000.0kW	Model depended
P02.02	Rated frequency of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	Rated speed of asynchronous motor 1	1–36000rpm	Model depended
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Model depended
P02.05	Rated current of asynchronous motor 1	0.8–6000.0A	Model depended

Function code	Name	Description	Default value
P02.15	Rated power of synchronous motor 1	0.1–3000.0kW	Model depended
P02.16	Rated frequency of synchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	Number of pole pairs of synchronous motor 1	1–50	2
P02.18	Rated voltage of synchronous motor 1	0–1200V	Model depended
P02.19	Rated current of synchronous motor 1	0.8–6000.0A	Model depended
P05.01–P05.06	Function of multi-function digital input terminal (S1–S4, HDIA, HDIB)	36: Command switches to keypad 37: Command switches to terminal 38: Command switches to communication	/
P07.01	Function parameter copying	Range: 0–4 0: No operation 1: Upload parameters to the keypad 2: Download all parameters (including motor parameters) 3: Download non-motor parameters. 4: Download motor parameters.	0
P07.02	QUICK/JOG key function	Range: 0x00–0x27 Ones: QUICK/JOG key function selection 0: No function 1: Jogging 2: Reserved 3: Switching between forward/reverse rotation 4: Clear UP/DOWN setting 5: Coast to stop	0x01

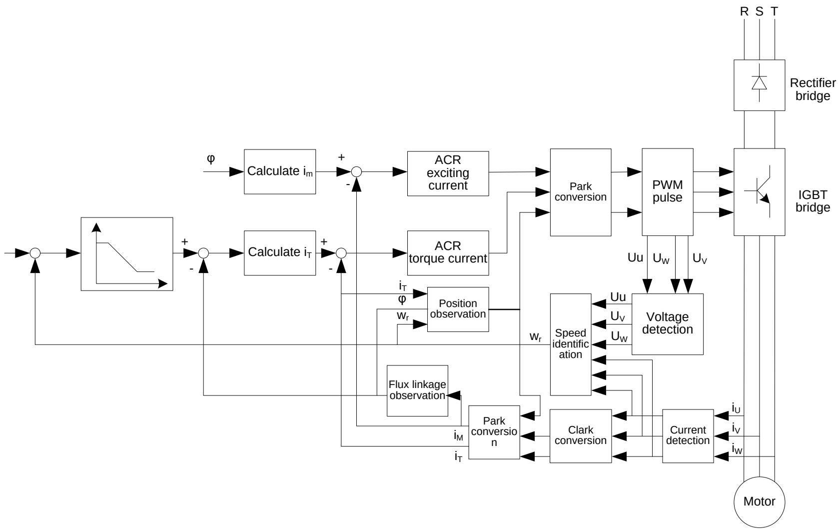
Function code	Name	Description	Default value
		6: Switch running command reference mode by sequence 7: Reserved Tens: Reserved	

6.5.3 Vector control

Asynchronous motors are featured with high order, non-linear, strong coupling and multi-variables, which makes it very difficult to control asynchronous motors during actual application. The vector control theory aims to solve this problem through measuring and controlling the stator current vector of asynchronous motor, and decomposing the stator current vector into exciting current (current component which generates internal magnet field) and torque current (current component which generates torque) based on field orientation principle, and then controlling the amplitude value and phase position of these two components (namely, control the stator current vector of motor) to realize decoupling control of exciting current and torque current, thus achieving high-performance speed regulation of asynchronous motor.

GD350-19 series VFD carries built-in speed sensor-less vector control algorithm, which can be used to drive the asynchronous motor and permanent-magnet synchronous motor simultaneously. As the core algorithm of vector control is based on accurate motor parameter model, the accuracy of motor parameters will impact the control performance of vector control. It is recommended to input accurate motor parameters and carry out motor parameter autotuning before vector operation.

As vector control algorithm is complicated, you should be cautious of regulation on dedicated function parameters of vector control.



Function code	Name	Description	Default value
P00.00	Speed control mode	0: SVC 0 1: SVC 1 2: SVPWM 3: VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load;	0

Function code	Name	Description	Default value
		3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned.	
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P03.00	Speed loop proportional gain 1	0–200.0	20.0
P03.01	Speed loop integral time 1	0.000–10.000s	0.200s
P03.02	Switching low point frequency	0.00Hz–P03.05	5.00Hz
P03.03	Speed loop proportional gain 2	0–200.0	20.0
P03.04	Speed loop integral time 2	0.000–10.000s	0.200s
P03.05	Switching high point frequency	P03.02–P00.03 (Max. output frequency)	10.00Hz
P03.06	Speed loop output filter	0–8 (corresponds to 0–2^8/10ms)	0
P03.07	Electromotion slip compensation coefficient of vector control	50%–200%	100%
P03.08	Brake slip compensation coefficient of vector control	50%–200%	100%
P03.09	Current loop proportional coefficient P	0–65535	1000
P03.10	Current loop integral coefficient I	0–65535	1000

Function code	Name	Description	Default value
P03.11	Torque setup mode selection	1: Set via keypad (P03.12) 2: Set via AI1 (100% corresponds to three times of rated motor current) 3: Set via AI2 (the same as above) 4: Set via AI3 (the same as above) 5: Set via pulse frequency HDIA (the same as above) 6: Set via multi-step torque (the same as above) 7: Set via MODBUS communication (the same as above) 8: Set via PROFIBUS/CANopen/DeviceNet communication (the same as above) 9: Set via Ethernet communication (the same as above) 10: Set via pulse frequency HDIB (the same as above) 11: Set via EtherCat/Profinet communication 12: Set via PLC **Note:** For the options 2–12, 100% corresponds to three times of rated motor current.	1
P03.12	Torque set by keypad	-300.0%–300.0% (motor rated current)	50.0%
P03.13	Torque reference filter time	0.000–10.000s	0.010s
P03.14	Source of upper limit frequency setup of forward rotation in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above)	0

Function code	Name	Description	Default value
		4: Pulse frequency HDIA (the same as above) 5: Multi-step speed (the same as above) 6: MODBUS communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCat/Profinet communication 11: PLC 12: Reserved **Note:** For the options 1–11, 100% corresponds to the max. frequency.	
P03.15	Source of upper limit frequency setup of reverse rotation in torque control	0: Keypad (P03.17) 1–11: same as P03.14	0
P03.16	Keypad limit value of upper limit frequency of forward rotation in torque control	Value range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz
P03.17	Keypad limit value of upper limit frequency of reverse rotation in torque control		50.00Hz
P03.18	Source of upper limit setup of the torque when motoring	0: Keypad (P03.20) 1: AI1 (100% relative to three times of motor current) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as	0

Function code	Name	Description	Default value
		above) 5: MODBUS communication (the same as above) 6: PROFIBUS/CANopen/DeviceNet communication (the same as above) 7: Ethernet communication (the same as above) 8: Pulse frequency HDIB (the same as above) 9: EtherCat/Profinet communication 10: PLC 11: Reserved **Note:** For the options 1–10, 100% is relative to three times of motor current.	
P03.19	Source of upper limit setup of brake torque	0: Keypad (P03.21) 1–10: the same as P03.18	0
P03.20	Set upper limit of the torque when motoring via keypad	0.0–300.0% (rated motor current)	180.0%
P03.21	Set upper limit of brake torque via keypad		180.0%
P03.22	Flux-weakening coefficient in constant power area	0.1–2.0	0.3
P03.23	Min. flux-weakening point in constant power area	10%–100%	20%
P03.24	Max. voltage limit	0.0–120.0%	100.0%
P03.25	Pre-exciting time	0.000–10.000s	0.300s
P03.32	Torque control enable	0:Disable 1:Enable	0
P03.35	Control optimization setting	Ones place: Reserved	0x0000

Function code	Name	Description	Default value
		0: Reserved 1: Reserved Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: ASR integral separation enabling 0: Disabled 1: Enabled Thousands place: Reserved 0: Reserved 1: Reserved Range: 0x0000–0x1111	
P03.36	ASR differential gain	0.00–10.00s	0.00s
P03.37	High-frequency ACR proportional coefficient	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the ACR high-frequency switching threshold (P03.39), the ACR PI parameters are P03.09 and P03.10; and when the frequency is higher than the ACR high-frequency switching threshold (P03.39), the ACR PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–20000 Setting range of P03.38: 0–20000 Setting range of P03.39: 0.0–100.0% (relative to the maximum frequency)	1000
P03.38	High-frequency ACR integral coefficient		1000
P03.39	ACR high-frequency switching threshold		100.0%
P17.32	Flux linkage	0.0–200.0%	0.0%

6.5.4 SVPWM control mode

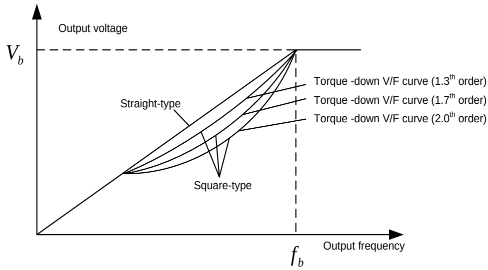
GD350-19 VFD also carries built-in SVPWM control function. SVPWM mode can be used in cases where mediocre control precision is enough. In cases where a VFD needs to drive multiple motors, it is also recommended to adopt SVPWM control mode.

GD350-19 VFD provides multiple kinds of V/F curve modes to meet different field needs. You can select corresponding V/F curve or set the V/F curve as needed.

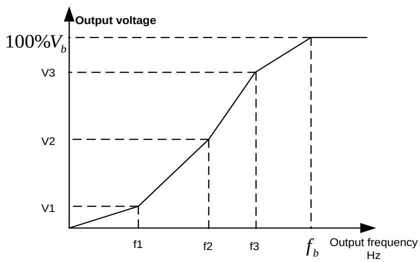
Suggestions:

1. For the load with constant moment, for example, conveyor belt which runs in straight line, as the moment must be constant during the whole running process, it is recommended to adopt straight-type V/F curve.

2. For the load with decreasing moment, for example, fan and water pump, as the relation between its actual torque and speed is squared or cubed, it is recommended to adopt the V/F curve corresponds to power 1.3, 1.7 or 2.0.



GD350-19 VFD also provides multi-point V/F curve. You can alter the V/F curve outputted by VFD through setting the voltage and frequency of the three points in the middle. The whole curve consists of five points starting from (0Hz, 0V) and ending in (fundamental motor frequency, rated motor voltage). During setup, it is required that 0≤f1≤f2≤f3≤Fundamental motor frequency, and 0≤V1≤V2≤V3≤Rated motor voltage



GD350-19 VFD provides dedicated function codes for SVPWM control mode. You can improve the performance of SVPWM through settings.

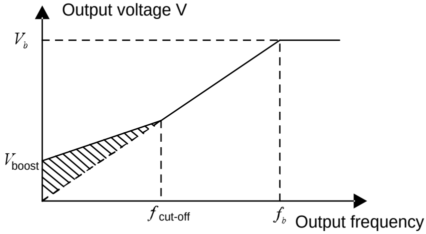
1. Torque boost

Torque boost function can effectively compensate for the low-speed torque performance during SVPWM control. Automatic torque boost has been set by default to enable the VFD to adjust the torque boost value based on actual load conditions.

Note:

(1) Torque boost is effective only under torque boost cut-off frequency;

(2) If the torque boost is too large, low-frequency vibration or overcurrent may occur to the motor, if such situation occurs, lower the torque boost value.



2. 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.

Note:

(1) This function is generally used in light load or no-load cases.

(2) This function is not suitable in cases where load transient occur frequently.

3. V/F slip compensation gain

SVPWM control belongs to open-loop mode, which will cause motor speed to fluctuate when motor load transients. In cases where strict speed requirement is needed, you can set the slip compensation gain to compensate for the speed variation caused by load fluctuation through internal output adjustment of VFD.

The setting range of slip compensation gain is 0–200%, in which 100% corresponds to the rated slip frequency.

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

4. Oscillation control

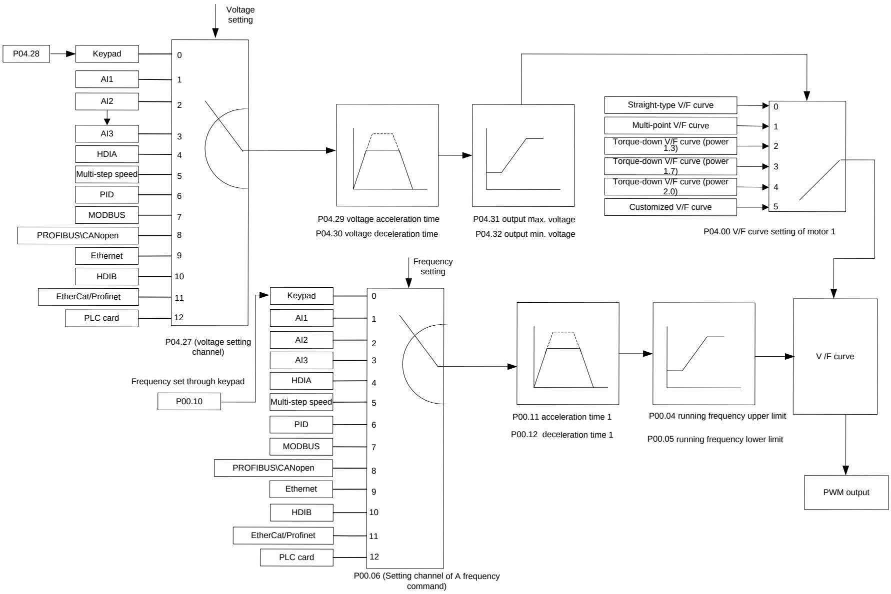
Motor oscillation often occurs in SVPWM control in large-power drive applications. To solve this problem, GD350-19 series VFD sets two function codes to control the oscillation factor, and you can set the corresponding function code based on the occurrence frequency of oscillation.

Note: The larger the set value, the better the control effect, however, if the set value is too large, it may easily lead to too large VFD output current.

5. Asynchronous motor I/F control

Generally, the I/F control mode is valid for asynchronous motors. It can be used for synchronous motors only when the motor frequency is extremely low. The I/F control described in this manual is only involved with asynchronous motors. I/F control is implemented by performing closed-loop control on the total VFD output current. The output voltage adapts to the current reference, and open-loop control is separately performed over the frequency of the voltage and current.

Customized V/F curve (V/F separation) function:



When selecting customized V/F curve function, you can set the reference channels and acceleration/deceleration time of voltage and frequency respectively, which will form a real-time V/F curve through combination.

Note: This V/F curve separation can be applied in various variable-frequency power source scenarios. However, exercise cautious when setting parameters as improper setting may damage the machine.

Function code	Name	Description	Default value
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2

Function code	Name	Description	Default value
P00.03	Max. output frequency	P00.04–400.00Hz	50.00Hz
P00.04	Upper limit of running frequency	P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	0.00Hz–P00.04	0.00Hz
P00.11	Acceleration time 1	0.0–3600.0s	Model depended
P00.12	Deceleration time 1	0.0–3600.0s	Model depended
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P02.02	Rated power of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Model depended
P04.00	V/F curve setting of motor 1	0: Straight-type V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (power 1.3) 3: Torque-down V/F curve (power 1.7) 4: Torque-down V/F curve (power 2.0) 5: Customized V/F (V/F separation)	0
P04.01	Torque boost of motor 1	0.0%: (automatic) 0.1%–10.0%	0.0%
P04.02	Motor 1 torque boost cut-off	0.0%–50.0% (rated frequency of motor 1)	20.0%
P04.03	V/F frequency point 1 of motor 1	0.00Hz–P04.05	0.00Hz

Function code	Name	Description	Default value
P04.04	V/F voltage point 1 of motor 1	0.0%–110.0%	0.0%
P04.05	V/F frequency point 2 of motor 1	P04.03– P04.07	0.00Hz
P04.06	V/F voltage point 2 of motor 1	0.0%–110.0%	0.0%
P04.07	V/F frequency point 3 of motor 1	P04.05–P02.02 or P04.05–P02.16	0.00Hz
P04.08	V/F voltage point 3 of motor 1	0.0%–110.0%	0.0%
P04.09	V/F slip compensation gain of motor 1	0.0–200.0%	100.0%
P04.10	Low-frequency oscillation control factor of motor 1	0–100	10
P04.11	High-frequency oscillation control factor of motor 1	0–100	10
P04.12	Oscillation control threshold of motor 1	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.13	V/F curve setup of motor 2	0: Straight V/F curve; 1: Multi-point V/F curve 2: Torque-down V/F curve (1.3th order) 3: Torque-down V/F curve (1.7th order) 4: Torque-down V/F curve (2.0th order) 5: Customize V/F (V/F separation)	0
P04.14	Torque boost of motor 2	0.0%: (automatic) 0.1%–10.0%	0.0%

Function code	Name	Description	Default value
P04.15	Motor 2 torque boost cut-off	0.0%–50.0% (rated frequency of motor 1)	20.0%
P04.16	V/F frequency point 1 of motor 2	0.00Hz–P04.18	0.00Hz
P04.17	V/F voltage point 1 of motor 2	0.0%–110.0%	0.0%
P04.18	V/F frequency point 2 of motor 2	P04.16–P04.20	0.00Hz
P04.19	V/F voltage point 2 of motor 2	0.0%–110.0%	0.0%
P04.20	V/F frequency point 3 of motor 2	P04.18–P02.02 or P04.18–P02.16	0.00Hz
P04.21	V/F voltage point 3 of motor 2	0.0%–110.0%	0.0%
P04.22	V/F slip compensation gain of motor 2	0.0–200.0%	100.0%
P04.23	Low-frequency oscillation control factor of motor 2	0–100	10
P04.24	High-frequency oscillation control factor of motor 2	0–100	10
P04.25	Oscillation control threshold of motor 2	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.26	Energy-saving run	0: No 1: Automatic energy-saving run	0
P04.27	Channel of voltage setup	0: Keypad; output voltage is determined by P04.28 1: AI1	0

Function code	Name	Description	Default value
		2: AI2 3: AI3 4: HDIA 5: Multi-step 6: PID 7: MODBUS communication 8: PROFIBUS/CANopen communication 9: Ethernet communication 10: HDIB 11: EtherCat/Profinet communication 12: PLC card 13: Reserved	
P04.28	Set voltage value via keypad	0.0%–100.0% (rated motor voltage)	100.0%
P04.29	Voltage increase time	0.0–3600.0s	5.0s
P04.30	Voltage decrease time	0.0–3600.0s	5.0s
P04.31	Output max. voltage	P04.32–100.0% (rated motor voltage)	100.0%
P04.32	Output min. voltage	0.0%–P04.31 (rated motor voltage)	0.0%
P04.33	Flux-weakening coefficient in the constant power zone	1.00–1.30	1.00
P04.34	Input current 1 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is lower than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	20.0%

Function code	Name	Description	Default value
P04.35	Input current 2 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is higher than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	10.0%
P04.36	Frequency threshold for input current switching in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the frequency threshold for the switching between input current 1 and input current 2. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz
P04.37	Reactive current closed-loop proportional coefficient in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the proportional coefficient of the reactive current closed-loop control. Setting range: 0–3000	50
P04.38	Reactive current closed-loop integral time in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the integral coefficient of the reactive current closed-loop control. Setting range: 0–3000	30
P04.39	Reactive current closed-loop output limit in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this 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 this parameter. Setting range: 0–16000	8000
P04.40	Enable I/F mode for	0: Disabled	0

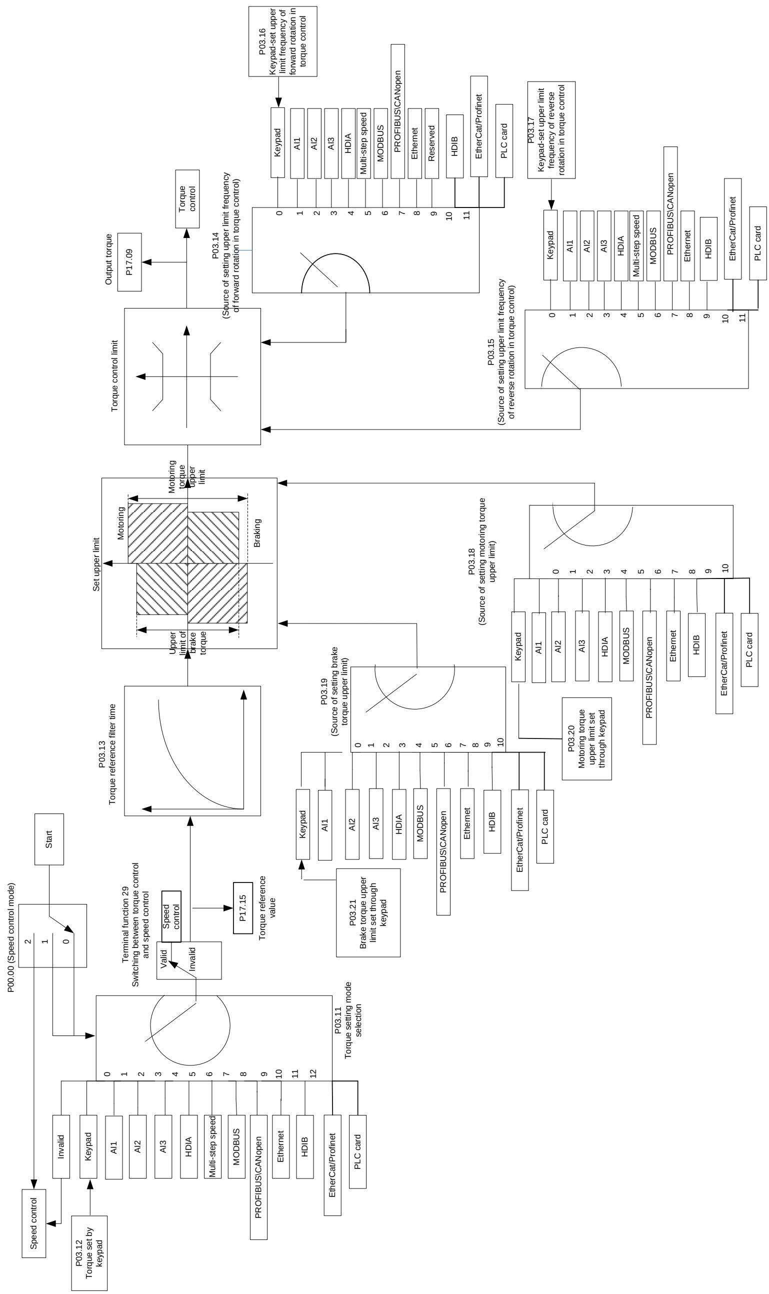
Function code	Name	Description	Default value
	asynchronous motor 1	1: Enabled **Note:** The I/F mode is not applicable to conical motors.	
P04.41	Current setting in I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%
P04.42	Proportional coefficient in I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	350
P04.43	Integral coefficient in I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150
P04.44	Starting frequency for switching off I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the starting frequency for switching off the output current closed-loop control. When the frequency is lower than the value of this parameter, the current closed-loop control in the I/F control mode is enabled; and when the frequency is higher than that, the current closed-loop control in the I/F control mode is disabled. Setting range: 0.00–20.00 Hz	10.00Hz
P04.45	Enabling I/F mode for asynchronous motor 2	0: Disable 1: Enable **Note:** The I/F mode is not applicable to conical motors.	0

Function code	Name	Description	Default value
P04.46	Current setting in I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this 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 I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	350
P04.48	Integral coefficient in I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150
P04.49	Starting frequency for switching off I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this parameter is used to set the Starting frequency for switching off the output current closed-loop control. When the frequency is lower than the value of this parameter, the current closed-loop control in the I/F control mode is enabled; and when the frequency is higher than that, the current closed-loop control in the I/F control mode is disabled. Setting range: 0.00–20.00 Hz	10.00Hz
P04.50	End frequency for switching off I/F mode for asynchronous motor 1	P04.44–P00.03	25.00Hz
P04.51	End frequency for switching off I/F mode for asynchronous motor 2	P04.49–P00.03	25.00Hz

Function code	Name	Description	Default value
P04.52	Current setting for reverse running in I/F mode for asynchronous motor 1	0.0–200.0%	120.0%
P04.53	Current setting for reverse running in I/F mode for asynchronous motor 2	0.0–200.0%	120.0%

6.5.5 Torque control

GD350-19 VFD supports torque control and speed control. Speed control mode 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 torque limit. Torque control mode aims to stabilize the torque to keep the set torque consistent with the actual output torque, meanwhile, the output frequency is restricted by upper/lower limit.


P03.16
Keypad-set upper limit frequency of forward rotation in torque control
Keypad
AI1
AI2
AI3
HDIA
Multi-step speed
MODBUS
PROFIBUS\CANopen
Ethernet
Reserved
HDIB
EtherCat/Profinet
PLC card
Torque control
Output torque
P17.09
P03.14
(Source of setting upper limit frequency of forward rotation in torque control)
P03.17
Keypad-set upper limit frequency of reverse rotation in torque control
P03.15
(Source of setting upper limit frequency of reverse rotation in torque control)
Torque control limit
Motoring torque upper limit
Motoring
Braking
Set upper limit
Upper limit of brake torque
P03.18
(Source of setting motoring torque upper limit)
P03.19
(Source of setting brake torque upper limit)
P03.20
Motoring torque upper limit set through keypad
P03.21
Brake torque upper limit set through keypad
P03.13
Torque reference filter time
Start
P00.00 (Speed control mode)
Terminal function 29
Switching between torque control and speed control
Valid
Invalid
Speed control
P17.15
Torque reference value
P03.11
Torque setting mode selection
Invalid
Speed control
P03.12
Torque set by keypad

Function code	Name	Description	Default value
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2
P03.32	Torque control enable	0:Disable 1:Enable	0
P03.11	Torque setup mode selection	0: Set via keypad (P03.12) 1: Set via keypad (P03.12) 2: Set via AI1 (100% corresponds to three times of rated motor current) 3: Set via AI2 (the same as above) 4: Set via AI3 (the same as above) 5: Set via pulse frequency HDIA (the same as above) 6: Set via multi-step torque (the same as above) 7: Set via MODBUS communication (the same as above) 8: Set via PROFIBUS/CANopen/DeviceNet communication (the same as above) 9: Set via Ethernet communication (the same as above) 10: Set via pulse frequency HDIB (the same as above) 11: Set via EtherCat/Profinet communication 12: Set via PLC **Note:** Set mode 2–12, 100% corresponds to three times of rated motor current.	0
P03.12	Torque set by keypad	-300.0%–300.0% (rated motor current)	50.0%

Function code	Name	Description	Default value
P03.13	Torque reference filter time	0.000–10.000s	0.010s
P03.14	Source of upper limit frequency setup of forward rotation in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: MODBUS communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCat/Profinet communication 11: PLC 12: Reserved **Note:** For the options 1-11, 100% is relative to the max. frequency.	0
P03.15	Source of upper limit frequency setup of reverse rotation in torque control	0: Keypad (P03.17) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: MODBUS communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above)	0

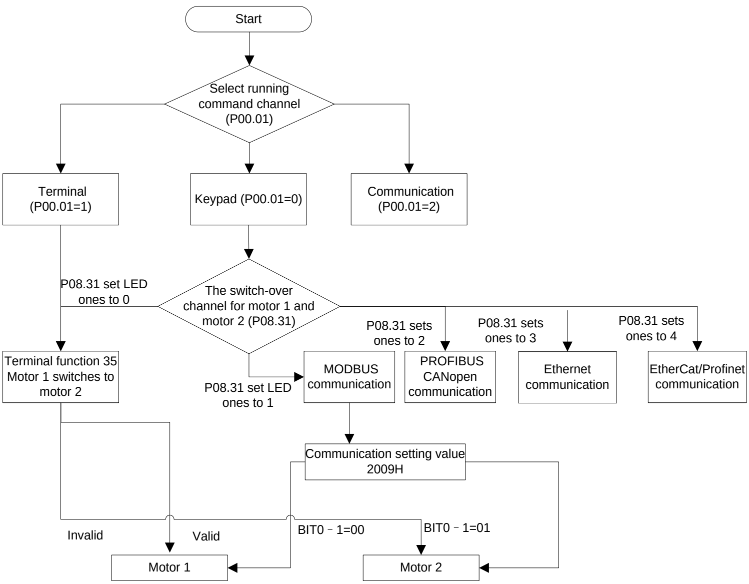
Function code	Name	Description	Default value
		8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCat/Profinet communication 11: PLC 12: Reserved **Note:** For the options 1-11, 100% is relative to the max. frequency.	
P03.16	Keypad limit value of upper limit frequency of forward rotation in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00 Hz
P03.17	Keypad limit value of upper limit frequency of reverse rotation in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00 Hz
P03.18	Source of upper limit setup of the torque during motoring	0: Keypad (P03.20) 1: AI1 (100% relative to three times of motor current) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: MODBUS communication (the same as above) 6: PROFIBUS/CANopen/DeviceNet communication (the same as above) 7: Ethernet communication (the same as above) 8: Pulse frequency HDIB (the same as above) 9: EtherCat/Profinet communication 10: PLC	0

Function code	Name	Description	Default value
		11: Reserved **Note:** Source 1–10, 100% relative to three times of motor current.	
P03.19	Source of upper limit setup of brake torque	0: Keypad (P03.21) 1: AI1 (100% relative to three times of motor current) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: MODBUS communication (the same as above) 6: PROFIBUS/CANopen/DeviceNet communication (the same as above) 7: Ethernet communication (the same as above) 8: Pulse frequency HDIB (the same as above) 9: EtherCat/Profinet communication 10: PLC 11: Reserved **Note:** Source 1–10, 100% relative to three times of motor current.	0
P03.20	Set upper limit of the torque when motoring via keypad	0.0–300.0% (rated motor current)	180.0%
P03.21	Set upper limit of brake torque via keypad	0.0–300.0% (rated motor current)	180.0%
P17.09	Motor output torque	-250.0–250.0%	0.0%
P17.15	Torque reference value	-300.0–300.0% (rated motor current)	0.0%

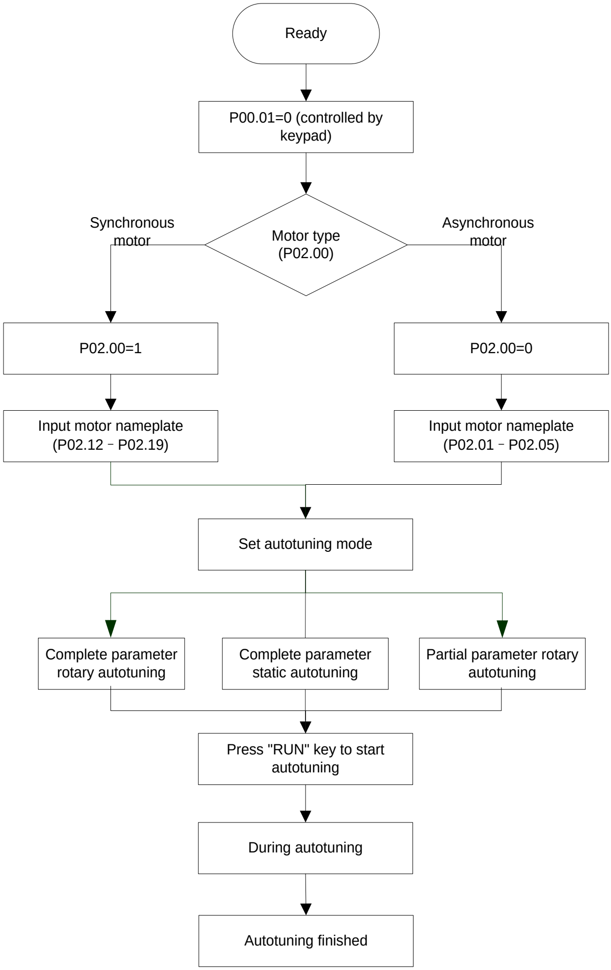
6.5.6 Motor parameter

⚡	✧ Check the safety conditions surrounding the motor and load machineries before autotuning as physical injury may occur due to sudden start of motor during autotuning. ✧ Although the motor does not run during static autotuning, the motor is stilled supplied with power, do not touch the motor during autotuning; otherwise, electric shock may occur.
⚠	✧ If the motor has been connected to load, do not carry out rotary autotuning; otherwise, misact or damage may occur to the VFD. If rotary autotuning is carried out on a motor which has been connected to load, wrong motor parameters and motor misacts may occur. Disconnect the load to carry out autotuning if necessary.

GD350-19 VFD can drive asynchronous motors and synchronous motors, and it supports two sets of motor parameters, which can be switched over by multi-function digital input terminals or communication modes.



The control performance of the VFD is based on accurate motor model, therefore, you need to carry out motor parameter autotuning before running the motor for the first time (take motor 1 as an example).



Note:

1. Motor parameters must be set correctly according to motor nameplate;
2. If rotary autotuning is selected during motor autotuning, it is a must to disconnect the motor from load to put the motor in static and no-load state, failed to do so may lead to inaccurate autotuned results. At this time, the asynchronous motor can autotune P02.06–P02.10, and synchronous motor can autotune P02.20–P02.23.
3. If static autotuning is selected during motor autotuning, there is no need to disconnect the motor from load, as only part of the motor parameters have been autotuned, the control performance

may be impacted, under such situation, the asynchronous motor can autotune P02.06–P02.10, while synchronous motor can autotune P02.20–P02.22, P02.23 (counter-emf constant of synchronous motor 1) can be obtained via calculation.

4. Motor autotuning can be carried out on current motor only, if you need to perform autotuning on the other motor, switch over the motor through selecting the switch-over channel of motor 1 and motor 2 by setting the ones of P08.31.

Related parameter list:

Function code	Name	Description	Default value
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned.	0
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P02.01	Rated power of asynchronous motor 1	0.1–3000.0kW	Model depended
P02.02	Rated frequency of	0.01Hz–P00.03 (Max. output frequency)	50.00Hz

Function code	Name	Description	Default value
	asynchronous motor 1		
P02.03	Rated speed of asynchronous motor 1	1–36000rpm	Model depended
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Model depended
P02.05	Rated current of asynchronous motor 1	0.8–6000.0A	Model depended
P02.06	Stator resistance of asynchronous motor 1	0.001–65.535Ω	Model depended
P02.07	Rotor resistance of asynchronous motor 1	0.001–65.535Ω	Model depended
P02.08	Leakage inductance of asynchronous motor 1	0.1–6553.5mH	Model depended
P02.09	Mutual inductance of asynchronous motor 1	0.1–6553.5mH	Model depended
P02.10	No-load current of asynchronous motor 1	0.1–6553.5A	Model depended
P02.15	Rated power of synchronous motor 1	0.1–3000.0kW	Model depended
P02.16	Rated frequency of synchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	Number of pole pairs of synchronous motor 1	1–50	2
P02.18	Rated voltage of synchronous motor 1	0–1200V	Model depended
P02.19	Rated current of synchronous motor 1	0.8–6000.0A	Model depended
P02.20	Stator resistance of	0.001–65.535Ω	Model

Function code	Name	Description	Default value
	synchronous motor 1		depended
P02.21	Direct-axis inductance of synchronous motor 1	0.01–655.35mH	Model depended
P02.22	Quadrature-axis inductance of synchronous motor 1	0.01–655.35mH	Model depended
P02.23	Counter-emf constant of synchronous motor 1	0–10000	300
P05.01–P05.06	Function of multi-function digital input terminal (S1–S4, HDIA,HDIB)	35: Motor 1 switches to motor 2	/
P08.31	Switching between motor 1 and motor 2	0x00–0x14 Ones: Switch-over channel 0: Switch over by terminal 1: Switch over by MODBUS communication 2: Switch over by PROFIBUS / CANopen /Devicenet 3: Switch over by Ethernet communication 4: Switch over by EtherCat/Profinet communication Tens: Motor switch-over during running 0: Disable switch-over during running 1: Enable switch-over during running	00
P12.00	Type of motor 2	0: Asynchronous motor 1: Synchronous motor	0
P12.01	Rated power of asynchronous motor 2	0.1–3000.0kW	Model depended
P12.02	Rated frequency of	0.01Hz–P00.03 (Max. output frequency)	50.00Hz

Function code	Name	Description	Default value
	asynchronous motor 2		
P12.03	Rated speed of asynchronous motor 2	1–36000rpm	Model depended
P12.04	Rated voltage of asynchronous motor 2	0–1200V	
P12.05	Rated current of asynchronous motor 2	0.8–6000.0A	
P12.06	Stator resistance of asynchronous motor 2	0.001–65.535Ω	
P12.07	Rotor resistance of asynchronous motor 2	0.001–65.535Ω	
P12.08	Leakage inductance of asynchronous motor 2	0.1–6553.5mH	
P12.09	Mutual inductance of asynchronous motor 2	0.1–6553.5mH	
P12.10	No-load current of asynchronous motor 2	0.1–6553.5A	
P12.15	Rated power of synchronous motor 2	0.1–3000.0kW	
P12.16	Rated frequency of synchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.17	Number of pole pairs of synchronous motor 2	1–50	2
P12.18	Rated voltage of synchronous motor 2	0–1200V	Model depended
P12.19	Rated current of synchronous motor 2	0.8–6000.0A	Model depended
P12.20	Stator resistance of	0.001–65.535Ω	Model

Function code	Name	Description	Default value
	synchronous motor 2		depended
P12.21	Direct-axis inductance of synchronous motor 2	0.01–655.35mH	Model depended
P12.22	Quadrature-axis inductance of synchronous motor 2	0.01–655.35mH	Model depended
P12.23	Counter-emf constant of synchronous motor 2	0–10000	300

6.5.7 Start/stop control

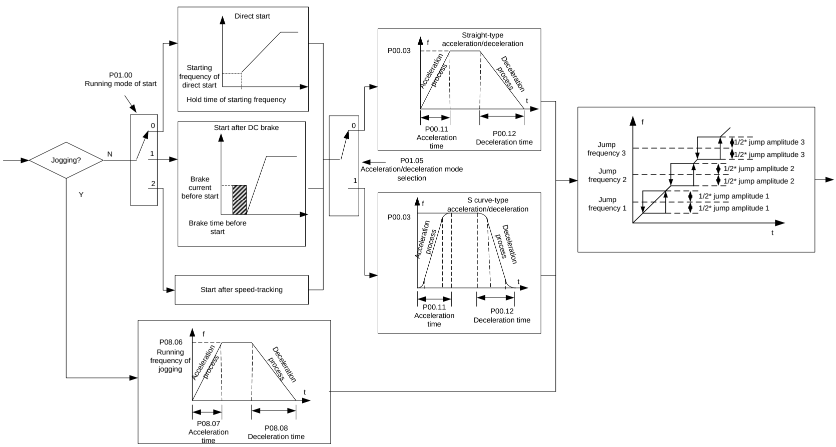
The start/stop control of the VFD is divided into three states: start after running command at power-up; start after restart-at-power-cut function is effective; start after automatic fault reset. Descriptions for these three start/stop control states are presented below.

There are three start modes for the VFD, which are start at starting frequency, start after DC brake, and start after speed-tracking. You can select the proper start mode based on field conditions.

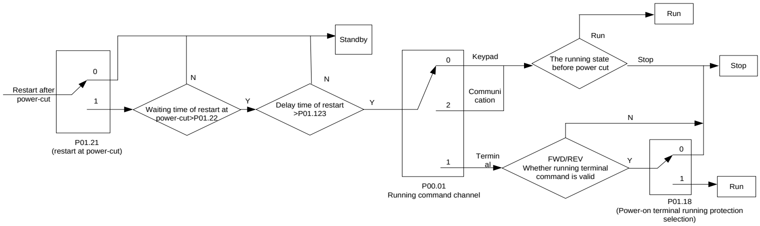
For large-inertia load, especially in cases where reversal may occur, you can choose to start after DC brake or start after speed-racking.

Note: It is recommended to drive synchronous motors in direct start mode.

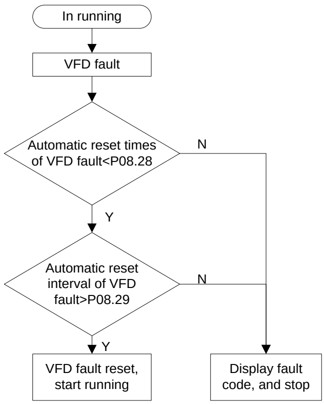
1. Logic diagram for running command after power-up



2. Logic diagram for restart after power-off



3. Logic diagram for restart after automatic fault reset



Related parameter list:

Function code	Name	Description	Default value
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0
P00.11	Acceleration time 1	0.0–3600.0s	Model depended
P00.12	Deceleration time 1	0.0–3600.0s	Model depended
P01.00	Running mode of start	0: Direct start 1: Start after DC brake 2: Start after speed-track 1 3: Start after speed-track 2	0

Function code	Name	Description	Default value
P01.01	Starting frequency of direct start	0.00–50.00Hz	0.50Hz
P01.02	Hold time of starting frequency	0.0–50.0s	0.0s
P01.03	DC brake current before start	0.0–100.0%	0.0%
P01.04	DC brake time before start	0.00–50.00s	0.00s
P01.05	Acceleration/deceleration mode	0: Straight line 1: S curve Note: If mode 1 is selected, it is required to set P01.07, P01.27 and P01.08 accordingly.	0
P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0
P01.09	Starting frequency of DC brake after stop	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P01.10	Waiting time of DC brake after stop	0.00–50.00s	0.00s
P01.11	DC brake current of stop	0.0–100.0%	0.0%
P01.12	DC brake time of stop	0.00–50.00s	0.00s
P01.13	Deadzone time of forward/reverse rotation	0.0–3600.0s	0.0s
P01.14	Forward/reverse rotation switch-over mode	0: Switch over after zero frequency 1: Switch over after starting frequency 2: Switch over after passing stop speed and delay	0
P01.15	Stop speed	0.00–100.00Hz	0.50 Hz
P01.16	Stop speed detection mode	0: Set value of speed (the only detection	1

Function code	Name	Description	Default value
		mode valid in SVPWM mode) 1: Detection value of speed	
P01.18	Power-on terminal running protection selection	0: Terminal running command is invalid at power up 1: Terminal running command is valid at power up	0
P01.19	Action selection when the running frequency is below lower limit (lower limit should be larger than 0)	0: Run at the lower limit frequency 1: Stop 2: Sleep	0
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid when P01.19 is 2)	0.0s
P01.21	Restart after power cut	0: Restart is disabled 1: Restart is enabled	0
P01.22	Waiting time of restart after power cut	0.0–3600.0s (valid when P01.21 is 1)	1.0s
P01.23	Start delay	0.0–60.0s	0.0s
P01.24	Stop speed delay	0.0–100.0s	0.0s
P01.25	Open-loop 0Hz output selection	0: No voltage output 1: With voltage output 2: Output as per DC brake current of stop	0
P01.26	Deceleration time of emergency-stop	0.0–60.0s	2.0s
P01.27	Time of starting section of deceleration S curve	0.0–50.0s	0.1s
P01.28	Time of ending section of deceleration S curve	0.0–50.0s	0.1s
P01.29	Short-circuit brake current	0.0–150.0% (rated VFD current)	0.0%

Function code	Name	Description	Default value
P01.30	Hold time of short-circuit brake at startup	0.00–50.00s	0.00s
P01.31	Hold time of short-circuit brake at stop	0.00–50.00s	0.00s
P05.01–P05.06	Digital input function selection	1: Forward running 2: Reverse running 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Running pause 21: Acceleration/deceleration time selection 1 22: Acceleration/deceleration time selection 2 30: Acceleration/deceleration disabled	/
P08.06	Running frequency of jog	0.00Hz–P00.03 (Max. output frequency)	5.00Hz
P08.07	Acceleration time at jogging	0.0–3600.0s	Model depended
P08.08	Deceleration time at jogging	0.0–3600.0s	Model depended
P08.00	Acceleration time 2	0.0–3600.0s	Model depended
P08.01	Declaration time 2	0.0–3600.0s	Model depended
P08.02	Acceleration time 3	0.0–3600.0s	Model depended
P08.03	Declaration time 3	0.0–3600.0s	Model

Function code	Name	Description	Default value
			depended
P08.04	Acceleration time 4	0.0–3600.0s	Model depended
P08.05	Declaration time 4	0.0–3600.0s	Model depended
P08.19	Switching frequency of acceleration/deceleration time	0.00–P00.03 (Max. output frequency) 0.00Hz: No switch over If the running frequency is larger than P08.19, switch to acceleration /deceleration time 2	0
P08.21	Reference frequency of acceleration/deceleration time	0: Max. output frequency 1: Set frequency 2: 100Hz **Note:** Valid for straight-line acceleration/deceleration only	0
P08.28	Automatic fault reset times	0–10	0
P08.29	Automatic fault reset time interval	0.1–3600.0s	1.0s

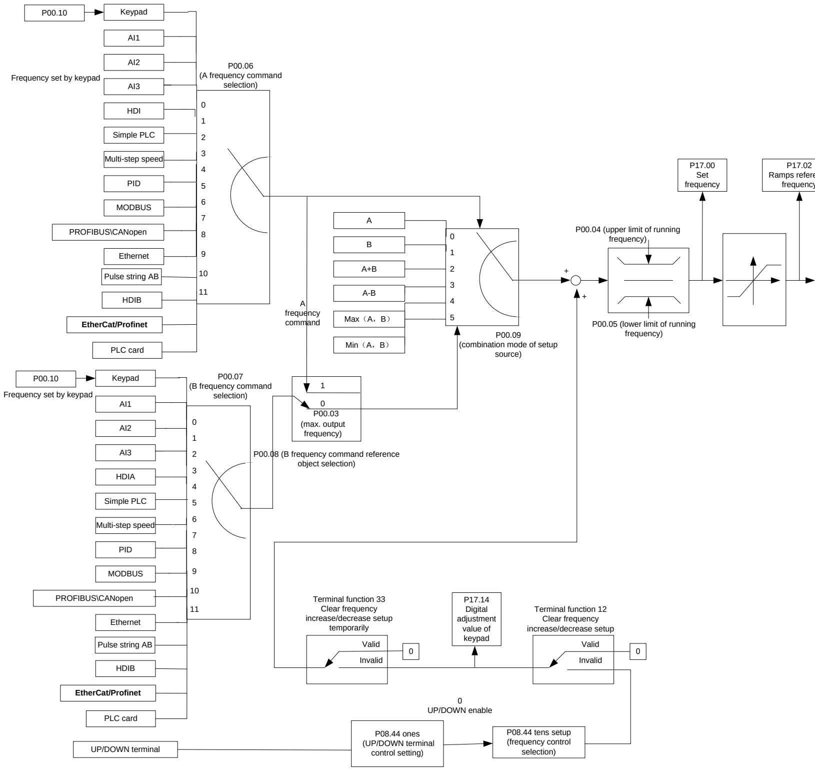
6.5.8 Frequency setting

GD350-19 series 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 by setting multi-function terminals.

There is one input mode for auxiliary reference channel, namely terminal UP/DOWN switch input. By setting function codes, you can enable the corresponding reference mode and the impact made on the VFD frequency reference by this reference mode.

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

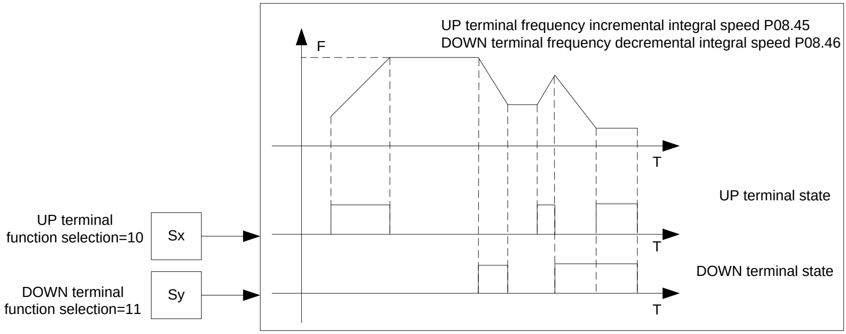


GD350-19 VFD supports switch-over between different reference channels, and the rules for channel switch-over are shown below.

Present reference channel P00.09	Multifunction terminal function 13 Channel A switches to channel B	Multifunction terminal function 14 Combination setup switches to channel A	Multifunction terminal function 15 Combination setup switches 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

Note: "/" indicates this multi-function terminal is invalid under present reference channel.

When setting the auxiliary frequency inside the VFD via multi-function terminal UP (10) and DOWN (11), you can increase/decrease the frequency quickly by setting P08.45 (UP terminal frequency incremental change rate) and P08.46 (DOWN terminal frequency decrement change rate).



Related parameter list:

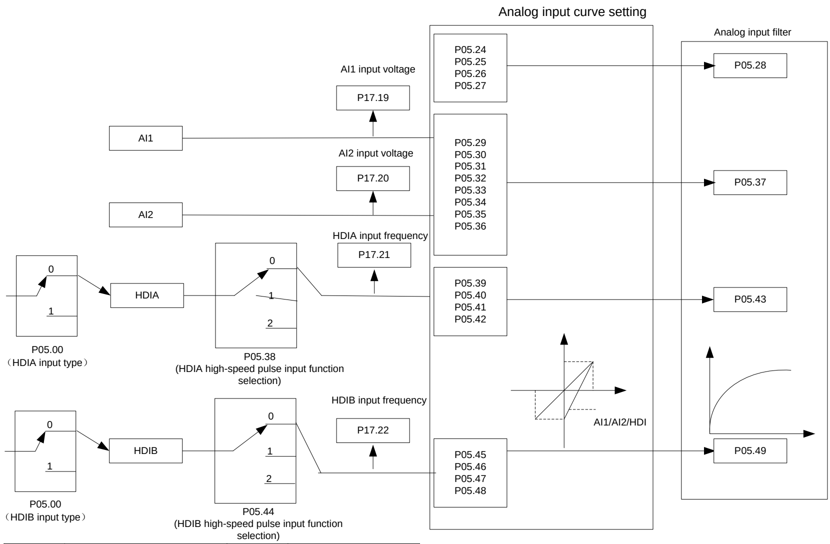
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th></tr>
<tr><td>P00.03</td><td>Max. output frequency</td><td>P00.04–400.00Hz</td><td>50.00Hz</td></tr>
<tr><td>P00.04</td><td>Upper limit of running frequency</td><td>P00.05–P00.03</td><td>50.00Hz</td></tr>
<tr><td>P00.05</td><td>Lower limit of running frequency</td><td>0.00Hz–P00.04</td><td>0.00Hz</td></tr>
<tr><td>P00.06</td><td>Setting channel of A frequency command</td><td rowspan="2">0: Keypad
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 communication
9: PROFIBUS/CANopen/DeviceNet communication
10: Ethernet communication
11: High speed pulse HDIB
12: Pulse string AB</td><td>0</td></tr>
<tr><td>P00.07</td><td>Setting channel of B frequency command</td><td>15</td></tr>
</table>

Function code	Name	Description	Default value
		13: EtherCat/Profinet communication 14: PLC card 15: Graded multi-step speed	
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0
P00.09	Combination mode of setup source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max (A, B) 5: Min (A, B)	0
P05.01–P05.06	Function of multi-function digital input terminal (S1–S4, HDIA, HDIB)	10: Frequency increase (UP) 11: Frequency decrease (DOWN) 12: Clear frequency increase/decrease setting 13: Switch-over between setup A and setup B 14: Switch-over between combination setup and setup A 15: Switch-over between combination setup and setup B	/
P08.44	UP/DOWN terminal control	0x000–0x221 Ones: Frequency enabling selection 0: UP/DOWN terminal setting is valid 1: UP/DOWN terminal setting is invalid Tens: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency modes 2: Invalid for multi-step speed when	0x000

Function code	Name	Description	Default value
		multi-step speed takes priority Hundreds: Action selection at stop 0: Valid 1: Valid during running, clear after stop 2: Valid during running, clear after receiving stop command	
P08.45	UP terminal frequency incremental change rate	0.01–50.00 Hz/s	0.50 Hz/s
P08.46	DOWN terminal frequency decrement change rate	0.01–50.00 Hz/s	0.50 Hz/s
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.02	Ramps reference frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.14	Digital adjustment value	0.00Hz–P00.03 (Max. output frequency)	0.00Hz

6.5.9 Analog input

GD350-19 series VFD carries two analog input terminals (AI1 is 0–10V/0–20mA; voltage input or current input can be set by P05.50); AI2 is -10–10V) and two high-speed pulse input terminals. Each input can be filtered separately, and the corresponding reference curve can be set by adjusting the reference corresponds to the max. value and min. value.



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 parameter list:

Function code	Name	Description	Default value
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.24	Lower limit value of AI1	0.00V–P05.26	0.00V
P05.25	Corresponding setting of lower limit of AI1	-100.0%–100.0%	0.0%

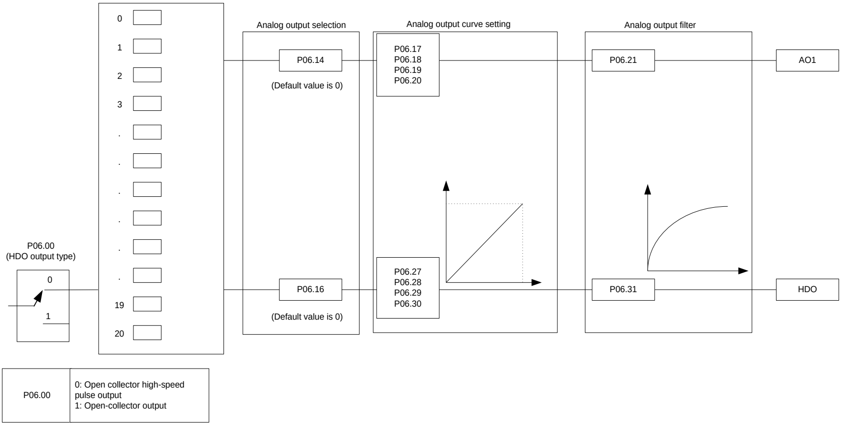
Function code	Name	Description	Default value
P05.26	Upper limit value of AI1	P05.24–10.00V	10.00V
P05.27	Corresponding setting of upper limit of AI1	-100.0%–100.0%	100.0%
P05.28	Input filter time of AI1	0.000s–10.000s	0.100s
P05.29	Lower limit value of AI2	-10.00V–P05.31	-10.00V
P05.30	Corresponding setting of lower limit of AI2	-100.0%–100.0%	-100.0%
P05.31	Intermediate value 1 of AI2	P05.29–P05.33	0.00V
P05.32	Corresponding setting of intermediate value 1 of AI2	-100.0%–100.0%	0.0%
P05.33	Intermediate value 2 of AI2	P05.31–P05.35	0.00V
P05.34	Corresponding setting of intermediate value 2 of AI2	-100.0%–100.0%	0.0%
P05.35	Upper limit value of AI2	P05.33–10.00V	10.00V
P05.36	Corresponding setting of upper limit of AI2	-100.0%–100.0%	100.0%
P05.37	Input filter time of AI2	0.000s–10.000s	0.100s
P05.38	HDIA high-speed pulse input function	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIB	0
P05.39	Lower limit frequency of HDIA	0.000 KHz – P05.41	0.000KHz
P05.40	Corresponding setting of lower limit frequency of HDIA	-100.0%–100.0%	0.0%
P05.41	Upper limit frequency of	P05.39 –50.000KHz	50.000KHz

Function code	Name	Description	Default value
	HDIA		
P05.42	Corresponding setting of upper limit frequency of HDIA	-100.0%–100.0%	100.0%
P05.43	HDIA frequency input filter time	0.000s–10.000s	0.030s
P05.44	HDIB high-speed pulse input function selection	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIA	0
P05.45	Lower limit frequency of HDIB	0.000 KHz – P05.47	0.000KHz
P05.46	Corresponding setting of lower limit frequency of HDIB	-100.0%–100.0%	0.0%
P05.47	Upper limit frequency of HDIB	P05.45 –50.000KHz	50.000KHz
P05.48	Corresponding setting of upper limit frequency of HDIB	-100.0%–100.0%	100.0%
P05.49	HDIB frequency input filter time	0.000s–10.000s	0.030s
P05.50	AI1 input signal type	0–1 0: Voltage type 1: Current type	0

Note: When you set P90.04=1 and use the analog reference frequency, use terminals to give the forward and reverse running commands.

6.5.10 Analog output

GD350-19 series VFD carries one analog output terminal (0–10V/0–20mA) and one high-speed pulse output terminal. Analog output signals can be filtered separately, and the proportional relation 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.



Instructions for output:

Setting	Function	Description
0	Running frequency	0–Max. output frequency
1	Set frequency	0–Max. output frequency
2	Ramps reference frequency	0–Max. output frequency
3	Running speed	0–Synchronous speed corresponding to Max. output frequency
4	Output current (relative to VFD)	0–Two times of rated current of VFD
5	Output current (relative to motor)	0–Two times of rated current of motor
6	Output voltage	0–1.5 times of rated voltage of VFD
7	Output power	0–Two times of rated power
8	Set torque value	0–Two times of rated current of motor
9	Output torque	0–Two times of rated current of motor

Setting	Function	Description
10	AI1 input value	0–10V/0–20mA
11	AI2 input value	-10V–10V
12	AI3 input value	0–10V/0–20mA
13	Input value of high-speed pulse HDIA	0.00–50.00kHz
14	Set value 1 of MODBUS communication	-1000–1000, 1000 corresponds to 100.0%
15	Set value 2 of MODBUS communication	-1000–1000, 1000 corresponds to 100.0%
16	Set value 1 of PROFIBUS/CANopen communication	-1000–1000, 1000 corresponds to 100.0%
17	Set value 2 of PROFIBUS/CANopen communication	-1000–1000, 1000 corresponds to 100.0%
18	Ethernet communication set value 1	-1000–1000, 1000 corresponds to 100.0%
19	Ethernet communication set value 2	-1000–1000, 1000 corresponds to 100.0%
20	High-speed pulse HDIB input value	0.00–50.00kHz
21	Reserved variable	
22	Torque current (bipolar, 100% corresponds to 10V)	0–Two times of rated current of motor
23	Exciting current (100% corresponds to 10V)	0–One times of rated current of motor
24	Set frequency (bipolar)	0–Max. output frequency
25	Ramps reference frequency	0–Max. output frequency

Setting	Function	Description
	(bipolar)	
26	Running speed (bipolar)	0–Max. output frequency
27	EtherCat/Profinet communication set value 2	-1000–1000, 1000 corresponds to 100.0%
28	C_AO1 from PLC	1000 corresponds to 100.0%
29	C_AO2 from PLC	1000 corresponds to 100.0%
30	Running speed	0–Two times of rated synchronous speed of motor
31–47	Reserved variable	

Related parameter list:

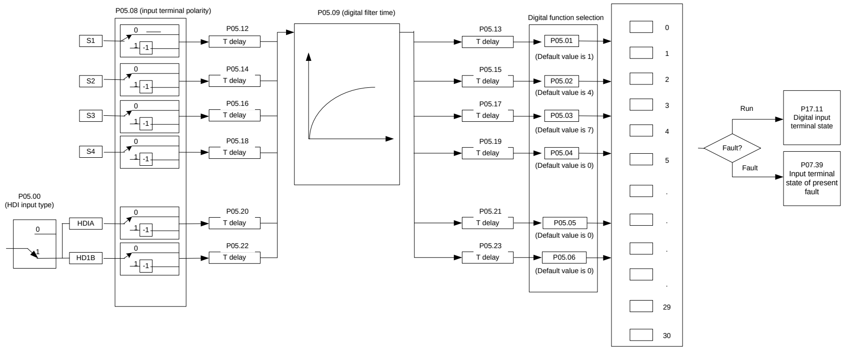
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th></tr>
<tr><td>P06.00</td><td>HDO output type</td><td>0: Open collector high-speed pulse output
1: Open collector output</td><td>0</td></tr>
<tr><td>P06.14</td><td>AO1 output selection</td><td rowspan="3">0: Running frequency
1: Set frequency
2: Ramps reference frequency
3: Running speed
4: Output current (relative to twice the VFD rated current)
5: Output current (relative to twice the motor rated current)
6: Output voltage (relative to 1.5 times the VFD rated voltage)
7: Output power (relative to twice the motor rated power)
8: Set torque value (relative to twice the motor rated torque)
9: Output torque (relative to twice the</td><td>0</td></tr>
<tr><td>P06.15</td><td>Reserved variable</td><td>0</td></tr>
<tr><td>P06.16</td><td>HDO high-speed pulse output</td><td>0</td></tr>
</table>

Function code	Name	Description	Default value
		motor rated torque) 10: Analog AI1 input value 11: Analog AI2input value 12: Analog AI3 input value 13: Input value of high-speed pulse HDIA 14: Set value 1 of MODBUS communication 15: Set value 2 of MODBUS communication 16: Set value 1 of PROFIBUS/CANopen communication 17: Set value 2 of PROFIBUS/CANopen communication 18: Ethernet communication set value 1 19: Ethernet communication set value 2 20: High-speed pulse HDIB input value 21: EtherCat/Profinet communication set value 1 22: Torque current (relative to triple the motor rated current) 23: Exciting current (relative to triple the motor rated current) 24: Set frequency (bipolar) 25: Ramps reference frequency (bipolar) 26: Running speed (bipolar) 27: EtherCat/Profinet communication set value 2 28: C_AO1 from PLC (You need to set P27.00 to 1.)	

Function code	Name	Description	Default value
		29: C_AO2 from PLC (You need to set P27.00 to 1.) 30: Running speed (relative to twice the synchronous speed of motor) 31–47: Reserved variable	
P06.17	Lower limit of AO1 output	-300.0%–P06.19	0.0%
P06.18	Corresponding AO1 output of lower limit	0.00V–10.00V	0.00V
P06.19	Upper limit of AO1 output	P06.17–100.0%	100.0%
P06.20	Corresponding AO1 output of upper limit	0.00V–10.00V	10.00V
P06.21	AO1 output filter time	0.000s–10.000s	0.000s
P06.22–P06.26	Reserved variable	0–65535	0
P06.27	Lower limit of HDO output	-300.0%–P06.29	0.0%
P06.28	Corresponding HDO output of lower limit	0.00–50.00kHz	0.0kHz
P06.29	Upper limit of HDO output	P06.27–100.0%	100.0%
P06.30	Corresponding HDO output of upper limit	0.00–50.00kHz	50.00kHz
P06.31	HDO output filter time	0.000s–10.000s	0.000s

6.5.11 Digital input

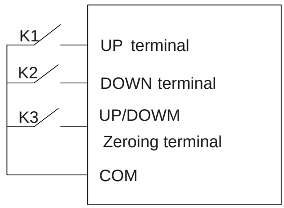
GD350-19 series VFD carries four programmable digital input terminals and two HDI input terminals. The function of all the digital input terminals can be programmed by function codes. HDI input terminal can be set to act as high-speed pulse input terminal or common digital input terminal; if it is set 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.



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

Note: Two different multi-function input terminals cannot be set to the same function.

Setting	Function	Description
0	No function	The VFD does not act even if there is signal input; you can set the unused terminals to "no function" to avoid misacts.
1	Forward running (FWD)	Control the forward/reverse running of the VFD by external terminals.
2	Reverse running (REV)	
3	3-wire control/Sin	Set the VFD running mode to 3-wire control mode by this terminal. See P05.13 for details.
4	Forward jogging	Frequency when jogging, see P08.06, P08.07 and P08.08 for jogging acceleration/deceleration time.
5	Reverse jogging	
6	Coast to stop	The VFD blocks output, and the stop process of motor is uncontrolled by the VFD. This mode is applied in cases of large-inertia load and free stop time; its definition is the Same as P01.08, and it is mainly used in remote control.
7	Fault reset	External fault reset function, its function is the Same as the STOP/RST key on the keypad. This function can be used in remote fault reset.
8	Running pause	The VFD decelerates to stop, however, all the running parameters are in memory state, such as PLC parameter, wobbling frequency, and PID parameter. After

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td></td><td></td><td>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>Frequency increase (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>11</td><td>Frequency decrease (DOWN)</td></tr>
<tr><td>12</td><td>Clear frequency increase/decrease setting</td></tr>
<tr><td>13</td><td>Switching between A setting and B setting</td><td rowspan="3">Used to switch between the frequency setting channels.
A frequency reference channel and B frequency reference channel can be switched by no. 13 function; the combination channel set by P00.09 and the A frequency reference channel can be switched by no. 14 function; the combination channel set by P00.09 and the B frequency reference channel can be switched by no. 15 function.</td></tr>
<tr><td>14</td><td>Switching between combination setting and A setting</td></tr>
<tr><td>15</td><td>Switching between combination setting and B setting</td></tr>
<tr><td>16</td><td>Multi-step speed terminal 1</td><td rowspan="4">16-step speeds can be set by combining digital states of these four terminals.
Note: Multi-step speed 1 is low bit, multi-step speed 4 is high bit.
<table><tr><th>Multi-step speed 4</th><th>Multi-step speed 3</th><th>Multi-step 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>
</table>

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td>20</td><td>Multi-step speed pause</td><td>Pause multi-step speed selection function to keep the set value in present state.</td></tr>
<tr><td>21</td><td>Acceleration/deceleration time selection 1</td><td rowspan="2">Use these two terminals to select four groups of acceleration/decoration time.<table>
<tr><th>Terminal 1</th><th>Terminal 2</th><th>Acceleration or deceleration time selection</th><th>Corresponding parameter</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Acceleration/ deceleration time 1</td><td>P00.11/P00.12</td></tr>
<tr><td>ON</td><td>OFF</td><td>Acceleration/ deceleration time 2</td><td>P08.00/P08.01</td></tr>
<tr><td>OFF</td><td>ON</td><td>Acceleration/ deceleration time 3</td><td>P08.02/P08.03</td></tr>
<tr><td>ON</td><td>ON</td><td>Acceleration/ deceleration time 4</td><td>P08.04/P08.05</td></tr>
</table></td></tr>
<tr><td>22</td><td>Acceleration/deceleration time selection 2</td></tr>
<tr><td>23</td><td>Simple PLC stop reset</td><td>Restart simple PLC process and clear previous PLC state information.</td></tr>
<tr><td>24</td><td>Simple PLC pause</td><td>The program pauses during PLC execution, and keeps running in current speed step. After this function is cancelled, simple PLC keeps running.</td></tr>
<tr><td>25</td><td>PID control pause</td><td>PID is ineffective temporarily, and the VFD maintains current frequency output.</td></tr>
<tr><td>26</td><td>Wobbling frequency pause (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>Wobbling frequency reset (revert to center frequency)</td><td>The set frequency of VFD reverts to center frequency.</td></tr>
<tr><td>28</td><td>Counter reset</td><td>Zero out the counter state.</td></tr>
<tr><td>29</td><td>Switching between speed</td><td>The VFD switches from torque control mode to speed</td></tr>
</table>

Setting	Function	Description
	control and torque control	control mode, or vice versa.
30	Acceleration/deceleration disabled	Ensure the VFD will not be impacted by external signals (except for stop command), and maintains current output frequency.
31	Counter trigger	Enable pulse counting of the counter.
33	Clear frequency increase/decrease setting temporarily	When the terminal is closed, the frequency value set by UP/DOWN can be cleared to restore the reference frequency to the frequency given by frequency command channel; when terminal is disconnected, it will revert to the frequency value after frequency increase/decrease setting.
34	DC brake	The VFD starts DC brake immediately after the command becomes valid.
35	Switching between motor 1 and motor 2	When this terminal is valid, you can realize switch-over control of two motors.
36	Command switches to keypad	When this terminal is valid, the running command channel will switch to keypad compulsorily. If this function becomes invalid, the running command channel will revert to the original state.
37	Command switches to terminal	When this terminal is valid, the running command channel will switch to terminal compulsorily. If this function becomes invalid, the running command channel will revert to the original state.
38	Command switches to communication	When this terminal is valid, the running command channel will switch to communication compulsorily. If this function becomes invalid, the running command channel will revert to the original state.
39	Pre-exciting command	When this terminal is valid, motor pre-exciting will be started until this terminal becomes invalid.
40	Clear power consumption quantity	After this command becomes valid, the power consumption quantity of the VFD will be zeroed out.

Setting	Function	Description
41	Maintain power consumption quantity	When this command is valid, current operation of the VFD will not impact the power consumption quantity.
42	Source of upper torque limit switches to keypad	When this command is valid, the upper limit of the torque will be set by keypad.
43	Position reference point input	Valid only for S1, S2, and S3.
44	Prohibit spindle orientation	The spindle positioning function is invalid.
45	Spindle zeroing/local positioning zeroing	Used to trigger spindle positioning.
46	Spindle zero-point position selection 1	Terminal-selected spindle zero-point position 1.
47	Spindle zero-point position selection 2	Terminal-selected spindle zero-point position 2.
48	Spindle scale-division selection 1	Terminal-selected spindle scale-division 1.
49	Spindle scale-division selection 2	Terminal-selected spindle scale-division 2.
50	Spindle scale-division selection 3	Terminal-selected spindle scale-division 3.
51	Position/speed control switching terminal	Used to switch position control and speed control.
52	Pulse input inhibition	When the terminal is valid, pulse input is invalid.
53	Clear position deviation	Used to clear the input deviation of the position loop.
54	Position proportional gain switchover	Used to switch position proportional gains.
55	Enable cyclic digital positioning	When the digital positioning mode is valid, the cyclic positioning function can be enabled.
56	Emergency stop	When this command is valid, the motor decelerate to

Setting	Function	Description
		emergency stop as per the time set by P01.26.
57	Motor over-temperature fault input	Motor stops at motor over-temperature fault input.
59	FVC switches to V/F control	When this terminal is valid in stop state, switch to SVPWM control.
60	Switch to FVC control	When this terminal is valid in stop state, switch to closed-loop vector control.
61	PID polarity switch-over	Switching the output polarity of PID, this terminal should be used in conjunction with P09.03
62	Switch to SVC1 control (open-loop vector control mode 1)	Switching from closed-loop vector control to open-loop vector control
63	Enable servo	When the thousands place in P21.00 is set to enable servo, the servo enabling terminal is valid. If the VFD is managed to enter zero servo control, at this time, no start command is needed.
64	FWD position limit	Forward rotation position limit for stop. When receiving this signal during forward rotation, the VFD stops.
65	REV position limit	Reverse rotation position limit for stop. When receiving this signal during reverse rotation, the VFD stops.
66	Clear the encoder counting	Zero out the position counting value
67	Pulse increase	When the terminal function is valid, the pulse input is increased according to the P21.27 pulse speed.
68	Enable pulse superimposition	When the pulse superimposition is enabled, pulse increase and pulse decrease are effective.
69	Pulse decrease	When the terminal function is valid, the pulse input is decreased according to the P21.27 pulse speed.
70	Electronic gear selection	When the terminal is valid, the proportional numerator is switched to the P21.30 numerator of the 2nd command ratio.
71	Switch to the master	When the terminal is valid, the switchover from the slave

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td></td><td></td><td>to the master can be implemented.</td></tr>
<tr><td>72</td><td>Switch to the slave</td><td>When the terminal is valid, the switchover from the master to the slave can be implemented.</td></tr>
<tr><td>73</td><td>Enable the VFD</td><td>When the terminal is valid, the VFD is enabled.</td></tr>
<tr><td>74</td><td>Contactor feedback signal</td><td>Contactor status feedback.</td></tr>
<tr><td>75</td><td>Brake feedback signal</td><td>Brake status feedback.</td></tr>
<tr><td>76</td><td>Operating lever zero-point position</td><td>When the terminal is valid, the operating level sets the zero-point input signal.</td></tr>
<tr><td>77</td><td>Graded reference terminal 1</td><td rowspan="5">Five terminals can be used to implement graded speed setting.
<table>
<tr><th>Trml1</th><th>Trml 2</th><th>Trml 3</th><th>Trml 4</th><th>Trml 5</th><th>Speed setting</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Graded setting 0</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Graded setting 1</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Graded setting 2</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>Graded setting 3</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>Graded setting 4</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>Graded setting 5</td></tr>
</table></td></tr>
<tr><td>78</td><td>Graded reference terminal 2</td></tr>
<tr><td>79</td><td>Graded reference terminal 3</td></tr>
<tr><td>80</td><td>Graded reference terminal 4</td></tr>
<tr><td>81</td><td>Graded reference terminal 5</td></tr>
<tr><td>82</td><td>Upward DEC limit position</td><td>When the terminal is valid, the VFD enters the upward slow speed area and runs at the frequency specified by P91.35.</td></tr>
<tr><td>83</td><td>Downward DEC limit position</td><td>When the terminal is valid, the VFD enters the downward slow speed area and runs at the frequency specified by P91.35.</td></tr>
<tr><td>84</td><td>Light load speed boost signal</td><td>When P91.08=5, the terminal command is valid, light load speed boost is performed.</td></tr>
<tr><td>85</td><td>Brake detection</td><td>When the terminal command is valid, brake detection is performed</td></tr>
<tr><td>86</td><td>Valid signal of PTC overtemperature</td><td>Supporting only the terminals S5﹣S8 of EC-IO502-00. When receiving this signal, the PTC overtemperature alarm or fault is reported.</td></tr>
</table>

Setting	Function	Description
87	Position synchronization pulse counting reset	The position synchronization pulse counter status is cleared.
88	Switchover between motors 1 and 3	When the terminal is valid, the switchover between the two motors can be controlled.
89	Anti-snag protection input	When the terminal command is valid, the VFD stops with the torque specified by P92.27 within the time specified by P92.28.

Related parameter list:

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th></tr>
<tr><td>P05.00</td><td>HDI input type</td><td>0x00–0x11
Ones: HDIA input type
0: HDIA is high-speed pulse input
1: HDIA is digital input
Tens: HDIB input type
0: HDIB is high-speed pulse input
1: HDIB is digital input</td><td>0x00</td></tr>
<tr><td>P05.01</td><td>Function of S1 terminal</td><td rowspan="7">0: No function
1: Forward running
2: Reverse running
3: 3-wire control/Sin
4: Forward jogging
5: Reverse jogging
6: Coast to stop
7: Fault reset
8: Running pause
9: External fault input
10: Frequency increase (UP)
11: Frequency decrease (DOWN)</td><td>1</td></tr>
<tr><td>P05.02</td><td>Function of S2 terminal</td><td>2</td></tr>
<tr><td>P05.03</td><td>Function of S3 terminal</td><td>7</td></tr>
<tr><td>P05.04</td><td>Function of S4 terminal</td><td>0</td></tr>
<tr><td>P05.05</td><td>Function of HDIA terminal</td><td>0</td></tr>
<tr><td>P05.06</td><td>Function of HDIB terminal</td><td>0</td></tr>
<tr><td>P05.07</td><td>Reserved variables</td><td>0</td></tr>
</table>

Function code	Name	Description	Default value
		12: Clear frequency increase/decrease setting 13: Switch-over between setup A and setup B 14: Switch-over between combination setting and A setting 15: Switch-over between combination setting and setup B 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: Multi-step speed pause 21: Acceleration/deceleration time selection 1 22: Acceleration/deceleration time selection 2 23: Simple PLC stop reset 24: Simple PLC pause 25: PID control pause 26: Wobbling frequency pause 27: Wobbling frequency reset 28: Counter reset 29: Switching between speed control and torque control 30: Acceleration/deceleration disabled 31: Counter trigger 32: Reserved 33: Clear frequency increase/decrease setting	

Function code	Name	Description	Default value
		temporarily 34: DC brake 35: Switching between motor 1 and motor 2 36: Command switches to keypad 37: Command switches to terminal 38: Command switches to communication 39: Pre-exciting command 40: Zero out power consumption quantity 41: Maintain power consumption quantity 42: Source of upper torque limit switches to keypad 43: Position reference point input (valid only for S1, S2, and S3) 44: Prohibit spindle orientation 45: Spindle zeroing/local positioning zeroing 46: Spindle zero-point position selection1 47: Spindle zero-point position selection2 48: Spindle scale-division selection 1 49: Spindle scale-division selection 2 50: Spindle scale-division selection 3 51: Position/speed control switching terminal 52: Pulse input inhibition 53: Clear position deviation 54: Position proportional gain switchover 55: Enable cyclic digital positioning	

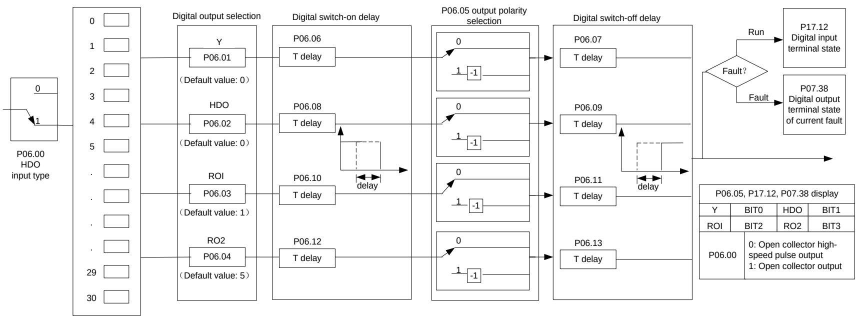
Function code	Name	Description	Default value
		56: Emergency stop 57: Motor over-temperature fault input 59: Switch to V/F control 60: Switch to FVC control 61: PID polarity switch-over 62: Switch to SVC1 control (open-loop vector control mode 1) 63: Enable the servo 64: FWD position limit 65: REV position limit 66: Zero out encoder counting 67: Pulse increase 68: Enable pulse superimposition 69: Pulse decrease 70: Electronic gear selection 71: Switch to the master 72: Switch to the slave 73: Enable the VFD 74: Contactor feedback signal 75: Brake feedback signal 76: Operating lever zero-point position 77: Graded reference terminal 1 78: Graded reference terminal 2 79: Graded reference terminal 3 80: Graded reference terminal 4 81: Graded reference terminal 5 82: Upward DEC limit position 83: Downward DEC limit position 84: Light load speed boost signal 85: Brake detection	

Function code	Name	Description	Default value
		86: Valid signal of PTC overtemperature (Supporting only the terminals S5–S8 of EC-IO502-00) 87: Position synchronization pulse counting reset 88: Switchover between motors 1 and 3 89: Anti-snag protection input	
P05.08	Polarity of input terminal	0x00–0x3F	0x00
P05.09	Digital filter time	0.000–1.000s	0.010s
P05.10	Virtual terminal setting	0x00–0x3F (0: disable, 1: enable) BIT0: S1 virtual terminal BIT1: S2 virtual terminal BIT2: S3 virtual terminal BIT3: S4 virtual terminal BIT4: HDIA virtual terminal BIT8: HDIB virtual terminal	0x00
P05.11	2-wire or 3-wire control mode	0: 2-wire control 1 1: 2-wire control 2 2: 3-wire control 1 3: 3-wire control 2	0
P05.12	S1 terminal switch-on delay	0.000–50.000s	0.000s
P05.13	S1 terminal switch-off delay	0.000–50.000s	0.000s
P05.14	S2 terminal switch-on delay	0.000–50.000s	0.000s
P05.15	S2 terminal switch-off delay	0.000–50.000s	0.000s
P05.16	S3 terminal switch-on delay	0.000–50.000s	0.000s
P05.17	S3 terminal switch-off delay	0.000–50.000s	0.000s

Function code	Name	Description	Default value
P05.18	S4 terminal switch-on delay	0.000–50.000s	0.000s
P05.19	S4 terminal switch-off delay	0.000–50.000s	0.000s
P05.20	HDIA terminal switch-on delay	0.000–50.000s	0.000s
P05.21	HDIA terminal switch-off delay	0.000–50.000s	0.000s
P05.22	HDIB terminal switch-on delay	0.000–50.000s	0.000s
P05.23	HDIB terminal switch-off delay	0.000–50.000s	0.000s
P07.39	Input terminal state of present fault		0
P17.12	Digital input terminal state		0

6.5.12 Digital output

GD350-19 series VFD carries two groups of relay output terminals, one open collector Y output terminal and one high-speed pulse output (HDO) terminal. The function of all the digital output terminals can be programmed by function codes, of which the high-speed pulse output terminal HDO can also be set to high-speed pulse output or digital output by function code.



The table below lists the options for the above four function parameters, and you are allowed to select the same output terminal functions repetitively.

Setting	Function	Description
0	Invalid	Output terminal has no function
1	In running	Output ON signal when there is frequency output during

Setting	Function	Description
		running
2	In forward running	Output ON signal when there is frequency output during forward running
3	In reverse running	Output ON signal when there is frequency output during reverse running
4	In jogging	Output ON signal when there is frequency output during jogging
5	VFD fault	Output ON signal when VFD fault occurred
6	Frequency level detection FDT1	Refer to P08.32 and P08.33
7	Frequency level detection FDT2	Refer to P08.34 and P08.35
8	Frequency reached	Refer to P08.36
9	Running in zero speed	Output ON signal when the VFD output frequency and reference frequency are both zero.
10	Reach upper limit frequency	Output ON signal when the running frequency reaches upper limit frequency
11	Reach lower limit frequency	Output ON signal when the running frequency reached lower limit frequency
12	Ready to run	Main circuit and control circuit powers are established, the protection functions do not act; when the VFD is ready to run, output ON signal.
13	In pre-exciting	Output ON signal during pre-exciting of the VFD
14	Overload pre-alarm	Output ON signal after the pre-alarm time elapsed based on the pre-alarm threshold; see P11.08–P11.10 for details.
15	Underload pre-alarm	Output ON signal after the pre-alarm time elapsed based on the pre-alarm threshold; see P11.11–P11.12 for details.

Setting	Function	Description
16	Simple PLC state completed	Output signal when current stage of simple PLC is completed
17	Simple PLC cycle completed	Output signal when a single cycle of simple PLC operation is completed
23	Virtual terminal output of MODBUS communication	Output corresponding signal based on the set value of MODBUS; output ON signal when it is set to 1, output OFF signal when it is set to 0
24	Virtual terminal output of Profibus/CANopen/ DeviceNet communication	Output corresponding signal based on the set value of PROFIBUS/CANopen; output ON signal when it is set to 1, output OFF signal when it is set to 0
25	Virtual terminal output of Ethernet communication	Output corresponding signal based on the set value of Ethernet; output ON signal when it is set to 1, output OFF signal when it is set to 0.
26	DC bus voltage established	Output is valid when the bus voltage is above the undervoltage threshold of the inverter.
27	Z pulse output	Output is valid when the encoder Z pulse is arrived, and is invalid after 10 ms.
28	During pulse superposition	Output is valid when the pulse superposition terminal input function is valid
29	STO action	Output when STO fault occurred
30	Positioning completed	Output is valid when position control positioning is completed
31	Spindle zeroing completed	Output is valid when spindle zeroing is completed
32	Spindle scale-division completed	Output is valid when spindle scale-division is completed
33	In speed limit	Output is valid when the frequency is limited
34	Virtual terminal output of EtherCat/Profinet communication	The corresponding signal is output according to the set value of Profinet communication. When it is set to 1, the ON signal is output, and when it is set to 0, the OFF

Setting	Function	Description
		signal is output.
35	Reserved	
36	Speed/position control switch-over completed	Output is valid when the mode switch-over is completed
37–40	Reserved	
41	C_Y1	C_Y1 from PLC (You need to set P27.00 to 1.)
42	C_Y2	C_Y2 from PLC (You need to set P27.00 to 1.)
43	C_HDO	C_HDO from PLC (You need to set P27.00 to 1.)
44	C_RO1	C_RO1 from PLC(You need to set P27.00 to 1.)
45	C_RO2	C_RO2 from PLC (You need to set P27.00 to 1.)
46	C_RO3	C_RO3 from PLC (You need to set P27.00 to 1.)
47	C_RO4	C_RO4 from PLC (You need to set P27.00 to 1.)
48	Contactor output	The contactor is VFD controlled. It outputs the ON signal during running and it outputs the OFF signal during stop.
49	Brake output	It outputs the ON signal during brake release and it outputs the OFF signal during brake closing.
50	Ready to release the brake	If the torque verification succeeds, and the running frequency is no less than the brake release frequency, it outputs the ON signal when it is ready to release the brake. Otherwise, it outputs the OFF signal.
51	Ready to close the brake	If the stop command is given, and the running frequency is no greater than the brake closing frequency, it outputs the ON signal when it is ready to close the brake. Otherwise, it outputs the OFF signal.
52	Upward limit position reached	The output is valid when the upward limit position is reached.
53	Downward limit position reached	The output is valid when the downward limit position is reached.

Setting	Function	Description
54	Low voltage protection	The output is valid at low voltage.
55	Overload protection	The output is valid at overload.
56	Brake detection reminding	When the brake detection reminding time is reached, it outputs the ON signal. Otherwise, it outputs the OFF signal.
57	Brake failure alarm	The output is valid when the brake fails.
58	Input phase loss alarm	The output is valid when an input phase loss alarm is reported.
59	Loose rope status	The output is valid when a FWD loose rope protection or REV loose rope alarm or fault occurs.
60	In motor 1 state	The output is valid when motor 1 is selected.
61	In motor 2 state	The output is valid when motor 2 is selected.
62	In motor 3 state	The output is valid when motor 3 is selected.
63	PT100 temperature alarm	The output is valid when a PT100 temperature alarm is reported.
64	PT1000 temperature alarm	The output is valid when a PT1000 temperature alarm is reported.
65	Boosting the speed with light load	It outputs the ON signal when the speed is boosted with light load.
66	Derating the frequency with voltage	It outputs the ON signal when the frequency is derated with the voltage.

Related parameter list:

Function code	Name	Description	Default value
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th></tr>
<tr><td>P06.01</td><td>Y output selection</td><td rowspan="4">0: Invalid
1: In running
2: In forward running
3: In reverse running
4: In jogging
5: VFD fault
6: Frequency level detection FDT1
7: Frequency level detection FDT2
8: Frequency reached
9: Running in zero speed
10: Reach upper limit frequency
11: Reach lower limit frequency
12: Ready to run
13: In pre-exciting
14: Overload pre-alarm
15: Underload pre-alarm
16: Simple PLC stage completed
17: Simple PLC cycle completed
18: Reach set counting value
19: Reach designated counting value
20: External fault is valid
21: Reserved
22: Reach running time
23: Virtual terminal output of MODBUS communication
24: Virtual terminal output of POROFIBUS/CANopen communication
25: Virtual terminal output of Ethernet communication</td><td>0</td></tr>
<tr><td>P06.02</td><td>HDO output selection</td><td>0</td></tr>
<tr><td>P06.03</td><td>Relay RO1 output selection</td><td>1</td></tr>
<tr><td>P06.04</td><td>Relay RO2 output selection</td><td>5</td></tr>
</table>

Function code	Name	Description	Default value
		26: DC bus voltage established 27: Z pulse output 28: During pulse superposition 29: STO action 30: Positioning completed 31: Spindle zeroing completed 32: Spindle scale-division completed 33: In speed limit 34: Virtual terminal output of EtherCat/Profinet communication 35: Reserved 36: Speed/position control switch-over completed 37–40: Reserved 41: C_Y1 from PLC (You need to set P27.00 to 1.) 42: C_Y2 from PLC (You need to set P27.00 to 1.) 43: C_HDO from PLC (You need to set P27.00 to 1.) 44: C_RO1 from PLC (You need to set P27.00 to 1.) 45: C_RO2 from PLC (You need to set P27.00 to 1.) 46: C_RO3 from PLC (You need to set P27.00 to 1.) 47: C_RO4 from PLC (You need to set P27.00 to 1.) 48: Contactor output 49: Brake output 50: Ready to release the brake 51: Ready to close the brake	

Function code	Name	Description	Default value
		52: Upward limit position reached 53: Downward limit position reached 54: Low voltage protection 55: Overload protection 56: Brake detection reminding 57: Brake failure alarm 58: Input phase loss alarm 59: Loose rope state (FWD loose rope protection, REV loose rope alarm/fault) 60: In motor 1 state 61: In motor 2 state 62: In motor 3 state 63: PT100 temperature alarm 64: PT1000 temperature alarm 65: Boosting the speed with light load 66: Derating the frequency with voltage	
P06.05	Output terminal polarity selection	0x00–0x0F	0x00
P06.06	Y switch-on delay	0.000–50.000s	0.000s
P06.07	Y switch-off delay	0.000–50.000s	0.000s
P06.08	HDO switch-on delay	0.000–50.000s (valid only when P06.00=1)	0.000s
P06.09	HDO switch-off delay	0.000–50.000s (valid only when P06.00=1)	0.000s
P06.10	Relay RO1 switch-on delay	0.000–50.000s	0.000s
P06.11	Relay RO1 switch-off delay	0.000–50.000s	0.000s
P06.12	Relay RO2 switch-on delay	0.000–50.000s	0.000s
P06.13	Relay RO2 switch-off delay	0.000–50.000s	0.000s

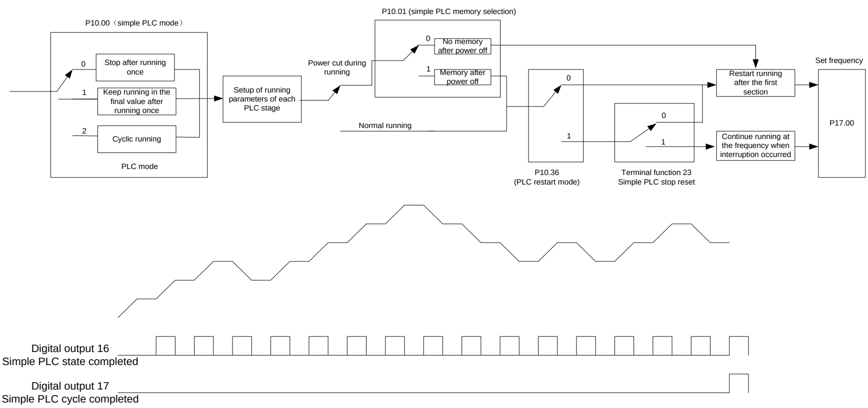
Function code	Name	Description	Default value
P07.40	Output terminal state of present fault		0
P17.13	Digital output terminal state		0

6.5.13 Simple PLC

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. Previously, such function was realized with external PLC, while now, the VFD itself can achieve this function.

GD350-19 series VFD can realize 16-step speeds control, and provide four groups of acceleration/deceleration time for you to choose from.

After the set PLC completes one cycle (or one section), one ON signal can be output by the multi-function relay.



Related parameter list:

Function code	Name	Description	Default value
P05.01–P05.06	Digital input function selection	23: Simple PLC stop reset 24: Simple PLC pausing 25: PID control pausing	
P06.01–P06.04	Digital output function selection	16: Simple PLC phase reached 17: Simple PLC cycle reached	

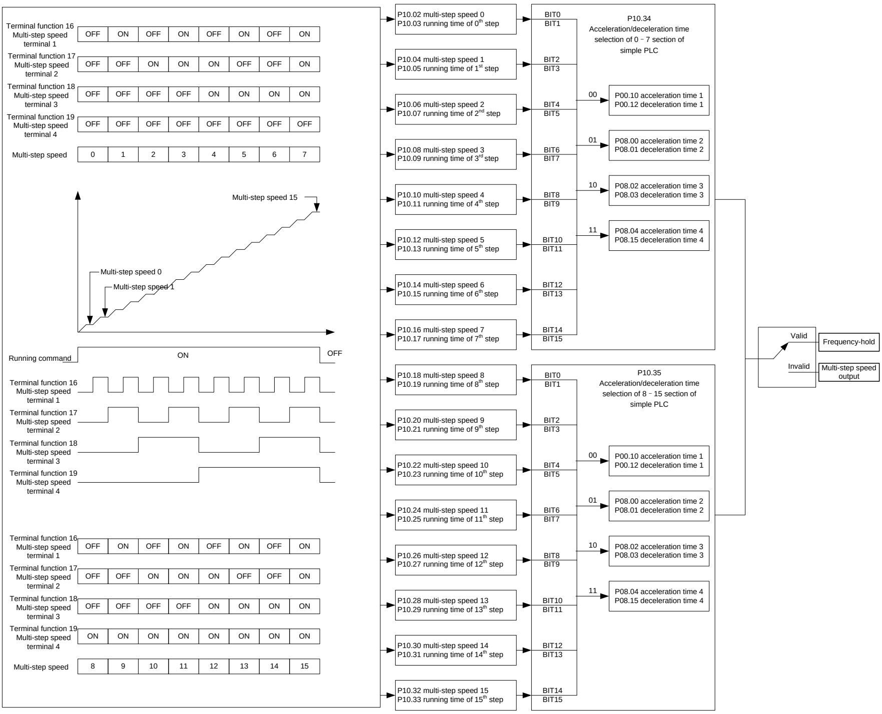
Function code	Name	Description	Default value
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running in the final value after running once 2: Cyclic running	0
P10.01	Simple PLC memory selection	0: No memory after power down 1: Memory after power down	0
P10.02	Multi-step speed 0	-100.0–100.0%	0.0%
P10.03	Running time of 0th step	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-100.0–100.0%	0.0%
P10.05	Running time of 1st step	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-100.0–100.0%	0.0%
P10.07	Running time of 2nd step	0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	-100.0–100.0%	0.0%
P10.09	Running time of 3rd step	0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	-100.0–100.0%	0.0%
P10.11	Running time of 4th step	0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	-100.0–100.0%	0.0%
P10.13	Running time of 5th step	0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	-100.0–100.0%	0.0%
P10.15	Running time of 6th step	0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	-100.0–100.0%	0.0%
P10.17	Running time of 7th step	0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	-100.0–100.0%	0.0%
P10.19	Running time of 8th step	0.0–6553.5s (min)	0.0s

Function code	Name	Description	Default value
P10.20	Multi-step speed 9	-100.0–100.0%	0.0%
P10.21	Running time of 9th step	0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	-100.0–100.0%	0.0%
P10.23	Running time of 10th step	0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	-100.0–100.0%	0.0%
P10.25	Running time of 11th step	0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	-100.0–100.0%	0.0%
P10.27	Running time of 12th step	0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	-100.0–100.0%	0.0%
P10.29	Running time of 13th step	0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	-100.0–100.0%	0.0%
P10.31	Running time of 14th step	0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	-100.0–100.0%	0.0%
P10.33	Running time of 15th step	0.0–6553.5s (min)	0.0s
P10.34	Acceleration/deceleration time of 0–7 stage of simple PLC	0x0000–0XFFFF	0000
P10.35	Acceleration/deceleration time of 8–15 stage of simple PLC	0x0000–0XFFFF	0000
P10.36	PLC restart mode	0: Restart from the first section 1: Continue running at the frequency when interruption occurred	0
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.27	Simple PLC and current	0–15	0

Function code	Name	Description	Default value
	stage number of multi-step speed		

6.5.14 Multi-step speed running

Set the parameters used in multi-step speed running. GD350-19 VFD can set 16-step speeds, which are selectable by multi-step speed terminals 1–4, corresponding to multi-step speed 0 to multi-step speed 15.



Related parameter list:

Function code	Name	Description	Default value
P05.01–P05.06	Digital input function selection	16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3	

Function code	Name	Description	Default value
		19: Multi-step speed terminal 4 20: Multi-step speed pausing	
P10.02	Multi-step speed 0	-100.0–100.0%	0.0%
P10.03	Running time of 0th step	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-100.0–100.0%	0.0%
P10.05	Running time of 1st step	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-100.0–100.0%	0.0%
P10.07	Running time of 2nd step	0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	-100.0–100.0%	0.0%
P10.09	Running time of 3rd step	0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	-100.0–100.0%	0.0%
P10.11	Running time of 4th step	0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	-100.0–100.0%	0.0%
P10.13	Running time of 5th step	0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	-100.0–100.0%	0.0%
P10.15	Running time of 6th step	0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	-100.0–100.0%	0.0%
P10.17	Running time of 7th step	0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	-100.0–100.0%	0.0%
P10.19	Running time of 8th step	0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	-100.0–100.0%	0.0%
P10.21	Running time of 9th step	0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	-100.0–100.0%	0.0%

Function code	Name	Description	Default value
P10.23	Running time of 10th step	0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	-100.0–100.0%	0.0%
P10.25	Running time of 11th step	0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	-100.0–100.0%	0.0%
P10.27	Running time of 12th step	0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	-100.0–100.0%	0.0%
P10.29	Running time of 13th step	0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	-100.0–100.0%	0.0%
P10.31	Running time of 14th step	0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	-100.0–100.0%	0.0%
P10.33	Running time of 15th step	0.0–6553.5s (min)	0.0s
P10.34	Acceleration/decoration time selection of 0–7 section of simple PLC	0x0000–0XFFFF	0000
P10.35	Acceleration/decoration time selection of 8–15 section of simple PLC	0x0000–0XFFFF	0000
P17.27	Simple PLC and current steps of multi-step speed	0–15	0

6.5.15 Graded multi-step speed reference

Graded reference is a speed reference method for hoisting applications. Graded reference supports the graded operating lever mode and graded remote-control mode. Graded reference can implement 6-step speeds by combing the five graded multi-step reference terminals.

Graded reference terminal 1	Graded reference terminal 2	Graded reference terminal 3	Graded reference terminal 4	Graded reference terminal 5	Speed setting	Function code
OFF	OFF	OFF	OFF	OFF	Graded multi-step speed reference 0	P90.06
NO	OFF	OFF	OFF	OFF	Graded multi-step speed reference 1	P90.07
NO	NO	OFF	OFF	OFF	Graded multi-step speed reference 2	P90.08
NO	NO	NO	OFF	OFF	Graded multi-step speed reference 3	P90.09
NO	NO	NO	NO	OFF	Graded multi-step speed reference 4	P90.10
NO	NO	NO	NO	NO	Graded multi-step speed reference 5	P90.11

,

Related parameter list:

Function code	Name	Description	Default value
P05.01–P05.06 I/O extension card P25.01–P25.08	Digital input function selection	77: Graded reference terminal 1 78: Graded reference terminal 2 79: Graded reference terminal 3 80: Graded reference terminal 4 81: Graded reference terminal 5	
P90.06	Graded multi-step speed reference 0	-100.0–100.0%, relative to P00.03	0.0%
P90.07	Graded multi-step speed reference 1	-100.0–100.0%, relative to P00.03	0.0%
P90.08	Graded multi-step speed reference 2	-100.0–100.0%, relative to P00.03	0.0%
P90.09	Graded multi-step speed reference 3	-100.0–100.0%, relative to P00.03	0.0%
P90.10	Graded multi-step speed reference 4	-100.0–100.0%, relative to P00.03	0.0%
P90.11	Graded multi-step speed reference 5	-100.0–100.0%, relative to P00.03	0.0%

Note: The multi-step settings of a higher grade can be closed only after the multi-step settings of all lower grades are closed.

6.5.16 Local encoder input

GD350-19 series VFD supports pulse count function by inputting the count pulse from HDI high-speed pulse port. When the actual count value is no less than the set value, digital output terminal outputs count-value-reached pulse signal, and the corresponding count value is cleared.

Function code	Name	Description	Default value
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.38	HDIA high-speed pulse input function	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIB	0
P05.44	HDIB high-speed pulse input function selection	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIA	0
P18.00	Actual frequency of encoder	-999.9–3276.7Hz	0.0Hz
P20.15	Speed measuring mode	0: PG card 1: local; realized by HDIA and HDIB; supports incremental 24V encoder only	0

6.5.17 Commissioning procedures for position control and spindle positioning function

1. Commissioning procedures for closed-loop vector control of asynchronous motor

Step 1: Restore to default value via keypad

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

Step 3: Motor parameter autotuning

Carry out rotary parameter autotuning or static parameter autotuning via keypad, if the motor can be disconnected from load, then you can carry out rotary parameter autotuning; otherwise, carry out static parameter autotuning, the parameter obtained from autotuning will be saved in P02 motor parameter group automatically.

Step 4: Verify whether the encoder is installed and set properly

a) Confirm the encoder direction and parameter setup

Set P20.01 (encoder pulse-per-revolution), set P00.00=2 and P00.10=20Hz, and run the VFD, at this point, the motor rotates at 20Hz, observe whether the speed measurement value of P18.00 is correct, if the value is negative, it indicates the encoder direction is reversed, under such situation, set P20.02 to 1; if the speed measurement value deviates greatly, it indicates P20.01 is set improperly. Observe whether P18.02 (encoder Z pulse count value) fluctuates, if yes, it indicates the encoder suffers interference or P20.01 is set improperly, requiring you to check the wiring and the shielding layer.

b) Determine Z pulse direction

Set P00.10=20Hz, and set P00.13 (running direction) to forward and reverse direction respectively to observe whether the difference value of P18.02 is less than 5, if the difference value remains to be larger than 5 after setting Z pulse reversal function of P20.02, power off and exchange phase A and phase B of the encoder, and then observe the difference between the value of P18.02 during forward and reverse rotation. Z pulse direction only affects the forward/reverse positioning precision of the spindle positioning carried out with Z pulse.

Step 5: Closed-loop vector pilot-run

Set P00.00=3, and carry out closed-loop vector control, adjust P00.10 and speed loop and current loop PI parameter in P03 group to make it run stably in the whole range.

Step 6: Flux-weakening control

Set flux-weakening regulator gain P03.26=0–8000, and observe the flux-weakening control effect. P03.22–P03.24 can be adjusted as needed.

2. Commissioning procedures for closed-loop vector control of synchronous motor

Step 1: Set P00.18=1, restore to default value

Step 2: Set P00.00=3 (VC) , set P00.03, P00.04, and motor nameplate parameters in P02 group.

Step 3: Set P20.00 and P20.01 encoder parameters

When the encoder is resolver-type encoder, set the encoder pulse count value to (resolver pole pair number × 1024), for example, if pole pair number is 4, set P20.01 to 4096.

Step 4: Ensure the encoder is installed and set correctly

When motor stops, observe whether P18.21 (resolver angle) fluctuates, if it fluctuates sharply, check the wiring and grounding. Rotates the motor slowly, observe whether P18.21 changes accordingly. If yes, it indicates motor is connected correctly; if the value of P18.02 keeps constant at a non-zero value after rotating for multiple circles, it indicates encoder Z signal is correct.

Step 5: Autotuning of initial position of magnetic pole

Set P20.11=2 or 3 (3: rotary autotuning; 2: static autotuning), press RUN key to run the VFD.

a) Rotary autotuning (P20.11 = 3)

Detect the position of current magnetic pole when autotuning starts, and then accelerates to 10Hz, autotuning corresponding magnetic pole position of encoder Z pulse, and decelerate to stop.

During running, if ENC1O or ENC1D fault occurred, set P20.02=1 and carry out autotuning again.

After autotuning is done, the angle obtained from autotuning will be saved in P20.09 and P20.10 automatically.

b) Static autotuning

In cases where the load can be disconnected, it is recommended to adopt rotary autotuning (P20.11=3) as it has high angle precision. If the load cannot be disconnected, you can adopt static autotuning (P20.11=2). The magnetic pole position obtained from autotuning will be saved in P20.09 and P20.10.

Step 6: Closed-loop vector pilot-run

Adjust P00.10 and speed loop and current loop PI parameter in P03 group to make it run stably in the whole range. If oscillation occurred, reduce the value of P03.00, P03.03, P03.09 and P03.10. If current oscillation noise occurred during low speed, adjust P20.05.

Note: It is necessary to re-determine P20.02 (encoder direction) and carry out magnetic pole position autotuning again if the wiring of motor or encoder is changed.

3. Commissioning procedures for pulse string control

Pulse input is operated based on closed-loop vector control; speed detection is needed in the subsequent spindle positioning, zeroing operation and division operation.

Step 1: Restore to default value by keypad

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

Step 3: Motor parameter autotuning: rotary parameter autotuning or static parameter autotuning

Step 4: Verity the installation and settings of encoder. Set P00.00=3 and P00.10=20Hz to run the system, and check the control effect and performance of the system.

Step 5: Set P21.00=0001 to set positioning mode to position control, namely pulse-string control. There are four kinds of pulse command modes, which can be set by P21.01 (pulse command mode).

Under position control mode, you can check high bit and low bit of position reference and feedback, P18.02 (count value of Z pulse), P18.00 (actual frequency of encoder), P18.17 (pulse command frequency) and P18.19 (position regulator output) via P18, through which you can figure out the relation between P18.8 (position of position reference point) and P18.02, pulse command frequency P18.17, feedforward P18.18 and position regulator output P18.19.

Step 6: The position regulator has two gains, namely P21.02 and P21.03, and they can be switched by speed command, torque command and terminals.

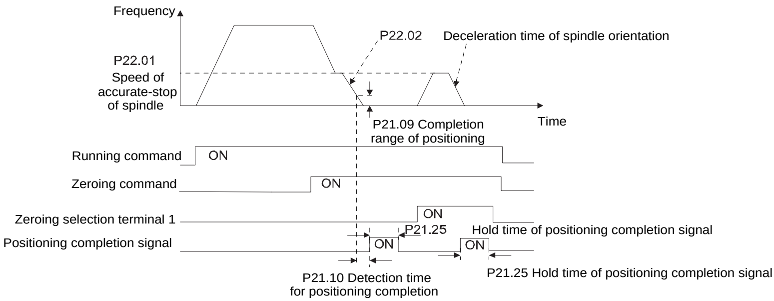
Step 7: When P21.08 (output limit of position controller) is set to 0, the position control will be invalid, and at this point, the pulse string acts as frequency source, P21.13 (position feedforward gain) should be set to 100%, and the speed acceleration/deceleration time is determined by the acceleration /deceleration time of pulse string, the pulse string acceleration/deceleration time of the system can be adjusted. If the pulse string acts as the frequency source in speed control, you can also set P21.00 to 0000, and set the frequency source reference P00.06 or P00.07 to 12 (set by pulse string AB), at this point, the acceleration/deceleration time is determined by the acceleration/deceleration time of the VFD, meanwhile, the parameters of pulse string AB is still set by P21 group. In speed mode, the filter time of pulse string AB is determined by P21.29.

Step 8: The input frequency of pulse string is the Same as the feedback frequency of encoder pulse, the relation between them can be changed by altering P21.11 (numerator of position command ratio) and P21.12 (denominator of position command ratio)

Step 9: When running command or servo enabling is valid (by setting P21.00 or terminal function 63), it will enter pulse string servo running mode.

4. Commissioning procedures for spindle positioning

Spindle orientation is to realize orientation functions like zeroing and division based on closed-loop vector control



Step 1–4: These four steps are the Same as the first four steps of the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control, thus realizing spindle positioning function in either position control or speed control mode.

Step 5: Set P22.00.bit0=1 to enable spindle positioning, set P22.00.bit1 to select spindle zero input. If the system adopts encoder for speed measurement, set P22.00.bit1 to 0 to select Z pulse input; if the system adopts photoelectric switch for speed measurement, set P22.00.bit1 to 1 to select photoelectric switch as zero input; set P22.00.bit2 to select zero search mode, set P22.00.bit3 to enable or disable zero calibration, and select zero calibration mode by setting P22.00.bit7.

Step 6: Spindle zeroing operation

a) Select the positioning direction by setting P22.00.bit4;

b) There are four zero positions in P22 group, you can choose one out of four zeroing positions by setting zeroing input terminal selection (46, 47) in P05 group. When executing zeroing function, the motor will stop accurately at corresponding zeroing position according to the set positioning direction, which can be viewed via P18.10;

c) The positioning length of spindle zeroing is determined by the deceleration time of accurate-stop and the speed of accurate-stop;

Step 7: Spindle scale-division operation

There are seven scale-division positions in P22 group, you can choose one out of seven scale-division positions by setting scale-division input terminal selection (48, 49, 50) in P05 group. Enable corresponding scale-division terminal after the motor stops accurately, and the motor will check the scale-division position state and switch to corresponding position incrementally, at this point, you can check P18.09.

Step 8: Priority level of speed control, position control and zeroing

The priority level of speed running is higher than that of the scale division, when the system runs in scale-division mode, if spindle orientation is prohibited, the motor will turn to speed mode or position mode.

The priority level of zeroing is higher than that of the scale division.

Scale-division command is valid when the scale-division terminal is from 000 state to non-000 state, for example, in 000–011, the spindle executes scale division 3. The transition time during terminal switch-over needs to be less than 10ms; otherwise, wrong scale division command may be executed.

Step 9: 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.

Step 10: Positioning command selection (bit6 of P22.00)

Electric level signal: Positioning command (zeroing and scale division) can be executed only when there is running command or the servo is enabled.

Step 11: Spindle reference point selection (bit0 of P22.00)

Encoder Z pulse positioning supports the following spindle positioning modes:

a) the encoder is installed on the motor shaft, the motor shaft and spindle is 1:1 rigid connection;

b) the encoder is installed on the motor shaft, the motor shaft and spindle is 1:1 belt connection;

At this point, the belt may slip during high-speed running and cause inaccurate positioning, it is recommended to install proximity switch on the spindle.

c) The encoder is installed on the spindle, and the motor shaft is connected to the spindle with belt, the drive ratio is not necessarily 1:1;

At this point, set P20.06 (speed ratio of the mounting shaft between motor and encoder), and set

P22.14 (spindle drive ratio) to 1. As the encoder is not installed on the motor, the control performance of closed-loop vector will be affected.

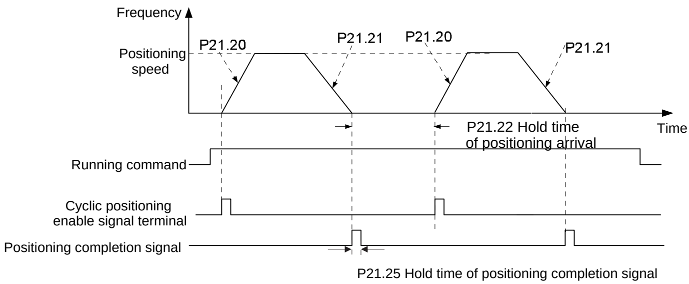
Proximity switch positioning supports the following spindle positioning modes:

a) The encoder is installed on the motor shaft, the drive ratio between motor shaft and spindle is not necessarily 1:1;

At this point, it is required to set P22.14 (spindle drive ratio).

5. Commissioning procedures for digital positioning

The diagram for digital positioning is shown below.



Step 1–4: These four steps are the Same as the first four steps of the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control.

Step 5: Set P21.00=0011 to enable digital positioning. Set P21.17, P21.11 and P21.12 (set positioning displacement) according to actual needs ; set P21.18 and P21.19 (set positioning speed); set P21.20 and P21.21 (set acceleration/deceleration time of positioning).

Step 6: Single positioning operation

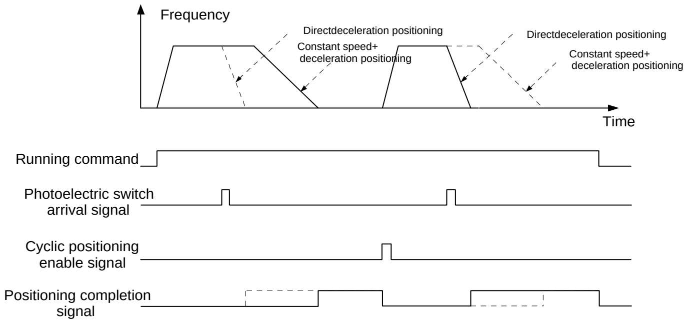
Set P21.16.bit1=0, and the motor will carry out single positioning action and stay in the positioning position according to the setup in step 5.

Step 7: Cyclic positioning operation

Set P21.16.bit1=1 to enable cyclic positioning. The cyclic positioning is divided into continuous mode and repetitive mode; you can also carry out cyclic positioning through terminal function (no. 55, enable digital positioning cycle)

6. Commissioning procedures for positioning of photoelectric switch

Photoelectric switch positioning is to realize positioning function based on closed-loop vector control.



Step 1–4: These four steps are the Same as the first four steps of the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control.

Step 5: Set P21.00=0021 to enable photoelectric switch positioning, the photoelectric switch signal can be connected to S8 terminal only, and set P05.03=43, meanwhile, set P21.17, P21.11 and P21.12 (set positioning displacement) based on actual needs; set P21.21 (deceleration time of positioning), however, when present running speed is too fast or the set positioning displacement is too small, the deceleration time of positioning will be invalid, and it will enter direct deceleration positioning mode.

Step 6: Cyclic positioning

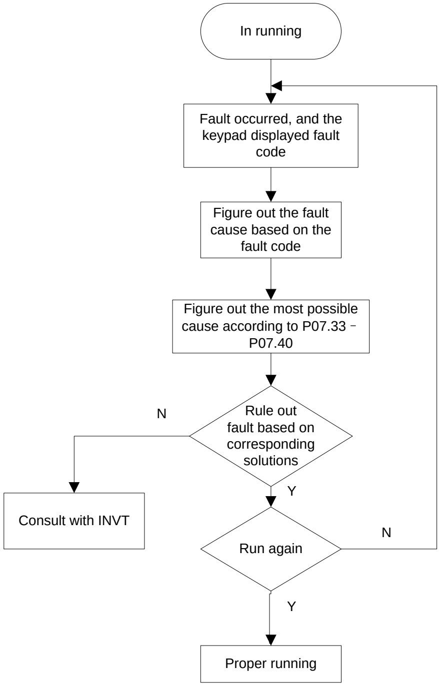
After positioning is done, the motor will stay in current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in P05 group; when the terminal receives cyclic positioning enable signal (pulse signal), the motor will continue running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

Step 7: 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.

6.5.18 Fault handling

GD350-19 series VFD provides abundant information concerning fault handling for easy maintenance.



Related parameter list:

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th></tr>
<tr><td>P07.27</td><td>Type of present fault</td><td rowspan="6">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 acceleration (OC1)
5: Overcurrent during deceleration (OC2)
6: Overcurrent during constant speed (OC3)
7: Overvoltage during acceleration (OV1)
8: Overvoltage during deceleration (OV2)</td><td>0</td></tr>
<tr><td>P07.28</td><td>Type of the last fault</td><td>/</td></tr>
<tr><td>P07.29</td><td>Type of the last but one fault</td><td>/</td></tr>
<tr><td>P07.30</td><td>Type of the last but two fault</td><td>/</td></tr>
<tr><td>P07.31</td><td>Type of the last but three fault</td><td>/</td></tr>
<tr><td>P07.32</td><td>Type of the last but four fault</td><td></td></tr>
</table>

Function code	Name	Description	Default value
		9: Overvoltage during constant speed (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 overheat (OH1) 16: Inverter module overheat (OH2) 17: External fault (EF) 18: 485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (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 DP communication fault (E-DP) 30: Ethernet communication fault (E-NET) 31: CANopen communication fault (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2)	

Function code	Name	Description	Default value
		34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder offline fault (ENC1O) 38: Encoder reversal fault (ENC1D) 39: Encoder Z pulse offline fault (ENC1Z) 40: Safe torque off (STO) 41: Channel H1 safety circuit exception (STL1) 42: Channel H2 safety circuit exception (STL2) 43: Channel H1 and H2 exception (STL3) 44: Safety code FLASH CRC check fault (CrCE) 45: PLC card defined fault 1 (P-E1) 46: PLC card defined fault 2 (P-E2) 47: PLC card defined fault 3 (P-E3) 48: PLC card defined fault 4 (P-E4) 49: PLC card defined fault 5 (P-E5) 50: PLC card defined fault 6 (P-E6) 51: PLC card defined fault 7 (P-E7) 52: PLC card defined fault 8 (P-E8) 53: PLC card defined fault 9 (P-E9) 54: PLC card defined fault 10 (P-E10) 55: Repetitive extension card type fault (E-Err) 56: Encoder UVW loss fault (ENCUV) 57: Profinet communication timeout fault (E-PN) 58: CAN communication fault (SECAN) 59: Motor over-temperature fault (OT) 60: Card slot 1 card identification failure	

Function code	Name	Description	Default value
		(F1-Er) 61: Card slot 2 card identification failure (F2-Er) 62: Card slot 3 card identification failure (F3-Er) 63: Card slot 1 card communication timeout fault (C1-Er) 64: Card slot 2 card communication timeout fault (C2-Er) 65: Card slot 3 card communication timeout fault (C3-Er) 66: EtherCat communication fault (E-CAT) 67: Bacnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: Master-slave synchronous CAN slave fault (S-Err) 70: VFD not enabled (dIS) 71: Contactor feedback fault (tbE) 72: Brake feedback fault (FAE) 73: Torque verification fault (tPF) 74: Operating lever zero-position fault (STC) 75: Low speed running protection fault (LSP) 76: Terminal command exception (tCE) 77: Power-on terminal command exception (POE) 78: Loose rope protection fault (SLE) 79: Brake failure (bE) 80: Master/slave position synchronization fault (ELS) 81: Analog speed reference deviation	

Function code	Name	Description	Default value
		fault (AdE) 82: PT100 overtemperature (OtE1) 83: PT1000 overtemperature (OtE2) 84: Set frequency fault (SFE) 85: Current imbalance fault (Cuu) 86: PTC overtemperature fault (PtcE)	
P07.33	Running frequency of present fault		0.00Hz
P07.34	Ramps reference frequency of present fault		0.00Hz
P07.35	Output voltage of present fault		0V
P07.36	Output current of present fault		0.0A
P07.37	Bus voltage of present fault		0.0V
P07.38	Max. temperature of present fault		0.0°C
P07.39	Input terminal state of present fault		0
P07.40	Output terminal state of present fault		0
P07.41	Running frequency of the last fault		0.00Hz
P07.42	Ramps reference frequency of the last fault		0.00Hz
P07.43	Output voltage of the last fault		0V
P07.44	Output current of the last fault		0.0A
P07.45	Bus voltage of the last fault		0.0V
P07.46	Max. temperature of the last fault		0.0°C
P07.47	Input terminal state of the last fault		0
P07.48	Output terminal state of the last fault		0
P07.49	Running frequency of the last but one fault		0.00Hz
P07.50	Ramps reference frequency of the last but one fault		0.00Hz

Function code	Name	Description	Default value
P07.51	Output voltage of the last but one fault		0V
P07.52	Output current of the last but one fault		0.0A
P07.53	Bus voltage of the last but one fault		0.0V
P07.54	Max. temperature of the last but one fault		0.0°C
P07.55	Input terminal state of the last but one fault		0
P07.56	Output terminal state of the last but one fault		0

7 Function parameter list

7.1 What this chapter contains

This chapter lists all the function codes and corresponding description of each function code.

7.2 Function parameter list

Function parameters of GD350-19 series VFD are categorized according to functions. Among the function groups, P90–P93 are hoisting function groups, P98 is the analog input/output calibration group, and P99 is the factory function group which cannot be accessed by users. The function code adopts three-level menu, for example, "P08.08" indicates it is the no. 8 function code in P8 group.

The function group numbers correspond to the level-1 menus, the function codes correspond to the level-2 menus, and the function parameters correspond to the level-3 menus.

1. The content of the function code table is as follows:

   Column 1 "Function code ": Code of the function group and parameter

   Column 2 "Name": Full name of the function parameter

   Column 3 "Description": Detailed description of the function parameter

   Column 4 " Default value": Initial value set in factory

   Column 5 " Modify": Whether the function parameter can be modified, and conditions for the modification

   "○" indicates that the value of the parameter can be modified when the VFD is in stopped or running state.

   "◎" indicates that the value of the parameter cannot be modified when the VFD is in running state.

   "●" indicates that the value of the parameter is detected and recorded, and cannot be modified.

   (The VFD automatically checks and constrains the modification of parameters, which helps prevent incorrect modifications.)

2. The parameters adopt the decimal system (DEC). If the hexadecimal system is adopted, all bits are mutually independent on data during parameter editing, and the setting ranges at some bits can be hexadecimal (0–F).

3. "Default value" indicates the factory setting of the function parameter. If the value of the parameter is detected or recorded, the value cannot be restored to the factory setting.

4. To better protect parameters, the VFD provides the password protection function. After a password is set (that is, P07.00 is set to a non-zero value), "0.0.0.0.0" is displayed when you press the PRG/ESC key to enter the function code editing interface. You need to enter the correct user password to enter the interface. For the factory parameters, you need to enter the

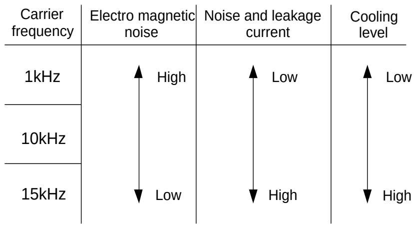
correct factory password to enter the interface. (You are not advised to modify the factory parameters. Incorrect parameter setting may cause operation exceptions or even damage to the VFD.) When password protection does not take effect, you can change the password any time. When P07.00 is set to 0, no user password is used. When P07.00 is set to a non-zero value during VFD power-on, parameters are prevented from being modified by using the user password function. When you modify function parameters through serial communication, the user password protection function is also applicant and compliant with the same rule.

7.2.1 P00 Basic functions

Function code	Name	Description	Default value	Modify
P00.00	Speed control mode	0: SVC 0 1: SVC 1 2: SVPWM 3: VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2	◎
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0	○
P00.02	Communication running command channel	0: MODBUS 1: PROFIBUS/CANopen/Devicenet 2: Ethernet 3: EtherCat/Profinet 4: PLC programmable card 5: Wireless communication card **Note:** 1, 2, 3, 4 and 5 are extended functions which are available only when corresponding cards are used.	0	○
P00.03	Max. output frequency	Used to set the maximum output frequency of the VFD. It is the basis of frequency setup and the acceleration/deceleration. Setting range: Max. (P00.04, 10.00) –150.00Hz	50.00Hz	◎
P00.04	Upper limit of running frequency	The upper limit of running frequency is upper limit value of VFD output frequency. This value cannot be greater than the maximum output frequency.	50.00Hz	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>When the set frequency is higher than the upper limit frequency, the VFD runs at the upper limit frequency.
Setting range: P00.05–P00.03 (Max. output frequency)</td><td></td><td></td></tr>
<tr><td>P00.05</td><td>Lower limit of running frequency</td><td>The lower limit of running frequency is the lower limit value of VFD output frequency.
When the set frequency is lower than the lower limit frequency, the VFD runs at the lower limit frequency.
Note: Max. output frequency ≥ upper limit frequency ≥ lower limit frequency.
Setting range: 0.00Hz–P00.04 (upper limit of running 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">0: Keypad
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 communication
9: PROFIBUS / CANopen / DeviceNet communication
10: Ethernet communication
11: High speed pulse HDIB
12: Pulse string AB
13: EtherCat/Profinet communication
14: PLC card</td><td>0</td><td>○</td></tr>
<tr><td>P00.07</td><td>Setting channel of B frequency command</td><td>1</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		15: Graded multi-step speed		
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0	○
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max. (A, B) 5: Min. (A, B)	0	○
P00.10	Set frequency via keypad	When A and B frequency commands are set by keypad, the value is the initial digital set value of the VFD frequency. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz	○
P00.11	Acceleration time 1	Acceleration time is the time needed for accelerating from 0Hz to Max. output frequency (P00.03).	Model depended	○
P00.12	Deceleration time 1	Deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz. Goodrive350-19 series VFD defines four groups of acceleration and deceleration time, which can be selected via multi-function digital input terminals (P05 group). The acceleration/deceleration time of the VFD is the first group by default. Setting range of P00.11 and P00.12: 0.0–3600.0s	Model depended	○
P00.13	Running direction	0: Run in default direction 1: Run in reverse direction 2: Reverse running is prohibited	0	○

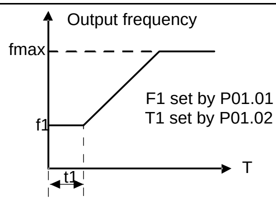
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>Note: It can be modified only after P11.26 is 1 indicating special functions are enabled.</td><td></td><td></td></tr>
<tr><td>P00.14</td><td>Carrier frequency setup</td><td>


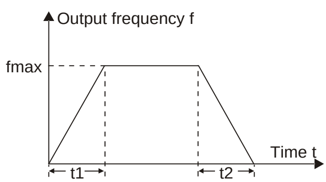
The relation between the model and carrier frequency is shown below.
<table>
<tr><th colspan="2">Model</th><th>Default value of carrier frequency</th></tr>
<tr><td rowspan="2">380V</td><td>0.4–11kW</td><td>4kHz</td></tr>
<tr><td>Above 15kW</td><td>1.5kHz</td></tr>
<tr><td rowspan="2">660V</td><td>22–55kW</td><td>4kHz</td></tr>
<tr><td>Above 75kW</td><td>2kHz</td></tr>
</table>
Advantages of high carrier frequency are as follows: ideal current waveform, few current harmonics and small motor noise.
Disadvantages of high carrier frequency are as follows: growing switch consumption, enlarged temperature rise, impacted output capacity; under high carrier frequency, the VFD needs to be derated for use, meanwhile, the leakage current will increase, which increases electromagnetic interference to the surroundings.
While low carrier frequency is the contrary. Low carrier frequency will cause unstable operation at low frequency, decrease the torque, or even lead</td><td>Model depended</td><td>○</td></tr>
</table>

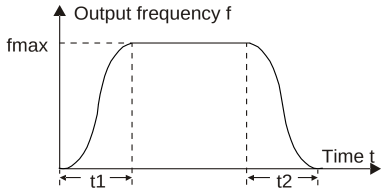
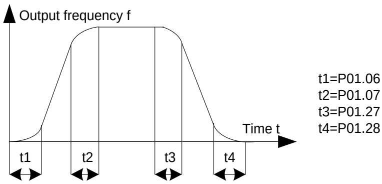
Function code	Name	Description	Default value	Modify
		to oscillation. The carrier frequency of VFD is set properly by default, and it should not be changed at will. If the default carrier frequency is exceeded during use, derating is required, derate by 10% for every additional 1k carrier frequency. Setting range: 1.0–15.0kHz		
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned. 4: Dynamic autotuning 2 (only valid to asynchronous motors) 5: Static autotuning 2 on certain parameters (only valid to asynchronous motors)	0	◎
P00.16	AVR function	0: Invalid 1: Valid during the whole process Automatic voltage regulation function is used to eliminate the impact on the output voltage of VFD when bus voltage fluctuates.	1	○
P00.17	Reserved	Reserved		

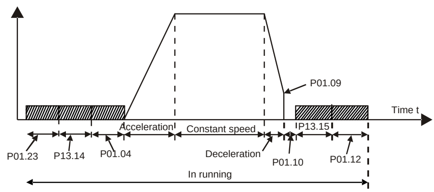
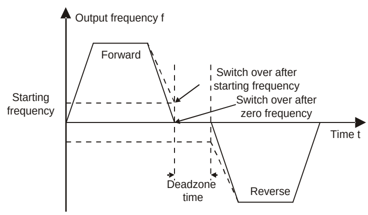
Function code	Name	Description	Default value	Modify
P00.18	Function parameter restoration	0: No operation 1: Restore to default value 2: Clear fault history 3: Lock keypad parameters Note: After the selected function operations are done, this function code will be restored to 0 automatically. Restoration to default value will clear the user password, this function should be used with caution.	0	◎

7.2.2 P01 Start/stop control

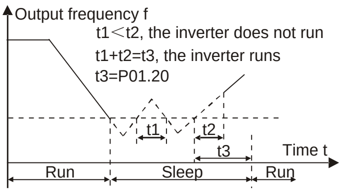
Function code	Name	Description	Default value	Modify
P01.00	Running mode of start	0: Direct start 1: Start after DC brake 2: Start after speed-tracking 1 3: Start after speed-tracking 2 **Note:** It can be modified only after P11.26 is 1 indicating special functions are enabled.	0	◎
P01.01	Starting frequency of direct start	Starting frequency of direct startup is the initial frequency when the VFD starts. See P01.02 (hold time of starting frequency) for details. Setting range: 0.00–50.00Hz	0.50Hz	◎
P01.02	Hold time of starting frequency	 A proper starting frequency can increase the torque during startup. Within the hold time of	0.0s	◎

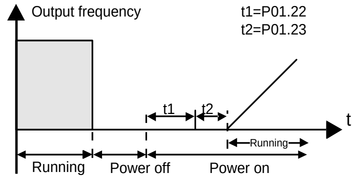
Function code	Name	Description	Default value	Modify
		starting frequency, the output frequency of VFD is the starting frequency, and then it runs from the starting frequency to the target frequency, if the target frequency (frequency command) is below the starting frequency, the VFD will be standby rather than running. The starting frequency value is unlimited by the lower limit frequency. Setting range: 0.0–50.0s		
P01.03	DC brake current before start	During starting, the VFD will first perform DC brake based on the set DC brake current before startup, and then it will accelerate after the set DC brake time before startup elapses. If the set DC brake time is 0, DC brake will be invalid. The larger the DC brake current, the stronger the brake force. The DC brake current before startup refers to the percentage relative to rated VFD current. Setting range of P01.03: 0.0–100.0% Setting range of P01.04: 0.00–50.00s	0.0%	◎
P01.04	DC brake time before start		0.00s	◎
P01.05	Acceleration/deceleration mode	This function code is used to select the frequency variation mode during starting and running. 0: Straight line; the output frequency increases or decreases in straight line;  1: S curve; the output frequency increases or decreases in S curve; S curve is generally used in cases where smooth start/stop is required, for example, elevator, conveyer belt, etc.	0	◎

Function code	Name	Description	Default value	Modify
		 **Note:** When it is set to 1, set P01.06, P01.07, P01.27 and P01.28 accordingly.		
P01.06	Time of starting section of acceleration S curve	The curvature of S curve is determined by acceleration range and acceleration and deceleration time.	0.1s	◎
P01.07	Time of ending section of acceleration S curve	 Setting range: 0.0–50.0s	0.1s	◎
P01.08	Stop mode	0: Decelerate to stop; after stop command is valid, the VFD lowers output frequency based on the deceleration mode and the defined deceleration time, after the frequency drops to the stop speed (P01.15), the VFD stops. 1: Coast to stop; after stop command is valid, the VFD stops output immediately, and the load coasts to stop as per mechanical inertia.	0	○
P01.09	Starting frequency of DC brake after stop	Starting frequency of DC brake after stop; during decelerating to stop, when this frequency is reached, DC brake will be performed after stop.	0.00Hz	○
P01.10	Waiting time of DC brake after stop	Demagnetization time (waiting time of DC brake after stop): Before the DC brake, the VFD will block output, and after the demagnetization time	0.00s	○

Function code	Name	Description	Default value	Modify
P01.11	DC brake current of stop	elapses, DC brake will start. This function is used to prevent overcurrent fault caused by DC brake during high speed.	0.0%	○
P01.12	DC brake time of stop	DC brake current after stop: it means the DC brake force applied, the larger the current, the stronger the DC brake effect.  Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency) Setting range of P01.10: 0.00–30.00s Setting range of P01.11: 0.0–100.0% Setting range of P01.12: 0.0–50.0s	0.00s	○
P01.13	Deadzone time of forward/reverse rotation	This function code refers to the transition time of the threshold set by P01.14 during setting forward/reverse rotation of the VFD, as shown below.  Setting range: 0.0–3600.0s	0.0s	○
P01.14	Forward/reverse rotation switch-over mode	0: Switch over after zero frequency 1: Switch over after starting frequency 2: Switch over after passing stop speed and delay	1	◎

Function code	Name	Description	Default value	Modify
P01.15	Stop speed	0.00–100.00Hz	0.50Hz	◎
P01.16	Stop speed detection mode	0: Set value of speed (the only detection mode valid in SVPWM mode) 1: Detection value of speed	0	◎
P01.17	Stop speed detection time	0.00–100.00s	0.50s	◎
P01.18	Running protection of power-on terminal	When the running command channel is controlled by terminals, the system will detect running terminal state automatically during power up. 0: Terminal running command is invalid during power up. The VFD will not run during power up even if the running command terminal is detected to be valid, and the system is in running protection state. The VFD will run only after this terminal is cancelled and enabled again. 1: Terminal running command is valid during power up. The system will start the VFD automatically after initialization is done if the running command terminal is detected to be valid during power up. 2: During power on, the terminal-given running command is invalid, and the POE fault is reported. During power on, the VFD does not run but reports the fault, although the running command terminal is valid. The fault disappears only when the running command is canceled. Note: This function must be set with caution, otherwise, serious consequences may occur.	0	○
P01.19	Action selection when the running frequency is below lower limit (lower limit should	This function code is used to set the running state of VFD when the set frequency is below lower limit frequency. 0: Run in lower limit of the frequency	0	◎

Function code	Name	Description	Default value	Modify
	be larger than 0)	1: Stop 2: Sleep When the set frequency is below lower limit frequency, the VFD coasts to stop; when the set frequency is above lower limit again and continues to be so after the time set by P01.20 elapses, the VFD will be restored to running state automatically.		
P01.20	Wake-up-from-sleep delay	This function code is used to set the sleep delay. When the running frequency of VFD is below the lower limit frequency, the VFD enters sleep state; when the set frequency is above the lower limit again and continues to be so after the time set by P01.20 elapses, the VFD will run automatically.  Setting range: 0.0–3600.0s (valid when P.01.19 is 2)	0.0s	○
P01.21	Restart after power cut	This function code sets the automatic running of the VFD at next power-on after power down. 0: Disable restart 1: Enable restart, namely the VFD will run automatically after the time set by P01.22 elapses if the starting conditions are met.	0	○
P01.22	Waiting time of restart after power cut	This function code sets the waiting time before automatically running at next power-on after power down.	1.0s	○

Function code	Name	Description	Default value	Modify
		 Setting range: 0.0–3600.0s (valid when P01.21 is 1)		
P01.23	Start delay	This function code sets the delay of the VFD's wake-up-from-sleep after running command is given, the VFD will start to run and output after the time set by P01.23 elapses to realize brake release. Setting range: 0.0–600.0s	0.0s	○
P01.24	Stop speed delay	0.0–600.0s	0.0s	○
P01.25	Open-loop 0Hz output selection	0: No voltage output 1: With voltage output 2: Output as per DC brake current of stop	0	○
P01.26	Deceleration time of emergency-stop	0.0–60.0s	2.0s	○
P01.27	Time of starting section of deceleration S curve	0.0–50.0s	0.1s	◎
P01.28	Time of ending section of deceleration S curve	0.0–50.0s	0.1s	◎
P01.29	Short-circuit brake current	When the VFD starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to	0.0%	○

Function code	Name	Description	Default value	Modify
P01.30	Hold time of short-circuit brake at startup	enter short-circuit brake. During stop, if the running frequency of VFD is below the starting frequency of brake after stop, set P01.31 to a non-zero value to enter short-circuit brake after stop, and then carry out DC brake in the time set by P01.12 (refer to P01.09–P01.12). Setting range of P01.29: 0.0–150.0% (VFD) Setting range of P01.30: 0.0–50.0s Setting range of P01.31: 0.0–50.0s	0.00s	○
P01.31	Hold time of short-circuit brake at stop		0.00s	○
P01.32	Pre-exciting time for jogging	0–10.000s	0.000s	○
P01.33	Starting frequency of stop braking during jogging	0–P00.03	0.00Hz	○
P01.34	Delay to enter the sleep state	0–3600.0s	0.0s	○

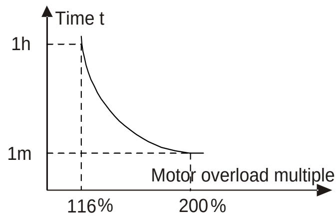
7.2.3 P02 Parameters of motor 1

Function code	Name	Description	Default value	Modify
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0	◎
P02.01	Rated power of asynchronous motor 1	0.1–3000.0kW	Model depended	◎
P02.02	Rated frequency of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.03	Rated speed of	1–36000rpm	Model	◎

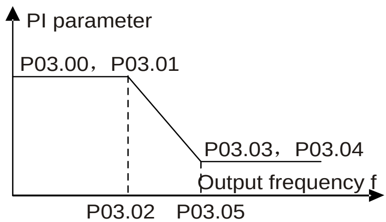
Function code	Name	Description	Default value	Modify
	asynchronous motor 1		depended	
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Model depended	◎
P02.05	Rated current of asynchronous motor 1	0.8–6000.0A	Model depended	◎
P02.06	Stator resistance of asynchronous motor 1	0.001–65.535Ω	Model depended	○
P02.07	Rotor resistance of asynchronous motor 1	0.001–65.535Ω	Model depended	○
P02.08	Leakage inductance of asynchronous motor 1	0.1–6553.5Mh	Model depended	○
P02.09	Mutual inductance of asynchronous motor 1	0.1–6553.5Mh	Model depended	○
P02.10	No-load current of asynchronous motor 1	0.1–6553.5A	Model depended	○
P02.11	Magnetic saturation coefficient 1 of iron core of asynchronous motor 1	0.0–100.0%	80.0%	○
P02.12	Magnetic saturation	0.0–100.0%	68.0%	○

Function code	Name	Description	Default value	Modify
	coefficient 2 of iron core of asynchronous motor 1			
P02.13	Magnetic saturation coefficient 3 of iron core of asynchronous motor 1	0.0–100.0%	57.0%	○
P02.14	Magnetic saturation coefficient 4 of iron core of asynchronous motor 1	0.0–100.0%	40.0%	○
P02.15	Rated power of synchronous motor 1	0.1–3000.0KW	Model depended	◎
P02.16	Rated frequency of synchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.17	Number of pole pairs of synchronous motor 1	1–128	2	◎
P02.18	Rated voltage of synchronous motor 1	0–1200V	Model depended	◎
P02.19	Rated current of synchronous motor 1	0.8–6000.0A	Model depended	◎

Function code	Name	Description	Default value	Modify
P02.20	Stator resistance of synchronous motor 1	0.001–65.535Ω	Model depended	○
P02.21	Direct-axis inductance of synchronous motor 1	0.01–655.35Mh	Model depended	○
P02.22	Quadrature-axis inductance of synchronous motor 1	0.01–655.35Mh	Model depended	○
P02.23	Counter-emf constant of synchronous motor 1	0–10000	300	○
P02.24	Reserved	0x0000–0xFFFF	0	●
P02.25	Reserved	0%–50% (rated motor current)	10%	●
P02.26	Overload protection of motor 1	0: No protection 1: Common motor (with low-speed compensation). As the cooling effect of common motor will be degraded in low speed, the corresponding electronic thermal protection value should also be adjusted properly, the low compensation here means to lower the overload protection threshold of the motor whose running frequency is below 30Hz. 2: Frequency-variable motor (without low speed compensation). As the cooling effect of frequency-variable motor is not affected by the rotating speed, there is no need to adjust the protection value during low speed running.	2	◎
P02.27	Overload	Motor overload multiples M=Iout/(In×K)	100.0%	○

Function code	Name	Description	Default value	Modify
	protection coefficient of motor 1	In is rated motor current, Iout is VFD output current, K is motor overload protection coefficient. The smaller the K, the larger the value of M, and the easier the protection. M=116%: protection will be applied when motor overloads for 1h; M=200%: protection will be applied when motor overloads for 60s; M>=400%: protection will be applied immediately.  Setting range: 20.0%–120.0%		
P02.28	Power display calibration coefficient of motor 1	This function adjusts the power display value of motor 1 only, and it does not affect the control performance of the VFD. Setting range: 0.00–3.00	1.00	○
P02.29	Parameter display of motor 1	0: Display as per motor type; under this mode, only parameters related to current motor type will be displayed. 1: Display all; under this mode, all the motor parameters will be displayed.	0	○
P02.30	System inertia of motor 1	0–30.000kgm2	0	○
P02.31–P02.32	Reserved variables	0–65535	0	○

7.2.4 P03 Vector control of motor 1

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P03.00</td><td>Speed loop proportional gain 1</td><td rowspan="6">Parameters of P03.00–P03.05 fit for vector control mode only. Below P03.02, speed loop PI parameter is P03.00 and P03.01; above P03.06, speed loop PI parameter is P03.03 and P03.04; in between, PI parameter is obtained by linear variation between two groups of parameters, as shown below.


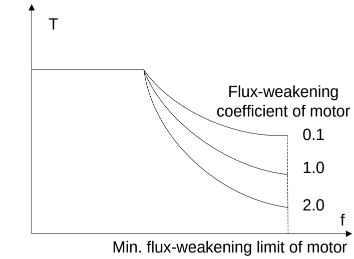
The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increase proportional gain or decrease integral time can accelerate dynamic response of speed loop, however, if the proportional gain is too 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.
Speed loop PI parameter is closely related to the system inertial, you should make adjustment based on default PI parameter according to different load characteristics to fulfill different needs.
Setting range of P03.00:0.0–200.0;
Setting range of P03.01: 0.000–10.000s
Setting range of P03.02: 0.00Hz–P03.05
Setting range of P03.03: 0.0–200.0</td><td>20.0</td><td>○</td></tr>
<tr><td>P03.01</td><td>Speed loop integral time 1</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.02</td><td>Switch low point frequency</td><td>5.00Hz</td><td>○</td></tr>
<tr><td>P03.03</td><td>Speed loop proportional gain 2</td><td>20.0</td><td>○</td></tr>
<tr><td>P03.04</td><td>Speed loop integral time 2</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.05</td><td>Switch over high point frequency</td><td>10.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		Setting range of P03.04: 0.000–10.000s Setting range of P03.05: P03.02–P00.03 (Max. output frequency)		
P03.06	Speed loop output filter	0–8 (corresponds to 0–2^8/10ms)	0	○
P03.07	Vector control slip compensation coefficient (motoring)	Slip compensation coefficient is used to adjust the slip frequency of vector control to improve speed control precision. This parameter can be used to control speed offset. Setting range: 50–200%	100%	○
P03.08	Vector control slip compensation coefficient (generating)		100%	○
P03.09	Current loop proportional coefficient P	**Note:** 1、 These two parameters are used to adjust PI parameters of current loop; it affects dynamic response speed and control precision of the system directly. The default value needs no adjustment under common conditions; 2、 Fit for SVC mode 0 (P00.00=0) and VC mode (P00.00=3); 3、 The value of this function code will be updated automatically after parameter autotuning of synchronous motor is done. Setting range: 0–65535	1000	○
P03.10	Current loop integral coefficient I		1000	○
P03.11	Torque setup mode selection	0–1: Set via keypad (P03.12) 2: Set via AI1 (100% corresponds to three times of rated motor current) 3: Set via AI2 (the same as above) 4: Set via AI3 (the same as above) 5: Set via pulse frequency HDIA (the same as	0	○

Function code	Name	Description	Default value	Modify
		above) 6: Set via multi-step torque (the same as above) 7: Set via MODBUS communication (the same as above) 8: Set via PROFIBUS/CANopen/DeviceNet communication (the same as above) 9: Set via Ethernet communication (the same as above) 10: Set via pulse frequency HDIB (the same as above) 11: Set via EtherCat/Profinet communication 12: Set via PLC		
P03.12	Torque set by keypad	-300.0%–300.0% (rated motor current)	20.0%	○
P03.13	Torque reference filter time	0.000–10.000s	0.010s	○
P03.14	Source of upper limit frequency setup of forward rotation in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: MODBUS communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCat/Profinet communication 11: PLC	0	○

Function code	Name	Description	Default value	Modify
		12: Reserved		
P03.15	Source of upper limit frequency setup of reverse rotation in torque control	0: Keypad (P03.17) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: MODBUS communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCat/Profinet communication 11: PLC 12: Reserved **Note:** For the options 1-11, 100% is relative to the max. frequency.	0	○
P03.16	Keypad limit value of upper limit frequency of forward rotation in torque control	This function code is used to set frequency limit. 100% corresponds to the max. frequency. P03.16 sets the value when P03.14=1; P03.17 sets the value when P03.15=1. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P03.17	Max. output frequency		50.00Hz	○
P03.18	Source of upper limit setup of the torque during motoring	0: Keypad (P03.20) 1: AI1 (100% relative to three times of motor current) 2: AI2 (the same as above) 3: AI3 (the same as above)	0	○

Function code	Name	Description	Default value	Modify
		4: Pulse frequency HDIA (the same as above) 5: MODBUS communication (the same as above) 6: PROFIBUS/CANopen/DeviceNet communication (the same as above) 7: Ethernet communication (the same as above) 8: Pulse frequency HDIB (the same as above) 9: EtherCat/Profinet communication 10: PLC 11: Reserved		
P03.19	Source of upper limit setup of brake torque	0: Keypad (P03.21) 1: AI1 (100% relative to three times of motor current) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: MODBUS communication (the same as above) 6: PROFIBUS/CANopen/DeviceNet communication (the same as above) 7: Ethernet communication (the same as above) 8: Pulse frequency HDIB (the same as above) 9: EtherCat/Profinet communication 10: PLC 11: Reserved	0	○
P03.20	Set upper limit of the torque when motoring via keypad	This function code is used to set torque limit. Setting range: 0.0–300.0% (rated motor current)	180.0%	○
P03.21	Set upper limit of brake torque via keypad		180.0%	○

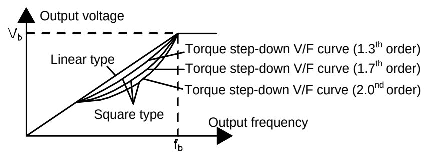
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P03.22</td><td>Flux-weakening coefficient of constant-power zone</td><td rowspan="2">Used when asynchronous motor is in flux-weakening control.


P03.22 and P03.23 are valid during constant power. When motor speed is above rated speed, motor enters flux-weakening running state. The flux-weakening control coefficient can change the flux-weakening curvature, the larger the coefficient, the steeper the curve, the smaller the coefficient, the smoother the curve.
Setting range of P03.22: 0.1–2.0
Setting range of P03.23: 10%–100%</td><td>0.3</td><td>○</td></tr>
<tr><td>P03.23</td><td>Min. flux-weakening point of constant-power zone</td><td>20%</td><td>○</td></tr>
<tr><td>P03.24</td><td>Max. voltage limit</td><td>P03.24 sets the maximum output voltage of the VFD, which is the percentage of rated motor voltage. This value should be set according to field conditions.
Setting range:0.0–120.0%</td><td>100.0%</td><td>○</td></tr>
<tr><td>P03.25</td><td>Pre-exciting time</td><td>Carry out motor pre-exciting during starting to build a magnetic field inside the motor to improve the torque characteristics of motor during starting.
Setting range: 0.000–10.000s</td><td>0.300s</td><td>○</td></tr>
<tr><td>P03.26</td><td>Flux-weakening proportional gain</td><td>0–8000</td><td>1000</td><td>○</td></tr>
<tr><td>P03.27</td><td>Vector control speed display</td><td>0: Display as per actual value
1: Display as per the set value</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P03.28	Static friction compensation coefficient	0.0–100.0%	0.0%	○
P03.29	Corresponding frequency point of static friction	0.50– P03.31	1.00Hz	○
P03.30	High speed friction compensation coefficient	0.0–100.0%	0.0%	○
P03.31	Corresponding frequency of high speed friction torque	P03.29–400.00Hz	50.00Hz	○
P03.32	Torque control enable	0:Disable 1:Enable	0	◎
P03.33	Flux weakening integral gain	0–8000	1200	○
P03.35	Control optimization setting	0–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: ASR integral separation enabling 0: Disabled 1: Enabled Thousands place: Reserved 0: Reserved	0x0000	○

Function code	Name	Description	Default value	Modify
		1: Reserved Range: 0x0000–0x1111		
P03.36	Speed loop differential gain	0.00–10.00s	0.00s	○
P03.37	High-frequency current loop proportional coefficient	Under closed-loop vector control mode (P00.00=3) and P03.39, the current loop PI parameters are P03.09 and P03.10; above P03.39, the PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–65535 Setting range of P03.38: 0–65535 Setting range of P03.39: 0.0–100.0% (relative to max. frequency)	1000	○
P03.38	High-frequency current loop integral coefficient		1000	○
P03.39	Current loop high-frequency switch-over point		100.0%	○
P03.40	Inertia compensation enable	0: Disable 1: Enable	0	○
P03.41	Upper limit of inertia compensation torque	Limit the max. inertia compensation torque to prevent inertia compensation torque from being too large. Setting range: 0.0–150.0% (rated motor torque)	10.0%	○
P03.42	Inertia compensation filter times	Filter times of inertia compensation torque, used to smooth inertia compensation torque. Setting range: 0–10	7	○
P03.43	Inertia identification torque value	Due to friction force, it is required to set certain identification torque for the inertia identification to be performed properly. 0.0–100.0% (rated motor torque)	10.0%	○
P03.44	Enable inertia identification	0: No operation 1: Enable	0	◎

7.2.5 P04 V/F control

Function code	Name	Description	Default value	Modify
P04.00	V/F curve setup of motor 1	This group of function code defines the V/F curve of motor 1 to satisfy different load characteristics needs. 0: Straight V/F curve; fit for constant-torque load 1: Multi-point V/F curve 2: Torque down V/F curve (1.3th order) 3: Torque down V/F curve (1.7th order) 4: Torque down V/F curve (2.0nd order) Curve 2–4 are suitable for torque-variable load of fan pump and similar equipment. You can make adjustment based on load characteristics to achieve optimal energy-saving effect. 5: Customized V/F (V/F separation); under this mode, V is separated from f. You can adjust f through the frequency reference channel set by P00.06 to change the curve characteristic, or adjust V through the voltage reference channel set by P04.27 to change the curve characteristics. **Note: The V_b** in the figure below corresponds to rated motor voltage, and $\mathbf{f_b}$ corresponds to rated motor frequency.  	0	◎
P04.01	Torque boost of motor 1	In order to compensate for low-frequency torque characteristics, you can make some boost compensation to the output voltage. P04.01 is relative to the maximum output voltage V_b.	0.0%	○
P04.02	Motor 1 torque boost cut-off	P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated motor frequency f_b. Torque boost can improve the	20.0%	○

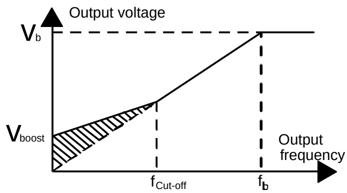
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

low-frequency torque characteristics of V/F.

You should select torque boost based on the load, for example, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which will cause increased output current and motor heat-up, thus degrading the efficiency.

When torque boost is set to 0.0%, the VFD is automatic torque boost.

Torque boost cut-off threshold: Below this frequency threshold, the torque boost is valid, exceeding this threshold will nullify torque boost.



Setting range of P04.01: 0.0%: (automatic) 0.1%–10.0%

Setting range of P04.02: 0.0%–50.0%

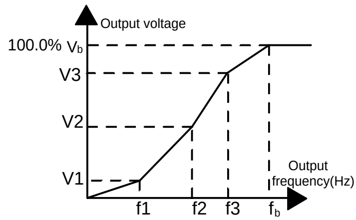
</td><td></td><td></td></tr>
<tr><td>P04.03</td><td>V/F frequency point 1 of motor 1</td><td rowspan="5">

When P04.00 =1 (multi-point V/F curve), you can set V/F curve via P04.03–P04.08.

V/F curve is usually set according to the characteristics of motor load.

Note: V1<V2<V3, f1<f2<f3. If low-frequency voltage is set too high, motor overheat or burnt-down may occur, and overcurrent stall or overcurrent protection may occur to the VFD.

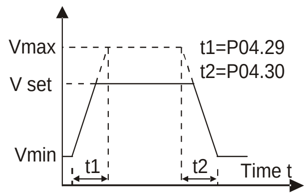
</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.04</td><td>V/F voltage point 1 of motor 1</td><td>00.0%</td><td>○</td></tr>
<tr><td>P04.05</td><td>V/F frequency point 2 of motor 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.06</td><td>V/F voltage point 2 of motor 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P04.07</td><td>V/F frequency point 3 of motor 1</td><td>0.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P04.08	V/F voltage point 3 of motor 1	 Setting range of P04.03: 0.00Hz–P04.05 Setting range of P04.04: 0.0%–110.0% (rated voltage of motor 1) Setting range of P04.05: P04.03–P04.07 Setting range of P04.06: 0.0%–110.0% (rated voltage of motor 1) Setting range of P04.07: P04.05–P02.02 (rated frequency of asynchronous motor 1) or P04.05–P02.16 (rated frequency of synchronous motor 1) Setting range of P04.08: 0.0%–110.0% (rated voltage of motor 1)	00.0%	○
P04.09	V/F slip compensation gain of motor 1	This parameter is used to compensate for the motor rotating speed change caused by load change in the SVPWM 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: $\triangle f = fb - n \times p/60$ where fb is the rated frequency of motor 1, corresponding to P02.02; n is the rated speed of motor 1, corresponding to P02.03; p is the number of pole pairs of motor 1. 100% corresponds to the rated slip frequency $\triangle f$ of motor 1. Setting range: 0.0–200.0%	0.0%	○
P04.10	Low-frequency oscillation control	Under SVPWM control mode, the motor, especially the large-power motor may experience	10	○

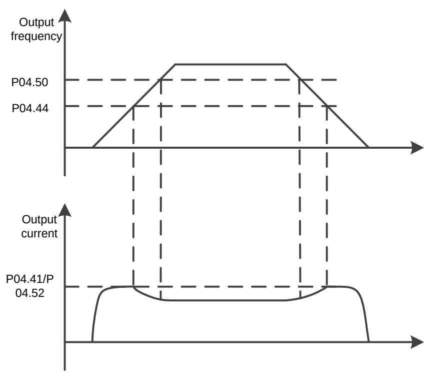
Function code	Name	Description	Default value	Modify
	factor of motor 1	current oscillation during certain frequencies, which may lead to unstable motor operation, or even VFD overcurrent, you can adjust these two parameters properly to eliminate such phenomenon. Setting range of P04.10: 0–100 Setting range of P04.11: 0–100 Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)		
P04.11	High-frequency oscillation control factor of motor 1		10	○
P04.12	Oscillation control threshold of motor 1		30.00Hz	○
P04.13	V/F curve setup of motor 2	This parameter defines the V/F curve of motor 2 of the Goodrive350-19 series to meet various load characteristic requirements. 0: Straight V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (1.3th order) 3: Torque-down V/F curve (1.7th order) 4: Torque-down V/F curve (2.0nd order) 5: Customize V/F (V/F separation)	0	◎
P04.14	Torque boost of motor 2	**Note:** Refer to the parameter description of P04.01 and P04.02. Setting range of P04.14: 0.0%: (automatic) 0.1%–10.0% Setting range of 0.0%–50.0% (relative to rated frequency of motor 2)	0.0%	○
P04.15	Motor 2 torque boost cut-off		20.0%	○
P04.16	V/F frequency point 1 of motor 2	**Note:** Refer to the parameter description of P04.03–P04.08 Setting range of P04.16: 0.00Hz–P04.18 Setting range of P04.17:0.0%–110.0% (rated voltage of motor 2) Setting range of P04.18: P04.16–P04.20	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2		00.0%	○
P04.18	V/F frequency point 2 of motor 2		0.00Hz	○

Function code	Name	Description	Default value	Modify
P04.19	V/F voltage point 2 of motor 2	Setting range of P04.19: 0.0%–110.0% (rated voltage of motor 2)	00.0%	○
P04.20	V/F frequency point 3 of motor 2	Setting range of P04.20: P04.18–P12.02 (rated frequency of asynchronous motor 2) or P04.18–P12.16 (rated frequency of synchronous motor 2)	0.00Hz	○
P04.21	V/F voltage point 3 of motor 2	Setting range of P04.21:0.0%–110.0%(rated voltage of motor 2)	00.0%	○
P04.22	V/F slip compensation gain of motor 2	This parameter is used to compensate for the motor rotating speed change caused by load change in the SVPWM 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: △f=fb-n*p/60 where fb is the rated frequency of motor 2, corresponding to P12.02; n is the rated speed of motor 2, corresponding to P12.03; p is the number of pole pairs of motor 2. 100% corresponds to the rated slip frequency △f of motor 2. Setting range: 0.0–200.0%	0.0%	○
P04.23	Low-frequency oscillation control factor of motor 2	In the SVPWM mode, current oscillation may easily occur on motors, especially large-power motors, at some frequency, which may cause unstable running of motors or even overcurrent of VFDs. You can modify this parameter to prevent current oscillation. Setting range of P04.23: 0–100	10	○
P04.24	High-frequency oscillation control factor of motor 2	Setting range of P04.24: 0–100	10	○
P04.25	Oscillation control threshold of motor 2	Setting range of P04.25: 0.00 Hz–P00.03 (Max. output frequency)	30.00Hz	○
P04.26	Energy-saving run	0: No action	0	◎

Function code	Name	Description	Default value	Modify
		1: Automatic energy-saving operation Under light-load state, the motor can adjust the output voltage automatically to achieve energy-saving purpose		
P04.27	Channel of voltage setup	0: Keypad; output voltage is determined by P04.28 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step (the set value is determined by P10 group) 6: PID 7: MODBUS communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: HDIB 11: EtherCat/Profinet communication 12: PLC programmable card 13: Reserved	0	○
P04.28	Set voltage value via keypad	When the channel for voltage setup is set to "keypad", the value of this function code is digital voltage set value. Setting range: 0.0%–100.0%	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed from outputting the min. voltage to accelerating to output the max. voltage.	5.0s	○
P04.30	Voltage decrease time	Voltage decrease time means the time needed from outputting max. voltage to outputting the min. voltage	5.0s	○

Function code	Name	Description	Default value	Modify
		Setting range: 0.0–3600.0s		
P04.31	Output max. voltage	Set the upper/lower limit value of output voltage.  Setting range of P04.31: P04.32–100.0% (rated motor voltage) Setting range of P04.32: 0.0%–P04.31	100.0%	◎
P04.32	Output min. voltage		0.0%	◎
P04.33	Flux-weakening coefficient in the constant power zone	1.00–1.30	1.00	○
P04.34	Input current 1 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is lower than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	20.0%	○
P04.35	Input current 2 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is higher than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	10.0%	○
P04.36	Frequency threshold for input current switching in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the frequency threshold for the switching between input current 1 and input current 2. Setting range: 0.00 Hz–P00.03 (Max. output	50.00Hz	○

Function code	Name	Description	Default value	Modify
		frequency)		
P04.37	Reactive current closed-loop proportional coefficient in synchronous motor VF	When the synchronous motor VF control mode is enabled, this parameter is used to set the proportional coefficient of the reactive current closed-loop control. Setting range: 0–3000	50	○
P04.38	Reactive current closed-loop integral time in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the integral coefficient of the reactive current closed-loop control. Setting range: 0–3000	30	○
P04.39	Reactive current closed-loop output limit in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the output limit of the reactive current in the 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 this parameter. Setting range: 0–16000	8000	○
P04.40	Enable I/F mode for asynchronous motor 1	0: Disabled 1: Enabled	0	◎
P04.41	Current setting in I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this 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%	○
P04.42	Proportional coefficient in I/F mode for asynchronous	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the proportional coefficient of the output current closed-loop control.	350	○

Function code	Name	Description	Default value	Modify
	motor 1	Setting range: 0–5000		
P04.43	Integral coefficient in I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150	○
P04.44	Starting frequency for switching off I/F mode for asynchronous motor 1	When I/F control is adopted for asynchronous motor 1, this parameter is used to set the starting frequency for switching off the output current closed-loop control. When the output frequency is lower than the value of this parameter, the current closed-loop control in the I/F control mode is enabled; and when the output frequency is higher than P04.50, the current closed-loop control in the I/F control mode is disabled.  Setting range: 0.00–20.00 Hz **Note:** The frequency for completely switching off the I/F control is a half of the motor rated frequency.	10.00Hz	○
P04.45	Enabling I/F mode for asynchronous	0: Disable	0	◎

Function code	Name	Description	Default value	Modify
	motor 2	1: Enable **Note:** The I/F mode is not applicable to conical motor applications.		
P04.46	Current setting in I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this 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 I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	350	○
P04.48	Integral coefficient in I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150	○
P04.49	Starting frequency for switching off I/F mode for asynchronous motor 2	When I/F control is adopted for asynchronous motor 2, this parameter is used to set the starting frequency for switching off the output current closed-loop control. When the frequency is lower than the value of this parameter, the current closed-loop control in the I/F control mode is enabled; and when the frequency is higher than that, the current closed-loop control in the I/F control mode is disabled. Setting range: 0.00–20.00 Hz	10.00Hz	○
P04.50	End frequency for switching off I/F mode for asynchronous	P04.44–P00.03	25.00Hz	○

Function code	Name	Description	Default value	Modify
	motor 1			
P04.51	End frequency for switching off I/F mode for asynchronous motor 2	P04.49–P00.03	25.00Hz	○
P04.52	Current setting for reverse running in I/F mode for asynchronous motor 1	0.0–200.0%	120.0%	○
P04.53	Current setting for reverse running in I/F mode for asynchronous motor 2	0.0–200.0%	120.0%	○

7.2.6 P05 Input terminals

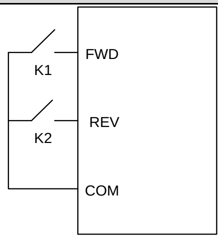
Function code	Name	Description	Default value	Modify
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00	◎
P05.01	Function of S1 terminal	0: No function 1: Forward running 2: Reverse running	1	◎
P05.02	Function of S2 terminal		2	◎

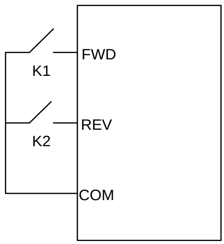
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P05.03</td><td>Function of S3 terminal</td><td rowspan="5">3: 3-wire control/Sin
4: Forward jogging
5: Reverse jogging
6: Coast to stop
7: Fault reset
8: Running pause
9: External fault input
10: Frequency increase (UP)
11: Frequency decrease (DOWN)
12: Clear frequency increase/decrease setting
13: Switch-over between setup A and setup B
14: Switch-over between combination setup and setup A
15: Switch-over between combination setup and setup B
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: Multi-step speed pause
21: Acceleration/deceleration time selection 1
22: Acceleration/deceleration time selection 2
23: Simple PLC stop reset
24: Simple PLC pause
25: PID control pause
26: Wobbling frequency pause
27: Wobbling frequency reset
28: Counter reset
29: Switch-over between speed control and torque</td><td>7</td><td>◎</td></tr>
<tr><td>P05.04</td><td>Function of S4 terminal</td><td>0</td><td>◎</td></tr>
<tr><td>P05.05</td><td>Function of HDIA terminal</td><td>0</td><td>◎</td></tr>
<tr><td>P05.06</td><td>Function of HDIB terminal</td><td>0</td><td>◎</td></tr>
<tr><td>P05.07</td><td>Reserved</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		control 30: Acceleration/deceleration disabled 31: Counter trigger 32: Reserved 33: Clear frequency increase/decrease setting temporarily 34: DC brake 35: Switch-over between motor 1 and motor 2 36: Command switches to keypad 37: Command switches to terminal 38: Command switches to communication 39: Pre-exciting command 40: Zero out power consumption quantity 41: Maintain power consumption quantity 42: Source of upper torque limit switches to keypad 43: Position reference point input (only S6, S7 and S8 are valid) 44: Spindle orientation disabled 45: Spindle zeroing/local positioning zeroing 46: Spindle zero position selection 1 47: Spindle zero position selection 2 48: Spindle scale division selection 1 49: Spindle scale division selection 2 50: Spindle scale division selection 3 51: Position control and speed control switch-over terminal 52: Pulse input disabled 53: Clear position deviation cleared		

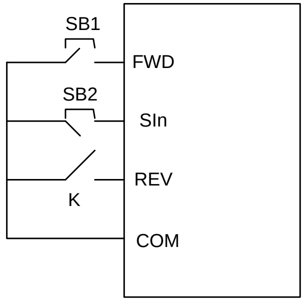
Function code	Name	Description	Default value	Modify
		54: Switch over position proportional gain 55: Enable cyclic positioning of digital position positioning 56: Emergency stop 57: Motor over-temperature fault input 58: Enable rigid tapping 59: Switches to V/F control 60: Switches to FVC control 61: PID polarity switch-over 62: Switch to SVC1 control (open-loop vector control mode 1) 63: Enable servo 64: Limit of forward run 65: Limit of reverse run 66: Zero out encoder counting 67: Pulse increase 68: Enable pulse superimposition 69: Pulse decrease 70: Electronic gear selection 71: Switch to the master 72: Switch to the slave 73: Enable the VFD 74: Contactor feedback signal 75: Brake feedback signal 76: Operating lever zero-point position 77: Graded reference terminal 1 78: Graded reference terminal 2 79: Graded reference terminal 3 80: Graded reference terminal 4 81: Graded reference terminal 5 82: Upward DEC limit position		

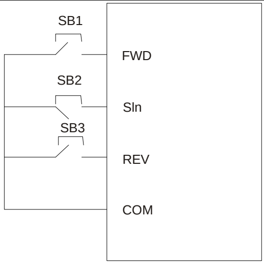
Function code	Name	Description	Default value	Modify
		83: Downward DEC limit position 84: Light load speed boost signal 85: Brake detection 86: Valid signal of PTC overtemperature (Supporting only the terminals S5 – S8 of EC-IO502-00) 87: Position synchronization pulse counting reset 88: Switchover between motors 1 and 3 89: Anti-snag protection input		
P05.08	Polarity of input terminal	This function code is used to set the polarity of input terminals. When the bit is set to 0, input terminal polarity is positive; When the bit is set to 1, input terminal polarity is negative; 0x000–0x3F	0x000	○
P05.09	Digital filter time	Set S1–S4, filter time of HDI terminal sampling. In cases where interference is strong, increase the value of this parameter to avoid mal-operation. 0.000–1.000s	0.010s	○
P05.10	Virtual terminal setting	0x000–0x3F (0: disable, 1: enable) BIT0: S1 virtual terminal BIT1: S2 virtual terminal BIT2: S3 virtual terminal BIT3: S4 virtual terminal BIT4: HDIA virtual terminal BIT5: HDIB virtual terminal	0x00	◎
P05.11	2/3 Wire control mode	Used to set the 2/3 Wire control mode. 0: 2-Wire control 1; integrate enabling function with direction. This mode is the most popular dual-line mode. Direction of motor rotation is determined by the defined FWD/REV terminal command.	0	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


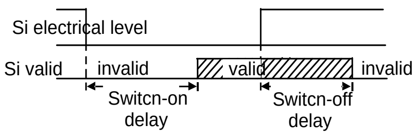
<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Reverse running</td></tr>
<tr><td>ON</td><td>ON</td><td>Hold</td></tr>
</table>
1: 2-wire control 2; separate enabling function with direction. In this mode, the defined FWD is enabling terminal, and the direction is determined by the state of REV.


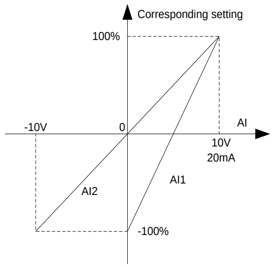
<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Stop</td></tr>
<tr><td>ON</td><td>ON</td><td>Reverse running</td></tr>
</table>
2: 3-wire control 1; This mode defines Sin as enabling terminal, and the running command is generated by FWD, the direction is controlled by REV. During running, the Sin terminal should be closed, and terminal FWD generates a rising edge signal, then the VFD starts to run in the direction set by the state of terminal REV; the VFD should be stopped by disconnecting terminal Sin.
</td><td></td><td></td></tr>
</table>

Function code	Name	Description	Default value	Modify
		 The direction control during running is shown below. <table><tr><th>SIn</th><th>REV</th><th>Previous running direction</th><th>Current running direction</th></tr><tr><td rowspan="2">ON</td><td rowspan="2">OFF→ON</td><td>Forward</td><td>Reverse</td></tr><tr><td>Reverse</td><td>Forward</td></tr><tr><td rowspan="2">ON</td><td rowspan="2">ON→OFF</td><td>Reverse</td><td>Forward</td></tr><tr><td>Forward</td><td>Reverse</td></tr><tr><td rowspan="2">ON→OFF</td><td>ON</td><td colspan="2" rowspan="2">Decelerate to stop</td></tr><tr><td>OFF</td></tr></table> SIn: 3-wire control/Sin, FWD: Forward running, REV: Reverse running 3: 3-wire control 2; This mode defines Sin as enabling terminal. The running command is generated by FWD or REV, and they control the running direction. During running, the terminal Sin should be closed, and terminal FWD or REV generates a rising edge signal to control the running and direction of VFD; the VFD should be stopped by disconnecting terminal Sin.		

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


<table>
<tr><th>SIn</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>Forward</td></tr>
<tr><td>OFF</td><td>Forward</td></tr>
<tr><td rowspan="2">ON</td><td>ON</td><td rowspan="2">OFF→ON</td><td>Reverse</td></tr>
<tr><td>OFF</td><td>Reverse</td></tr>
<tr><td rowspan="2">ON→OFF</td><td></td><td></td><td rowspan="2">Decelerate to stop</td></tr>
<tr><td></td><td></td></tr>
</table>
SIn: 3-wire control/Sin, FWD: Forward running, REV: Reverse running
Note: For dual-line running mode, when FWD/REV terminal is valid, if the VFD stops due to stop command given by other sources, it will not run again after the stop command disappears even if the control terminals FWD/REV are still valid. To make the VFD run again, 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.)
</td><td></td><td></td></tr>
<tr><td>P05.12</td><td>S1 terminal switch-on delay</td><td>These function codes define corresponding delay of the programmable input terminals during level</td><td>0.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P05.13	S1 terminal switch-off delay	variation from switch-on to switch-off .  Setting range: 0.000–50.000s **Note:** After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.	0.000s	○
P05.14	S2 terminal switch-on delay		0.000s	○
P05.15	S2 terminal switch-off delay		0.000s	○
P05.16	S3 terminal switch-on delay		0.000s	○
P05.17	S3 terminal switch-off delay		0.000s	○
P05.18	S4 terminal switch-on delay		0.000s	○
P05.19	S4 terminal switch-off delay		0.000s	○
P05.20	HDIA terminal switch-on delay		0.000s	○
P05.21	HDIA terminal switch-off delay		0.000s	○
P05.22	HDIB terminal switch-on delay		0.000s	○
P05.23	HDIB terminal switch-off delay		0.000s	○
P05.24	Lower limit value of AI1	These function codes define the relation between analog input voltage and corresponding set value of analog input. When the analog input voltage exceeds the range of max./min. input, the max. input or min. input will be adopted during calculation.	0.00V	○
P05.25	Corresponding setting of lower limit of AI1		0.0%	○
P05.26	Upper limit value	When analog input is current input, 0–20mA	10.00V	○

Function code	Name	Description	Default value	Modify
	of AI1	current corresponds to 0–10V voltage.		
P05.27	Corresponding setting of upper limit of AI1	In different applications, 100% of analog setting corresponds to different nominal values. The figure below illustrates several settings.	100.0%	○
P05.28	Input filter time of AI1	 	0.030s	○
P05.29	Lower limit value of AI2		-10.00V	○
P05.30	Corresponding setting of lower limit of AI2		-100.0%	○
P05.31	Intermediate value 1 of AI2	Input filter time: Adjust the sensitivity of analog input, increase this value properly can enhance the anti-interference capacity of analog variables; however, it will also degrade the sensitivity of analog input.	0.00V	○
P05.32	Corresponding setting of intermediate value 1 of AI2	**Note:** AI1 can support 0–10V/0–20mA input, when AI1 selects 0–20mA input; the corresponding voltage of 20mA is 10V; AI2 supports -10V–+10V input.	0.0%	○
P05.33	Intermediate value 2 of AI2	Setting range of P05.24: 0.00V–P05.26	0.00V	○
P05.34	Corresponding setting of intermediate value 2 of AI2	Setting range of P05.25: -300.0%–300.0% Setting range of P05.26: P05.24–10.00V Setting range of P05.27: -300.0%–300.0%	0.0%	○
P05.35	Upper limit value of AI2	Setting range of P05.28: 0.000s–10.000s Setting range of P05.29: -10.00V–P05.31	10.00V	○
P05.36	Corresponding setting of upper limit of AI2	Setting range of P05.30: -300.0%–300.0% Setting range of P05.31: P05.29–P05.33 Setting range of P05.32: -300.0%–300.0%	100.0%	○
P05.37	Input filter time of AI2	Setting range of P05.33: P05.31–P05.35 Setting range of P05.34: -300.0%–300.0%	0.030s	○

Function code	Name	Description	Default value	Modify
		Setting range of P05.35: P05.33–10.00V Setting range of P05.36: -300.0%–300.0% Setting range of P05.37: 0.000s–10.000s		
P05.38	HDIA high-speed pulse input function	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIB	0	◎
P05.39	Lower limit frequency of HDIA	0.000 KHz – P05.41	0.000 KHz	○
P05.40	Corresponding setting of lower limit frequency of HDIA	-300.0%–300.0%	0.0%	○
P05.41	Upper limit frequency of HDIA	P05.39 –50.000KHz	50.000 KHz	○
P05.42	Corresponding setting of upper limit frequency of HDIA	-100.0%–100.0%	100.0%	○
P05.43	HDIA frequency input filter time	0.000s–10.000s	0.030s	○
P05.44	HDIB high-speed pulse input function selection	0: Set input via frequency 1: Reserved 2: Encoder input, it should be used in combination with HDIA	0	◎
P05.45	Lower limit frequency of HDIB	0.000 KHz – P05.47	0.000 KHz	○
P05.46	Corresponding setting of lower	-300.0%–300.0%	0.0%	○

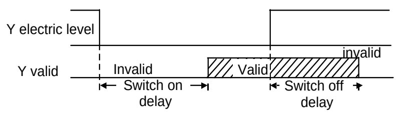
Function code	Name	Description	Default value	Modify
	limit frequency of HDIB			
P05.47	Upper limit frequency of HDIB	P05.45 –50.000KHz	50.000 KHz	○
P05.48	Corresponding setting of upper limit frequency of HDIB	-300.0%–300.0%	100.0%	○
P05.49	HDIB frequency input filter time	0.000s–10.000s	0.030s	○
P05.50	AI1 input signal type	0: Voltage type 1: Current type **Note:** You can set the AI1 input signal type through the corresponding function code.	0	◎

7.2.7 P06 Output terminals

Function code	Name	Description	Default value	Modify
P06.00	HDO output type	0: Open collector high-speed pulse output: Max. frequency of the 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	Y output selection	0: Invalid 1: In running 2: In forward running 3: In reverse running 4: In jogging 5: VFD fault	0	○
P06.02	HDO output selection		0	○
P06.03	Relay RO1 output selection		1	○
P06.04	Relay RO2 output		5	○

Function code	Name	Description	Default value	Modify
	selection	6: Frequency level detection FDT1 7: Frequency level detection FDT2 8: Frequency reached 9: Running in zero speed 10: Reach upper limit frequency 11: Reach lower limit frequency 12: Ready to run 13: In pre-exciting 14: Overload pre-alarm 15: Underload pre-alarm 16: Simple PLC stage completed 17: Simple PLC cycle completed 18: Reach set counting value 19: Reach designated counting value 20: External fault is valid 21: Reserved 22: Reach running time 23: Virtual terminal output of MODBUS communication 24: Virtual terminal output of POROFIBUS/CANopen communication 25: Virtual terminal output of Ethernet communication 26: DC bus voltage established 27: Z pulse output 28: During pulse superposition 29: STO action 30: Positioning completed 31: Spindle zeroing completed		

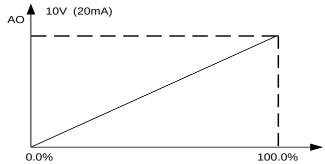
Function code	Name	Description	Default value	Modify
		32: Spindle scale-division completed 33: In speed limit 34: Virtual terminal output of EtherCat/Profinet communication 35: Reserved 36: Speed/position control switch-over completed 37: Any frequency reached 38–40: Reserved 41: C_Y1 from PLC (You need to set P27.00 to 1.) 42: C_Y2 from PLC (You need to set P27.00 to 1.) 43: C_HDO from PLC (You need to set P27.00 to 1.) 44: C_RO1 from PLC (You need to set P27.00 to 1.) 45: C_RO2 from PLC (You need to set P27.00 to 1.) 46: C_RO3 from PLC (You need to set P27.00 to 1.) 47: C_RO4 from PLC (You need to set P27.00 to 1.) 48: Contactor output 49: Brake output 50: Ready to release the brake 51: Ready to close the brake 52: Upward limit position reached 53: Downward limit position reached 54: Low voltage protection 55: Overload protection 56: Brake detection reminding 57: Brake failure alarm 58: Input phase loss alarm 59: Loose rope state (FWD loose rope protection, REV loose rope alarm/fault)		

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>60: In motor 1 state
61: In motor 2 state
62: In motor 3 state
63: PT100 temperature alarm
64: PT1000 temperature alarm
65: Boosting the speed with light load
66: Derating the frequency with voltage</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>This function code is used to set the polarity of output terminals.
When the bit is set to 0, input terminal polarity is positive;
When the bit is set to 1 input terminal polarity is negative.
<table>
<tr><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr>
<tr><td>RO2</td><td>RO1</td><td>HDO</td><td>Y</td></tr>
</table>
Setting range: 0x0–0xF</td><td>00</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y switch-on delay</td><td rowspan="7">This function code defines the corresponding delay of the level variation from switch-on to switch-off.


Setting range: 0.000–50.000s
Note: P06.08 and P06.09 are valid only when P06.00=1.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.07</td><td>Y switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.08</td><td>HDO switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.09</td><td>HDO switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.10</td><td>Relay RO1 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.11</td><td>Relay RO1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.12</td><td>Relay RO2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P06.13</td><td>Relay RO2 switch-off delay</td><td></td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.14</td><td>AO1 output selection</td><td rowspan="2">0: Running frequency (0–Max. output frequency)
1: Set frequency (0–Max. output frequency)
2: Ramp reference frequency (0–Max. output frequency)
3: Running speed (0–Synchronous rotation speed corresponding to max. output frequency)
4: Output current (0–Twice the VFD rated current)
5: Output current (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 (0–Twice the motor rated torque)
9: Output torque (0–Twice the motor rated torque)
10: Analog AI1 input value (0–10V/0–20mA)
11: Analog AI2 input value(0–10V)
12: Analog AI3 input value(0–10V/0–20mA)
13: High-speed pulse HDIA input value (0.00–50.00kHz)
14: MODBUS communication set value 1 (0–1000)
15: MODBUS communication set value 2 (0–1000)
16: PROFIBUS/CANopen/DeviceNet communication set value 1 (0–1000)
17: PROFIBUS/CANopen/DeviceNet communication set value 2 (0–1000)
18: Ethernet communication set value 1 (0–1000)
19: Ethernet communication set value 2 (0–1000)</td><td>0</td><td>○</td></tr>
<tr><td>P06.16</td><td>HDO high-speed pulse output</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		20: High-speed pulse HDIB input value (0.00–50.00kHz) 21: EtherCat/Profinet communication set value 1 (0–1000) 22: Torque current (0–Triple the motor rated current) 23: Exciting current (0–Triple the motor rated current) 24: Set frequency (bipolar, 0–Max. output frequency) 25: Ramps reference frequency (bipolar, 0–Max. output frequency) 26: Running speed (bipolar; 0–Synchronous rotation speed corresponding to max. output frequency) 27: EtherCat/Profinet communication set value 2 (0–1000) 28: C_AO1 from PLC (You need to set P27.00 to 1.) (0–1000) 29: C_AO2 from PLC (You need to set P27.00 to 1.) (0–1000) 30: Running speed (0–Twice the synchronous speed of motor) 31: Output torque (Actual value, 0–Twice motor rated torque) 32–47: Reserved variable		
P06.17	Lower limit of AO1 output	Above function codes define the relation between output value and analog output. When the output value exceeds the set max./min. output range, the upper/low limit of output will be adopted during calculation.	0.0%	○
P06.18	Corresponding AO1 output of lower limit		0.00V	○

Function code	Name	Description	Default value	Modify
P06.19	Upper limit of AO1 output	When analog output is current output, 1mA corresponds to 0.5V voltage. In different applications, 100% of output value corresponds to different analog outputs.  Setting range of P06.17: -300.0%–P06.19 Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–100.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s	100.0%	○
P06.20	Corresponding AO1 output of upper limit		10.00V	○
P06.21	AO1 output filter time		0.000s	○
P06.27	Lower limit of HDO output	-300.0%–P06.29	0.00%	○
P06.28	Corresponding HDO output of lower limit	0.00–50.00kHz	0.00kHz	○
P06.29	Upper limit of HDO output	P06.27–100.0%	100.0%	○
P06.30	Corresponding HDO output of upper limit	0.00–50.00kHz	50.00 kHz	○
P06.31	HDO output filter time	0.000s–10.000s	0.000s	○
P06.33	Frequency reaching detection value	0–P00.03	1.00Hz	○
P06.34	Frequency reaching	0–3600.0s	0.5s	○

Function code	Name	Description	Default value	Modify
	detection time			

7.2.8 P07 HMI

Function code	Name	Description	Default value	Modify
P07.00	User password	0–65535 Set it to any non-zero value to enable password protection. 00000: Clear previous user password and disable password protection. After user password becomes valid, if wrong password is inputted, you will be denied entry. It is necessary to keep the user password in mind. Password protection will be effective one minute after exiting function code edit state, and it will display "0.0.0.0.0" if you press PRG/ESC key to enter function code edit state again, you need to input the correct password. **Note: Restoring to default values will clear user password, use this function with caution.**	0	○
P07.01	Function parameter copying	Range: 0–4 0: No operation 1: Upload parameters to the keypad 2: Download all parameters (including motor parameters) 3: Download non-motor parameters. 4: Download motor parameters.	0	◎
P07.02	Function of keys	Range: 0x00–0x27 Ones: Function selection of QUICK/JOG key 0: No function 1: Jogging	0x01	◎

Function code	Name	Description	Default value	Modify
		2: Reserved 3: Forward/reverse rotation switch-over 4: Clear UP/DOWN setting 5: Coast to stop 6: Switch over the running command reference mode in sequence 7: Reserved Tens: Reserved		
P07.03	Running command channel switch-over sequence of QUICK key	When P07.02=6, set the switch-over sequence of running command channel. 0: keypad control→terminal control→ communication control 1: keypad control←→terminal control 2: keypad control←→communication control 3: terminal control←→communication control	0	○
P07.04	Stop function selection of STOP/RST key	Validness selection of stop function of STOP/RST. For fault reset, STOP/RST is valid under any situation. 0: valid only for panel control only 1: valid for both panel and terminal control 2: valid for both panel and communication control 3: valid for all control modes	0	○
P07.05	Displayed parameter selection 1 for running state	0x0000–0xFFFF	0x03FF	
P07.06	Displayed parameter selection 2 for running state	0x0000–0xFFFF	0x0000	

Function code	Name	Description	Default value	Modify
P07.07	Displayed parameter selection for stopped state	0x0000–0xFFFF	0x00FF	
P07.08	Frequency display coefficient	0.01–10.00 Display frequency=running frequency× P07.08	1.00	○
P07.09	Speed display coefficient	0.1–999.9% Mechanical speed=120×display running frequency×P07.09/number of motor pole pairs	100.0%	○
P07.10	Linear speed display coefficient	0.1–999.9% Linear speed=mechanical speed×P07.10	1.0%	○
P07.11	Temperature of rectifier bridge module	-20.0–120.0°C	/	●
P07.12	Temperature of VFD module	-20.0–120.0°C	/	●
P07.13	Software version of control board	1.00–655.35	/	●
P07.14	Accumulated running time	0–65535h	/	●
P07.15	High bit of VFD power consumption	Display the power consumption of the VFD. VFD power consumption=P07.15×1000+P07.16 Setting range of P07.15: 0–65535 kWh (×1000) Setting range of P07.16: 0.0–999.9 kWh	/	●
P07.16	Low bit of VFD power consumption		/	●
P07.17	Reserved		/	/
P07.18	Rated power of VFD	0.4–3000.0kW	/	●

Function code	Name	Description	Default value	Modify
P07.19	Rated voltage of VFD	50–1200V	/	●
P07.20	Rated current of VFD	0.1–6000.0A	/	●
P07.21	Factory barcode 1	0x0000–0xFFFF	/	●
P07.22	Factory barcode 2	0x0000–0xFFFF	/	●
P07.23	Factory barcode 3	0x0000–0xFFFF	/	●
P07.24	Factory barcode 4	0x0000–0xFFFF	/	●
P07.25	Factory barcode 5	0x0000–0xFFFF	/	●
P07.26	Factory barcode 6	0x0000–0xFFFF	/	●
P07.27	Type of present fault	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 acceleration (OC1) 5: Overcurrent during deceleration (OC2) 6: Overcurrent during constant speed (OC3) 7: Overvoltage during acceleration (OV1) 8: Overvoltage during deceleration (OV2) 9: Overvoltage during constant speed (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 overheat (OH1) 16: Inverter module overheat (OH2)	/	●
P07.28	Type of the last fault		/	●
P07.29	Type of the last but one fault		/	●
P07.30	Type of the last but two fault		/	●
P07.31	Type of the last but three fault		/	●
P07.32	Type of the last but four fault		/	●

Function code	Name	Description	Default value	Modify
		17: External fault (EF) 18: 485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (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 fault (E-NET) 31: CANopen communication fault (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 offline fault (ENC1O) 38: Encoder reversal fault (ENC1D) 39: Encoder Z pulse offline fault (ENC1Z) 40: Safe torque off (STO) 41: Channel H1 safety circuit exception (STL1) 42: Channel H2 safety circuit exception (STL2) 43: Channel H1 and H2 exception (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: PLC card customized fault 1 (P-E1)		

Function code	Name	Description	Default value	Modify
		46: PLC card customized fault 2 (P-E2) 47: PLC card customized fault 3 (P-E3) 48: PLC card customized fault 4 (P-E4) 49: PLC card customized fault 5 (P-E5) 50: PLC card customized fault 6 (P-E6) 51: PLC card customized fault 7 (P-E7) 52: PLC card customized fault 8 (P-E8) 53: PLC card customized fault 9 (P-E9) 54: PLC card customized fault 10 (P-E10) 55: Repetitive extension card type fault (E-Err) 56: Encoder UVW loss fault (ENCUV) 57: Profibus communication fault (E-PN) 58: CANopen communication fault (ESCAN) 59: Motor over-temperature fault (OT) 60: Card slot 1 card identification failure (F1-Er) 61: Card slot 2 card identification failure (F2-Er) 62: Card slot 3 card identification failure (F3-Er) 63: Card slot 1 card communication timeout fault (C1-Er) 64: Card slot 2 card communication timeout fault (C2-Er) 65: Card slot 3 card communication timeout fault (C3-Er) 66: EtherCat communication fault (E-CAT) 67: Bacnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: Master-slave synchronous CAN slave fault (S-Err) 70: VFD not enabled (dIS) 71: Contactor feedback fault (tbE)		

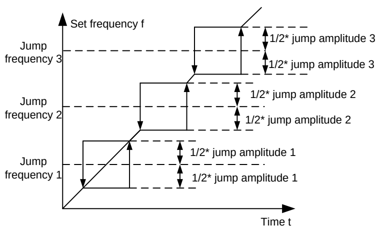
Function code	Name	Description	Default value	Modify
		72: Brake feedback fault (FAE) 73: Torque verification fault (tPF) 74: Operating lever zero-position fault (STC) 75: Low speed running protection fault (LSP) 76: Terminal command exception (tCE) 77: Power-on terminal command exception (POE) 78: Loose rope protection fault (SLE) 79: Brake failure (bE) 80: Master/slave position synchronization fault (ELS) 81: Analog speed reference deviation fault (AdE) 82: PT100 overtemperature (OtE1) 83: PT1000 overtemperature (OtE2) 84: Set frequency fault (SFE) 85: Current imbalance fault (Cuu) 86: PTC overtemperature fault (PtcE)		
P07.33	Running frequency of present fault		0.00Hz	●
P07.34	Ramps reference frequency of present fault		0.00Hz	●
P07.35	Output voltage of present fault		0V	●
P07.36	Output current of present fault		0.0A	●
P07.37	Bus voltage of present fault		0.0V	●
P07.38	Max. temperature of present fault		0.0°C	●
P07.39	Input terminal state of present		0	●

Function code	Name	Description	Default value	Modify
	fault			
P07.40	Output terminal state of present fault		0	●
P07.41	Running frequency of the last fault		0.00Hz	●
P07.42	Ramps reference frequency of the last fault		0.00Hz	●
P07.43	Output voltage of the last fault		0V	●
P07.44	Output current of the last fault		0.0A	●
P07.45	Bus voltage of the last fault		0.0V	●
P07.46	Max. temperature of the last fault	-20.0–120.0°C	0.0°C	●
P07.47	Input terminal state of the last fault		0	●
P07.48	Output terminal state of the last fault		0	●
P07.49	Running frequency of the last but one fault		0.00Hz	●
P07.50	Ramps reference frequency of the last but one fault		0.00Hz	●

Function code	Name	Description	Default value	Modify
P07.51	Output voltage of the last but one fault		0V	●
P07.52	Output current of the last but one fault		0.0A	●
P07.53	Bus voltage of the last but one fault		0.0V	●
P07.54	Max. temperature of the last but one fault	-20.0–120.0°C	0.0°C	●
P07.55	Input terminal state of the last but one fault		0	●
P07.56	Output terminal state of the last but one fault		0	●

7.2.9 P08 Enhanced functions

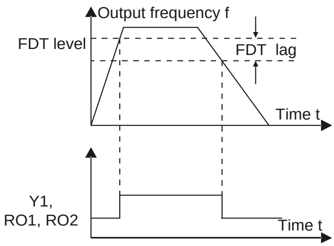
Function code	Name	Description	Default value	Modify
P08.00	Acceleration time 2	See P00.11 and P00.12 for detailed definitions. Goodrive350-19 series VFD defines four groups of acceleration/deceleration time, which can be selected by multi-function digital input terminal (P05 group). The acceleration/deceleration time of the VFD is the first group by default. Setting range: 0.0–3600.0s	Model depended	○
P08.01	Deceleration time 2		Model depended	○
P08.02	Acceleration time 3		Model depended	○
P08.03	Deceleration time 3		Model depended	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P08.04</td><td>Acceleration time 4</td><td rowspan="2"></td><td>Model depended</td><td>○</td></tr>
<tr><td>P08.05</td><td>Deceleration time 4</td><td>Model depended</td><td>○</td></tr>
<tr><td>P08.06</td><td>Running frequency of jogging</td><td>This function code is used to define the reference frequency of the VFD during jogging.
Setting range: 0.00Hz–P00.03 (Max. output frequency)</td><td>5.00Hz</td><td>○</td></tr>
<tr><td>P08.07</td><td>Acceleration time of jogging</td><td rowspan="2">Jogging acceleration time is the time needed for the VFD to accelerate from 0Hz to Max. output frequency (P00.03).
Jogging deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz.
Setting range: 0.0–3600.0s</td><td rowspan="2">Model depended</td><td>○</td></tr>
<tr><td>P08.08</td><td>Deceleration time of jogging</td><td>○</td></tr>
<tr><td>P08.09</td><td>Jump frequency 1</td><td rowspan="6">When the set frequency is within the range of jump frequency, the VFD will run at the boundary of jump frequency.
The VFD can avoid mechanical resonance point by setting the jump frequency, and three jump frequency points can be set. If the jump frequency points are set to 0, this function will be invalid.


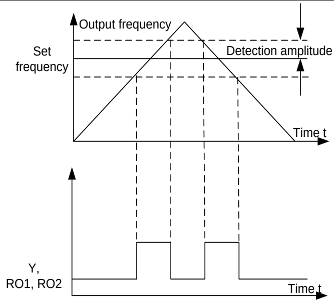
Setting range: 0.00Hz–P00.03 (Max. output frequency)</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.10</td><td>Jump frequency amplitude 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.11</td><td>Jump frequency 2</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.12</td><td>Jump frequency amplitude 2</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.13</td><td>Jump frequency 3</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.14</td><td>Jump frequency amplitude 3</td><td>0.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P08.15	Amplitude of wobbling frequency	0.0–100.0% (relative to set frequency)	0.0%	○
P08.16	Amplitude of jump frequency	0.0–50.0% (relative to amplitude of wobbling frequency)	0.0%	○
P08.17	Rise time of wobbling frequency	0.1–3600.0s	5.0s	○
P08.18	Descend time of wobbling frequency	0.1–3600.0s	5.0s	○
P08.19	Switching frequency of acceleration/deceleration time	0.00–P00.03 (Max. output frequency) 0.00Hz: no switch-over Switch to acceleration/deceleration time 2 if the running frequency is larger than P08.19	0.00Hz	○
P08.20	Frequency threshold of the start of droop control	0.00–50.00Hz	2.00Hz	○
P08.21	Reference frequency of acceleration/deceleration time	0: Max. output frequency 1: Set frequency 2: 100Hz **Note:** Valid for straight acceleration/deceleration only	0	◎
P08.22	Output torque calculation mode	0: Calculated based on torque current	0	○
P08.23	Number of decimal points of frequency	0: Two decimal points 1: One decimal point	0	○

Function code	Name	Description	Default value	Modify
P08.24	Number of decimal points of linear speed	0: No decimal point 1: One 2: Two 3: Three	0	○
P08.25	Set count value	P08.26–65535	0	○
P08.26	Designated count value	0–P08.25	0	○
P08.27	Set running time	0–65535min	0min	○
P08.28	Automatic fault reset times	Automatic fault reset times: When the VFD selects automatic fault reset, it is used to set the times of automatic reset, if the continuous reset times exceeds the value set by P08.29, the VFD will report fault and stop to wait for repair. Interval of automatic fault reset: select the interval time from when fault occurred to automatic fault reset actions. After VFD starts, if no fault occurred during 60s, the fault reset times will be zeroed out. Setting range of P08.28: 0–10 Setting range of P08.29: 0.1–3600.0s	0	○
P08.29	Automatic fault reset time interval		1.0s	○
P08.30	Reduction ratio of droop control	This function code sets the variation rate of the VFD output frequency based on the load; it is mainly used in balancing the power when multiple motors drive the same load. Setting range: 0.00–50.00Hz	0.00Hz	○
P08.31	Switch-over between motor 1 and motor 2	0x00–0x14 Ones: Switch-over channel 0: Switch over by terminal 1: Switch over by MODBUS communication 2: Switch over by	0x00	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>PROFIBUS/CANopen/DeviceNet
3: Switch over by Ethernet communication
4: Switch over by EtherCat/Profinet communication
Tens: Motor switch over during running
0: Disable switch over during running
1: Enable switch over during running</td><td></td><td></td></tr>
<tr><td>P08.32</td><td>FDT1 level detection value</td><td rowspan="4">When the output frequency exceeds the corresponding frequency of FDT level, multi-function digital output terminal outputs "frequency level detection FDT" signal, this signal will be valid until the output frequency lowers to below the corresponding frequency (FDT level-FDT lag detection value), the waveform is shown in the figure below.


Setting range of P08.32: 0.00Hz–P00.03 (Max. output frequency)
Setting range of P08.33: 0.0–100.0% (FDT1 level)
Setting range of P08.34: 0.00Hz–P00.03 (Max. output frequency)
Setting range of P08.35: 0.0–100.0% (FDT2 level)</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P08.33</td><td>FDT1 lag detection value</td><td>5.0%</td><td>○</td></tr>
<tr><td>P08.34</td><td>FDT2 level detection value</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P08.35</td><td>FDT2 lag detection value</td><td>5.0%</td><td>○</td></tr>
<tr><td>P08.36</td><td>Detection value for frequency arrival</td><td>When the output frequency is within the positive /negative detection range of the set frequency, the multi-function digital output terminal outputs "frequency arrival" signal as shown below.</td><td>0.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		 Setting range: 0.00Hz–P00.03 (Max. output frequency)		
P08.37	Enable energy-consumption brake	0x00–0x11 Ones place: 0: Disable energy-consumption 1: Enable energy-consumption Tens place: 0: Disable braking short circuit protection 1: Enable braking short circuit protection There is no braking short circuit protection for the 22kW and lower VFD models by default.	0x01	○
P08.38	Energy-consumption brake threshold voltage	Set the starting bus voltage of energy-consumption brake, adjust this value properly can brake the load effectively. The default value will change with the change of voltage class. Setting range: 200.0–2000.0V	220V voltage: 380.0V; 380V voltage: 700.0V; 660V voltage: 1120.0V	○
P08.39	Running mode of cooling fan	0: Common running mode 1: The fan keeps running after power up	0	○

Function code	Name	Description	Default value	Modify
		2: Running mode 2		
P08.40	PWM selection	0x0000–0x1121 Ones: PWM mode 0: PWM mode 1, 3PH and 2PH modulation 1: PWM mode 2, 3PH modulation Tens: PWM low-speed carrier wave limit 0: Limit low-speed carrier wave, limit mode 1 1: Limit low-speed carrier wave, limit mode 2 2: No limit on low-speed carrier Hundreds: Reserved Thousands: PWM loading mode 0: Interrupt loading 1: Normal loading	0x1101	◎
P08.41	Overmodulation selection	0x00–0x11 Ones 0: Overmodulation is invalid 1: Overmodulation is valid Tens 0: Mild overmodulation 1: Deepened overmodulation Hundreds: carrier frequency limit selection 0: Limit 1: Not limit Thousands: Output voltage compensation selection 0: Not compensate 1: Compensate	01	◎
P08.42	Reserved	000–1223	0x0003	○

Function code	Name	Description	Default value	Modify
P08.43	Reserved	0.01–10.00	0.10s	○
P08.44	UP/DOWN terminal control setup	0x000–0x221 Ones: Frequency control selection 0: UP/DOWN terminal setup is valid 1: UP/DOWN terminal setup is invalid Tens: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: All frequency modes are valid 2: Invalid for multi-step speed when multi-step speed takes priority Hundreds: Action selection during stop 0: Valid 1: Valid during running, clear after stop 2: Valid during running, clear after receiving stop command	0x000	○
P08.45	UP terminal frequency incremental integral rate	0.01–50.00Hz/s	0.50Hz/s	○
P08.46	DOWN terminal frequency decrement change rate	0.01–50.00Hz/s	0.50Hz/s	○
P08.47	Action selection for frequency setup during power down	0x000–0x111 Ones: Action selection for frequency setup (by keypad digits) during power down 0: Save during power down 1: Zero out during power down Tens: Action selection for frequency setup (by MODBUS) during power down	0x000	○

Function code	Name	Description	Default value	Modify
		0: Save during power down 1: Zero out during power down Hundreds: Action selection for frequency setup (by DP communication) during power down 0: Save during power down 1: Zero out during power down		
P08.48	High bit of initial value of power consumption	Set the initial value of power consumption. Initial value of power consumption=P08.48×1000+ P08.49 Setting range of P08.48: 0–59999 kWh (k) Setting range of P08.49: 0.0–999.9 kWh	0°	○
P08.49	Low bit of initial value of power consumption		0.0°	○
P08.50	Flux braking	This function code is used to enable flux braking function. 0: Invalid 100–150: The larger the coefficient, the stronger the brake intensity The VFD enables motor to decelerate quickly by increasing the motor flux which converts energy generated during braking into thermal energy. The VFD monitors motor state continuously even during flux braking, thus flux braking can be applied in motor stop or used to change motor speed. The flux braking also carries the following advantages. 1) Brake immediately after sending stop command, removing the need to wait for flux to attenuate. 2) Better cooling effect. During flux braking, the stator current of the motor increases, while the rotor current does not change, while the cooling effect of stator is much more effective than that of	0	○

Function code	Name	Description	Default value	Modify
		the rotor.		
P08.51	Current regulation coefficient on input side	This function code is used to adjust the current display value on the AC input side. 0.00–1.00	0.56	○
P08.52	STO lock	0: STO alarm lock Alarm-lock means STO alarm must be reset after state restoration when STO occurs. 1: STO alarm unlock Alarm-unlock means when STO occurs, after state restoration, STO alarm will disappear automatically.	0	○
P08.53	Bias value of upper limit frequency of torque control	0.00 Hz–P00.03 (Max. output frequency) **Note:** This parameter is valid only for the torque control mode.	0.00Hz	○
P08.54	Acceleration/deceleration selection of upper limit frequency of torque control	0: No limit on acceleration or deceleration 1: Acceleration/deceleration time 1 2: Acceleration/deceleration time 2 3: Acceleration/deceleration time 3 4: Acceleration/deceleration time 4	0	○

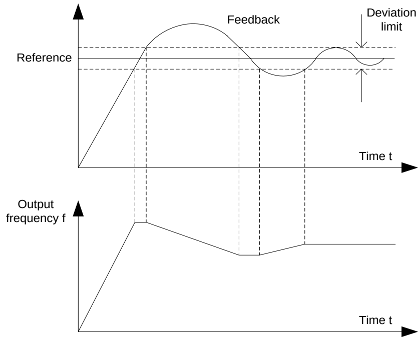
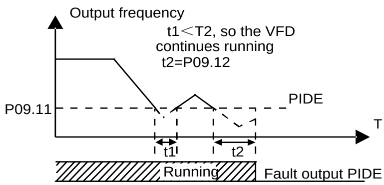
7.2.10 P09 PID control

Function code	Name	Description	Default value	Modify
P09.00	PID reference source	When frequency command (P00.06, P00. 07) is set to 7, or channel of voltage setup (P04.27) is set to 6, the VFD running mode is process PID control. This parameter determines the target reference channel of process PID. 0: Keypad (P09.01)	0	○

Function code	Name	Description	Default value	Modify
		1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step 6: MODBUS communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCat/Profinet communication 11: Programmable extension card 12: Reserved The set target value of process PID is relative value, the set 100% corresponds to 100% of the feedback signal of controlled system. The system operates based on the relative value (0–100.0%)		
P09.01	Pre-set PID reference of keypad	You need to set this parameter when P09.00 is set to 0, the reference value of this parameter is the feedback variable of the system. Setting range: -100.0%–100.0%	0.0%	○
P09.02	PID feedback source	This parameter is used to select PID feedback channel. 0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: MODBUS communication 5: PROFIBUS/CANopen/DeviceNet	0	○

Function code	Name	Description	Default value	Modify
		communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCat/Profinet communication 9: Programmable extension card 10: Reserved **Note:** The reference channel and feedback channel cannot overlap; otherwise, PID cannot be controlled effectively.		
P09.03	PID output characteristics	0: PID output is positive characteristic: namely, the feedback signal is larger than the PID reference, which requires the VFD output frequency to decrease for PID to reach balance, for example, tension PID control of winding 1: PID output is negative characteristics: namely the feedback signal is less than PID reference, which requires VFD output frequency to increase for PID to reach balance, for example, tension PID control of unwinding.	0	○
P09.04	Proportional gain (Kp)	This function code is suitable for proportional gain P of PID input. It determines the regulation intensity of the whole PID regulator, the larger the value of P, the stronger the regulation intensity. If this parameter is 100, it means when the deviation between PID feedback and reference is 100%, the regulation amplitude of PID regulator (ignoring integral and differential effect) on output frequency command is the max. frequency (ignoring integral and differential actions). Setting range: 0.00–100.00	1.80	○
P09.05	Integral time (Ti)	It determines the speed of integral regulation made on the deviation between PID feedback and	0.90s	○

Function code	Name	Description	Default value	Modify
		reference by PID regulator. When the deviation between PID feedback and reference is 100%, the regulation of integral regulator (ignoring integral and differential actions), after undergoing continuous regulation during this time period, can reach Max. output frequency (P00.03) The shorter the integral time, the stronger the regulation intensity. Setting range: 0.00–10.00s		
P09.06	Derivative time (Td)	It determines the intensity of the regulation made on the change rate of deviation between PID feedback and reference by PID regulator. If feedback changes by 100% during this period, the regulation of differential regulator (ignoring integral and differential actions) is Max. output frequency (P00.03) The longer the derivative time, the stronger the regulation intensity. Setting range: 0.00–10.00s	0.00s	○
P09.07	Sampling cycle (T)	It means the sampling cycle of feedback. The regulator operates once during each sampling cycle. The larger the sampling cycle, the slower the response. Setting range: 0.001–10.000s	0.001s	○
P09.08	Limit of PID control deviation	It is the max. allowable deviation of PID system output value relative to closed-loop reference value. Within this limit, PID regulator stops regulation. Set this function code properly to regulate the precision and stability of PID system. Setting range: 0.0–100.0%	0.0%	○

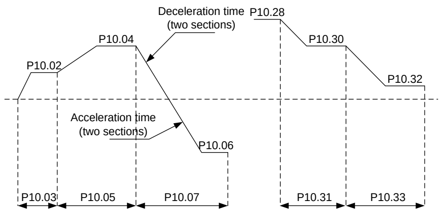
Function code	Name	Description	Default value	Modify
				
P09.09	Upper limit value of PID output	These two function codes are used to set the upper/lower limit value of PID regulator. 100.0% corresponds to Max. output frequency (P00.03) or max. voltage (P04.31) Setting range of P09.09: P09.10–100.0% Setting range of P09.10: -100.0%–P09.09	100.0%	○
P09.10	Lower limit value of PID output		0.0%	○
P09.11	Feedback offline detection value	Set PID feedback offline detection value, when the detection value is no more than the feedback offline detection value, and the duration exceeds the value set in P09.12, the VFD will report "PID feedback offline fault", and keypad displays PIDE.  Setting range of P09.11: 0.0–100.0% Setting range of P09.12: 0.0–3600.0s	0.0%	○
P09.12	Feedback offline detection time		1.0s	○
P09.13	PID control selection	0x0000–0x1111 Ones: 0: Continue integral control after the frequency	0x0001	○

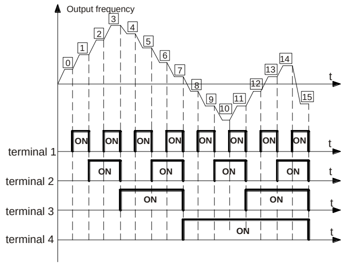
Function code	Name	Description	Default value	Modify
		reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens: 0: The Same as the main reference direction 1: Contrary to the main reference direction Hundreds: 0: Limit based on the max. frequency 1: Limit based on A frequency Thousands: 0: A+B frequency, acceleration /deceleration 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 and deceleration are determined by P08.04 (acceleration time 4).		
P09.14	Low-frequency proportional gain (Kp)	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	Acceleration/ deceleration time of PID command	0.0–1000.0s	0.0s	○
P09.16	Filter time of PID output	0.000–10.000s	0.000s	○
P09.18	Low frequency integral time	0.00–10.00s	0.90s	○

Function code	Name	Description	Default value	Modify
P09.19	Low frequency differential time	0.00–10.00s	0.00s	○
P09.20	Low frequency point of switching PID parameters	0–P09.21	5.00Hz	○
P09.21	High frequency point of switching PID parameters	P09.20–P00.03	10.00Hz	○

7.2.11 P10 Simple PLC and multi-step speed control

Function code	Name	Description	Default value	Modify
P10.00	Simple PLC mode	0: Stop after running once; the VFD stops automatically after running for one cycle, and it can be started only after receiving running command. 1: Keep running in the final value after running once; 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 stop command and stops.	0	○
P10.01	Simple PLC memory selection	0: No memory after power down 1: Memory after power down; PLC memories its running stage and running frequency before power down.	0	○
P10.02	Multi-step speed 0	Setting range of the frequency in 0th –15th sections are -100.0–100.0%, 100% corresponds to Max. output frequency P00.03. Setting range of the running time in 0th –15th sections are 0.0–6553.5s (min), the time unit is	0.0%	○
P10.03	Running time of 0th step		0.0s(min)	○
P10.04	Multi-step speed 1		0.0%	○

Function code	Name	Description	Default value	Modify
P10.05	Running time of 1st step	determined by P10.37. When simple PLC operation is selected, it is required to set P10.02–P10.33 to determine the running frequency and running time of each section. **Note:** The symbol of multi-step speed determines the running direction of simple PLC, and the negative value means reverse running.  When selecting multi-step speed running, the multi-step speed is within the range of -fmax–fmax, and it can be set continuously. The start/stop of multi-step stop is also determined by P00.01. Goodrive350-19 series VFD can set 16-step speed, which are set by combined codes of multi-step terminals 1–4 (set by S terminal, correspond to function code P05.01–P05.06) and correspond to multi-step speed 0 to multi-step speed 15.	0.0s(min)	○
P10.06	Multi-step speed 2		0.0%	○
P10.07	Running time of 2nd step		0.0s(min)	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Running time of 3rd step		0.0s(min)	○
P10.10	Multi-step speed 4		0.0%	○
P10.11	Running time of 4th step		0.0s(min)	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Running time of 5th step		0.0s(min)	○
P10.14	Multi-step speed 6		0.0%	○
P10.15	Running time of 6th step		0.0s(min)	○
P10.16	Multi-step speed 7		0.0%	○
P10.17	Running time of 7th step		0.0s(min)	○
P10.18	Multi-step speed 8		0.0%	○
P10.19	Running time of 8th step		0.0s(min)	○
P10.20	Multi-step speed 9		0.0%	○
P10.21	Running time of 9th step		0.0s(min)	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P10.22</td><td>Multi-step speed 10</td><td rowspan="12">


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.

The relation between terminal 1, terminal 2, terminal 3 and terminal 4 are shown in the table below.

<table>
<tr><td>Trml 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>Trml 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>Trml 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Trml 4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Trml 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>Trml 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>Trml 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Trml 4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
</table>
</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.23</td><td>Running time of 10th step</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.24</td><td>Multi-step speed 11</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.25</td><td>Running time of 11th step</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.26</td><td>Multi-step speed 12</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.27</td><td>Running time of 12th step</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.28</td><td>Multi-step speed 13</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.29</td><td>Running time of 13th step</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.30</td><td>Multi-step speed 14</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.31</td><td>Running time of 14th step</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.32</td><td>Multi-step speed 15</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.33</td><td>Running time of 15th step</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.34</td><td>Acceleration/deceleration time of 0th –7th step of simple PLC</td><td>Detailed illustration is shown in the table below.
<table>
<tr><th>Function code</th><th>Binary</th><th>Step</th><th>ACC/DEC time 1</th><th>ACC/DEC time 2</th><th>ACC/DEC time 3</th><th>ACC/DEC time 4</th></tr>
</table>
</td><td>0x0000</td><td>○</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P10.35</td><td>Acceleration/deceleration time of 8th – 15th step of simple PLC</td><td>
<table>
<tr><td rowspan="8">P10.34</td><td>BIT1</td><td>BIT0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td rowspan="8">P10.35</td><td>BIT1</td><td>BIT0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into hexadecimal number, finally, set corresponding function code.

Acceleration/deceleration time 1 is set by P00.11 and P00.12; Acceleration/deceleration time 2 is set by P08.00 and P08.01; Acceleration/deceleration time 3 is set by P08.02 and P08.03; Acceleration /deceleration time 4 is set by P08.04 and P08.05.

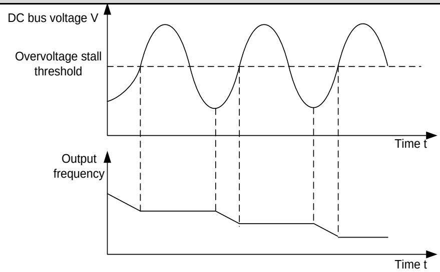
Setting range: 0x0000–0xFFFF</td><td>0x0000</td><td>○</td></tr>
<tr><td>P10.36</td><td>PLC restart mode</td><td>0: Restart from the first step, namely if the VFD stops during running (caused by stop command, fault or power down), it will run from the first step after restart.

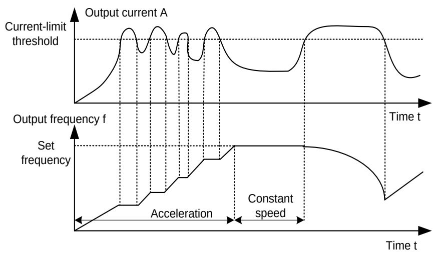
1: Continue running from the step frequency when interruption occurred, namely if the VFD stops during running (caused by stop command or fault), it will record the running time of current step, and enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.</td><td>0</td><td>◎</td></tr>
<tr><td>P10.37</td><td>Multi-step time</td><td>0: s; the running time of each step is counted in</td><td>0</td><td>◎</td></tr>
</table>

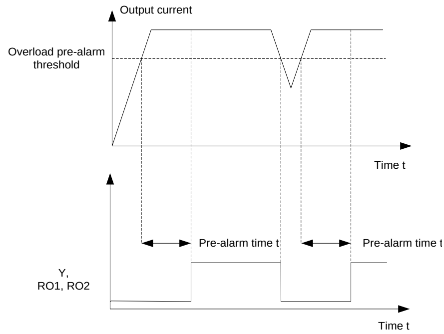
Function code	Name	Description	Default value	Modify
	unit	seconds; 1: min; the running time of each step is counted in minutes;		

7.2.12 P11 Protection parameters

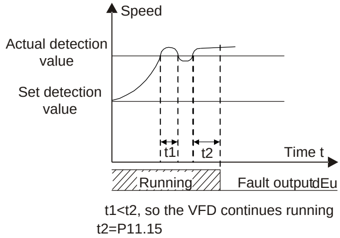
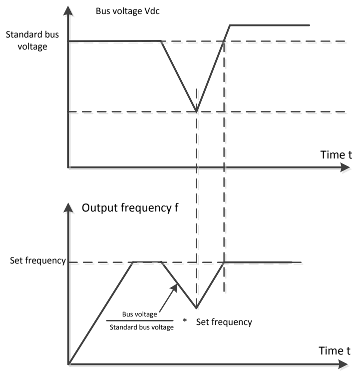
Function code	Name	Description	Default value	Modify
P11.00	Phase-loss protection	0x000–0x1111 Ones place: Reserved Tens place: 0: Disable output phase loss protection 1: Enable output phase loss protection Hundreds place: 0: Disable hardware input phase loss protection 1: Enable hardware input phase loss protection Thousands place: 0: During stop, if a hardware input phase loss fault occurs, it reports SPI. 1: During stop, if a hardware input phase loss fault occurs, it reports A-SPI.	Model depended	○
P11.01	Frequency-drop at transient power down	0: Disable 1: Enable	0	○
P11.02	Energy braking selection for stop	0: Enable 1: Disable	0	◎
P11.03	Overvoltage stall protection	0: Disable 1: Enable	0	○

Function code	Name	Description	Default value	Modify
		 **Note:** It can be modified only after P11.26 is 1 indicating special functions are enabled.		
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, if no measures are taken, the VFD may trip due to overcurrent during acceleration. 0x00–0x21 Ones: Hardware and software current-limit action selection 0: Invalid 1: Always valid Tens: Hardware current-limit overload alarm selection 0: OL2 is valid 1: OL2 is invalid 2: Reserved **Note:** It can be modified only after P11.26 is 1 indicating special functions are enabled.	10	◎
P11.06	Automatic current-limit level	Current-limit protection function detects output current during running, and compares it with the	250.0%	◎

Function code	Name	Description	Default value	Modify
P11.07	Frequency-drop rate during current limit	current-limit level defined by P11.06, if it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or run in decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching lower limit frequency. When the output current is detected to be lower than the current-limit level again, it will continue accelerated running.  Setting range of P11.06: 50.0–250.0% Setting range of P11.07: 0.00–50.00Hz/s	10.00 Hz/s	◎
P11.08	VFD or motor overload/underload pre-alarm	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.	0x0000	○
P11.09	Overload pre-alarm detection level		150%	○
P11.10	Overload pre-alarm detection time		1.00s	○

Function code	Name	Description	Default value	Modify
		 Setting range of P11.08: Enable and define overload pre-alarm function of the VFD and motor Setting range: 0x000–0x131 Ones: 0: Motor overload/underload pre-alarm, relative to rated motor current; 1: VFD overload/underload pre-alarm, relative to rated VFD current. Tens: 0: The VFD continues running after overload/underload alarm; 1: The VFD continues running after underload alarm, and stops running after overload fault; 2: The VFD continues running after overload alarm, and stops running after underload fault; 3: The VFD stops running after overload/underload fault. Hundreds: 0: Always detect 1: Detect during constant-speed running Setting range of P11.09: P11.11–200%		

Function code	Name	Description	Default value	Modify
		Setting range of P11.10: 0.01–3600.00s		
P11.11	Underload pre-alarm detection level	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 of P11.11: 0– P11.09 Setting range of P11.12: 0.01–360.00s	25%	○
P11.12	Underload pre-alarm detection time		0.05s	○
P11.13	Fault output terminal action during fault	This function code is used to set the action of fault output terminals during undervoltage and fault reset. 0x00–0x11 Ones: 0: Act during undervoltage fault 1: Do not act during undervoltage fault Tens: 0: Act during fault reset 1: Do not act during fault reset	0x00	○
P11.14	Speed deviation detection value	0.0–50.0% This parameter is used to set the speed deviation detection value.	10.0%	○
P11.15	Speed deviation detection time	This parameter is used to set the speed deviation detection time. If P11.14 is set to a non-zero value, and the speed deviation is greater than the value of P11.14, which lasts the time specified by P11.15, the speed deviation fault dEu is reported. **Note:** Speed deviation protection will be invalid if P11.15 is set to 0.0.	2.0s	○

Function code	Name	Description	Default value	Modify
		 Setting range: 0.0–10.0s		
P11.16	Automatic frequency-reduction during voltage drop	0–1 0: Invalid 1: Valid 	0	○
P11.17	Proportional coefficient of voltage regulator during undervoltage stall	This parameter is used to set the proportional coefficient of the bus voltage regulator during undervoltage stall. Setting range: 0–1000	100	○
P11.18	Integral coefficient of voltage regulator during undervoltage stall	This parameter is used to set the integral coefficient of the bus voltage regulator during undervoltage stall. Setting range: 0–1000	40	○

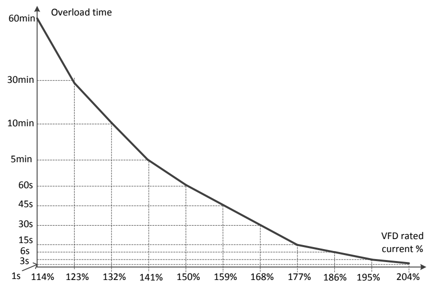
Function code	Name	Description	Default value	Modify
P11.19	Proportional coefficient of current regulator during undervoltage stall	This parameter is used to set the proportional coefficient of the active current regulator during undervoltage stall. Setting range: 0–1000	25	○
P11.20	Integral coefficient of current regulator during undervoltage stall	This parameter is used to set 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	This parameter is used to set the proportional coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000	60	○
P11.22	Integral coefficient of voltage regulator during overvoltage stall	This parameter is used to set the integral coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000	10	○
P11.23	Proportional coefficient of current regulator during overvoltage stall	This parameter is used to set 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	This parameter is used to set the integral coefficient of the active current regulator during overvoltage stall. Setting range: 0–2000	250	○
P11.25	Enable VFD overload integral	0: Disabled 1: Enabled When this parameter is set to 0, the overload timing value is reset to zero after the VFD is stopped. In this case, the determination of VFD	0	

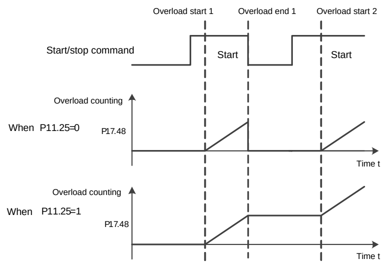
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

overload takes more time, and therefore the effective protection over the VFD is weakened.

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

The VFD overload curve is similar to the following:





</td><td></td><td></td></tr>
<tr><td>P11.26</td><td>Enable special functions</td><td>0–1
0: Disable special functions
1: Enable special functions
Special functions include P11.03 Overvoltage stall protection, P11.05 Current-limit selection, P01.00 Running mode of start, and P00.13 Running direction.
When the value is set to 0, special function codes are restored to the factory settings and are not</td><td>0</td><td>◎</td></tr>
</table>

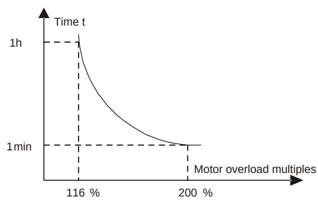
Function code	Name	Description	Default value	Modify
		displayed, and therefore cannot be modified. When the value is set to 1, special function codes can be modified and used normally. **Note:** Use this function only in special cases.		
P11.27	Vibration control method for VF control	0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: Reserved	0x00	◎

7.2.13 P12 Parameters of motor 2

Function code	Name	Description	Default value	Modify
P12.00	Type of motor 2	0: Asynchronous motor 1: Synchronous motor	0	◎
P12.01	Rated power of asynchronous motor 2	0.1–3000.0kW	Model depended	◎
P12.02	Rated frequency of asynchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	Rated speed of asynchronous motor 2	1–36000rpm	Model depended	◎
P12.04	Rated voltage of asynchronous motor 2	0–1200V	Model depended	◎
P12.05	Rated current of asynchronous motor 2	0.8–6000.0A	Model depended	◎
P12.06	Stator resistance	0.001–65.535Ω	Model	○

Function code	Name	Description	Default value	Modify
	of asynchronous motor 2		depended	
P12.07	Rotor resistance of asynchronous motor 2	0.001–65.535Ω	Model depended	○
P12.08	Leakage inductance of asynchronous motor 2	0.1–6553.5mH	Model depended	○
P12.09	Mutual inductance of asynchronous motor 2	0.1–6553.5mH	Model depended	○
P12.10	No-load current of asynchronous motor 2	0.1–6553.5A	Model depended	○
P12.11	Magnetic saturation coefficient 1 of iron core of asynchronous motor 2	0.0–100.0%	80%	○
P12.12	Magnetic saturation coefficient 2 of iron core of asynchronous motor 2	0.0–100.0%	68%	○
P12.13	Magnetic saturation coefficient 3 of iron core of asynchronous	0.0–100.0%	57%	○

Function code	Name	Description	Default value	Modify
	motor 2			
P12.14	Magnetic saturation coefficient 4 of iron core of asynchronous motor 2	0.0–100.0%	40%	○
P12.15	Rated power of synchronous motor 2	0.1–3000.0kW	Model depended	◎
P12.16	Rated frequency of synchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.17	Number of pole pairs of synchronous motor 2	1–128	2	◎
P12.18	Rated voltage of synchronous motor 2	0–1200V	Model depended	◎
P12.19	Rated voltage of synchronous motor 2	0.8–6000.0A	Model depended	◎
P12.20	Stator resistance of synchronous motor 2	0.001–65.535Ω	Model depended	○
P12.21	Direct-axis inductance of synchronous motor 2	0.01–655.35mH	Model depended	○
P12.22	Quadrature-axis inductance of	0.01–655.35mH	Model	○

Function code	Name	Description	Default value	Modify
	synchronous motor 2		depended	
P12.23	Counter-emf constant of synchronous motor 2	0–10000V	300	○
P12.24	Reserved	0–0xFFFF	0x0000	●
P12.25	Reserved	0%–50% (of the rated current of the motor)	10%	●
P12.26	Overload protection of motor 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	Motor overload multiples M = Iout/(In×K) In is rated motor current, Iout is VFD output current, K is motor overload protection coefficient. The smaller the K, the larger the value of M, the easier the protection. if M is 116%, protection will be applied when motor overloads for 1h; if M is 200%, protection will be applied when motor overloads for 60s; if M is no less than 400%, protection will be applied immediately.  Setting range: 20.0%–120.0%	100.0%	○
P12.28	Power display calibration	0.00–3.00	1.00	○

Function code	Name	Description	Default value	Modify
	coefficient of motor 2			
P12.29	Parameter display of motor 2	0: Display based on the motor type; under this mode, only parameters related to current motor type will be displayed. 1: Display all; under this mode, all the parameters will be displayed.	0	○
P12.30	System inertia of motor 2	0–30.000kgm^2	0.000	○

7.2.14 P13 Control parameters of synchronous motor

Function code	Name	Description	Default value	Modify
P13.00	Reduction rate of the injection current of synchronous motor	This parameter is used to set 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 reduced to improve the power factor of the motor. Setting range: 0.0%–100.0% (of the rated current of the motor)	80.0%	○
P13.01	Initial pole detection mode	0: No detection 1: High-frequency current injection 2: Pulse superposition	0	◎
P13.02	Pull-in current 1	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 frequency threshold. If you need to increase the starting torque, increase the value of this function code properly. Setting range: 0.0%–100.0% (rated motor current)	20.0%	○

Function code	Name	Description	Default value	Modify
P13.03	Pull-in current 2	Pull-in current is the pole position orientation current; pull-in current 2 is valid within the upper limit of pull-in current switch-over frequency threshold, and you do not need to change pull-in current 2 under common situations. Setting range: 0.0%–100.0% (rated motor current)	10.0%	○
P13.04	Switch-over frequency of input current	0.00Hz–P00.03 (Max. output frequency)	10.00Hz	○
P13.05	High-frequency superposition frequency (reserved)	200Hz–1000Hz	500Hz	◎
P13.06	Pulse current setting	This parameter is used to set 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: 0.0–300.0% (of the rated voltage of the motor)	100.0%	◎
P13.07	Reserved variables	0.0–400.0	0.0	○
P13.08	Control parameter 1	0–0xFFFF	0	○
P13.09	Control parameter 2	This parameter is 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 this parameter, the phase-locked loop is disabled; and when the running frequency is higher than that, the phase-locked loop is enabled. Setting range: 0–655.35	2.00	○

Function code	Name	Description	Default value	Modify
P13.10	Reserved variables	0.0–359.9	0.0	○
P13.11	Maladjustment detection time	This parameter is 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	High-frequency compensation coefficient of synchronous motor	This parameter is valid when the motor speed exceeds the rated speed. If motor oscillation occurred, adjust this parameter properly. Setting range: 0.0–100.0%	0.0	○
P13.13	High-frequency injection current	0–300.0%	20.0%	◎

7.2.15 P14 Serial communication function

Function code	Name	Description	Default value	Modify
P14.00	Local communication address	Setting range: 1–247 When the master is writing frames, and the slave communication address is set to 0, it is the broadcast communication address, and all the slaves on the MODBUS bus will accept this frame, but the slave never responds. Local communication address is unique in the communication network, which is the basis for point-to-point communication between the upper computer and the VFD. **Note: The slave address cannot be set to 0.**	1	○
P14.01	Communication	This parameter is used to set the data	4	○

Function code	Name	Description	Default value	Modify
	baud rate setup	transmission speed between upper computer and the VFD. 0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS 6: 57600BPS 7: 115200BPS **Note:** Baud rate of the upper computer must be the Same as the VFD; otherwise, communication cannot be performed. The larger the baud rate, the faster the communication speed.		
P14.02	Data bit check setup	The data format of upper computer must be the Same as the VFD; otherwise, communication cannot be performed. 0: No parity check (N, 8, 1) for RTU 1: Even parity (E, 8, 1) for RTU 2: Odd parity (O, 8, 1) for RTU 3: No parity check (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	1	○
P14.03	Communication response delay	0–200ms It refers to the time interval from when the data is received by the VFD to the moment when the data is sent to the upper computer. If the response delay is less than the system processing time, the response delay will be subject to system processing time; if the response delay is longer than the system processing time, data will be sent	5	○

Function code	Name	Description	Default value	Modify
		to the upper computer at a delay after data process is done by system.		
P14.04	Communication timeout period	0.0 (invalid) –60.0s This parameter will be invalid if it is set to 0.0; When it is set to a non-zero value, if the time interval between current communication and the next communication exceeds the communication timeout period, the system will report "485 communication fault" (CE). Under common situations, it is set to 0.0. In systems which have continuous communication, you can monitor the communication condition by setting this parameter.	0.0s	○
P14.05	Transmission error processing	0: Alarm and coast to stop 1: Do not alarm and continue running 2: Do not alarm and stop as per the stop mode (under communication control mode only) 3: Do not alarm and stop as per the stop mode (under all control modes)	0	○
P14.06	Communication processing action	0x00–0x11 Ones: 0: Write operation has response 1: Write operation has no response Tens: 0: Communication password protection is invalid 1: Communication password protection is valid	0x00	○

7.2.16 P15 Functions of communication extension card 1

Function code	Name	Description	Default value	Modify
P15.00–P15.27	See GD350 communication extension card operation manual for details.			
P15.28	Master/slave CAN communication address	0–127	1	◎
P15.29	Master/slave CAN communication baud rate selection	0: 50Kbps 1: 100 Kbps 2: 125Kbps 3: 250Kbps 4: 500Kbps 5: 1M bps	2	◎
P15.30	Master/slave CAN communication timeout period	0.0 (invalid)–300.0s	0.0s	○
P15.31–P15.69	See GD350 communication extension card operation manual for details.			

7.2.17 P16 Functions of communication extension card 2

Function code	Name	Description	Default value	Modify
P16.00–P16.23	See GD350 communication extension card operation manual for details.			
P16.24	Identification time for the extension card in card slot 1	0.0–600.0s If it is set to 0.0, identification fault will not be detected	0.0s	0.0
P16.25	Identification time for the extension	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	0.0

Function code	Name	Description	Default value	Modify
	card in card slot 2			
P16.26	Identification time for the extension card in card slot 3	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	/
P16.27	Communication timeout period of extension card in card slot 1	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	/
P16.28	Communication timeout period of extension card in card slot 2	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	/
P16.29	Communication timeout period of extension card in card slot 3	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	/
P16.30–P16.69	See GD350 communication extension card operation manual for details.			

P17 State-check functions

Function code	Name	Description	Default value	Modify
P17.00	Set frequency	Displays current set frequency of the VFD. Range: 0.00Hz–P00.03	50.00Hz	●
P17.01	Output frequency	Displays current output frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramps reference frequency	Displays current ramps reference frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●

Function code	Name	Description	Default value	Modify
P17.03	Output voltage	Displays current output voltage of the VFD. Range: 0–1200V	0V	●
P17.04	Output current	Displays the valid value of current output current of the VFD. Range: 0.0–5000.0A	0.0A	●
P17.05	Motor speed	Displays current motor speed. Range: 0–65535RPM	0 RPM	●
P17.06	Torque current	Displays current torque current of the VFD. Range: -3000.0–3000.0A	0.0A	●
P17.07	Exciting current	Displays current exciting current of the VFD. Range: -3000.0–3000.0A	0.0A	●
P17.08	Motor power	Displays current motor power; 100% relative to rated motor power, positive value is motoring state, negative value is generating state. Range: -300.0–300.0% (relative to rated motor power)	0.0%	●
P17.09	Motor output torque	Displays current output torque of the VFD; 100% relative to rated motor torque, during forward running, positive value is motoring state, negative value is generating state, during reverse running, positive value is generating state, negative value is motoring state. Range: -250.0–250.0%	0.0%	●
P17.10	Estimated motor frequency	The estimated motor rotor frequency under open-loop vector condition. Range: 0.00– P00.03	0.00Hz	●
P17.11	DC bus voltage	Displays current DC bus voltage of the VFD. Range: 0.0–2000.0V	0V	●

Function code	Name	Description	Default value	Modify
P17.12	Digital input terminal state	Displays current digital input terminal state of the VFD. 0x00–0x3F Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively	0	●
P17.13	Digital output terminal state	Displays current digital output terminal state of the VFD. 0x0–0xF Corresponds to RO2, RO1, HDO and Y1 respectively	0	●
P17.14	Digital adjustment variable	Displays the regulating variable by UP/DOWN terminals of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.15	Torque reference value	Relative to percentage of the rated torque of current motor, display torque reference. Range: -300.0%–300.0% (rated motor current)	0.0%	●
P17.16	Linear speed	0–65535	0	●
P17.17	Reserved variables	0–65535	0	●
P17.18	Count value	0–65535	0	●
P17.19	AI1 input voltage	Displays input signal of AI 1 Range: 0.00–10.00V	0.00V	●
P17.20	AI2 input voltage	Displays input signal of AI2 Range: -10.00V–10.00V	0.00V	●
P17.21	HDIA input frequency	Displays input frequency of HDIA Range: 0.000–50.000kHz	0.000 kHz	●

Function code	Name	Description	Default value	Modify
P17.22	HDIB input frequency	Displays input frequency of HDIB Range: 0.000–50.000kHz	0.000 kHz	●
P17.23	PID reference value	Displays PID reference value Range: -100.0–100.0%	0.0%	●
P17.24	PID feedback value	Displays PID feedback value Range: -100.0–100.0%	0.0%	●
P17.25	Motor power factor	Displays the power factor of current motor. Range: -1.00–1.00	1.00	●
P17.26	Current running time	Displays current running time of the VFD. Range: 0–65535min	0m	●
P17.27	Simple PLC and current step number of multi-step speed	Displays simple PLC and current step number of multi-step speed Range: 0–15	0	●
P17.28	Motor ASR controller output	Displays the speed loop ASR controller output value under vector control mode, relative to the percentage of rated torque of the motor. Range: -300.0%–300.0% (rated motor current)	0.0%	●
P17.29	Pole angle of open-loop synchronous motor	Displays initial identification angle of synchronous motor Range: 0.0–360.0	0.0	●
P17.30	Phase compensation of synchronous motor	Displays phase compensation of synchronous motor Range: -180.0–180.0	0.0	●
P17.31	High-frequency superposition current of	0.0%–200.0% (rated motor current)	0.0	●

Function code	Name	Description	Default value	Modify
	synchronous motor			
P17.32	Motor flux linkage	0.0%–200.0%	0.0%	●
P17.33	Exciting current reference	Display the exciting current reference value under vector control mode Range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Display torque current reference value under vector control mode Range: -3000.0–3000.0A	0.0A	●
P17.35	AC incoming current	Display the valid value of incoming current on AC side Range: 0.0–5000.0A	0.0A	●
P17.36	Output torque	Display output torque value, during forward running, positive value is motoring state, negative value is generating state; during reverse running, positive value is generating state, negative value is motoring state. Range: -3000.0Nm–3000.0Nm	0.0Nm	●
P17.37	Motor overload count value	0–65535	0	●
P17.38	Process PID output	-100.0%–100.0%	0.00%	●
P17.39	Parameter download wrong function code	0.00–99.00	0.00	●
P17.40	Motor control mode	Ones: Control mode 0: Vector 0 1: Vector 1 2: SVPWM control	0x2	●

Function code	Name	Description	Default value	Modify
		3: VC Tens: Control state 0: Speed control 1: Torque control 2: Position control Hundreds: Motor number 0: Motor 1 1: Motor 2		
P17.41	Upper limit of the torque when motoring	0.0%–300.0% (rated motor current)	180.0%	●
P17.42	Upper limit of brake torque	0.0%–300.0% (rated motor current)	180.0%	●
P17.43	Upper limit frequency of forward running of torque control	0.00–P00.03	50.00Hz	●
P17.44	Upper limit frequency of reverse running of torque control	0.00–P00.03	50.00Hz	●
P17.45	Inertia compensation torque	-100.0%–100.0%	0.0%	●
P17.46	Friction compensation torque	-100.0%–100.0%	0.0%	●
P17.47	Motor pole pairs	0–65535	0	●
P17.48	VFD overload count value	0–65535	0	●

Function code	Name	Description	Default value	Modify
P17.49	Frequency set by A source	0.00–P00.03	0.00Hz	●
P17.50	Frequency set by B source	0.00–P00.03	0.00Hz	●
P17.51	PID proportional output	-100.0%–100.0%	0.00%	●
P17.52	PID integral output	-100.0%–100.0%	0.00%	●
P17.53	PID differential output	-100.0%–100.0%	0.00%	●
P17.54	Present proportional gain	0.00–100.00	0.00%	●
P17.55	Present integral time	0.00–10.00s	0.00%	●
P17.56	Present differential time	0.00–10.00s	0.00%	●

7.2.18 P18 Closed-loop control state check

Function code	Name	Description	Default value	Modify
P18.00	Actual frequency of encoder	The actual-measured encoder frequency; the value of forward running is positive; the value of reverse running is negative. Range: -999.9–3276.7Hz	0.0Hz	●
P18.01	Encoder position count value	Encoder count value, quadruple frequency, Range: 0–65535	0	●
P18.02	Encoder Z pulse count value	Corresponding count value of encoder Z pulse. Range: 0–65535	0	●
P18.03	High bit of position	High bit of position reference value, zero out after	0	●

Function code	Name	Description	Default value	Modify
	reference value	stop. Range: 0–30000		
P18.04	Low bit of position reference value	Low bit of position reference value, zero out after stop. Range: 0–65535	0	●
P18.05	High bit of position feedback value	High bit of position feedback value, zero out after stop. Range: 0–30000	0	●
P18.06	Low bit of position feedback value	Low bit of position feedback value, zero out after stop. Range: 0–65535	0	●
P18.07	Position deviation	Deviation between current reference position and actual running position. Range: -32768–32767	0	●
P18.08	Position of position reference point	Position of reference point of Z pulse when the spindle stops accurately. Range: 0–65535	0	●
P18.09	Current position setup of spindle	Current position setup when the spindle stops accurately. Range: 0–359.99	0.00	●
P18.10	Current position when spindle stops accurately	Current position when spindle stops accurately. Range: 0–65535	0	●
P18.11	Encoder Z pulse direction	Z pulse direction display. When the spindle stops accurately, there may be a couple of pulses' error between the position of forward and reverse orientation, which can be eliminated by adjusting Z pulse direction of P20.02 or exchanging phase AB of encoder.	0	●

Function code	Name	Description	Default value	Modify
		0: Forward 1: Reverse		
P18.12	Encoder Z pulse angle	Reserved. Range: 0.00–359.99	0.00	●
P18.13	Encoder Z pulse error times	Reserved. Range: 0–65535	0	●
P18.14	High bit of encoder pulse count value	0–65535	0	●
P18.15	Low bit of encoder pulse count value	0–65535	0	●
P18.16	Main control board speed measuring value	-3276.8–3276.7Hz	0.0Hz	●
P18.17	Pulse command frequency	Pulse command (A2, B2 terminal) is converted to the set frequency, and it is valid under pulse position mode and pulse speed mode. Range: 0–655.35Hz	0.00Hz	●
P18.18	Pulse command feedforward	Pulse command (A2, B2 terminal) is converted to the set frequency, and it is valid under pulse position mode and pulse speed mode. Range: 0–655.35Hz	0.00Hz	●
P18.19	Position regulator output	The output frequency of the position regulator during position control. Range: 0–65535	0	●
P18.20	Count value of resolver	Count value of resolver. Range: 0–65535	0	●
P18.21	Resolver angle	The pole position angle read according to the	0.00	●

Function code	Name	Description	Default value	Modify
		resolver-type encoder. Range: 0.00–359.99		
P18.22	Pole angle of closed-loop synchronous motor	Current pole position. Range: 0.00–359.99	0.00	●
P18.23	State control word 2	0–65535	0	●
P18.24	High bit of count value of pulse reference	0–65535	0	●
P18.25	Low bit of count value of pulse reference	0–65535	0	●
P18.26	PG card speed measuring value	-3276.8–3276.7Hz	0.0Hz	●
P18.27	Encoder UVW sector	0–7	0	●
P18.28	Encoder PPR (pulse-per-revolution) display	0–65535	0	●
P18.29	Angle compensation value of synchronous motor	-180.0–180.0	0.00	●
P18.30	Reserved variables	0–65535	0	●
P18.31	Pulse reference Z pulse value	0–65535	0	●

Function code	Name	Description	Default value	Modify
P18.32	Main control board measured speed with pulse reference	-3276.8–3276.7Hz	0.0Hz	●
P18.33	PG card measured speed with pulse reference	-3276.8–3276.7Hz	0.0Hz	●
P18.34	Present encoder filter width	0–63	0	●
P18.35	Reserved	0–65535	0	●

7.2.19 P19 Extension card state check

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P19.00</td><td>Type of extension card at slot 1</td><td rowspan="3">0–65535
0: No card
1: PLC programmable card
2: I/O card 1
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 signal</td><td>0</td><td>●</td></tr>
<tr><td>P19.01</td><td>Type of extension card at slot 2</td><td>0</td><td>●</td></tr>
<tr><td>P19.02</td><td>Type of extension card at slot 3</td><td>0</td><td>●</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		13: Sine/Cosine PG card with CD signal 14: Absolute encoder PG card 15: CAN master/slave communication card 16: MODBUS communication card 17: EtherCat communication card 18: BacNet communication card 19: DeviceNet communication card 20: I/O card 2 for hoisting		
P19.03	Software version of the extension card in card slot 1	0.00–655.35	0.00	●
P19.04	Software version of the extension card in card slot 2	0.00–655.35	0.00	●
P19.05	Software version of the extension card in card slot 3	0.00–655.35	0.00	●
P19.06	Input state of extension I/O card terminals	0–0xFFFF	0	●
P19.07	Output state of extension I/O card terminals	0–0xFFFF	0	●
P19.09	AI3 input voltage of extension I/O card	0.00–10.00V	0.00V	●
P19.10	Alarm display value	0–13 0: No alarm 1: Input phase loss alarm (A-SPI) 2: Upward position limit alarm (A-LU) 3: Downward position limit alarm (A-Ld)	0	●

Function code	Name	Description	Default value	Modify
		4: Low voltage protection alarm (A-LvP) 5: Overload protection alarm (A-OL) 6: Brake failure alarm (A-bS) 7: Brake feedback alarm (A-FA) 8: Loose rope protection alarm (A-SL) 9: PT100 overtemperature alarm (A-Ot1) 10: PT1000 overtemperature alarm (A-Ot2) 11: PT100 disconnection alarm (A-Pt1) 12: PT1000 disconnection alarm (A-Pt2) 13: PTC overtemperature alarm (A-Ptc)		
P19.11	Torque for load detection	0.0%–150.0% (of the motor rated torque)	0.0%	●
P19.12	Brake detection reminding interval	0.0–1000.0h	0.0	●
P19.13	Present step of graded multi-step speed	0–6	0	●
P19.14	Zero-point position status	0–2 0: VFD in running, with zero-point position input 1: VFD stopped, with zero-point position signal input, zero-point position delay reached (zero-point position valid) 2: In the condition of status 1, running command valid when running command given and zero-point position left (no zero-point position signal input)	0	●
P19.15	Measured height	0.00–655.35m (Hook lowering distance using the upward limit position as the reference point)	0.00	●
P19.16	MSB of measured height	0–65535	0	●
P19.17	LSB of measured height	0–65535	0	●

Function code	Name	Description	Default value	Modify
P19.18	PT100 present temperature	-50.0–150.0°C	0.0° C	●
P19.19	PT100 present digital	0–4096	0	●
P19.20	PT1000 present temperature	-50.0–150.0°C	0.0° C	●
P19.21	PT1000 present digital	0–4096	0	●
P19.22	Brake slip speed	0.00Hz–10.00Hz	0.00Hz	●
P19.23	Brake slip pulse value	0–65535	0	●
P19.24	Light load speed boost status	0–3 0: Normal 1: FWD light load speed boost 2: RVS light load speed boost 3: Constant-power speed boost	0	●
P19.25	Status of derating frequency with voltage	0–1 0: Normal 1: Derating frequency with voltage	0	●
P19.26	Torque value for stable rope loosening	0.0%–150.0% (of the motor rated torque)	0.0%	●
P19.27	Present load torque change ratio of stable lifting	0.0–100.0%/s	0.0%	●
P19.28	Stable lifting status	0–1 0: Normal 1: In stable state	0	●
P19.29	Current imbalance	0.0–6553.5	0.0	●

Function code	Name	Description	Default value	Modify
	multiple			

7.2.20 P20 Encoder of motor 1

Function code	Name	Description	Default value	Modify
P20.00	Encoder type display	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Endat absolute encoder	0	●
P20.01	Encoder pulse number	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–60000	1024	◎
P20.02	Encoder direction	Ones: AB direction 0: Forward 1: Reverse Tens: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P20.03	Detection time of encoder offline fault	The detection time of encoder offline fault (ENC1O). Setting range: 0.0–10.0s	1.0s	○
P20.04	Detection time of encoder reversal fault	Detection time of encoder reversal fault(ENC1D). Setting range: 0.0–100.0s	0.8s	○
P20.05	Filter times of	Setting range: 0x00–0x99	0x33	○

Function code	Name	Description	Default value	Modify
	encoder detection	Ones: Low-speed filter time, corresponds to 2^(0–9)×125us. Tens: High-speed filter times, corresponds to2^(0–9)×125us.		
P20.06	Speed ratio between encoder mounting shaft and motor	You need to set this parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.001–65.535	1.000	○
P20.07	Control parameters of synchronous motor	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Select resolver speed measurement mode Bit4: Z pulse capture mode Bit5: Do not detect encoder initial angle in v/f control Bit6: Enable CD signal calibration Bit7: Disable sin/cos sub-division speed measurement Bit8: Do not detect encoder fault during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable initial Z pulse calibration optimization Bit12: Clear Z pulse arrival signal after stop	0x0003	○
P20.08	Enable Z pulse offline detection	0x00–0x11 Ones: Z pulse 0: Do not detect 1: Enable Tens: UVW pulse (for synchronous motor) 0: Do not detect	0x10	○

Function code	Name	Description	Default value	Modify
		1: Enable		
P20.09	Initial angle of Z pulse	Relative electric angle of encoder Z pulse and motor pole position. Setting range: 0.00–359.99	0.00	○
P20.10	Initial angle of the pole	Relative electric angle of encoder position and motor pole position. Setting range: 0.00–359.99	0.00	○
P20.11	Autotuning of initial angle of pole	0–3 1: Rotary autotuning (DC brake) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	0	◎
P20.12	Speed measurement optimization selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P20.13	CD signal zero offset gain	0–65535	0	○
P20.14	Encoder type selection	Ones: Incremental encoder 0: without UVW 1: with UVW Tens: Sin/Cos encoder 0: without CD signal 1: with CD signal	0x00	◎
P20.15	Speed measuring mode	0: PG card speed measuring/HDI height measuring 1: Local speed measuring, implemented through HDIA and HDIB; supporting only incremental 24V encoders	0	◎

Function code	Name	Description	Default value	Modify
		Note: HDI height measuring is implemented through the HDIA and HDIB and supports only incremental 24V encoders.		
P20.16	Frequency division coefficient	0–255 When this parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P20.17	Pulse filer processing	0x0000–0xffff Bit0: Whether to enable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode (set Bit0 or Bit2 to 1) 0: Self-adaptive filter 1: Use P20.18 filter parameters Bit2: Whether to enable encoder frequency-division output filter 0: No filter 1: Filter Bit3: Reserved Bit4: Whether to enable pulse reference filter 0: No filter 1: Filter Bit5: Pulse reference filter mode (valid when Bit4 is set to 1) 0: Self-adaptive filter 1: Use P20.19 filter parameters Bit6: Frequency-divided output source setting 0: Encoder signals 1: Pulse reference signals	0x0033	○

Function code	Name	Description	Default value	Modify
		Bits7–15: Reserved		
P20.18	Encoder pulse filter width	0–63 The filtering time is P20.18×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P20.19	Pulse reference filter width	0–63 The filtering time is P20.18×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P20.20	Pulse number of pulse reference	0–65535	1024	◎
P20.21	Enable angle compensation of synchronous motor	0–1	0	○
P20.22	Switch-over frequency threshold of speed measurement mode	0–630.00Hz **Note:** This parameter is valid only when P20.12 is set to 0.	1.00Hz	○
P20.23	Angle compensation coefficient	-200.0–200.0	100.0%	○
P20.24	Motor pole pair number in initial pole angle autotuning	1–128	2	◎

7.2.21 P21 Position control

Function code	Name	Description	Default value	Modify
P21.00	Positioning mode	Ones: Control mode selection 0: Speed control 1: Position control Tens: Position command source 0: Pulse string 1: Digital position 2: Positioning of photoelectric switch during stop Hundreds: Position feedback source (reserved, fixed to channel P) 0: PG1 1: PG2 Thousands: servo mode Bit0: Position deviation mode 0: No deviation 1: With deviation Bit1: Whether to enable servo 0: Disable (The servo can be enabled by terminals.) 1: Enable Bit2–Bit7: (reserved) **Note:** In the pulse string or spindle positioning mode, the VFD enters the servo operation mode when 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.	0x0000	○
P21.01	Pulse command mode	Ones: Pulse mode 0: A/B quadrature pulse; A precedes B 1: A: PULSE; B: SIGN	0x0000	◎

Function code	Name	Description	Default value	Modify
		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: 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: Pulse direction Bit0: Set pulse direction 0: Forward 1: Reverse Bit1: Set pulse direction by running direction 0: Disable, and BIT0 is valid; 1: Enable Hundreds: Pulse/direction frequency-doubling selection (reserved) 0: No frequency-doubling 1: Frequency-doubling Thousands: Pulse control selection Bit0: Pulse filter selection 0: Inertia filter 1: Average moving filter Bit1: Overspeed control 0: No control 1: Control		
P21.02	APR gain 1	The two automatic position regulator (APR) gains are switched based on the switching mode set in P21.04. When the spindle orientation function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used	20.0	○
P21.03	APR gain 2		30.0	○

Function code	Name	Description	Default value	Modify
		for dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0		
P21.04	Switching mode of position loop gain	This parameter is used to set the APR gain switching mode. 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 switching 2: Torque command 3: Speed command 3–5: Reserved	0	○
P21.05	Torque command level during position gain switch-over	0.0–100.0% (rated motor torque)	10.0%	○
P21.06	Speed command level during position gain switch-over	0.0–100.0% (rated motor speed)	10.0%	○
P21.07	Smooth filter coefficient during gain switch-over	The smooth filter coefficient during position gain switch-over. Setting range: 0–15	5	○
P21.08	Output limit of position controller	The output limit of position regulator, if the limit value is 0, position regulator will be invalid, and no position control can be performed, however, speed control is available. Setting range: 0.0–100.0% (Max. output frequency P00.03)	20.0%	○
P21.09	Completion range of positioning	When the position deviation is less than P21.09, and the duration is larger than P21.10, positioning	10	○

Function code	Name	Description	Default value	Modify
		completion signal will be outputted. Setting range: 0–1000		
P21.10	Detection time for positioning completion	0.0–1000.0ms	10.0ms	○
P21.11	Numerator of position command ratio	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement. Setting range: 1–65535	1000	○
P21.12	Denominator of position command ratio	Setting range: 1–65535	1000	○
P21.13	Position feedforward gain	0.00–120.00% For pulse string reference only (position control)	100.00	○
P21.14	Position feedforward filter time constant	0.0–3200.0ms For pulse string reference only (position control)	3.0ms	○
P21.15	Position command filter time constant	The position feedforward filter time constant during pulse string positioning. 0.0–3200.0ms	0.0ms	◎
P21.16	Digital positioning mode	Bit0: Positioning mode selection 0: Relative position 1: Absolute position (home) (reserved) Bit1: Positioning cycle selection 0: Cyclic positioning by terminals 1: Automatic cyclic positioning Bit2: Cycle mode 0: Continuous 1: Repetitive (supported by automatic cyclic	0	○

Function code	Name	Description	Default value	Modify
		positioning only) Bit3: P21.17 digital setting mode 0: Incremental 1: Position type (do not support continuous mode) Bit4: Home searching mode 0: Search for the home just once 1: Search for the home during each run Bit5: Home calibration mode 0: Calibrate in real time 1: Single calibration Bit6: Positioning completion signal selection 0: Valid during the time set by P21.25 (Hold time of positioning completion signal) 1: Always valid Bit7: Initial positioning selection (for cyclic positioning by terminals) 0: Invalid (do not rotate) 1: Valid Bit8: Positioning enable signal selection (for cyclic positioning by terminals only; positioning function is always enabled for automatic cyclic positioning) 0: Pulse signal 1: Level signal Bit9: Position source 0: P21.17 setting 1: PROFIBUS/CANopen setting Bit10: indicates whether to save the encoder pulse counting value at power outage 0: Not save 1: Save		

Function code	Name	Description	Default value	Modify
		Bit11: Reserved Bit12: Positioning curve selection (reserved) 0: Straight line 1: S curve		
P21.17	Position digital reference	Set digital positioning position; Actual position=P21.17×P21.11/P21.12 0–65535	0	○
P21.18	Positioning speed setup selection	0: Set by P21.19 1: Set by AI1 2: Set by AI2 3: Set by AI3 4: Set by high speed pulse HDIA 5: Set by high speed pulse HDIB	0	○
P21.19	Positioning speed digits	0–100.0% max. frequency	20.0%	○
P21.20	Acceleration time of positioning	Set the acceleration/deceleration time of positioning process.	3.00s	○
P21.21	Deceleration time of positioning	Acceleration time of positioning means the time needed for the VFD to accelerate from 0Hz to Max. output frequency (P00.03). Deceleration time of positioning means the time needed for the VFD to decelerate from Max. output frequency (P00.03) to 0hz. Setting range of P21.20: 0.01–300.00s Setting range of P21.21: 0.01–300.00s	3.00s	○
P21.22	Hold time of positioning arrival	Set the hold time of waiting when target positioning position is reached. Setting range: 0.000–60.000s	0.100s	○

Function code	Name	Description	Default value	Modify
P21.23	Home search speed	0.00–50.00Hz	2.00Hz	○
P21.24	Home position offset	0–65535	0	○
P21.25	Hold time of positioning completion signal	The hold time of positioning completion signal, this parameter is also valid for positioning completion signal of spindle orientation. Setting range: 0.000–60.000s	0.200s	○
P21.26	Pulse superposition value	0–65535	0	○
P21.27	Pulse superposition speed	0–6553.5	8.0	○
P21.28	Acceleration/deceleration time after disabling pulse	000.0–3000.0s	5.0s	○
P21.29	Speed feedforward filter time constant (pulse string speed mode)	It is the filter time constant detected by pulse string when the speed reference source is set to pulse string (P0.06=12 or P0.07=12). Setting range: 0–3200.0ms	10.0ms	○
P21.30	Numerator of the 2nd command ratio	1–65535	1000	○

7.2.22 P22 Spindle positioning

Function code	Name	Description	Default value	Modify
P22.00	Spindle positioning mode	Bit0: Enable spindle positioning 0: Disable	0	○

Function code	Name	Description	Default value	Modify
	selection	1: Enable Bit1: Select spindle positioning reference point 0: Z pulse input 1: S2/S3/S4 terminal input Bit2: Search for reference point 0: Search the reference point only once 1: Search the reference point every time Bit3: Enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1 0: Set direction positioning 1: Near-by direction positioning Bit5: Positioning mode selection 2 0: Forward positioning 1: Reverse positioning Bit6: Zeroing command selection 0: Electric level mode 1: Pulse mode Bit7: Reference point calibration mode 0: Calibrate at the first time 1: Calibrate in real time Bit8: Action selection after zeroing signal cancellation (electric level type) 0: Switch to speed mode 1: Position lock mode Bit9: Positioning completion signal selection 0: Electric level signal 1: Pulse signal		

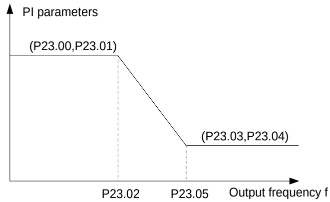
Function code	Name	Description	Default value	Modify
		Bit10: Z pulse signal source 0: Motor 1: Spindle Bit11–15: Reserved		
P22.01	Speed of spindle orientation	During spindle orientation, the speed of the position point of orientation will be searched, and then it will switch over to position control orientation. Setting range: 0.00–100.00Hz	10.00Hz	○
P22.02	Deceleration time of spindle orientation	Deceleration time of spindle orientation. Spindle orientation deceleration time means the time needed for the VFD to decelerate from Max. output frequency (P00.03) to 0Hz. Setting range: 0.0–100.0s	3.0s	○
P22.03	Spindle zeroing position 0	You can select the zeroing positions of four spindles by terminals (function code 46, 47). Setting range: 0–39999	0	○
P22.04	Spindle zeroing position 1	Setting range: 0–39999	0	○
P22.05	Spindle zeroing position 2	Setting range: 0–39999	0	○
P22.06	Spindle zeroing position 3	Setting range: 0–39999	0	○
P22.07	Spindle scale-division angle 1	You can select seven spindle scale-division values by terminals (function code 48, 49 and 50). Setting range: 0.00–359.99	15.00	○
P22.08	Spindle scale-division angle 2	Setting range: 0.00–359.99	30.00	○

Function code	Name	Description	Default value	Modify
P22.09	Spindle scale-division angle 3	Setting range: 0.00–359.99	45.00	○
P22.10	Spindle scale-division angle 4	Setting range: 0.00–359.99	60.00	○
P22.11	Spindle scale-division angle 5	Setting range: 0.00–359.99	90.00	○
P22.12	Spindle scale-division angle 6	Setting range: 0.00–359.99	120.00	○
P22.13	Spindle scale-division angle 7	Setting range: 0.00–359.99	180.00	○
P22.14	Spindle drive ratio	This function code sets the reduction ratio of the spindle and the mounting shaft of the encoder. Setting range: 0.000–30.000	1.000	○
P22.15	Zero-point communication setup of spindle	P22.15 sets spindle zero-point offset, if the selected spindle zero point is P22.03, the final spindle zero point will be the sum of P22.03 and P22.15. Setting range: 0–39999	0	○
P22.16	Reserved variables	0–65535	0	○
P22.17	Reserved variables	0–65535	0	○
P22.18	Rigid tapping selection	Ones: Whether to enable 0: Disable 1: Enable	0x00	◎

Function code	Name	Description	Default value	Modify
		Tens: Analog port selection 0: Invalid 1: AI1 2: AI2 3: AI3		
P22.19	Analog filter time of rigid tapping	0.0ms–1000.0ms	1.0ms	○
P22.20	Max. frequency of rigid tapping	0.00–400.00Hz	50.00Hz	○
P22.21	Corresponding frequency of analog zero drift of rigid tapping	0.00–10.00Hz	0.00Hz	○
P22.22	Pulse reference speed measuring method	0–2 0: Measured by the main control board 1: Measured by the PG card 2: Hybrid speed measuring	0	○
P22.23	Reserved	0–65535	0	
P22.24	Encoder counting clearing setting	0–65535	0	○

7.2.23 P23 Vector control of motor 2

Function code	Name	Description	Default value	Modify
P23.00	Speed loop proportional gain 1	P23.00–P23.05 fit for vector control mode only. Below switch-over frequency 1 (P23.02), the speed loop PI parameters are P23.00 and P23.01. Above switch-over frequency 2 (P23.05), the speed loop PI parameters are P23.03 and P23.04;	20.0	○
P23.01	Speed loop integral time 1		0.200s	○

Function code	Name	Description	Default value	Modify
P23.02	Switch over low point frequency	in between them, the PI parameters are obtained by linear variation between two groups of parameters, as shown in the figure below.	5.00Hz	○
P23.03	Speed loop proportional gain 2		20.0	○
P23.04	Speed loop integral time 2		0.200s	○
P23.05	Switch over high point frequency	The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increase proportional gain or decrease 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 large overshoot may occur; if proportional gain is too small, stable oscillation or speed offset may occur. Speed loop PI parameter is closely related to the system inertia, you should make adjustment according to different load characteristics based on the default PI parameter to fulfill different needs. Setting range of P23.00: 0.0–200.0 Setting range of P23.01: 0.000–10.000s Setting range of P23.02: 0.00Hz–P23.05 Setting range of P23.03: 0.0–200.0 Setting range of P23.04: 0.000–10.000s Setting range of P23.05: P23.02–P00.03 (Max. output frequency)	10.00Hz	○
P23.06	Speed loop output filter	0–8 (corresponds to 0–2^8/10ms)	0	○

Function code	Name	Description	Default value	Modify
P23.07	Slip compensation coefficient of vector control (motoring)	Slip compensation coefficient is used to adjust the slip frequency of vector control to improve system speed control precision. You can effectively control the static error of speed by adjusting this parameter properly. Setting range: 50–200%	100%	○
P23.08	Slip compensation coefficient of vector control (generating)		100%	○
P23.09	Current loop proportional coefficient P	**Note:** 1. These two parameters are used to adjust PI parameters of current loop; it affects dynamic response speed and control precision of the system directly. The default value needs no adjustment under common conditions; 2. Fit for SVC mode 0 (P00.00=0) and VC mode (P00.00=3); 3. The value of this function code will be updated automatically after parameter autotuning of synchronous motor is done. Setting range: 0–65535	1000	○
P23.10	Current loop integral coefficient I		1000	○
P23.11	Speed loop differential gain	0–10.00s	0.00s	○
P23.12	Proportional coefficient of high-frequency current loop	Under VC mode (P00.00=3), below current loop high-frequency switch-over threshold (P23.14), current loop PI parameters are P23.09 and P23.10; above current loop high-frequency switch-over threshold, current loop PI parameters are P23.12 and P23.13. Setting range of P23.12: 0–65535 Setting range of P23.13: 0–65535 Setting range of P23.14: 0.0–100.0% (relative to max. frequency)	1000	○
P23.13	Integral coefficient of high-frequency current loop		1000	○
P23.14	High-frequency switch-over threshold of		100.0%	○

Function code	Name	Description	Default value	Modify
	current loop			

7.2.24 P24 Encoder of motor 2

Function code	Name	Description	Default value	Modify
P24.00	Encoder type display	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Endat absolute encoder	0	●
P24.01	Encoder pulse number	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–60000	1024	◎
P24.02	Encoder direction	Ones: AB direction 0: Forward 1: Reverse Tens: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P24.03	Detection time of encoder offline fault	The detection time of encoder offline fault. Setting range: 0.0–10.0s	2.0s	○
P24.04	Detection time of encoder reversal fault	Detection time of encoder reversal fault. Setting range: 0.0–100.0s	0.8s	○

Function code	Name	Description	Default value	Modify
P24.05	Filter times of encoder detection	Setting range: 0x00–0x99 Ones: Low-speed filter times, corresponds to 2^(0–9)×125us. Tens: High-speed filter times; corresponds to 2^(0–9)×125us.	0x33	○
P24.06	Speed ratio between encoder mounting shaft and motor	You need to set this parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.001–65.535	1.000	○
P24.07	Control parameters of synchronous motor	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Select resolver speed measurement mode Bit4: Z pulse capture mode Bit5: Do not detect encoder initial angle in v/f control Bit6: Enable CD signal calibration Bit7: Disable sin/cos sub-division speed measurement Bit8: Do not detect encoder fault during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable initial Z pulse calibration optimization Bit12: Clear Z pulse arrival signal after stop	0x3	○
P24.08	Enable Z pulse offline detection	0x00–0x11 Ones: Z pulse Reserved Tens: UVW pulse 0: Do not detect	0x10	○

Function code	Name	Description	Default value	Modify
		1: Enable		
P24.09	Initial angle of Z pulse	Relative electric angle of encoder Z pulse and motor pole position. Setting range: 0.00–359.99	0.00	○
P24.10	Initial angle of the pole	Relative electric angle of encoder position and motor pole position. Setting range: 0.00–359.99	0.00	○
P24.11	Autotuning of initial angle of pole	0–3 1: Rotary autotuning (DC brake) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	0	◎
P24.12	Speed measurement optimization selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P24.13	CD signal zero offset gain	0–65535	0	○
P24.14	Encoder type selection	Ones: Incremental encoder 0: without UVW 1: with UVW Tens: Sin/Cos encoder 0: without CD signal 1: with CD signal	0x00	◎
P24.15	Speed measuring mode	0: PG card speed measuring/HDI height measuring 1: Local measuring, implemented through HDIA and HDIB; supporting only incremental 24V encoders	0	◎

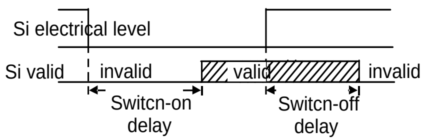
Function code	Name	Description	Default value	Modify
		Note: HDI height measuring is implemented through HDIA and HDIB and supports only incremental 24V encoders.		
P24.16	Frequency-division coefficient	0–255 When this parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P24.17	Pulse filer processing	0x0000–0xffff Bit0: Whether to enable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode (set Bit0 or Bit2 to 1) 0: Self-adaptive filter 1: Use P20.18 filter parameters Bit2: Whether to enable encoder frequency-division output filter 0: No filter 1: Filter Bit3: Reserved Bit4: Whether to enable pulse reference filter 0: No filter 1: Filter Bit5: Pulse reference filter mode (valid when Bit4 is set to 1) 0: Self-adaptive filter 1: Use P24.19 filter parameters Bit6: Frequency-divided output source setting 0: Encoder signals 1: Pulse reference signals	0x0033	○

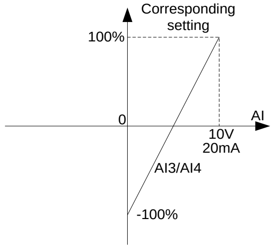
Function code	Name	Description	Default value	Modify
		Bits7–15: Reserved		
P24.18	Encoder pulse filter width	0–63 The filtering time is P24.18×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P24.19	Pulse reference filter width	0–63 The filtering time is P24.19×0.25 μs. The value 0 or 1 indicates 0.25 μs.	10	○
P24.20	Pulse number of pulse reference	0–65535	1024	◎
P24.21	Enable angle compensation of synchronous motor	0–1	0	○
P24.22	Switch-over frequency threshold of speed measurement mode	0–630.00Hz	1.00Hz	○
P24.23	Angle compensation coefficient	-200.0–200.0%	100.0%	○
P24.24	Motor pole pair number in initial pole angle autotuning	0–128	2	◎

7.2.25 P25 Extension I/O card input functions

Function code	Name	Description	Default value	Modify
P25.01	S5 terminal	Same as P05 group	0	◎

Function code	Name	Description	Default value	Modify
	function			
P25.02	S6 terminal function		0	◎
P25.03	S7 terminal function		0	◎
P25.04	S8 terminal function		0	◎
P25.05	S9 terminal function		0	◎
P25.06	S10 terminal function		0	◎
P25.07	S11 terminal function		0	◎
P25.08	S12 terminal function		0	◎
P25.10	Input terminal polarity of extension card	0x000–0x1FF BIT7 | BIT6 | BIT5 | BIT4 S12 | S11 | S10 | S9 BIT3 | BIT2 | BIT1 | BIT0 S8 | S7 | S6 | S5	0x000	○
P25.11	Virtual terminal setup of extension card	0x000–0x7F (0: disable, 1: enable) BIT0: S5 virtual terminal BIT1: S6 virtual terminal BIT2: S7 virtual terminal BIT3: S8 virtual terminal BIT4: S9 virtual terminal BIT5: S10 virtual terminal BIT6: S11 virtual terminal	0x000	◎

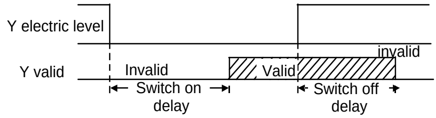
Function code	Name	Description	Default value	Modify
		BIT7: S12 virtual terminal BIT8: HDI3 virtual terminal		
P25.14	S5 terminal switch-on delay	These function codes define corresponding delay of the programmable input terminals during level variation from switch-on to switch-off .  Setting range: 0.000–50.000s	0.000s	○
P25.15	S5 terminal switch-off delay		0.000s	○
P25.16	S6 terminal switch-on delay		0.000s	○
P25.17	S6 switch-off delay		0.000s	○
P25.18	S7 terminal switch-on delay		0.000s	○
P25.19	S7 switch-off delay		0.000s	○
P25.20	S8 terminal switch-on delay		0.000s	○
P25.21	S8 switch-off delay		0.000s	○
P25.22	S9 terminal switch-on delay		0.000s	○
P25.23	S9 switch-off delay		0.000s	○
P25.24	S10 terminal switch-on delay		0.000s	○
P25.25	S10 switch-off delay		0.000s	○
P25.26	S11 terminal switch-on delay		0.000s	○

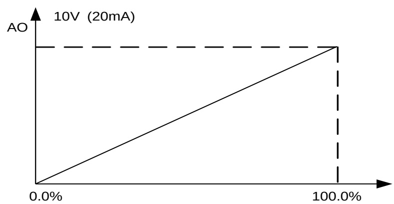
Function code	Name	Description	Default value	Modify
P25.27	S11 switch-off delay		0.000s	○
P25.28	S12 terminal switch-on delay		0.000s	○
P25.29	S12 switch-off delay		0.000s	○
P25.30	Lower limit value of AI3	These function codes define the relation between analog input voltage and corresponding set value of analog input. When the analog input voltage exceeds the range of max./min. input, the max. input or min. input will be adopted during calculation.	0.00V	○
P25.31	Corresponding setting of lower limit of AI3		0.0%	○
P25.32	Upper limit value of AI3	When analog input is current input, 0–20mA current corresponds to 0–10V voltage.	10.00V	○
P25.33	Corresponding setting of upper limit of AI3	In different application cases, 100% of the analog setting corresponds to different nominal values. The figure below illustrates several settings.	100.0%	○
P25.34	Input filter time of AI3	 Input filter time: Adjust the sensitivity of analog input, increase this value properly can enhance the anti-interference capacity of analog variables; however, it will also degrade the sensitivity of analog input. **Note:** AI3 can support 0–10V/0–20mA input, when AI3 selects 0–20mA input, the corresponding voltage of 20mA is 10V;	0.030s	○

Function code	Name	Description	Default value	Modify
		Setting range of P25.30: 0.00V–P25.32 Setting range of P25.31: -300.0%–300.0% Setting range of P25.32: P25.30–10.00V Setting range of P25.33: -300.0%–300.0% Setting range of P25.34: 0.000s–10.000s		
P25.41	AI3 input signal type	Range: 0–1 0: Voltage type 1: Current type	0	○
P25.42	S-terminal power signal selection (S terminal on I/O extension card 2)	0–1 0: DC (24–48VDC) 1: AC (24–48VAC)	0	◎

7.2.26 P26 Output functions of extension I/O card

Function code	Name	Description	Default value	Modify
P26.02	Y2 output selection	Same as P06.01	0	○
P26.04	Relay RO3 output selection		0	○
P26.05	Relay RO4 output selection		0	○
P26.12	Output terminal polarity of extension card	0x0000–0x7FF RO10, RO9…RO3, HDO2,Y3, Y2 in sequence	0x000	○
P26.15	Y2 switch-on delay	The function codes define the corresponding delay of the level variation from switch-on to switch-off.	0.000s	○
P26.16	Y2 switch-off delay		0.000s	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P26.19</td><td>Relay RO3 switch-on delay</td><td rowspan="4">

Setting range: 0.000–50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.20</td><td>Relay RO3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.21</td><td>Relay RO4 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.22</td><td>Relay RO4 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.35</td><td>AO2 output selection</td><td>Same as P06.14</td><td>0</td><td>○</td></tr>
<tr><td>P26.38</td><td>Lower limit of AO2 output</td><td rowspan="5">Above function codes define the relation between output value and analog output. When the output value exceeds the set max./min. output range, the upper/low limit of output will be adopted during calculation.
When analog output is current output, 1mA corresponds to 0.5V voltage. In different applications, 100% of output value corresponds to different analog outputs.


Setting range of P26.38: -300.0%–P26.40
Setting range of P26.39: 0.00V–10.00V
Setting range of P26.40: P26.38–300.0%
Setting range of P26.41: 0.00V–10.00V
Setting range of P26.42: 0.000s–10.000s</td><td>0.0%</td><td>○</td></tr>
<tr><td>P26.39</td><td>Corresponding AO2 output of lower limit</td><td>0.00V</td><td>○</td></tr>
<tr><td>P26.40</td><td>Upper limit of AO2 output</td><td>100.0%</td><td>○</td></tr>
<tr><td>P26.41</td><td>Corresponding AO2 output of upper limit</td><td>10.00V</td><td>○</td></tr>
<tr><td>P26.42</td><td>AO2 output filter time</td><td>0.000s</td><td>○</td></tr>
</table>

7.2.27 P28 Master/slave control functions

Function code	Name	Description	Default value	Modify
P28.00	Master/slave mode selection	0: The master/slave control is invalid 1: This machine is a master 2: This machine is a slave	0	◎
P28.01	Master/slave communication data selection	0: CAN 1: Reserved	0	◎
P28.02	Master/slave control mode	Ones: Master/slave running mode selection 0: Master/slave mode 0 (The master and slave adopt speed control and maintains the power balance by droop control) 1: Master/slave mode 1 (The master and slave must be in the same type of vector control mode. The master is speed control, and the slave will be forced to be in the torque control mode. 2: Master/slave mode 2 Start in the slave first speed mode (master/slave mode 0) and then switch to torque mode at a certain frequency point (master/slave mode 1) 3: Reserved 4: Closed-loop master/slave mode (master/slave mode 4) If the position synchronization mode is used, both the master and slave must be installed with the encoder. Both the master and slave adopt the speed control and correct the speed by using the position pulse deviation value. 5: Master/slave mode 5 Both the master and slave use closed-loop speed control, and the slave use the speed loop output of the master to perform power balancing. Tens: Slave start command source selection	0x001	◎

Function code	Name	Description	Default value	Modify
		0: Follow the master to start 1: Determined by P00.01 Hundreds: Slave transmitting/master receiving data enable 0: Enable 1: Disable		
P28.03	Slave speed gain	0.0–500.0%	100.0%	○
P28.04	Slave torque gain	0.0–500.0%	100.0%	○
P28.05	Speed/torque mode switching frequency point of master/slave mode 2	0.00–10.00Hz	5.00Hz	○
P28.06	Number of slaves	0–15	1	◎
P28.07	Master/slave transmission unit pulse ratio	0.00–100.00	1.00	○
P28.08	Position synchronization deviation deadzone setting	0–50000 When the position difference is greater than P28.08, correction on the slave is valid.	50	○
P28.09	Position synchronization deviation threshold	0–50000 When the position difference is greater than P28.09, the master/slave position fault (ELS) is reported.	1000	○
P28.10	Position synchronization regulator output limit	0.0–100.0%	5.0%	○
P28.11	Position synchronization pulse count reset method	0–1 0: Automatic During stop, the position synchronization pulse count is automatically reset. 1: Terminal based If the input terminal selects the position synchronization pulse count reset function, the	0	◎

Function code	Name	Description	Default value	Modify
		pulse count is automatically reset when there is signal input.		
P28.12	Position synchronization proportional coefficient	0.000 – 10.000	0.005	○
P28.13	Position synchronization integral time	0.01 – 80.00	8.00s	○
P28.14	Position synchronization filtering time	0.00–10.00	0.05s	○
P28.15	Enabling the slave speed deviation window	0–1 0: Disable 1: Enable When the slave adopts the torque control mode, the speed deviation monitoring function can be enabled.	0	○
P28.16	Slave positive speed deviation window upper limit	0.00–50.00Hz When the actual speed is higher than the given speed, if the actual speed is higher than (given speed +P28.16) and exceeds this upper limit, the speed has to be adjusted.	5.00Hz	○
P28.17	Slave negative speed deviation window lower limit	0.00–50.00Hz When the actual speed is lower than the given speed, if the actual speed is lower than (given speed -P28.17) and exceeds this lower limit, the speed has be adjusted.	5.00Hz	○
P28.18	Slave rotation speed regulation coefficient Kb	0–50000 Applicable only in master/slave mode 5.	100	○
P28.19	Rotation speed difference compensation coefficient Kc (Reserved)	0–50000 Applicable only in master/slave mode 5, in which there are only one master and one slave.	100	○

Function code	Name	Description	Default value	Modify
P28.20	Rotation speed difference compensation target setting (Reserved)	0–2 0: Not compensate 1: Compensate both the master and slave 2: Compensate only the slave	0	○

7.2.28 P29 Parameters of motor 3

Function code	Name	Description	Default value	Modify
P29.00	Type of motor 3	0: Asynchronous motor 1: Synchronous motor	0	◎
P29.01	Rated power of asynchronous motor 3	0.1–3000.0kW	Model depended	◎
P29.02	Rated frequency of asynchronous motor 3	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P29.03	Rated speed of asynchronous motor 3	1–36000rpm	Model depended	◎
P29.04	Rated voltage of asynchronous motor 3	0–1200V	Model depended	◎
P29.05	Rated current of asynchronous motor 3	0.8–6000.0A	Model depended	◎
P29.06	Stator resistance of asynchronous motor 3	0.001–65.535Ω	Model depended	○
P29.07	Rotor resistance of asynchronous motor 3	0.001–65.535Ω	Model depended	○
P29.08	Leakage inductance of asynchronous	0.1–6553.5mH	Model depended	○

Function code	Name	Description	Default value	Modify
	motor 3			
P29.09	Mutual inductance of asynchronous motor 3	0.1–6553.5mH	Model depended	○
P29.10	No-load current of asynchronous motor 3	0.1–6553.5A	Model depended	○
P29.11	Magnetic saturation coefficient 1 of iron core of asynchronous motor 3	0.0–100.0%	80.0%	○
P29.12	Magnetic saturation coefficient 2 of iron core of asynchronous motor 3	0.0–100.0%	68.0%	○
P29.13	Magnetic saturation coefficient 3 of iron core of asynchronous motor 3	0.0–100.0%	57.0%	○
P29.14	Magnetic saturation coefficient 4 of iron core of asynchronous motor 3	0.0–100.0%	40.0%	○

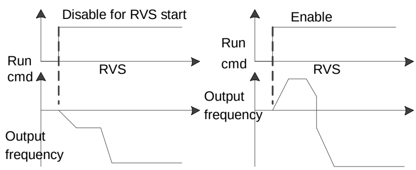
Function code	Name	Description	Default value	Modify
P29.15	Rated power of synchronous motor 3	0.1–3000.0kW	Model depended	◎
P29.16	Rated frequency of synchronous motor 3	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P29.17	Number of pole pairs of synchronous motor 3	1–128	2	◎
P29.18	Rated voltage of synchronous motor 3	0–1200V	Model depended	◎
P29.19	Rated current of synchronous motor 3	0.8–6000.0A	Model depended	◎
P29.20	Stator resistance of synchronous motor 3	0.001–65.535Ω	Model depended	○
P29.21	Direct-axis inductance of synchronous motor 3	0.01–655.35mH	Model depended	○
P29.22	Quadrature-axis inductance of synchronous motor 3	0.01–655.35mH	Model depended	○
P29.23	Counter-emf constant of synchronous motor 3	0–10000V	300	○
P29.24	Initial magnetic pole position of synchronous motor 3 (Reserved)	0–0xFFFF	0x0000	●

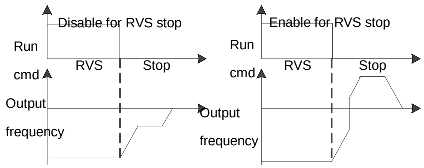
Function code	Name	Description	Default value	Modify
P29.25	Identification current of synchronous motor 3 (Reserved)	0%–50% (of the motor rated current)	10%	●
P29.26	Overload protection selection of motor 3	0: Disable protection 1: Enable protection for common motors (with low-speed compensation) 2: Enable protection for variable-frequency motors (without low-speed compensation)	2	◎
P29.27	Overload protection coefficient of motor 3	20.0%–120.0%	100.0%	○
P29.28	Power display correction coefficient of motor 3	0.00–3.00	1.00	○
P29.29	Parameter display selection of motor 3	0: Display by motor type 1: Display all	0	○
P29.30	System inertia of motor 3	0–30.000kgm2	0.000	○

7.2.29 P90 Hoisting functions

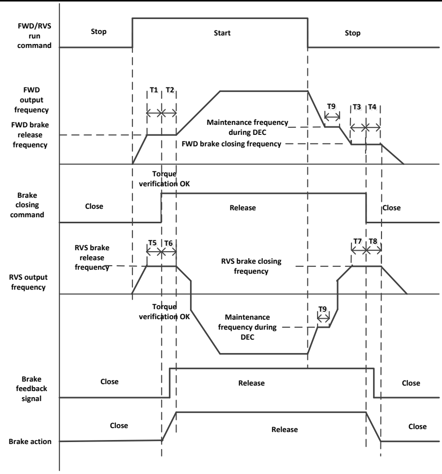
Function code	Name	Description	Default value	Modify
P90.00	Hoisting function macro setting	0–12 0: Common application mode 1: Lifting mode 1 (in open-loop vector control) 2: Lifting mode 2 (in closed-loop vector control) 3: Horizontal moving mode (in space voltage vector control) 4: Tower crane rotating mode 5: Conical motor application mode 6: User-defined function macro 1	0	◎

Function code	Name	Description	Default value	Modify
		7: User-defined function macro 2 8: User-defined function macro 3 9: Lifting mode 3 (in space voltage vector control) 10: Construction hoist mode 11: Closed-loop winching (for lifting in mineral wells and winches) 12: Open-loop winching (for lifting in mineral wells and winches)		
P90.01	Terminal-switched function macro setting	0–12 The switched function macro is determined by P90.03. 0: Common application mode 1: Lifting mode 1 (in open-loop vector control) 2: Lifting mode 2 (in closed-loop vector control) 3: Horizontal moving mode (in space voltage vector control) 4: Tower crane rotating mode 5: Conical motor application mode 6: User-defined function macro 1 7: User-defined function macro 2 8: User-defined function macro 3 9: Lifting mode 3 (in space voltage vector control) 10: Construction hoist mode 11: Closed-loop winching (for lifting in mineral wells and winches) 12: Open-loop winching (for lifting in mineral wells and winches)	0	◎
P90.02	User-defined function macro setting	0–3 1: Enter the settings of user-defined function macro 1 2: Enter the settings of user-defined function macro 2 3: Enter the settings of user-defined function macro 3	0	◎
P90.03	Method for terminals to switch function	0–4 0: No function macro switchover 1: Switch from motor 1 to motor 2	0	◎

Function code	Name	Description	Default value	Modify
	macros	2: Switch from motor 1 to motor 3 3: Switch from the master to the slave 4: Switch from the slave to the master 5: Switch to SVC1 control (open-loop vector control mode 1)		
P90.04	Enabling brake-oriented logic	0–1 0: The brake is controlled by an external controller. 1: The brake is controlled by the VFD.	0	◎
P90.05	Enabling forward torque for reverse-running start/stop	0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The reverse-running start direction complies with the command.) 1: Enable (The reverse-running start direction is always the forward-running direction.)  Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The reverse-running stop direction complies with the command.) 1: Enable (The reverse-running stop direction is always the forward-running direction.)	0x00	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

When function is enabled, the VFD will first run in forward direction and then run in reverse direction, so as to ensure enough torque to drive the load.</td><td></td><td></td></tr>
<tr><td>P90.06</td><td>Graded multi-step speed reference 0</td><td rowspan="6">Multi-step speed setting is special for hoisting. The five multi-step speed setting terminals can be combined to form six speed settings
<table>
<tr><th>Trml1</th><th>Trml 2</th><th>Trml 3</th><th>Trml 4</th><th>Trml 5</th><th>Speed setting</th><th>Function code</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step setting 0</td><td>P90.06</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step setting 1</td><td>P90.07</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step setting 2</td><td>P90.08</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>Multi-step setting 3</td><td>P90.09</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>Multi-step setting 4</td><td>P90.10</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>Multi-step setting 5</td><td>P90.11</td></tr>
</table>
Set P00.06=15 or P00.07=15. The multi-step speed setting terminals are specified by P05 or P25, which can select functions 77–8. The speeds are specified by P90.06–P90.11 (P00.03 percentage of max. frequency)
P90.06, P90.07, P90.08, P90.09, P90.10, P90.11 setting range: 0.0－100.0%
Note: The multi-step settings of a higher grade can be closed only after the multi-step settings of all lower grades are closed.</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.07</td><td>Graded multi-step speed reference 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.08</td><td>Graded multi-step speed reference 2</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.09</td><td>Graded multi-step speed reference 3</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.10</td><td>Graded multi-step speed reference 4</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.11</td><td>Graded multi-step speed reference 5</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.12</td><td>Forward brake release current</td><td>Brake timing sequence in V/F mode:</td><td>0.0%</td><td>○</td></tr>
</table>

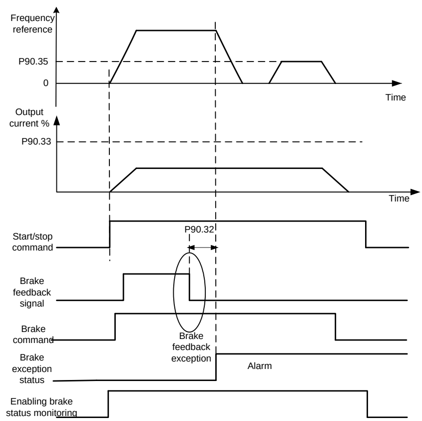
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P90.13</td><td>Reverse brake release current</td><td rowspan="15">

T1: Delay before forward brake release P90.20
T2: Delay after forward brake release P90.22
T5: Delay before reverse brake release P90.21
T6: Delay after reverse brake release P90.23
T9: Maintenance frequency hold time during DEC P90.29
T3: Delay before forward brake closing P90.24
T4: Delay after forward brake closing P90.26
T7: Delay before reverse brake closing P90.25
T8: Delay after reverse brake closing P90.27
Use forward-running timing sequence as example:
Start: When the VFD is in standby state, the brake output signal is closed. After receiving the running command, the VFD accelerates with the target frequency P90.16. In addition, the VFD starts torque verification, if the verification is OK (condition: output current>= P90.12 (it is P90.13 in reverse running) and output torque >= P90.14 (it is P90.15 in reverse running), output frequency is at least equal to P90.16 (it is P90.17 in reverse running), the delay before forward brake release starts, and the VFD outputs the brake release signal when P90.20 (or P90.21 in reverse running) is reached. Then the delay after forward brake release starts. The VFD normally accelerates to the set frequency within the time specified by P90.22 (or P90.23 in reverse running).
Stop: To prevent hook slip, sufficient output torque must be ensured before brake is closed. After receiving the stop command, the VFD decelerates</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.14</td><td>Forward brake release torque</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.15</td><td>Reverse brake release torque</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.16</td><td>Forward brake release frequency</td><td>3.00Hz</td><td>○</td></tr>
<tr><td>P90.17</td><td>Reverse brake release frequency</td><td>3.00Hz</td><td>○</td></tr>
<tr><td>P90.18</td><td>Forward brake closing frequency</td><td>3.00Hz</td><td>○</td></tr>
<tr><td>P90.19</td><td>Reverse brake closing frequency</td><td>3.00Hz</td><td>○</td></tr>
<tr><td>P90.20</td><td>Delay before forward brake release</td><td>0.300s</td><td>○</td></tr>
<tr><td>P90.21</td><td>Delay before reverse brake release</td><td>0.000s</td><td>○</td></tr>
<tr><td>P90.22</td><td>Delay after forward brake release</td><td>0.300s</td><td>○</td></tr>
<tr><td>P90.23</td><td>Delay after reverse brake release</td><td>0.000s</td><td>○</td></tr>
<tr><td>P90.24</td><td>Delay before forward brake closing</td><td>0.300s</td><td>○</td></tr>
<tr><td>P90.25</td><td>Delay before reverse brake closing</td><td>0.000s</td><td>○</td></tr>
<tr><td>P90.26</td><td>Delay after forward brake closing</td><td>0.300s</td><td>○</td></tr>
<tr><td>P90.27</td><td>Delay after reverse brake</td><td>0.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
	closing	to P90.28 with a maintenance frequency within P90.29. When output frequency <= P90.18 (or P90.19 in reverse running), the delay before brake release starts. When the delay reaches P90.24 (or P90.25 in reverse running), the VFD outputs brake closing signal. The delay after brake release starts. The VFD decelerates to zero and stops within the time P90.26 (or P90.27 in reverse running) P90.12 , P90.13 setting range: 0.0–200.0% (of the motor rated current) P90.14, P90.15 setting range: 0.0–200.0% (of the motor rated torque) P90.16, P90.17, P90.18, P90.19 setting range: 0.00–20.00Hz P90.20, P90.21, P90.22, P90.23, P90.24, P90.25, P90.26, P90.27 setting range: 0.000–5.000s **Note:** If reverse-running delay is 0, the forward-running delay is used. P90.28 setting range: 0.00–50.00Hz P90.29 setting range: 0.000–5.000s P90.30 setting range: 0.000–10.000s		
P90.28	Maintenance frequency for stop		5.00Hz	○
P90.29	Maintenance frequency hold time for stop		0.000s	○
P90.30	Torque verification fault detection time		3.000s	○
P90.31	Enabling the monitoring on brake status	P90.31 setting range: 0–1 0: Disable 1: Enable When the function is disabled, no brake feedback fault is reported. After it is enabled, brake status can be monitored. In open-loop mode: If the actual brake status is different from the S-terminal given brake feedback signal during running or stop, the brake feedback fault (FAE) is reported after the brake feedback exception delay P90.32. In closed-loop mode: During the stop, if a brake feedback exception occurs, the brake feedback fault (FAE) is reported after the brake feedback exception delay P90.32. During running, if a brake	0	◎
P90.32	Brake feedback exception delay (brake feedback detection time)		1.000s	○
P90.33	Brake monitoring current threshold		100.0%	○
P90.34	Enabling speed reference under brake status error		0	◎
P90.35	Speed reference under brake status error		5.00Hz	○

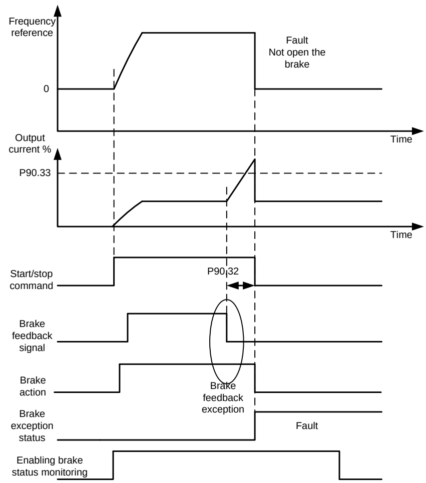
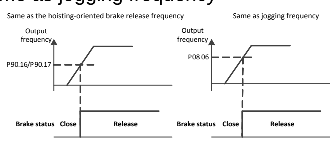
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

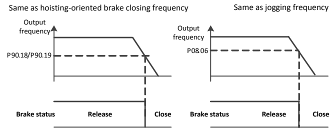
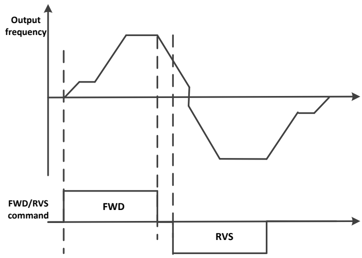
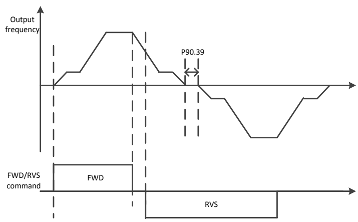
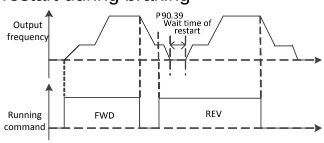
feedback exception occurs, the current is monitored after the brake feedback exception delay P90.32. If the present current is less than the monitored current, it is considered that the brake is not closed, and the action specified by P90.34 is performed. If P90.34=0, the VFD directly reports the brake feedback fault (FAE). If P90.34=1, the VFD opens the brake and runs at the speed specified by P90.35, and reports the brake feedback alarm (A-FA).

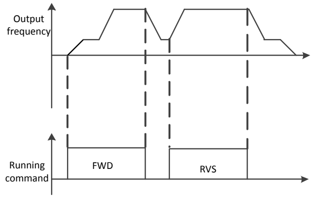


In closed-loop mode: During running, if a brake feedback exception occurs, the VFD starts monitoring current after the brake feedback exception delay P90.32. If the present current is greater than the brake monitoring current, the present actual frequency is checked. If the actual frequency is lower than the forward brake frequency during forward rotating or the actual frequency is lower than the reverse brake frequency during reverse rotating, it is considered that the brake has been closed, the brake feedback fault (FAE) is reported.

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

Function code	Name	Description	Default value	Modify
		 P90.32 setting range: 0.00–20.000s P90.33 setting range: 0.0%–200.0% (100.0% corresponding to the motor rated current) P90.34 setting range: 0–1 0: Disable (Report the brake feedback fault FAE directly) 1: Enable brake status error speed giving (Report the brake feedback alarm A-FA simultaneously) P90.35 setting range: 0.00–50.00Hz		
P90.36	Jogging brake type	0x00–0x11 Ones place: Brake release type selection 0: Same as hoisting-oriented brake release frequency 1: Same as jogging frequency  Tens place: Brake closing type selection 0: Same as hoisting-oriented brake closing frequency	0x00	◎

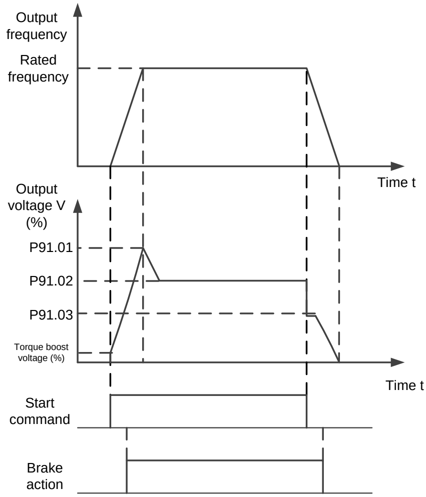
Function code	Name	Description	Default value	Modify
		1: Same as jogging frequency  		
P90.37	Brake selection for forward/reverse switchover	0–1 0: Perform switchover without braking 1: Perform switchover with braking When P90.37=0, the switchover is performed directly, and the brake does not act.  When P90.37=1, during the switchover, the VFD decelerates with braking to stop, and then opens the brake to run in reverse direction.  	0	◎
P90.38	Restart selection during braking	P90.38 setting range: 0–1 0: No restart during braking  1: Restart allowed during braking	0	◎
P90.39	Wait time of restart		0.5s	◎

Function code	Name	Description	Default value	Modify
		 Though the brake closing command has been output during stop, the VFD accepts a new start command. P90.39 setting range: 0.0–10.0s		
P90.40	Braking method in open-loop vector control	0–4 0: Common mode 1: Torque limit mode 2: Torque/speed switchover mode 1 (boost with braking) 3: DC braking mode 4: Torque/speed switchover mode 2 (horizontal moving)	0	◎
P90.41	Torque limit 1 in open-loop vector control	Setting range: 0.0–300.0% (of the motor rated current) (P90.40=1 torque limit mode)	120.0%	○
P90.42	Torque setting for brake release	0.0–200.0% The brake is released when the feedback value is >= 80% of the set value if P90.40=2 (Torque/speed switchover mode 1).	120.0%	○
P90.43	Brake open delay after startup DC braking starts	0.00–50.00s If P90.40=3 (DC braking mode), after the startup DC braking starts, the brake opens with a delay. The delay must be equal to or less than the startup DC braking time.	0.00s	○
P90.44	Brake closing delay after stop DC braking starts	0.00–50.00s If P90.40=3 (DC braking mode), after the stop DC braking starts, the brake closes with a delay. The delay must be equal to or less than the stop DC braking time.	0.00s	○
P90.45	Torque/speed switchover	0.00–50.00Hz If P90.40=4 (Torque/speed switchover mode 2,	8.00Hz	◎

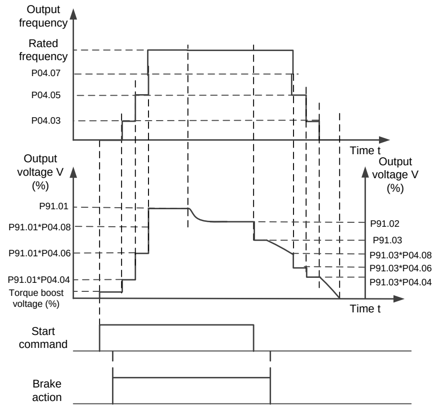
Function code	Name	Description	Default value	Modify
	frequency point	horizontal moving), torque control is applied when the frequency is lower than P90.45, while speed control is applied when the frequency is higher than P90.45.		

7.2.30 P91 Extended functions for hoisting

Function code	Name	Description	Default value	Modify
P91.00	Enabling conical motor functions	The conical motor does not require external braking since it implements braking by using internal magnetic flux control. During start, the starting frequency needs to be increased for brake release. During stop, quick demagnetizing needs to be implemented to prevent slip in case of overdue brake closing. P91.00 setting range: 0–1 0: Disable 1: Enable P91.01 setting range: P91.02–150.0% (100% corresponding to the motor rated voltage) P91.02 setting range: P91.03–P91.01 P91.03 setting range: 0.0–P91.02	0	◎
P91.01	Conical motor ACC process voltage coefficient K1		120.0%	○
P91.02	Conical motor constant process voltage coefficient K2		100.0%	○
P91.03	Conical motor DEC process voltage coefficient K3		80.0%	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


It is used when the conical motor function is different from the multi-dot V/F.

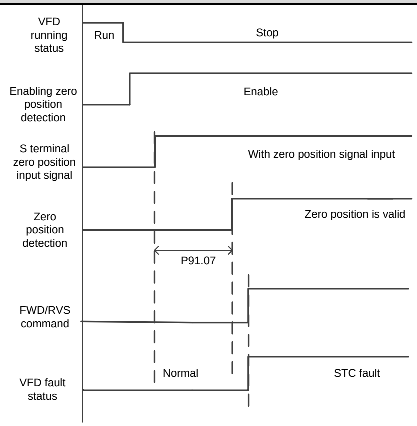
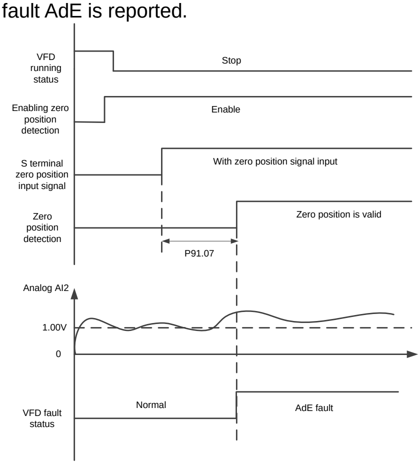


It is used when the conical motor function is the same as the multi-dot V/F.

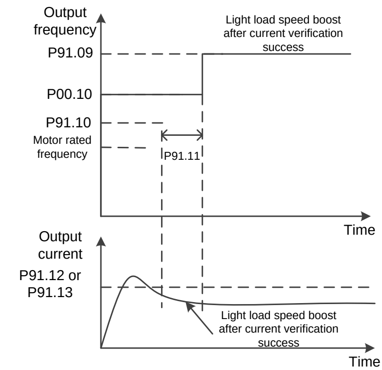
Note:

• The torque boost voltage is related to P04.01.
• I/F is invalid to conical motor application.
</td><td></td><td></td></tr>
<tr><td>P91.04</td><td>Contactor control selection</td><td>0–1
0: Controlled by an external controller</td><td>0</td><td>◎</td></tr>
</table>

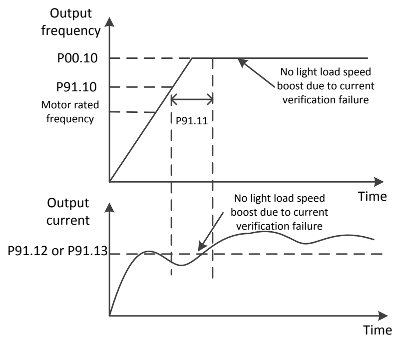
Function code	Name	Description	Default value	Modify
		1: Controlled by the VFD		
P91.05	Contactor feedback detection time	0.00–20.000s	1.000s	◎
P91.06	Enabling operating lever zero point position detection	0x00–0x11 Ones place 0: Disable zero point position detection 1: Enable zero point position detection Tens place: 0: Not detect AI2 1: Detect AI2	0	◎
P91.07	Operating lever zero point position delay	After the zero position detection signal is enabled, the terminal zero position signal is given in stop state, the zero position detection is completed (valid) with a delay specified by P91.07, the zero position signal is released, and the VFD runs only after being given with the running command. After the zero position signal detection takes effect, if both the zero position signal and running command signal are detected, the operating lever zero position fault STC is reported. If the running command is given during zero position detection, the VFD does not respond. If both the zero position signal and running command signal still exist after zero position detection, the operating lever zero position fault STC is also reported. If the zero position signal is removed suddenly during zero position detection, the VFD does not respond to the running command since zero position detection is incomplete.	0.300s	○

Function code	Name	Description	Default value	Modify
		 After the VFD stops, the VFD starts zero position detection. When the zero position detection delay is reached, if the detection finds that AI2 is greater than 1.00V, the analog speed reference deviation fault AdE is reported.  Setting range: 0.000–10.000s		
P91.08	Light load speed boost function selection	0–5 0: Disable 1: Constant power speed boost 2: Constant power speed limit 3: Stepped speed limit 4: Light load speed boost 1	0	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>5: Speed boost through external terminal signal</td><td></td><td></td></tr>
<tr><td>P91.09</td><td>Light-load speed-boost target frequency setting</td><td rowspan="5">P91.08=4: Light load speed boost mode 1 (according to set current and frequency)

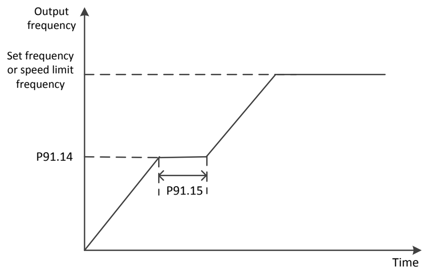


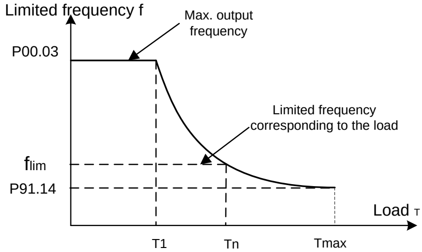
Light load speed boost after current verification success

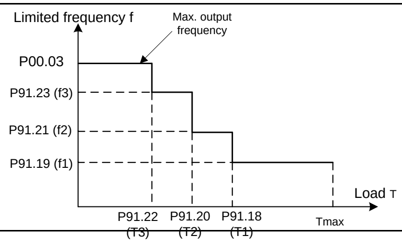


No light load speed boost due to current verification failure

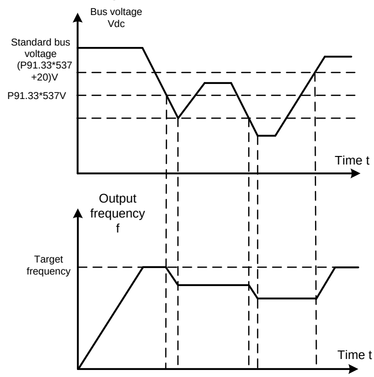
If light load speed boost mode 1 is enabled, processing for light load speed boost is performed only when the set frequency is no less than P02.02 (Motor rated frequency). After running, if the ramp frequency is equal to or greater than P91.10, current is detected and count starts. When P91.11 is reached, if the current is less than P91.12 (or P91.13 in reverse running), the current detection</td><td>70.00Hz</td><td>○</td></tr>
<tr><td>P91.10</td><td>Light-load speed-boost detection frequency</td><td>90.0%</td><td>○</td></tr>
<tr><td>P91.11</td><td>Light-load speed-boost current detection time</td><td>1.000s</td><td>○</td></tr>
<tr><td>P91.12</td><td>FWD light-load speed-boost current detection value</td><td>60.0%</td><td>○</td></tr>
<tr><td>P91.13</td><td>RVS light-load speed-boost current detection value</td><td>40.0 %</td><td>○</td></tr>
</table>

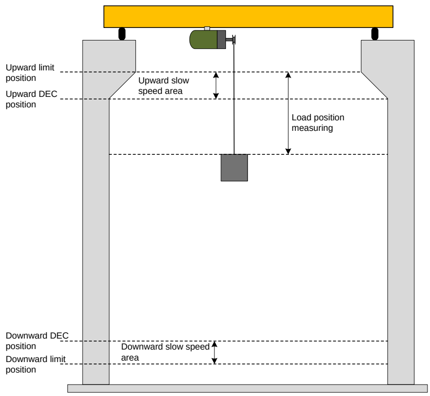
Function code	Name	Description	Default value	Modify
		passes, the VFD increases the frequency to P91.09. If the current detection fails, the VFD remains the original frequency. Note: The light-load speed-boost target frequency setting must be higher than the set frequency. Otherwise, speed boost cannot be implemented although the conditions are met. If the set frequency is higher than P91.10, the original frequency is remained. P91.09 setting range: 0.00–100.00Hz P91.10 setting range: 50.0%–100.0%(100.0% corresponding to the motor rated frequency) P91.11 setting range: 0.0–10.000s P91.12, P91.13 setting range: 0.0–150.0% Note: Light load speed boost mode 1 is applicable to the open-loop mode.		
P91.14	Heavy-load speed-limit detection frequency		40.00Hz	○
P91.15	Heavy-load speed-limit detection delay	When the set frequency is greater than the heavy load speed-limit detection frequency (P91.14), the motor running frequency becomes stable after reaching the detection frequency (P91.14), and load detection is performed after the time specified by P91.15. The load detection value is used for heavy load speed limit calculation. The load detection value P94.01 can be viewed through the keypad. P91.14 setting range: 0.00Hz–P02.02 P91.15 setting range: 0.00–5.00s P94.01 setting range: 0.0%–150.0% (of the motor rated torque)	0.35s	○

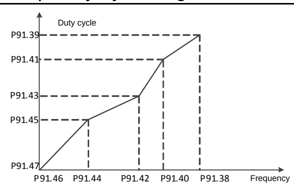
Function code	Name	Description	Default value	Modify
P91.16	Electric power upper limit of constant-power speed boost/limit	 Constant power speed limit frequency = Power upper limit * Motor rated frequency/Load detection value	90.0%	○
P91.17	Electricity generation power upper limit of constant-power speed boost/limit	The constant power mode is used for speed adjustment. The constant power speed limit frequency under the present load is calculated by using algorithms (using P91.16, P91.17, and P19.11 for reference). (1) When P91.08=1, in constant power speed boost mode, if the constant power speed limit frequency is lower than or equal to the frequency upper limit P00.04, the VFD runs at the constant power speed limit frequency. At the same time, if the set frequency is higher than or equal to the constant power speed limit frequency, the speed is limited at constant power; if the set frequency is lower than the constant power speed limit frequency, the speed boosts. (2) When P91.08=2, in constant power speed limit mode, if the constant power speed limit frequency is lower than or equal to the frequency upper limit P00.04: if the set frequency is higher than or equal to the constant power speed limit frequency, the speed is limited at constant power; if the set frequency is lower than the constant power speed limit frequency, the set frequency is used for running. For example, when P00.03=100Hz,	100.0%	○

Function code	Name	Description	Default value	Modify
		P91.16=90.0%, and motor rated frequency=50.00Hz: If the detected load value during motor upward running is 30.0%, the limited frequency=150Hz(90.0%*50.00Hz/30.0%), the calculated limited frequency is higher than P00.03. If P91.08=1, the set frequency P00.03 is used for running. If P91.08=2, the constant power speed limit frequency does not work, and the set frequency is used for running. If the detected load value during motor upward running is 60.0%, the limited frequency =75Hz(90.0%*50.00Hz/60.0%), the heavy load speed limit function works. The upward max. output frequency is limited to 75Hz. If P91.08=1, the frequency 75Hz is used for running. If P91.08=2, the max. running frequency is 75Hz, and the set frequency is used for running. The similar calculation method is applicable to motor downward running, only replacing P91.16 with P91.17. Note: During open/closed loop switchover (there is difference in load detection value), adjust P91.16 and P91.17, and the heavy load speed limit frequency cannot be lower than the heavy load speed limit detection frequency P91.14. P91.16, P91.17 setting range: 30.0%–120.0% (of the motor rated power)		
P91.18	Stepped speed limit upward running load limit T1		70.0%	○
P91.19	Stepped speed limit upward running		50.00Hz	○

Function code	Name	Description	Default value	Modify
	restricted frequency f1	When the stepped speed limit mode is used, the limit parameters for upward running and for downward running are set separately and can be adjusted according to the actual situation. When the detected load (open-loop output current or closed-loop output torque) exceeds the limited value, the running frequency must be lower than the set restricted frequency. For example, during motor upward running, when the detected load is greater than P91.18, the frequency is restricted to P91.19 (or when the set frequency is less than P91.19, the running frequency is the set frequency). When the detected load is greater than P91.20 (but less than P91.18), the frequency is restricted to P91.21. The detected load values in open/closed loop state have deviation. During the open/closed loop switchover process, the load limit value can be adjusted through P91.24. P91.24 is valid for P91.18, P91.20, and P91.22. For example, when the same load is carried upward and tested, if P94.01=50.0% in closed-loop state and P94.01=55.0% in open-loop state, there is a difference of 5%. In the actual use, after setting closed-loop parameters, if you need to switch to the open-loop state, you only need to set P91.24 to 5.0% (0 in closed-loop state), and you do not need to modify P91.18, P91.20, and P91.22. The situation of downward running is similar and therefore you only need to set parameters related to downward running. Note: The heavy load speed limit frequency cannot be lower than P91.14. P91.18, P91.20, P91.22, P91.26, P91.28, P91.30 setting range: 0.0%–150.0% (Open-loop output current is relative to the motor rated current, while		
P91.20	Stepped speed limit upward running load limit T2		45.0%	○
P91.21	Stepped speed limit upward running restricted frequency f2		75.00Hz	○
P91.22	Stepped speed limit upward running load limit T3		25.0%	○
P91.23	Stepped speed limit upward running restricted frequency f3		100.00Hz	○
P91.24	Stepped speed limit upward running load limit adjusted gain		0.0%	○
P91.25	Stepped speed limit downward running torque limit adjusted gain		0.0%	○
P91.26	Stepped speed limit downward running load limit T1		55.0%	○
P91.27	Stepped speed limit downward running		50.00Hz	○

Function code	Name	Description	Default value	Modify
	restricted frequency f1	closed-loop output torque is relative to the motor rated torque.)		
P91.28	Stepped speed limit downward running load limit T2	P91.19, P91.21, P91.23, P91.27, P91.29, P91.31 setting range: 0.00– P00.04 P91.24, P91.25 setting range: -20.0%–20.0% (Open-loop output current is relative to the motor rated current, while closed-loop output torque is relative to the motor rated torque.)	48.0%	○
P91.29	Stepped speed limit downward running restricted frequency f2		75.00Hz	○
P91.30	Stepped speed limit downward running load limit T3		25.0%	○
P91.31	Stepped speed limit downward running restricted frequency f3		100.00Hz	○
P91.32	Enabling frequency derating with voltage	Frequency derating with voltage indicates that the VFD can automatically decrease the output frequency to maintain torque output in case of low line or bus voltage.	1	◎
P91.33	Starting voltage of derating frequency with voltage	 The following assumes that the target frequency is set as the rated frequency.	85.0%	○

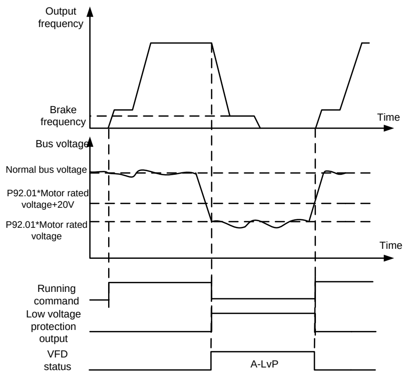
Function code	Name	Description	Default value	Modify
		When P91.32=1, if the bus voltage is less than the starting frequency (Standard bus voltage*P91.33), output frequency starts decrease, the regulated target frequency is (Rated frequency*Present bus voltage/Standard bus voltage); if the bus voltage increases but it does not reach the restoration voltage (Standard bus voltage*(P91.33+5%), the output frequency remains unchanged; if the bus voltage continuously decreases, the output frequency continuously decreases; if the bus voltage rises and becomes greater than the restoration voltage, the output frequency increases to the rated frequency. P91.32 setting range: 0: Disable 1: Enable P91.33 setting range: 70.0%–95.0% (Standard bus voltage 537V)		
P91.34	DEC position limit mode	0–1 0: Single direction limit 1: Bi-directional limit  Single direction limit: When the upward DEC limit position is reached, the upward slow speed area is entered, the VFD runs at P91.35 and stops at sudden if the upward limit position is reached; the upward speed is restricted, but the downward speed is not restricted. Downward DEC position limit uses the similar rule. (Terminal command mode)	0	◎

Function code	Name	Description	Default value	Modify
P91.35	DEC position limit restricted frequency	0.00–20.00Hz	10.00Hz	○
P91.36	Function selection under set frequency fault	0–3 0: Invalid 1: When Set frequency before brake release < Brake release frequency, the VFD reports A-SSF alarm. When Set frequency after brake release < Brake closing frequency, the VFD reports A-rSF, the brake closes and the VFD runs at the set frequency. 2: Set frequency before brake release < Brake release frequency, the VFD reports A-SSF. When Set frequency after brake release < Brake closing frequency, the VFD reports A-rSF, the brake closes and the VFD stops. 3: When Set frequency before brake release < Brake release frequency, the VFD reports A-SSF. When Set frequency after brake release < Brake closing frequency, the VFD reports SFE fault.	2	◎
P91.37	Enabling tower crane rotating turbulence control by HDO	0–1 0: HDO keeps the same function as specified by P06.00 1: HDO is used as PWM signal P91.37=1: Enable the tower crane rotating turbulence control. HDO connects to the PWM input of the turbulence module. You can enable the output voltage of the turbulence module to change with the frequency by setting P91.38–P91.47.	0	◎
P91.38	f0 frequency point	 Duty cycle and multi-step frequency regulation are used.	50.00Hz	○
P91.39	Duty cycle corresponding to f0 frequency point		100.0%	○
P91.40	f1 frequency point		40.00Hz	○
P91.41	Duty cycle		80.0%	○

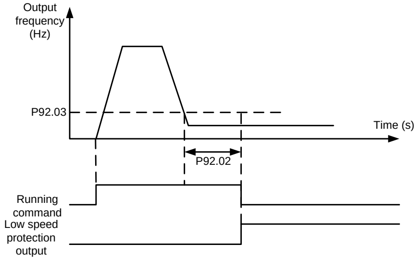
Function code	Name	Description	Default value	Modify
	corresponding to f1 frequency point	P91.38 setting range: P91.40–P00.03 (Max. output frequency) P91.40 setting range: P91.42– P91.38 P91.42 setting range: P91.44– P91.40 P91.44 setting range: P91.46– P91.42 P91.46 setting range: 0.00Hz–P91.44 P91.39, P91.41, P91.43, P91.47 setting range: 0.0%–100.0% **Note:** The duty ratio and frequency segmenting are used for regulation.		
P91.42	f2 frequency point		20.00Hz	○
P91.43	Duty cycle corresponding to f2 frequency point		40.0%	○
P91.44	f3 frequency point		10.00Hz	○
P91.45	Duty cycle corresponding to f3 frequency point		20.0%	○
P91.46	f4 frequency point		0.00Hz	○
P91.47	Duty cycle corresponding to f4 frequency point		0.0%	○
P91.48	HDO carrier frequency	0.5–10.0kHz	1.0kHz	○
P91.49	HDO closing delay during stop	0–100.0s	5.0s	○
P91.50	Pre torque input signal source	0–4 0: Invalid 1: AI1 2: AI2 3: Modbus 4: Internally given	0	○
P91.51	Pre torque offset	In closed-loop mode: Setting pre torque is to output the torque corresponding to load weight in advance so as to reduce the start impact and prevent reserve driving or slip during start. Setting P91.51 is to eliminate the impact of mechanical counterweight for lifting; pre torque compensation is directly performed if there is no mechanical counterweight. Pre torque compensation quantity = K*(P91.50–P91.51), in which K= P91.52 when the	0.0%	○
P91.52	Drive-side gain		1.000	○
P91.53	Braking-side gain		1.000	○

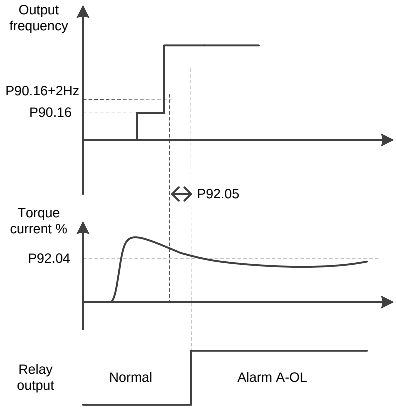
Function code	Name	Description	Default value	Modify
		motor is in electromotive state and K= P91.53 when the motor is in power generation (braking) state. P91.51 setting range: -100.0–100.0% P91.52, P91.53 setting range: 0.000–7.000		
P91.54	Pre torque direction	0–1 0: Forward 1: Reverse	0	○

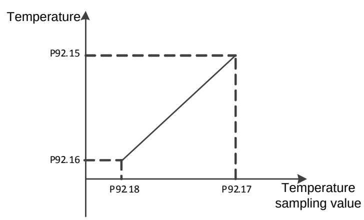
7.2.31 P92 Hoisting protection function group 3

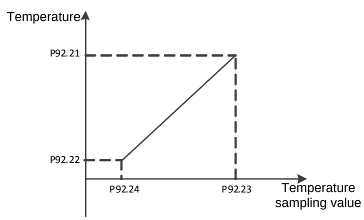
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P92.00</td><td>Enabling low voltage protection</td><td rowspan="2">

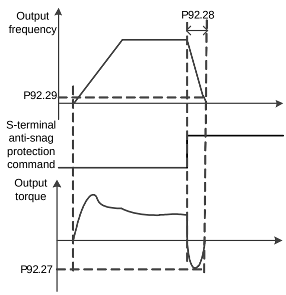
When P92.00=1, if the bus voltage is less than (P92.01*Motor rated voltage), low voltage protection is started, the VFD decelerates to stop. If the bus voltage restores to a value greater than (P92.01*Motor rated voltage)+20V, low voltage protection is automatically disabled.
P92.00 setting range:
0: Disable
1: Enable
P92.01 setting range: 1.00–1.30</td><td>0</td><td>◎</td></tr>
<tr><td>P92.01</td><td>Low voltage protection point</td><td>1.05</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P92.02	Low-speed running protection time	Low-speed running protection is applied to devices to which long-time low speed running is not applicable, preventing overheating caused by late dissipation.  When P92.02 is a non-zero value, low-speed running protection is enabled, if the running frequency of the VFD is equal to or less than P92.03, and the last time is equal to or greater than P92.02, the VFD reports a low-speed running protection fault (LSP). P92.02 setting range: 0.000–50.000s P92.03 setting range: 0.00–20.00Hz	0.000s	◎
P92.03	Setting of low-speed running frequency		5.00Hz	○
P92.04	Overload protection current detection value	When P92.04>0, overload protection is enabled, if the ramp frequency is equal to or greater than (P90.16+2.00Hz) during upward running, the VFD starts checking the current (closed-loop torque current or open-closed output current). If the current is equal to or greater than P92.04, the VFD reports the overload protection alarm after the detection time reaches P92.05. This restriction is not applicable to downward running.	0.0%	◎
P92.05	Overload detection time		0.5s	○

Function code	Name	Description	Default value	Modify
		 P92.04 setting range: 0.0–150.0% (relative to the motor rated torque in closed-loop state; relative to the motor rated current in open-loop state; 0 indicates disabling) P92.05 setting range: 0.0–5.0s		
P92.06	Brake detection reminding interval	When P92.06>0, the brake detection reminding function is enabled, if the accumulative running time of the VFD is equal to or greater than P92.06, the signal indicator is controlled through relay output signal or braking detection is reminded through the buzzer. The reminding hold time is specified by P92.07. After the time elapsed, reminding is not performed until re-power on. P92.06 setting range: 0.0–1000.0h P92.07 setting range: 0–100min	0.0	◎
P92.07	Brake detection reminding hold time		5	○
P92.08	Brake detection torque setting	In open-loop control: Set a fixed torque and frequency and run the VFD. Through visual inspection, if the brake is not opened within the detection time, braking is normal. Otherwise, braking is abnormal. In closed-loop control: When the braking force detection terminal enabling signal is valid, the VFD keeps the brake closed, if a running command is	150.0%	○
P92.09	Brake detection frequency setting		5.00Hz	○
P92.10	Brake detection time setting		5.0s	○
P92.11	Brake detection		500	○

Function code	Name	Description	Default value	Modify
	judging pulse threshold (closed-loop)	input, the VFD runs with P92.08 at P92.09 and detects the encoder pulse count. If the detected encoder pulse count exceeds P92.11 within P92.10, it is considered that braking force is insufficient and slip risk may exist. Then the multifunction output terminal outputs brake failure signal and the brake slip fault and outputs the brake failure fault (bE). P92.08 setting range: 0.0%–180.0% (of the motor rated torque) P92.09 setting range: 0.00Hz–20.00Hz P92.10 setting range: 0.0s–30.0s P92.11 setting range: 0–20000		
P92.12	Enabling PT100/PT1000 temperature detection	0x00–0x11 Ones place: whether to enable PT100 temperature detection 0: Disable 1: Enable Tens place: whether to enable PT1000 temperature detection 0: Disable 1: Enable	0x00	◎
P92.13	PT100 overtemperature protection point	0.0–150.0°C	120.0°C	○
P92.14	PT100 overtemperature alarm point	0.0–150.0°C	100.0°C	○
P92.15	PT100 calibration temperature upper limit		120.0°C	○
P92.16	PT100 calibration temperature lower limit		10.0°C	○
P92.17	Digital of PT100 calibration upper limit	To enable PT100 temperature detection, perform	2950	○

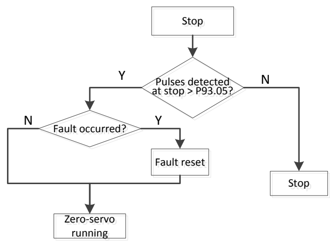
Function code	Name	Description	Default value	Modify
P92.18	Digital of PT100 calibration lower limit	calibration first: Step 1. Select two temperature points as the calibration temperature upper and lower limits. Step 2. Test the sampling values of the resistance values corresponding to the two calibration temperature points and use the sampling values as the calibration temperature upper and lower limit digitals (after calibration temperature points are set, digitals can be directly transferred after the enabling is performed by setting P92.26). PT1000 temperature calibration uses the same rule. P92.15 setting range: 50.0–150.0°C P92.16 setting range: -20.0–50.0°C P92.17, P92.18 setting range: 0–4096 **Note:** If the temperature measurement range is from -20°C to 150.0°C, it is recommended that 10°C and 120°C be used as the calibration temperature points.	1270	○
P92.19	PT1000 overtemperature protection point	0.0–150.0°C	120.0°C	○
P92.20	PT1000 overtemperature alarm point	0.0–150.0°C	100.0°C	○
P92.21	PT1000 calibration temperature upper limit		120.0°C	○
P92.22	PT1000 calibration temperature lower limit		10.0°C	○
P92.23	Digital of PT1000 calibration upper limit	P92.21 setting range: 50.0–150.0°C P92.22 setting range: -20.0–50.0°C	3100	○
P92.24	Digital of PT1000 calibration lower	P92.23, P92.24 setting range: 0–4096	1100	○

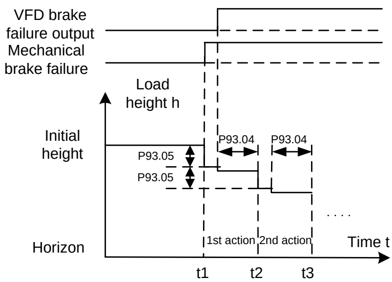
Function code	Name	Description	Default value	Modify
	limit			
P92.25	Enabling PT100/PT1000 disconnection detection	0x00–0x11 Ones place: PT100 disconnection detection 0: Disable 1: Enable Tens place: PT1000 disconnection detection 0: Disable 1: Enable	0x00	○
P92.26	Enabling digital of PT100/PT1000 calibration temperature	0–4 0: Invalid 1: Enable PT100 calibration lower limit digital 2: Enable PT100 calibration upper limit digital 3: Enable PT1000 calibration lower limit digital 4: Enable PT1000 calibration upper limit digital For example: When P92.26=1, P94.09 is transferred to P92.18, and P92.26=0.	0	○
P92.27	Anti-snag protection braking torque		0.0%	○
P92.28	Braking torque ACC/DEC time		0.200s	○
P92.29	Braking torque end frequency	Anti-snag indicates that the VFD outputs reserve torque so that the motor can stop at the fastest speed. A smaller value of P92.28 indicates a faster braking speed. When the motor decelerates to P92.29, the VFD stops. P92.27 setting range: 0.0–300.0% (of the motor rated current) P92.28 setting range: 0.000–10.000s P92.29 setting range: 0.00–30.00Hz	0.10Hz	○
P92.30	Enabling set	0–1	0	◎

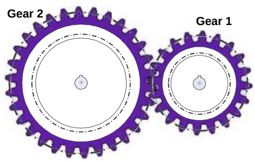
Function code	Name	Description	Default value	Modify
	frequency protection	0: Disable 1: Enable After the function is enabled, if the brake is opened, detection protection is performed. When the set frequency is equal to or lower than the value of P92.31, a fault is reported (the frequency setting fault SFE is reported after the speed is decreased if the speed is high); if the brake is closed, no detection is performed.		
P92.31	Set frequency fault protection threshold	0.00–10.00Hz	2.00Hz	◎
P92.32	Current imbalance multiple	0.0–5.5 When the value is not zero, current imbalance detection is enabled. When the 3PH current max. value divided by the min. value is greater than this multiple, the Cuu fault is reported.	0.0	◎
P92.33	PTC overtemperature protection selection	0–1 0: The PTC function is valid through terminal selection, the PTC overtemperature alarm A-Ptc is reported, but the machine still runs properly. 1: The PTC function is valid through terminal selection, the PTC overtemperature fault PtcE is reported, but the machine stops.	0	◎

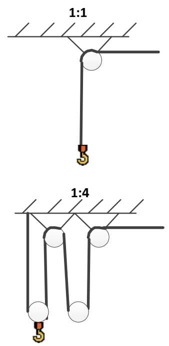
7.2.32 P93 Hoisting closed-loop functions

Function code	Name	Description	Default value	Modify
P93.00	Brake slip speed threshold	1.00–5.00Hz	1.00Hz	○
P93.01	Brake slip fault delay	0.000–5.000s The value 0 indicates brake slip is not detected, while a non-zero value indicates brake slip is detected. If the feedback frequency is greater than the value of P93.00, which lasts the time specified	0.500s	○

Function code	Name	Description	Default value	Modify
		by P93.01, the brake failure fault (bE) is reported. For details, see the torque verifying and brake slip descriptions in the brake function commissioning section.		
P93.02	Zero servo protection mode	The zero servo function is applied in the closed-loop vector control mode. When P93.02=1, the zero servo input slows down, the load is slowly put on the ground in zero servo state. When P93.02=2, the motor is locked to the stopped state, which indicates that the VFD keeps the motor in the position where the motor stops even if external force is applied to the motor. 0–2 0: Disable zero servo 1: Zero servo input slows down 2: Zero servo input is always valid (keep running at zero speed)  **Note:** • When certain faults (that cannot be reset, such as VFD internal hardware damage) occurred, the zero servo state cannot be entered. When other faults (that can be reset) occurred, the zero servo state can be entered when the zero servo condition is met. • Every time the zero servo state is exited, torque verification is not performed for the first given running command, but it is performed for the later given running commands.	0	○
P93.03	Brake failure	(1) When P93.02=1:	4.00Hz	○

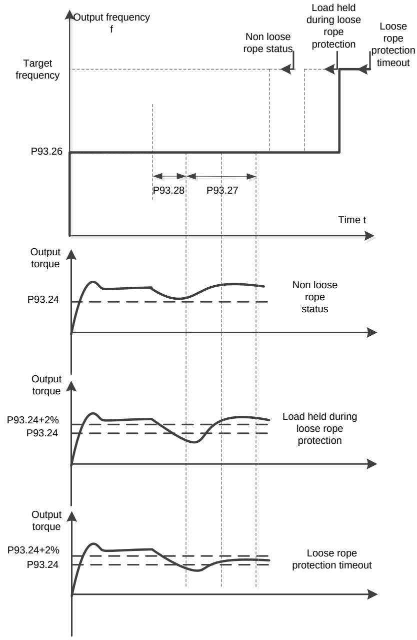
Function code	Name	Description	Default value	Modify
	protection frequency			
P93.04	Slow lowering hold time		2.0s	○
P93.05	Zero servo tolerance pulse threshold	Zero servo is used in closed-loop vector control to check whether the pulse count at stop is greater than the threshold P93.05. If the threshold is exceeded, a brake failure alarm is reported. The output can be set through relay. After the time P93.06 (if the pulse count is greater than triple of P93.05, the delay P93.06 is directly skipped), if the option " Zero servo input slows down" is selected, the VFD runs downward slowly at the frequency P93.03 and coasts to stop within the time P93.04. Then the VFD performs inspection again. (2) When P93.02=2: Zero servo input is always valid (keeping running at zero speed). P93.03 setting range: P90.17 (Reverse brake release frequency)–8.00Hz P93.04 setting range: 0.0s–30.0s P93.05 setting range: 0–20000	20000	○
P93.06	Brake failure alarm protection input delay	0–20.000s	1.000s	○
P93.07	Brake failure alarm protection reset method	0–1 0: Only for downward running 1: Both for upward and downward running	1	◎
P93.08	Enabling height measuring	0–1 0: Disable 1: Enable internal measuring (motor encoder) 2: Enable external measuring (HDI)	0	◎

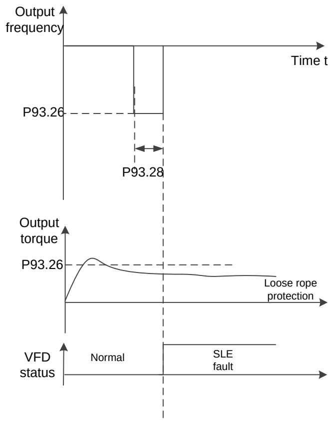
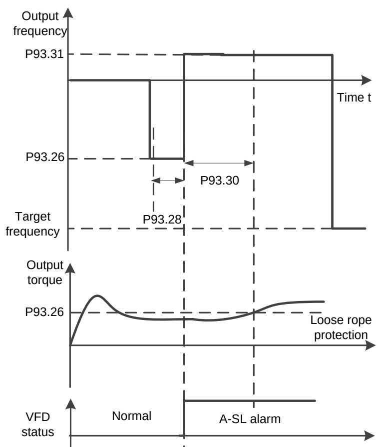
Function code	Name	Description	Default value	Modify
		Note: When P93.08=2 and P20.15=0, HDI is used to measure heights.		
P93.09	Mechanical transmission ratio	For internal measurement (motor encoder), the encoder is mounted on the motor shaft, and P93.09 is the reduction ratio between the motor shaft and drum shaft. For external measurement (HDI), P93.09 is the reduction ratio between the encoder mounting shaft and pulley shaft. If the encoder is mounted on the pulley, set P93.09=1. For example, for gear speed reduction, Mechanical transmission ratio = (Number of teeth in gear 2)/(Number of teeth in gear 1)  Setting range: 0.01–300.00	10.00	○
P93.10	Suspension ratio	1–4 1: 1:1 2: 1:2 3: Reserved 4: 1:4 Example: Suspension ratio	1	◎

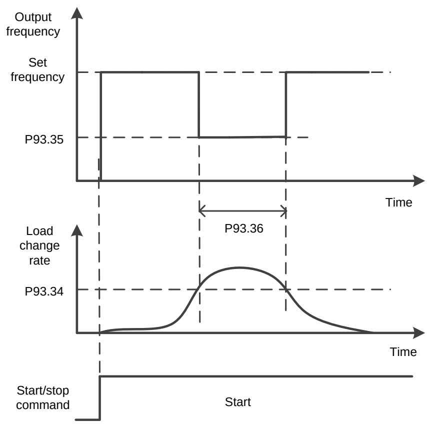
Function code	Name	Description	Default value	Modify
		**Note:** The suspension ratio is related to the pulley through which the steel rope goes.		
P93.11	Rope length compensation	Rope length to compensate the distance from the center of gravity of the weight to the hook. 0.00m–50.00m	0.00m	○
P93.12	Cable diameter	(1) To measure heights correctly in closed-loop mode, the actual running distance of the motor is calculated by using the encoder pulse count. Before first running, the upward limit position must be calibrated. Do as follows: Set the upward limit position terminal, for example, P05.05=64. Then the HDI terminal functions as the upward limit position input. If internal measurement (motor encoder) is enabled, set P93.08=1. Start the tower crane to run upward and stop at the upward limit position. Record the values of P93.14 and P93.15. (2) In open/closed loop mode, if external measurement (HDI) is enabled, set P93.08=2. Start the tower crane to run upward and stop at the upward limit position. P93.12 setting range: 0.1–100.0mm P93.13 setting range: 1–200 P93.14 setting range: 0–P93.13 (Winding turns of	10.0	○
P93.13	Per-layer turns of drum winding		30	○
P93.14	Initial turns of drum winding		0	○
P93.15	Initial diameter of drum/pulley diameter		600.0	◎

Function code	Name	Description	Default value	Modify
		the outermost layer in upward limit) P93.15 setting range: 100.0–2000.0mm (Max. drum diameter in upward limit, including cable thickness) P94.05 setting range: 0.00–655.35m (hook lowering distance) P94.06, P94.07 setting range: 0–65535		
P93.16	Enabling upward/downward limit position check	0x00–0x11 Ones place: 0: The upward limit position is not reached. 1: The upward limit position is reached. Tens place: 0: The downward limit position is not reached. 1: The downward limit position is reached. For example, when the upward/downward limit position needs to be set manually, you can enable the check of whether the upward/downward limit position is reached. P93.17 displays the height from the downward limit position to the upward limit position, P93.18 displays the height using the downward limit position as the reference point (the height is 0 at the downward limit position, the height is positive when it is above the downward limit position, the height is negative when it is under the downward limit position), and P94.05 displays the height using the upward limit position as the reference point (the height is 0 at the upward limit position, and only downward running is allowed when the upward limit position is reached, and P94.05 indicates the rope droop length when the upward limit position is not reached).	0x00	○
P93.17	Total height measured	0.00–655.35m (Total height measured from the upward limit position to the downward limit position)	0.00m	●
P93.18	Measured height 1	-50.00m–655.35m (The downward limit position is used as the	0.00m	●

Function code	Name	Description	Default value	Modify
		reference point, during downward limit, P93.18=0.00m)		
P93.19	Loose rope autotuning	0: Invalid 1: Autotuning for upward 2: Autotuning for downward	0	◎
P93.20	Enabling loose rope protection	0–2 0: Disable 1: Enable 2: Enable stable lifting protection	0	◎
P93.21	Loose rope detection method	0–2 0: Set through torque 1: Set through torque autotuning 2: Set through external signal detection (AI1)	0	◎
P93.22	Upward fixed value of external loose rope signal	0.0–10.0V	0.0V	○
P93.23	Downward fixed value of external loose rope signal	0.0–10.0V	0.0V	○
P93.24	Torque setting for upward loose rope protection	After loose rope protection is enabled, loose rope detection is performed during hoist startup: When the hoist runs upward and reaches P93.26, torque detection is performed after the delay P93.28. If the detected status is non loose rope (Torque value > Loose rope torque P93.24 or P93.25 for downward running), normal ACC/DEC is performed. If the detected status is loose rope (Torque value <= Loose rope torque P93.24), the output frequency is restricted to P93.26 within P93.27. If load holding, (Torque value) > (Loose rope torque P93.24+2%), is detected within P93.27, normal ACC/DEC is performed from this time. If the time exceeds P93.27, normal ACC/DEC is performed from this time. P93.24 can be set with the reference to the autotuning result P93.33. Generally, the value of	5.0%	○
P93.25	Torque setting for downward loose rope protection		5.0%	○
P93.26	Loose rope protection maintenance frequency		15.00Hz	○
P93.27	Loose rope protection maintenance time		2.0s	○
P93.28	Loose rope detection delay		0.5s	○

Function code	Name	Description	Default value	Modify
		P93.24 can be the value of P93.33 added by 1%–2%.  P93.24, P93.25 setting range: 0.0–50.0% (rated torque) P93.26 setting range: 10.00Hz–P02.02 P93.27 setting range: 0.0–50.0s P93.28 setting range: 0.0–5.0s		
P93.29	Downward loose rope protection mode	P93_29 setting range: 0–1 During downward running, if the loose rope status occurs after the loose rope detection delay, the preset processing way is used. 0: Mode 1. The VFD reports the loose rope protection fault (SLE) and stops.	0	◎
P93.30	REV running time of downward loose rope mode 2		5.00s	○
P93.31	Frequency setting of downward loose rope mode		5.00Hz	○

Function code	Name	Description	Default value	Modify
	2	 1: Mode 2. The VFD outputs the loose rope protection alarm (A-SL), changes the direction, and runs upward at the frequency specified by P93.31, and the VFD runs downward only when the time specified by P93.30 is reached or the loose rope status disappears.  P93.30 setting range: 0–20.00s P93.31 setting range: 1.00Hz–10.00Hz		

Function code	Name	Description	Default value	Modify
		Note: P93.30 must be greater than the sum of the time taken to decelerate from P93.26 to 0Hz and the time taken to accelerate from 0Hz to P93.31.		
P93.32	Torque of upward loose rope autotuning	The autotuning procedure is as follows: Step 1 Put the hook on the ground and loosen the rope. Step 2 Set P93.19=1 (or P93.19=2 for downward running). Step 3 Push the operating lever to step-2 speed (higher than 10Hz), which is held at least 1s in the loose rope state after the frequency is stable (to autotune stable frequency torque). Step 4 Stop the device and check the autotuning result. If P93.32 (or P93.33 for downward running) is not 0, autotuning is successful. Otherwise, you have to perform autotuning again. P93.32, P93.33 setting range: 0.0–50.0%	0.0%	○
P93.33	Torque of downward loose rope autotuning		0.0%	○
P93.34	Stable lifting protection frequency	 When P93.20=2, indicating stable lifting protection is enabled, and the VFD has started, the VFD runs at the frequency specified by P93.35 if the lifting load change rate is greater than P93.34; the VFD runs at the set frequency if the lifting load change	30.0%/s	○
P93.35	Stable lifting torque change ratio protection point 1 (in ACC)		10.00HZ	○
P93.36	Stable lifting torque change ratio protection point 2 (in constant speed running)		2.0s	○

Function code	Name	Description	Default value	Modify
		rate is equal to or less than P93.34. P93.34 setting range: 0.0–100.0%/s P93.35 setting range: 0.00–50.00Hz P93.36 setting range: 0.00–10.0s **Note:** Stable lifting is valid only for upward running.		
P93.37	Stable lifting torque change ratio protection point 3 (exiting stable lifting)		10.0%/s	

8 Troubleshooting

8.1 What this chapter contains

The chapter tells how to reset faults and check faults history. A complete list of alarms and fault information as well as possible causes and corrective measures are presented in this chapter.

	✧ Only well-trained and qualified professionals are allowed to carry out the work described in this chapter. Operations should be carried out according to the instructions presented in Safety precautions.

8.2 Indications of alarms and faults

The fault is indicated by indicators. When TRIP indicator is on, the alarm or fault code displayed in the keypad indicates the VFD is in exception state. This chapter covers most of the alarms and faults, and their possible causes and corrective measures, if you cannot figure out the alarm or fault causes, contact local INVT office.

8.3 Fault reset

You can reset the VFD via STOP/RST key on the keypad, digital inputs, or by cutting off the VFD power. After faults are removed, the motor can be start again.

8.4 Fault history

P07.27–P07.32 record the six latest fault types; P07.33–P07.40, P07.41–P07.48, and P07.49–P07.56 record the running data of the VFD when the latest three faults occurred.

8.5 VFD faults and solutions

When fault occurred, process the fault as shown below.

1. When VFD fault occurred, confirm whether keypad display is improper? If yes, contact INVT;
2. If keypad works properly, check the function codes in P07 group to confirm the corresponding fault record parameters, and determine the real state when current fault occurred through parameters;
3. Check the table below to see whether corresponding exception states exist based on the corresponding corrective measures;
4. Rule out the faults or ask for help from professionals;
5. After confirming faults are removed, reset the fault and start running.

8.5.1 Details of faults and solutions

Fault code	Fault type	Possible cause	Corrective measure
OUt1	Inverter unit Phase-U protection	Acceleration is too fast;	Increase acceleration time;

Fault code	Fault type	Possible cause	Corrective measure
OUt2	Inverter unit Phase-V protection	IGBT module is damaged; Misacts caused by interference; drive wires are poorly connected; To-ground short circuit occurs	Replace the power unit; Check drive wires; Check whether there is strong interference surrounds the peripheral equipment
OUt3	Inverter unit Phase-W protection		
OV1	Over-voltage during acceleration	Exception occurred to input voltage; Large energy feedback; Lack of braking units; Dynamic brake is not enabled	Check input power; Check whether load deceleration time is too short; or the motor starts during rotating; Install dynamic braking units; Check the setup of related function codes
OV2	Over-voltage during deceleration		
OV3	Over-voltage during constant speed running		
OC1	Over-current during acceleration	Acceleration is too fast; Grid voltage is too low; VFD power is too small; Load transient or exception occurred; To-ground short circuit or output phase loss occur; Strong external interference sources; Overvoltage stall protection is not enabled	Increase acceleration /deceleration time; Check input power; Select the VFD with larger power; Check if the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth; Check the output wiring; Check if there is strong interference; Check the setup of related function codes.
OC2	Over-current during deceleration		
OC3	Over-current during constant speed running		
UV	Bus undervoltage fault	Grid voltage is too low; Overvoltage stall protection is not enabled	Check grid input power; Check the setup of related function codes

Fault code	Fault type	Possible cause	Corrective measure
OL1	Motor overload	Grid voltage is too low; Rated motor current is set improperly; Motor stall or load jumps violently	Check grid voltage; Reset rated motor current; Check the load and adjust torque boost
OL2	VFD overload	Acceleration is too fast; The motor in rotating is restarted; Grid voltage is too low; Load is too large; Power is too small;	Increase acceleration time; Avoid restart after stop; Check grid voltage; Select the VFD with larger power; Select proper motor
SPI	Phase loss on input side	Phase loss or violent fluctuation occurred to R, S and T input	Check the input power; Check installation wiring
SPO	Phase loss on output side	Phase loss occurred to U, V, W output (or the three phases of motor is asymmetrical)	Check the output wiring; Check the motor and cable
OH1	Overheat of rectifier module	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; Lower the ambient temperature
OH2	Overheat of inverter module		
EF	External fault	SI external fault input terminal acts	Check external device input
CE	485 communication fault	Baud rate is set improperly; Communication line fault; Communication address error; Communication suffers from	Set proper baud rate; Check the wiring of communication interfaces; Set proper communication address;

Fault code	Fault type	Possible cause	Corrective measure
		strong interference	Replace or change the wiring to enhance anti-interference capacity
ItE	Current detection fault	Poor contact of the connector of control board; Hall component is damaged; Exception occurred to amplification circuit	Check the connector and re-plug; Replace the hall component; Replace the main control board
tE	Motor autotuning fault	Motor capacity does not match with the VFD capacity, this fault may occur easily if the difference between them is exceeds five power classes; Motor parameter is set improperly; The parameters gained from autotuning deviate sharply from the standard parameters; Autotuning timeout	Change the VFD model, or adopt V/F mode for control; Set proper motor type and nameplate parameters; Empty the motor load and carry out autotuning again; Check motor wiring and parameter setup; Check whether upper limit frequency is larger than 2/3 of the rated frequency
EEP	EEPROM fault	R/W error occurred to the control parameters; EEPROM is damaged	Press STOP/RST to reset; Replace the main control board
PIDE	PID feedback offline fault	PID feedback offline; PID feedback source disappears;	Check PID feedback signal wires; Check PID feedback source
bCE	Braking unit fault	Brake circuit fault or brake tube is damaged; The resistance of external braking resistor is too small	Check the braking unit, replace with new brake tubes; Increase brake resistance

Fault code	Fault type	Possible cause	Corrective measure
END	Running time is up	The actual running time of the VFD is larger than the set running time	Ask help from the supplier, adjust the set running time
OL3	Electronic overload fault	The VFD releases overload pre-alarm based on the set value	Check the load and overload pre-alarm threshold
PCE	Keypad communication fault	The keypad wire is poorly contacted or disconnected; The keypad wire is too long and suffers strong interference; Circuit fault occurred to the keypad or communication part of the main board	Check the keypad wires to confirm whether fault exists; Check the surroundings to rule out interference source; Replace the hardware and ask for maintenance service
UPE	Parameter upload error	The keypad wire is poorly contacted or disconnected; The keypad wire is too long and suffers strong interference; Circuit fault occurred to the keypad or communication part of the main board	Check the surroundings to rule out interference source; Replace the hardware and ask for maintenance service; Replace the hardware and ask for maintenance service
DNE	Parameter download error	The keypad wire is poorly contacted or disconnected; The keypad wire is too long and suffers strong interference; Data storage error occurred to the keypad	Check the surroundings to rule out interference source; Replace the hardware and ask for maintenance service; Re-backup keypad data
ETH1	To-ground short circuit fault 1	VFD output is short connected to the ground; Current detection circuit is	Check whether motor wiring is proper;

Fault code	Fault type	Possible cause	Corrective measure
		faulty; Actual motor power setup deviates sharply from the VFD power	Replace the hall component; Replace the main control board; Reset the motor parameters properly
ETH2	To-ground short circuit fault 1	VFD output is short connected to ground; Current detection circuit is faulty; Actual motor power setup deviates sharply from the VFD power	Check whether motor wiring is proper; Replace the hall component; Replace the main control board; Reset the motor parameters properly
dEu	Speed deviation fault	Load is too heavy, or stall occurred	Check the load to ensure it is proper, increase the detection time; Check whether control parameters are set properly
STo	Maladjustment fault	Control parameters of synchronous motor is set improperly; The parameter gained from autotuning is inaccurate; The VFD is not connected to motor	Check the load to ensure it is proper, Check whether load is proper; Check whether control parameters are set correctly; Increase maladjustment detection time
LL	Electronic underload fault	The VFD performs underload pre-alarm based on the set value	Check the load and overload pre-alarm threshold
ENC1O	Encoder offline fault	Encoder line sequence is wrong, or signal wires are poorly connected	Check the encoder wiring

Fault code	Fault type	Possible cause	Corrective measure
ENC1D	Encoder reversal fault	The encoder speed signal is contrary to the motor running direction	Reset encoder direction
ENC1Z	Encoder Z pulse offline fault	Z signal wires are disconnected	Check the wiring of Z signal
OT	Motor over-temperature fault	Motor over-temperature input terminal is valid; Exception occurred to t temperature detection Exception occurred to resistor; Long-time overload running or exception occurred	Check the wiring of motor over-temperature input terminal (terminal function 57); Check whether temperature sensor is proper; Check the motor and perform maintenance on the motor
STO	Safe torque off	Safe torque off function is enabled by external forces	/
STL1	Exception occurred to safe circuit of channel H1	The wiring of STO is improper; Fault occurred to external switch of STO; Hardware fault occurred to safety circuit of channel H1	Check whether terminal wiring of STO is proper and firm enough; Check whether external switch of STO can work properly; Replace the control board
STL2	Exception occurred to channel H2 safe circuit	The wiring of STO is improper; Fault occurred to external switch of STO; Hardware fault occurred to safety circuit of channel H2	Check whether terminal wiring of STO is proper and firm enough; Check whether external switch of STO can work properly; Replace the control board
STL3	Exception occurred to channel H1 and channel H2	Hardware fault occurred to STO circuit	Replace the control board

Fault code	Fault type	Possible cause	Corrective measure
CrCE	Safety code FLASH CRC check fault	Control board is faulty	Replace the control board
E-Err	Repetitive extension card type	The two inserted extension cards are of the same type	You should not insert two cards with the same type; check the type of extension card, and remove one card after power down
ENCUV	Encoder UVW loss fault	No electric level variation occurred to UVW signal	Check the wiring of UVW; Encoder is damaged
F1-Er	Failed to identify the extension card in card slot 1	There is data transmission in interfaces of card slot 1, however, it cannot read the card type	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
F2-Er	Failed to identify the extension card in card slot 2	There is data transmission in interfaces of card slot 2, however, it cannot read the card type	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
F3-Er	Failed to identify the extension card in	There is data transmission in interfaces of card slot 3,	Confirm whether the extension card inserted can be supported;

Fault code	Fault type	Possible cause	Corrective measure
	card slot 3	however, it cannot read the card type	Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
C1-Er	Communication timeout occurred to the extension card in card slot 1	There is no data transmission in interfaces of card slot 1	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
C2-Er	Communication timeout occurred to the extension card in card slot 2	There is no data transmission in interfaces of card slot 2	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
C3-Er	Communication timeout occurred to the extension card in card slot 3	There is no data transmission in interfaces of card slot 3	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still

Fault code	Fault type	Possible cause	Corrective measure
			occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
E-DP	Profibus card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-NET	Ethernet card communication timeout fault	There is no data transmission between the communication card and the host computer	Check whether the communication card wiring is loose or dropped
E-CAN	CANopen card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-PN	Profinet card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-CAT	EtherCat card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-BAC	BACNet card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-DEV	DeviceNET card communication timeout fault	There is no data transmission between the communication card and the	Check whether the communication card wiring is loose or dropped

Fault code	Fault type	Possible cause	Corrective measure
		host computer (or PLC)	
ESCAN	Can master/slave communication card communication timeout fault	There is no data transmission between the CAN master and slave communication cards	Check whether the communication card wiring is loose or dropped
S-Err	Master-slave synchronous CAN slave fault	Fault occurred to one of the CAN slave VFDs	Detect the CAN slave VFD and analyze the corresponding fault cause of the VFD
dIS	Failure to enable the VFD	The input terminal selects VFD enabling, but the terminal signal is invalid.	Check the input terminal setting and terminal signal.
tbE	Contactor feedback fault	The contactor feedback circuit is disconnected or in poor contact. The contactor feedback detection time is too short.	Check the contactor feedback circuit. Increase the detection time P91.05 to a proper value.
FAE	Brake feedback fault	The brake feedback circuit is disconnected or in poor contact. The brake feedback detection time is too short.	Check the brake feedback circuit. Increase the detection time P90.32 to a proper value.
tPF	Torque verification fault	The torque verification current, moment force setting, and torque verification fault detection time are set improperly.	Set the torque verification current, moment force setting, and torque verification fault detection time P90.30 properly.
StC	Operating lever zero-position fault	The operating lever does not return to the zero position. The operating lever zero-position signal is adhered.	Put the operating lever to the zero position. Check out the operating lever zero-position signal.
LSP	Low-speed running protection fault	The running speed is too low.	Check whether the running speed is continuously lower than P92.03.
tCE	Terminal command	The terminal gives both the	Check the input terminal signal.

Fault code	Fault type	Possible cause	Corrective measure
	exception	upward and downward commands at the same time.	
POE	Terminal command exception at power-on	The terminal command is detected at power-on.	Check whether P01.18 is set to enable the VFD reports a fault when a terminal command is valid at power-on. Check the input terminal signal.
SLE	Loose rope protection fault	The hook rope is abnormal. The downward loose rope parameter setting is improper.	Check whether the hook rope is normal. Check whether the downward loose rope detection torque is proper.
bE	Brake failure	The brake force is insufficient. The brake detection parameter setting is improper.	Check whether the brake is normal. Check whether the brake slip parameter setting is proper.
ELS	Master/salve position synchronization fault	The encoder pulse difference between the master and slave is too great. The pulse threshold setting is improper.	Check the encoders for the master and slave. Check whether the pulse threshold of the slave is too small.
AdE	Analog speed reference deviation fault	If the speed is given by analog, the analog voltage is greater than 1.0V after zero-position detection is complete.	Check the analog wiring and current voltage value.
OtE1	PT100 overtemperature fault	The current environment temperature is too high. PT100 detection circuit is abnormal. PT100 overtemperature protection setting is improper.	Check the current environment temperature. Check PT100 circuit. Check whether PT100 overtemperature protection point is too small.
OtE2	PT1000 overtemperature	The current environment temperature is too high.	Check the current environment temperature.

Fault code	Fault type	Possible cause	Corrective measure
	fault	PT1000 detection circuit is abnormal. PT1000 overtemperature protection setting is improper.	Check PT1000 circuit. Check whether PT1000 overtemperature protection point is too small.
SFE	Set frequency fault	The set frequency is too small.	Check whether the frequency reference is smaller than the set frequency protection point.
PtcE	PTC overtemperature fault	The current environment temperature is too high.	Check the current environment temperature.

8.5.2 VFD alarms and corrective measures

Alarm code	Alarm type	Possible cause	Corrective measure
A-SPI	Input phase loss alarm	During stop, a loss of either input phase R, S, or T occurs or fluctuation is great.	Check the input power source and wiring.
A-LU	Upward position limit alarm	The input terminal has set the upward limited position reaching function, and there is a signal reference to the terminal.	Check whether the allowed highest position point has been reached. Check the input terminal signal.
A-Ld	Downward position limit alarm	The input terminal has set the downward limited position reaching function, and there is a signal reference to the terminal.	Check whether the allowed lowest position point has been reached. Check the input terminal signal.
A-LvP	Low voltage alarm	The bus voltage is too low.	Check whether the voltage protection point is too high. Check whether the grid voltage or rectifier module is abnormal.
A-OL	Overload protection alarm	The load is too heavy. The overload protection parameter is set is improperly.	Check whether the load is too heavy. Check whether the overload protection point is too small.

Alarm code	Alarm type	Possible cause	Corrective measure
A-bS	Brake failure alarm	The brake force is insufficient. The encoder is abnormal. The zero servo detection parameter is set is improperly.	Check whether the brake works normally. Check whether the encoder works normally. Check whether the zero servo tolerance pulse threshold is too small.
A-FA	Brake feedback alarm	The brake feedback circuit is disconnected or in poor contact. The brake feedback detection time is too short.	Check the brake feedback circuit. Increase the detection time P90.32 to a proper value.
A-SL	Loose rope protection alarm	The hook rope is abnormal. The downward loose rope parameter setting is improper.	Check whether the hook rope is normal. Check whether the downward loose rope detection torque is proper.
A-Ot1	PT100 overtemperature alarm	The current environment temperature is too high. PT100 overtemperature protection setting is improper.	Check the current environment temperature. Check whether PT100 overtemperature protection point is too small.
A-Ot2	PT1000 overtemperature alarm	The current environment temperature is too high. PT1000 overtemperature alarm setting is improper.	Check the current environment temperature. Check whether PT1000 overtemperature protection point is too small.
A-Pt1	PT100 disconnection alarm	PT100 connection circuit is opened.	Check PT100 connection circuit.
A-Pt2	PT1000 disconnection alarm	PT1000 connection circuit is opened.	Check PT1000 connection circuit.
A-Ptc	PTC overtemperature alarm	The current environment temperature is too high.	Check the current environment temperature.

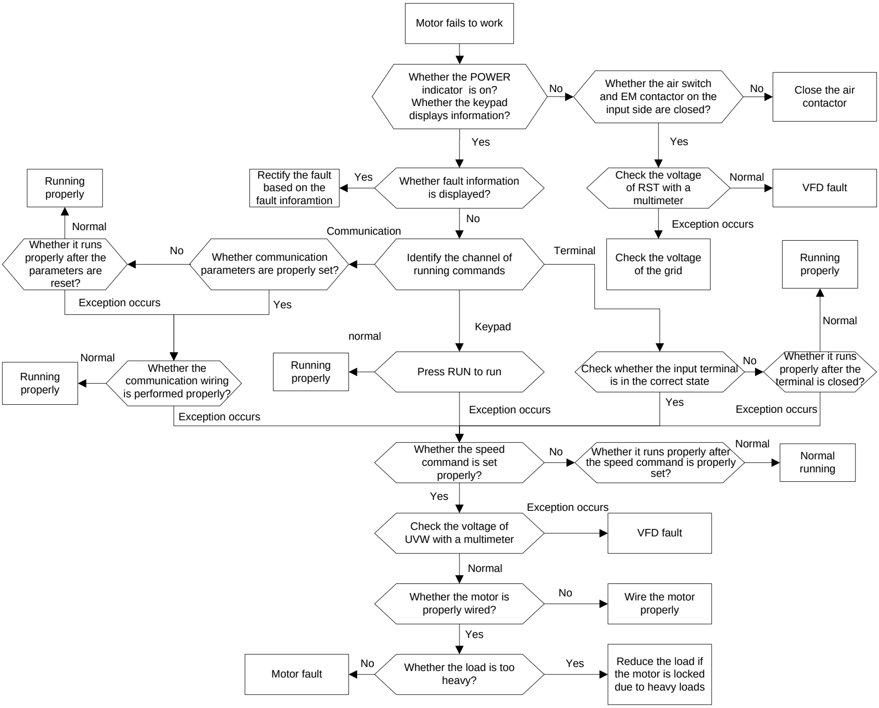
Note: After fault recovery, the corresponding alarm is automatically reset.

8.5.3 Other status

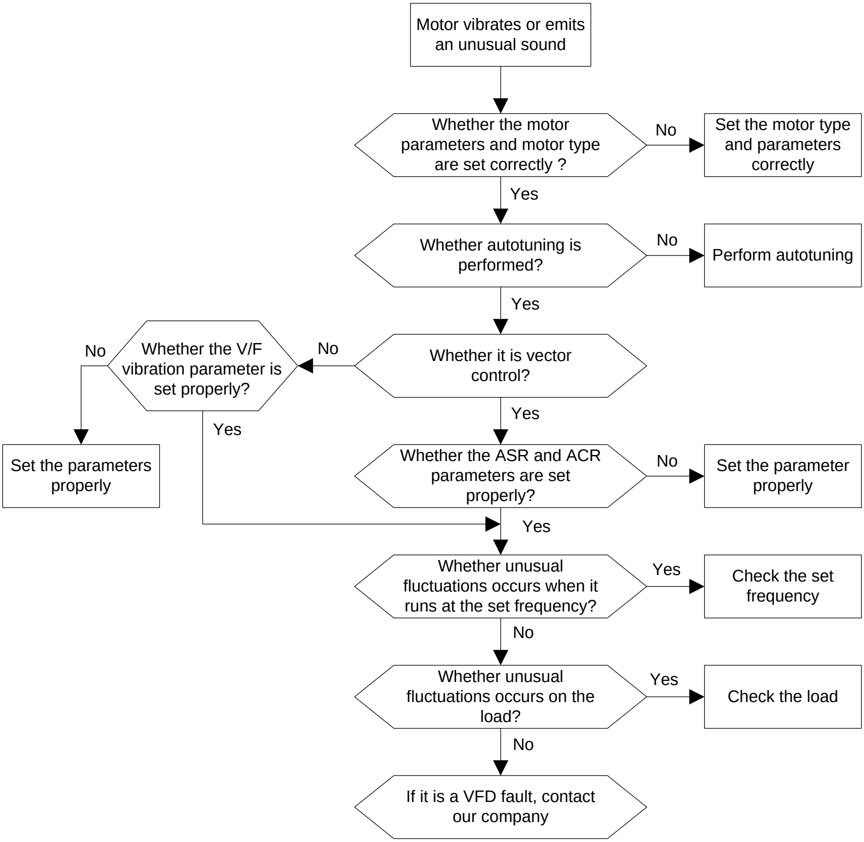
Display code	Status	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.

8.6 Analysis on common faults

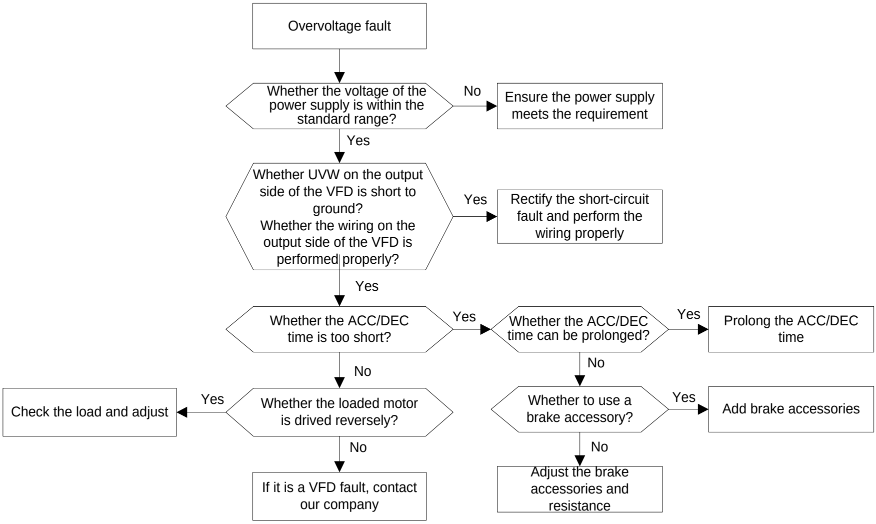
8.6.1 Motor fails to work



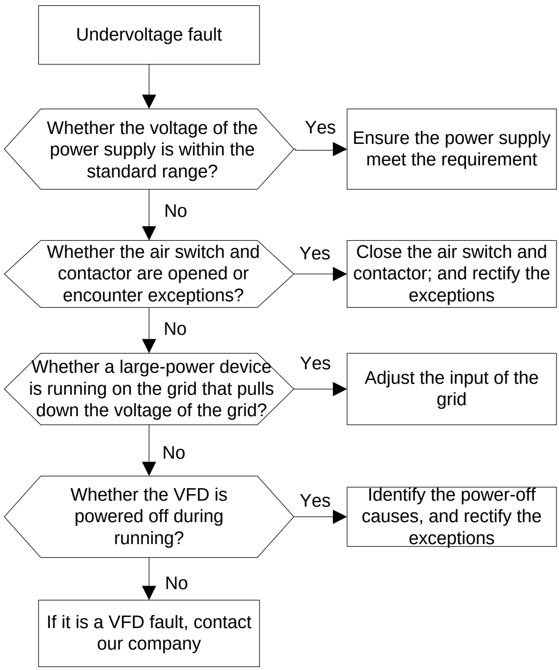
8.6.2 Motor vibrates



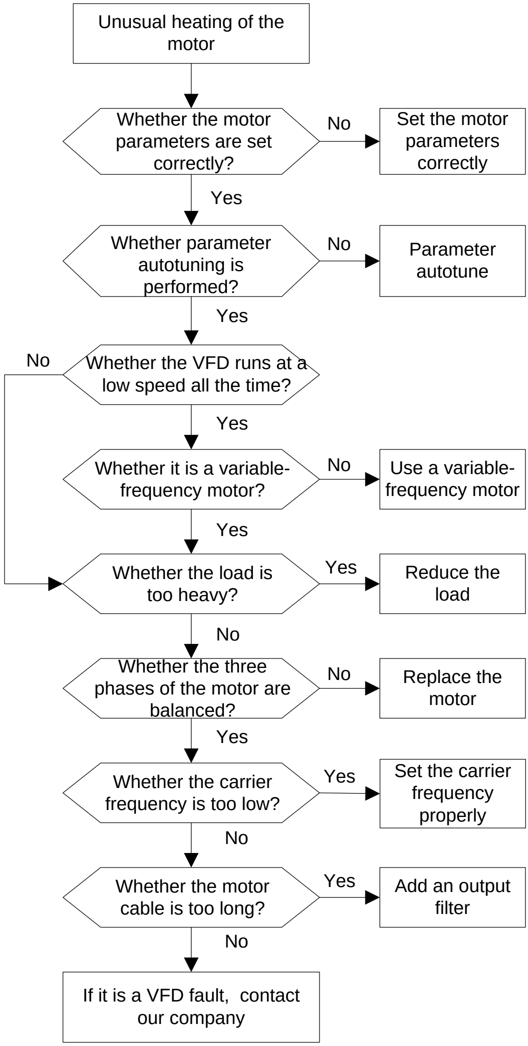
8.6.3 Overvoltage



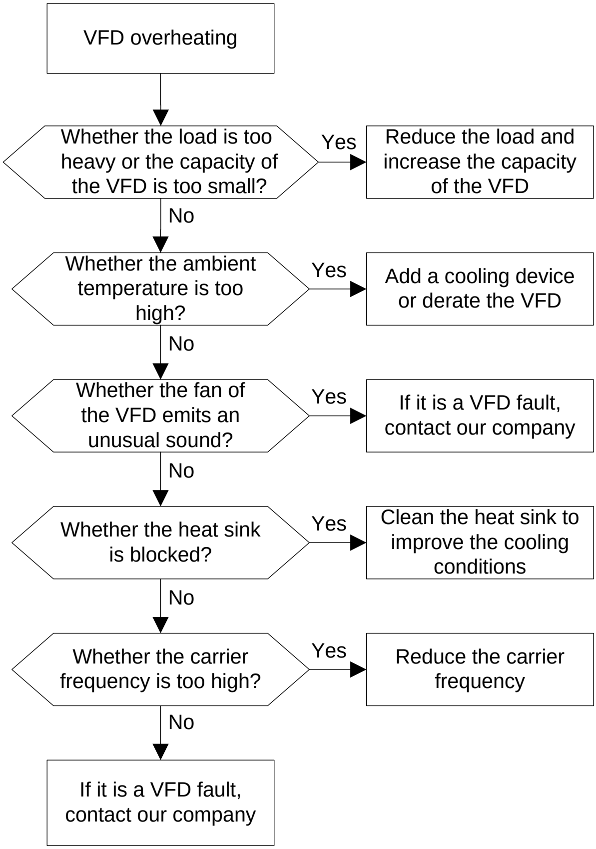
8.6.4 Undervoltage



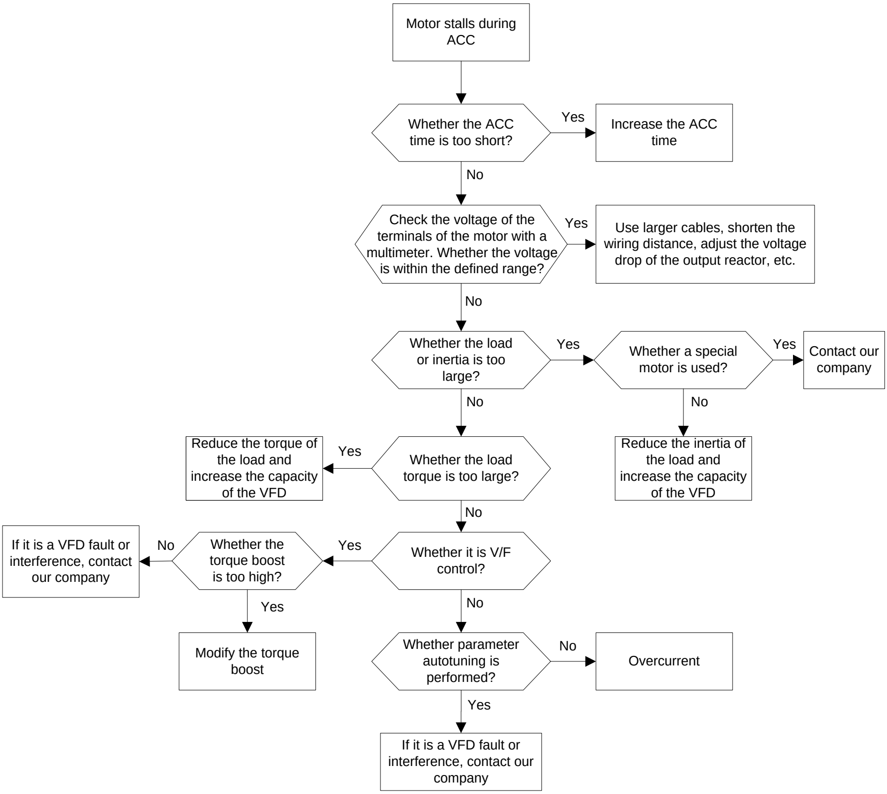
8.6.5 Unusual heating of motor



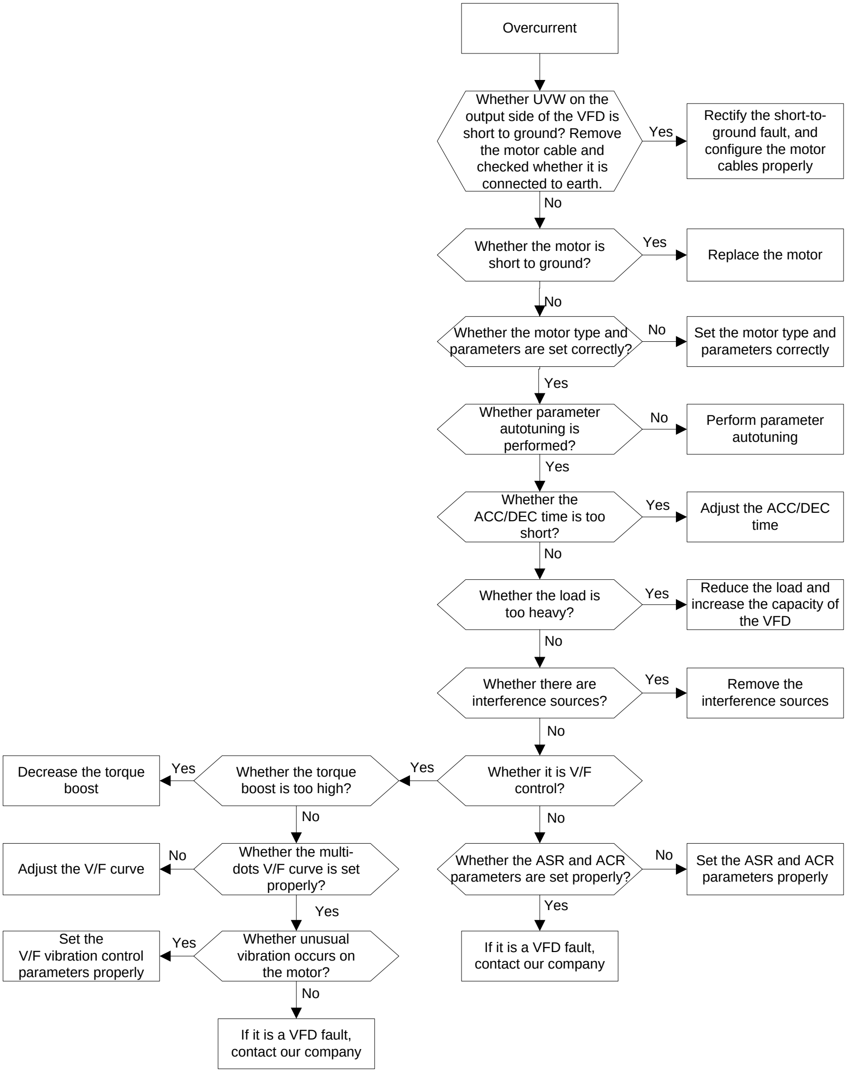
8.6.6 VFD overheating



8.6.7 Motor stalls during ACC



8.6.8 Overcurrent



8.7 Countermeasures on common interference

8.7.1 Interference on meter switches and sensors

Interference phenomenon

Pressure, temperature, displacement, and other signals of a sensor are collected and displayed by a human-machine interaction device. The values are incorrectly displayed as follows after the VFD is started:

1. The upper or lower limit is wrongly displayed, for example, 999 or -999.
2. The display of values jumps (usually occurring on pressure transmitters).
3. 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).
4. A signal collected by a sensor is not displayed but functions as a drive system running feedback signal. For example, a 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.
5. After a VFD is started, the display of all kinds of meters (such as frequency meter and current meter) that are connected to the analog output (AO) terminal of the VFD is severely affected, displaying the values incorrectly.
6. Proximity switches are used in the system. After a VFD is started, the indicator of a proximity switch flickers, and the output level flips.

Solution

1. Check and ensure that the feedback cable of the sensor is 20 cm or farther away from the motor cable.
2. 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).
3. Try to add a safety capacitor of 0.1 μF to the signal end of the feedback signal terminal of the sensor.
4. Try to add a safety capacitor of 0.1 μF to the power end of the sensor meter (pay attention to the voltage of the power supply and the voltage endurance of the capacitor).
5. For interference on meters connected to the AO terminal of a VFD, if AO uses current signals of 0 to 20 mA, add a capacitor of 0.47 μF between the AO and GND terminals; and if AO uses voltage signals of 0 to 10 V, add a capacitor of 0.1 μF between the AO and GND terminals.

Note:

1. 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.

2. If a large number of meters or sensors are disturbed. It is recommended that you configure an external C2 filter on the input power end of the VFD. For models of filters, see section D.8.

8.7.2 Interference on communication

Interference phenomenon

The interference described in this section on 485 communication mainly includes communication delay, out of sync, occasional power-off, or complete power-off that occurs after a VFD is started.

If the communication cannot be implemented properly, regardless of whether the VFD is running, the exception is not necessarily caused by interference. You can find out the causes as follows:

1. Check whether the 485 communication bus is disconnected or in poor contact.
2. Check whether the two ends of line A or B are connected reversely.
3. Check whether the communication protocol (such as the baud rate, data bits, and check bit) of the VFD is consistent with that of the upper computer.

If you are sure that communication exceptions are caused by interference, you can resolve the problem through the following measures:

1. Simple inspection.
2. Arrange the communication cables and motor cables in different cable trays.
3. In multi-VFD application scenarios, adopt the chrysanthemum connection mode to connect the communication cables between VFDs, which can improve the anti-interference capability.
4. In multi-VFD application scenarios, check and ensure that the driving capacity of the master is sufficient.
5. In the connection of multiple VFDs, you need to configure one 120 Ω terminal resistor on each end.

Solution

1. 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).
2. Do not connect the VFD and motor to the same ground terminal as the upper computer. It is recommended that you connect the VFD and motor to the power ground, and connect the upper computer separately to a ground stud.
3. Try to short the signal reference ground terminal (GND) of the VFD with that of the upper

computer controller to ensure that ground potential of the communication chip on the control board of the VFD is consistent with that of the communication chip of the upper computer.

4. Try to short GND of the VFD to its ground terminal (PE).
5. Try to add a safety capacitor of 0.1 μF on the power terminal of the upper computer (PLC, HMI, and touch screen). During this process, pay attention to the voltage of the power supply and the voltage endurance capability of the capacitor. Alternatively, you can use a magnet ring (Fe-based nanocrystalline magnet rings are recommended). Put the power L/N line or +/- line of the upper computer through the magnet ring in the same direction and wind 8 coils around the magnet ring.

8.7.3 Failure to stop and indicator shimmering due to motor cable coupling

Interference phenomenon

1. 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 VFD.

2. Indicator shimmering

After a VFD is started, the relay indicator, power distribution box indicator, PLC indicator, and indication buzzer shimmers, blinks, or emits unusual sounds unexpectedly.

Solution

1. Check and ensure that the exception signal cable is arranged 20 cm or farther away from the motor cable.
2. Add a safety capacitor of 0.1 μF between the digital input terminal (S) and the COM terminal.
3. 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 connect S1 to S4 in parallel.

   Note: If the controller (such as PLC) in the system controls more than 5 VFDs at the same time through digital input terminals (S), this scheme is not available.

8.7.4 Leakage current and interference on RCD

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 misoperation of a RCD.

1. Rules for selecting RCDs

(1) VFD 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.

(2) 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 20 ms. For example, 1s, 0.5s, and 0.2s.

(3) 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, 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

2. Solution to RCD misoperation (handling the VFD)

1. Try to remove the jumper cap at "EMC/J10" on the middle casing of the VFD.
2. Try to reduce the carrier frequency to 1.5 kHz (P00.14=1.5).
3. Try to modify the modulation mode to "3PH modulation and 2PH modulation" (P8.40=0).

3. Solution to RCD misoperation (handling the system power distribution)

(1) Check and ensure that the power cable is not soaking in water.

(2) Check and ensure that the cables are not damaged or spliced.

(3) Check and ensure that no secondary grounding is performed on the neutral wire.

(4) Check and ensure that the main power cable terminal is in good contact with the air switch or contactor (all screws are tightened).

(5) Check 1PH powered devices, and ensure that no earth lines are used as neutral wires by these devices.

(6) Do not use shielded cables as VFD power cables and motor cables.

8.7.5 Live device chassis

Phenomenon

After a VFD is started, there is sensible voltage on the chassis, and you may feel an electric shock when touching the chassis. 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.

Solution

1. If there is power distribution grounding or ground stud on the site, ground the cabinet chassis of the drive system through the power ground or stud.
2. If there is no grounding on the site, you need to connect the motor chassis to the ground terminal PE of the VFD, and ensure that the jumper at "EMC/J10" on the middle casing of the VFD is shorted.

9 Maintenance

9.1 What this chapter contains

This chapter describes how to carry out preventive maintenance on Goodrive350-19 series VFDs.

9.2 Periodical inspection

Little maintenance is required when VFDs are installed in environments that meet requirements. The following table describes the routine maintenance periods recommended by INVT.

<table>
<tr><th colspan="2">Subject</th><th>Item</th><th>Method</th><th>Criterion</th></tr>
<tr><td colspan="2" rowspan="2">Ambient environment</td><td>Check the temperature, and humidity, and whether there is vibration, dust, gas, oil spray, and water droplets in the environment.</td><td>Visual inspection, and use instruments for measurement.</td><td>The requirements stated in this manual are met.</td></tr>
<tr><td>Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.</td><td>Visual inspection</td><td>There are no tools or dangerous substances placed nearby.</td></tr>
<tr><td colspan="2">Voltage</td><td>Check the voltage of the main circuit and control circuit.</td><td>Use multimeters or other instruments for measurement.</td><td>The requirements stated in this manual are met.</td></tr>
<tr><td colspan="2" rowspan="2">Keypad</td><td>Check the display of information.</td><td>Visual inspection</td><td>The characters are displayed properly.</td></tr>
<tr><td>Check whether characters are not completely displayed.</td><td>Visual inspection</td><td>The requirements stated in this manual are met.</td></tr>
<tr><td rowspan="3">Main circuit</td><td rowspan="3">Common</td><td>Check whether the bolts loose or come off.</td><td>Screw them up.</td><td>No exception occurs.</td></tr>
<tr><td>Check whether the machine is deformed, cracked, or damaged, or their color changes due to overheating and aging.</td><td>Visual inspection</td><td>No exception occurs.</td></tr>
<tr><td>Check whether there are stains and dust attached.</td><td>Visual inspection</td><td>No exception occurs.</td></tr>
</table>

Subject		Item	Method	Criterion
				Note: Discoloration of copper bars does not mean that they cannot work properly.
	Conductor and wire	Check whether the conductors are deformed or their color change due to overheat.	Visual inspection	No exception occurs.
		Check whether the wire sheaths are cracked or their color changes.	Visual inspection	No exception occurs.
	Terminal block	Check whether there is damage.	Visual inspection	No exception occurs.
	Filter capacitor	Check whether there is electrolyte leakage, discoloration, cracks, and chassis expansion.	Visual inspection	No exception occurs.
		Check whether the safety valves are released.	Determine the service life based on the maintenance information, or measure them through electrostatic capacity.	No exception occurs.
		Check whether the electrostatic capacity is measured as required.	Use instruments to measure the capacity.	Electrostatic capacity ≥ initial value × 0.85
	Resistor	Check whether there is displacement caused due to overheat.	Olfactory and visual inspection	No exception occurs.
		Check whether the resistors	Visual inspection, or	Resistance range:

Subject		Item	Method	Criterion
		are disconnected.	remove one end of the connection cable and use a multimeter for measurement.	±10% (of the standard resistance)
	Transformer and reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception occurs.
	Electromagnetic contactor and relay	Check whether there are vibration sounds in the workshop.	Auditory inspection	No exception occurs.
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.
Control circuit	Control PCB, connector	Check whether the screws and connectors loose.	Screw them up.	No exception occurs.
		Check whether there is unusual smell or discoloration.	Olfactory and visual inspection	No exception occurs.
		Check whether there are cracks, damage, deformation, or rust.	Visual inspection	No exception occurs.
		Check whether there is electrolyte leakage or deformation.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
Cooling system	Cooling fan	Check whether there are unusual sounds or vibration.	Auditory and visual inspection, and turn the fan blades with your hand.	The rotation is smooth.
		Check whether the bolts loose.	Screw them up.	No exception occurs.

Subject		Item	Method	Criterion
		Check whether there is discoloration caused due to overheat.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
	Ventilation duct	Check whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets.	Visual inspection	No exception occurs.

For more details about maintenance, contact the local INVT office, or visit our website www.invt.com, and choose **Service and Support** > **Online Service**.

9.3 Cooling fan

The service life of the cooling fan of the VFD is more than 25,000 hours. The actual service life of the cooling fan is related to the use of the VFD and the temperature in the ambient environment.

You can view the running duration of the VFD through P07.14 (Accumulated running time).

The increase of the bearing noise indicates a fan fault. If the VFD is applied in a key position, replace the fan once the fan starts to generate unusual noise. You can purchase spare parts of fans from INVT.

Cooling fan replacement

⚠	✧ Read the safety precautions carefully and follow the instructions to perform operations. Otherwise, physical injuries or damage to the device may be caused.

1. Stop the device, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Open the cable clamp to loose the fan cable (for VFDs of 380 V, 1.5 to 30 kW, the middle casing needs to be removed).
3. Remove the fan cable.
4. Remove the fan with a screwdriver.
5. Install a new fan in the VFD in the reverse steps. Assemble the VFD. Ensure that the air direction of the fan is consistent with that of the VFD, as shown in the following figure.

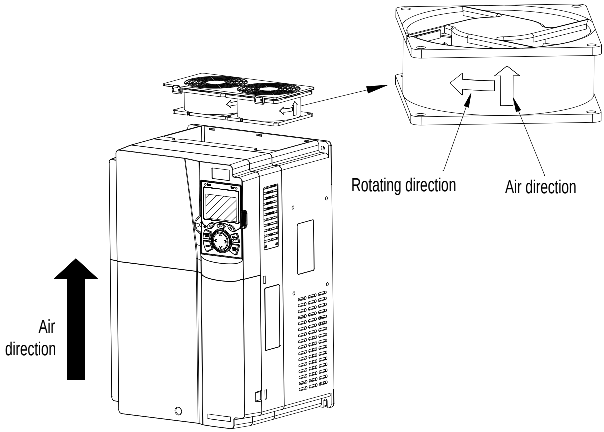


Figure 9.1 Fan maintenance for VFDs of 7.5 kW or higher

6. Power on the VFD.

9.4 Capacitor

9.4.1 Capacitor reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the VFD is delivered.

Storage time	Operation principle
Less than 1 year	No charging operation is required.
1 to 2 years	The VFD needs to be powered on for 1 hour before the first running command.
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 380 V 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.

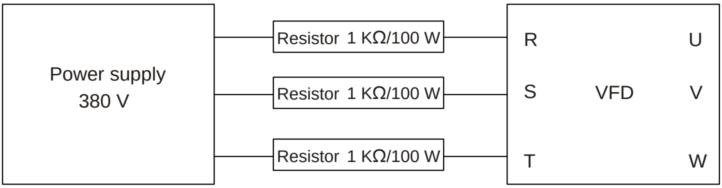


Figure 9.2 Charging circuit example of driving devices of 380 V

9.4.2 Electrolytic capacitor replacement

⚠	✧ Read the safety precautions carefully and follow the instructions to perform operations. Otherwise, physical injuries or damage to the device may be caused.

The electrolytic capacitor of a VFD must be replaced if it has been used for more than 35,000 hours. For details about the replacement, contact the local INVT office.

9.5 Power cable

⚠	✧ Read the safety precautions carefully and follow the instructions to perform operations. Otherwise, physical injuries or device damage may be caused.

1. Stop the VFD, disconnect the power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Check the connection of the power cables. Ensure that they are firmly connected.
3. Power on the VFD.

10 Communication protocols

10.1 What this chapter contains

This chapter describes the communication protocols supported by GD350-19 series VFDs.

GD350-19 series VFDs provide RS485 communication interfaces and adopt the master/slave communication based on the international standard Modbus communication protocol. You can implement centralized control (setting commands for controlling VFDs, modifying the running frequency and related function parameters, and monitoring the running status and fault information of the VFDs) through PC/PLC, upper control computers, or other devices to meet specific application requirements.

10.2 MODBUS protocol introduction

Modbus is a software protocol, a common language used in electronic controllers. By using this protocol, a controller can communicate with other devices through transmission lines. It is a general industrial standard. With this standard, control devices produced by different manufacturers can be connected to form an industrial network and be monitored in a centralized way.

The Modbus protocol provides two transmission modes, namely American Standard Code for Information Interchange (ASCII) and Remote Terminal Unit (RTU). On one Modbus network, all the devices must be consistent in transmission modes, baud rates, data bits, check bits, end bits, and other basic parameters.

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 one slave or all the slaves by sending broadcast messages. For separate access commands, a slave needs to return a response. For broadcast messages, slaves do not need to return responses.

10.3 Application of Modbus

GD350-19 series VFDs use the Modbus RTU mode and communicate through RS485 interfaces.

10.3.1 RS485

RS485 interfaces work in half-duplex mode and send data signals in the differential transmission way, which is also referred to as balanced transmission. An RS485 interface uses a twisted pair, in which one wire is defined as A (+), and the other B (-). Generally, if the positive electrical level between the transmission drives A and B ranges from +2V to +6V, the logic is "1"; and if it ranges from -2V to -6V, the logic is "0". On the VFD terminal block, the 485+ terminal corresponds to A, and 485- corresponds to B.

The communication baud rate (P14.01) indicates the number of bits sent in a second, and the unit is bit/s (bps). A higher baud rate indicates faster transmission and poorer anti-interference capability. When a twisted pair of 0.56 mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

Baud rate (bps)	Max. transmission distance (meter)	Baud rate (bps)	Max. transmission distance (meter)
2400	1800	9600	800
4800	1200	19200	600

When RS485 interfaces are used for long-distance communication, it is recommended that you use shielded cables, and use the shielding layer as the ground wires.

When there are fewer devices and the transmission distance is short, the whole network works well without terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120 Ω terminal resistor when the transmission distance is long.

10.3.1.1 When one VFD is used

Figure 10.1 is the Modbus wiring diagram for the network with one VFD and PC. Generally, PCs do not provide RS485 interfaces, and therefore you need to convert an RS232 or USB interface of a PC to an RS485 interface through a converter. Then, connect end A of the RS485 interface to the 485+ port on the terminal block of the VFD, and connect end B to the 485- port. It is recommended that you use shielded twisted pairs. When an RS232-RS485 converter is used, the cable used to connect the RS232 interface of the PC and the converter cannot be longer than 15 m. Use a short cable when possible. It is recommended that you insert the converter directly into the PC. Similarly, when a USB-RS485 converter is used, use a short cable when possible.

When the wiring is completed, select the correct port (for example, COM1 to connect to the RS232-RS485 converter) for the upper computer of the PC, and keep the settings of basic parameters such as communication baud rate and data check bit consistent with those of the VFD.

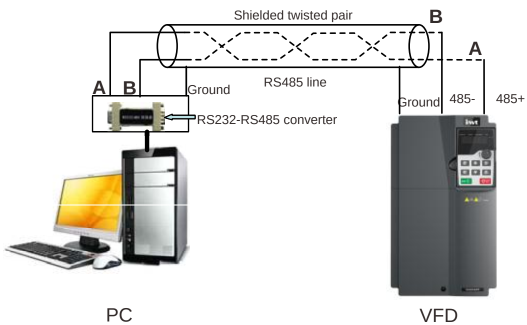


Figure 10.1 RS485 wiring diagram for the network with one VFD

10.3.1.2 When multiple VFDs are used

In the network with multiple VFDs, chrysanthemum connection and star connection are commonly used.

According to the requirements of the RS485 industrial bus standards, all the devices need to be connected in chrysanthemum mode with one 120 Ω terminal resistor on each end, as shown in Figure 10.2. Figure 10.3 simplified wiring diagram, and Figure 10.4 is the practical application diagram.

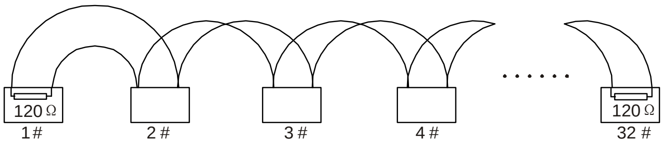


Figure 10.2 Onsite chrysanthemum connection diagram

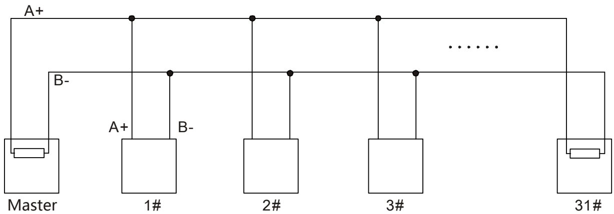


Figure 10.3 Simplified chrysanthemum connection diagram

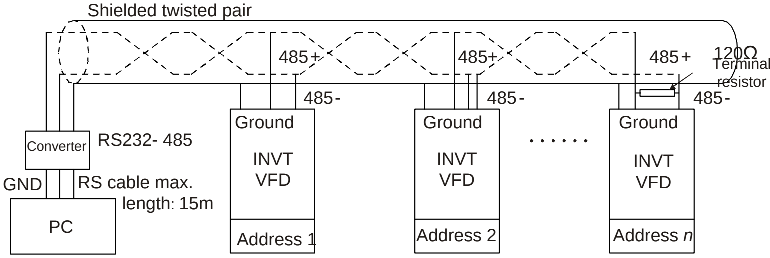


Figure 10.4 Practical application diagram of chrysanthemum connection

Figure 10.5 shows the start connection diagram. When this connection mode is adopted, the two devices that are farthest away from each other on the line must be connected with a terminal resistor (in this figure, the two devices are devices 1# and 15#).

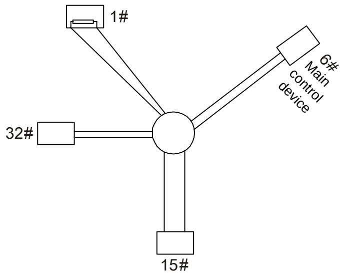


Figure 10.5 Star connection

Use shielded cable, if possible, in multi-VFD connection. The baud rates, data bit check settings, and other basic parameters of all the devices on the RS485 line must be set consistently, and addresses cannot be repeated.

10.3.2 RTU

10.3.2.1 RTU communication frame structure

When a controller is set to use the RTU communication mode on a Modbus network, every byte (8 bits) in the message includes 2 hexadecimal characters (each includes 4 bits). Compared with the ASCII mode, the RTU mode can send more data at the same baud rate.

Code system

- 1 start bit
- 7 or 8 data bits; the minimum valid bit is sent first. Each frame domain of 8 bits includes 2 hexadecimal characters (0–9, A–F).
- 1 odd/even check bit; this bit is not provided if no check is needed.
- 1 end bit (with check performed), 2 bits (without check)

Error detection domain

- Cyclic redundancy check (CRC)

The following tables provide the data formats.

11-bit character frame (Bits 1 to 8 are data bits)

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	BIT8	Check bit	End bit

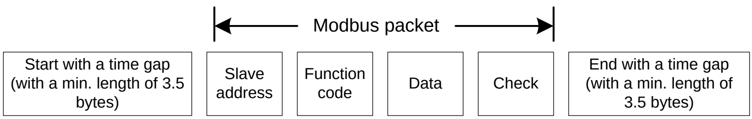
10-bit character frame (Bits 1 to 7 are data bits)

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	Check bit	End bit

In a character frame, only the data bits carry information. The start bit, check bit, and end bit are used to facilitate the transmission of the data bits to the destination device. In practical applications, you must set the data bits, parity check bits, and end bits consistently.

In RTU mode, a new frame must be always preceded by a time gap with a minimum length 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 sent in the following sequence: slave address, operation command code, data, and CRC check character. Each byte sent 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 sent, a similar transmission interval (with a minimum length of 3.5 bytes) is used to indicate that the frame transmission ends. Then, the transmission of a new frame starts.

RTU data frame format



The information of a frame must be sent 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.

The following table lists 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 (in decimal system) (0 indicates the broadcast address)
CMD (function domain)	03H: read slave parameters 06H: write slave parameters
DATA (N-1) ... DATA (0) (data domain)	Data of 2×N bytes, main content of the communication as well as the core of data exchanging

CRC CHK (LSBs)	Detection value: CRC (16 bits)
CRC CHK high bit (MSBs)	
END (frame tail)	T1-T2-T3-T4 (transmission time of 3.5 bytes)

10.3.2.2 RTU communication frame error check modes

During the transmission of data, errors may occur due to various factors. Without check, the data receiving device cannot identify data errors and may make a wrong response. The wrong response may cause severe problems. Therefore, the data must be checked.

The check is implemented as follows: The transmitter calculates the to-be-transmitted data based on a specific algorithm to obtain a result, adds the result to the rear of the message, and transmits them together. After receiving the message, the receiver calculates the data based on the same algorithm to obtain a result, and compares the result with that transmitted by the transmitter. If the results are the same, the message is correct. Otherwise, the message is considered wrong.

The error check of a frame includes two parts, namely, bit check on individual bytes (that is, odd/even check using the check bit in the character frame), and whole data check (CRC check).

Bit check on individual bytes (odd/even check)

You can select the bit check mode as required, or you can choose not to perform the check, which will affect the check bit setting of each byte.

Definition of even check: Before the data is transmitted, an even check bit is added to indicate whether the number of "1" in the to-be-transmitted data is odd or even. If it is even, the check bit is set to "0"; and if it is odd, the check bit is set to "1".

Definition of odd check: Before the data is transmitted, an odd check bit is added to indicate whether the number of "1" in the to-be-transmitted data is odd or even. If it is odd, the check bit is set to "0"; and if it is even, the check bit is set to "1".

For example, the data bits to be transmitted are "11001110", including five "1". If the even check is applied, the even check bit is set to "1"; and if the odd check is applied, the odd check bit is set to "0". During the transmission of the data, the odd/even check bit is calculated and placed in the check bit of the frame. The receiving device performs the odd/even check after receiving the data. If it finds that the odd/even parity of the data is inconsistent with the preset information, it determines that a communication error occurs.

CRC check mode

A frame in the RTU format includes an error detection domain based on the CRC calculation. The CRC domain checks all the content of the frame. The CRC domain consists of two bytes, including 16 binary bits. It is calculated by the transmitter and added to the frame. The receiver calculates the CRC of the received frame, and compares the result with the value in the received CRC domain. If the two

CRC values are not equal to each other, errors occur in the transmission.

During CRC, 0xFFFF is stored first, and then a process is invoked to process a minimum of 6 contiguous bytes in the frame based on the content in the current register. CRC is valid only for the 8-bit data in each character. It is invalid for the start, end, and check bits.

During the generation of the CRC values, the "exclusive or" (XOR) operation is performed on the each 8-bit character and the content in the register. The result is placed in the bits from the least significant bit (LSB) to the most significant bit (MSB), and 0 is placed in the MSB. Then, LSB is detected. If LSB is 1, the XOR operation is performed on the current value in the register and the preset value. If LSB is 0, no operation is performed. This process is repeated 8 times. After the last bit (8^{th} bit) is detected and processed, the XOR operation is performed on the next 8-bit byte and the current content in the register. The final values in the register are the CRC values obtained after operations are performed on all the bytes in the frame.

The calculation adopts the international standard CRC check rule. You can refer to the related standard CRC algorithm to compile the CRC calculation program as required.

The following example is a simple CRC calculation function for your reference (using the C programming language):

```
unsigned int crc_cal_value(unsigned char*data_value,unsigned char data_length)
{
    int i;
    unsigned int crc_value=0xffff;
    while(data_length--)
    {
        crc_value^=*data_value++;
        for(i=0;i<8;i++)
        {
            if(crc_value&0x0001)
                crc_value=(crc_value>>1)^0xa001;
            else
                crc_value=crc_value>>1;
        }
    }
    return(crc_value);
}
```

In the ladder logic, CKSM uses the table look-up method to calculate the CRC value according to the content in the frame. The program of this method is simple, and the calculation is fast, but the ROM space occupied is large. Use this program with caution in scenarios where there are space occupation requirements on programs.

10.4 RTU command code and communication data

10.4.1 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, starting from the data address of 0004H, to read two contiguous pieces of data (that is, to read content from the data addresses 0004H and 0005H), the frame structures are described in the following.

RTU master command (sent from the master to the VFD):

START	T1-T2-T3-T4 (time gap with a min. length 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 (time gap with a min. length of 3.5 bytes)

"START" and "END" are "T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)", indicating that a time gap with a minimum length of 3.5 bytes must be kept before RS485 communication is executed. The time gap is used to distinguish one message from another so that the two messages are not regarded as one message.

"ADDR" is "01H", indicating that the command is sent to the VFD whose address is 01H. The ADDR information occupies one byte.

"CMD" is "03H", indicating that the command is used to read data from the VFD. The CMD information occupies one byte.

"Start address" indicates that data reading is started from this address. It occupies two bytes, with the

MSB on the left and LSB on the right.

"Data count" indicates the count of data to be read (unit: word). "Start address" is "0004H" and "Data count" is 0002H, indicating that data is to be read from the data addresses of 0004H and 0005H.

CRC check occupies two bytes, with the LSB on the left and MSB on the right.

RTU slave response (sent from the VFD to the master):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	01H
CMD	03H
Number of bytes	04H
MSB of data in 0004H	13H
LSB of data in 0004H	88H
MSB of data in 0005H	00H
LSB of data in 0005H	00H
CRC LSB	7EH
CRC MSB	9DH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

The definition of the response information is described as follows:

"ADDR" is "01H", indicating that the message is sent from the VFD whose address is 01H. The ADDR information occupies one byte.

"CMD" is "03H", indicating that the message is a VFD response to the 03H command from the master for reading data. The CMD information occupies one byte.

"Number of bytes" indicates the number of bytes between a byte (not included) and the CRC byte (not included). The value "04" indicates that there are four bytes of data between "Number of bytes" and "CRC LSB", that is, "MSB of data in 0004H", "LSB of data in 0004H", "MSB of data in 0005H", and "LSB of data in 0005H".

A piece of data is two bytes, with the MSB on the left and LSB on the right. From the response, the data in 0004H is 1388H, and that in 0005H is 0000H.

CRC check occupies two bytes, with the LSB on the left and MSB on the right.

10.4.2 Command word 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, to write 5000 (1388H) to 0004H of the VFD whose address is 02H, the frame structures are described in the following.

RTU master command (sent from the master to the VFD):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of to-be-written data	13H
LSB of to-be-written data	88H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

RTU slave response (sent from the VFD to the master):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of to-be-written data	13H
LSB of to-be-written data	88H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

Note: Sections 10.4.1 and 10.4.2 mainly describe the command formats. For the detailed application, see the section 10.4.7.

10.4.3 Command code 08H, diagnosis

Sub-function code description:

Sub-function code	Description
0000	Return data based on query requests

For example, to query about the circuit detection information about the VFD whose address is 01H, the query and return strings are the same, and the formats are described in the following tables.

RTU master command:

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code MSB	00H
Sub-function code LSB	00H
Data MSB	12H
Data LSB	ABH
CRC CHK LSB	ADH
CRC CHK MSB	14H
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

RTU slave response:

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code MSB	00H
Sub-function code LSB	00H
Data MSB	12H
Data LSB	ABH
CRC CHK LSB	ADH
CRC CHK MSB	14H
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

10.4.4 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 count", and a maximum of 16 pieces of data can be written.

For example, to write 5000 (1388H) and 50 (0032H) respectively to 0004H and 0005H of the VFD whose slave address is 02H, the frame structures are described in the following.

RTU master command (sent from the master to the VFD)

START	T1-T2-T3-T4 (time gap with a min. length 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 in 0004H	13H
LSB of data in 0004H	88H
MSB of data in 0005H	00H
LSB of data in 0005H	32H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

RTU slave response (sent from the VFD to the master)

START	T1-T2-T3-T4 (time gap with a min. length 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 (time gap with a min. length of 3.5 bytes)

10.4.5 Data address definition

This section describes the address definition of communication data. The addresses are used for controlling the running, obtaining the status information, and setting function parameters of the VFD.

10.4.5.1 Function code address format rules

The address of a function code consists of two bytes, with the MSB on the left and LSB on the right. The MSB ranges from 00 to ffH, and the LSB also ranges from 00 to ffH. The MSB is the hexadecimal form of the group number before the dot mark, and LSB is that of the number behind 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 behind the dot mark is 06, that is, the LSB is the hexadecimal form of 06. Therefore, the function code address is 0506H in the hexadecimal form. For example, the parameter address of P10.01 is 0A01H.

Function code	Name	Description	Setting range	Default value	Change
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0–2	0	○
P10.01	Simple PLC memory selection	0: Without memory after power down 1: With memory after power down	0–1	0	○

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.
- The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. Some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the MSB of the corresponding function code address from 0 to 1. For example, if P00.07 is not to be stored in the EEPROM, you need only to modify the value in the RAM, that is, set the address to 8007H. The address can be used only for writing data to the on-chip RAM, and it is invalid when used for reading data.

10.4.5.2 Description of other function addresses

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as starting and stop it, and monitoring the operation status of the VFD. The following table describes other function parameters.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	

Function	Address	Data description	R/W
		0006H: Coast to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	
Communication-based value setting	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01 Hz)	R/W
	2002H	PID setting, range (0–1000, 1000 corresponding to 100.0%)	
	2003H	PID feedback, range (0–1000, 1000 corresponding to 100.0%)	R/W
	2004H	Torque setting (-3000 – +3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2005H	Setting of the upper limit of the forward running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2006H	Setting of the upper limit of the reverse running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2007H	Upper limit of the electromotion torque (0–3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2008H	Upper limit of the brake torque (0–3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2009H	Special control command word: Bit0–1: =00: Motor 1 =01: Motor 2 Bit2: =1 Enable speed/torque control switchover =0: Disable speed/torque control switchover Bit3: =1 Clear electricity consumption =0: Not clear electricity consumption Bit4: =1 Pre-excitation; =0: Disable pre-excitation Bit5: =1 DC brake =0: Disable DC brake	R/W
	200AH	Virtual input terminal command, range: 0x000–0x3FF Corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/ S3/ S2/S1	R/W

Function	Address	Data description	R/W
	200BH	Virtual output terminal command, range: 0x00–0x0F Corresponding to local RO2/RO1/HDO/Y1	R/W
	200CH	Voltage setting (used for V/F separation) (0–1000, 1000 corresponding to 100.0% of the motor rated voltage)	R/W
	200DH	AO output setting 1 (-1000–+1000, 1000 corresponding to 100.0%)	R/W
	200EH	AO output setting 2 (-1000–+1000, 1000 corresponding to 100.0%)	R/W
VFD status word 1	2100H	0001H: Forward running	R
		0002H: Reverse running	
		0003H: Stopped	
		0004H: Faulty	
		0005H: POFF	
		0006H: Pre-excited	
VFD status word 2	2101H	Bit0: =0: Not ready to run =1: Ready to run Bi1–2: =00: Motor 1 =01: Motor 2 Bit3: =0: Asynchronous motor =1: Synchronous motor Bit4: =0: No overload alarm =1: Overload alarm Bit5–Bit6: =00: Keypad-based control =01: Terminal-based control =10: Communication-based control Bit7: 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	R
VFD fault code	2102H	See the description of fault types.	R

Function	Address	Data description		R/W
VFD identification code	2103H	GD350-----0x01A0		R
Running frequency	3000H	0–Fmax(Unit: 0.01Hz)	Compatible with CHF100A and CHV100 communication addresses	R
Set frequency	3001H	0–Fmax(Unit: 0.01Hz)		R
Bus voltage	3002H	0.0–2000.0V(Unit: 0.1V)		R
Output voltage	3003H	0–1200V(Unit: 1V)		R
Output current	3004H	0.0–3000.0A(Unit: 0.1A)		R
Rotating speed	3005H	0–65535(Unit: 1RPM)		R
Output power	3006H	-300.0–300.0%(Unit: 0.1%)		R
Output torque	3007H	-250.0–250.0%(Unit: 0.1%)		R
Closed-loop setting	3008H	-100.0–100.0%(Unit: 0.1%)		R
Closed-loop feedback	3009H	-100.0–100.0%(Unit: 0.1%)		R
Input state	300AH	000–3F Corresponding to the local HDIB/ HDIA/ S4/ S3/ S2/ S1		R
Output state	300BH	000–0F Corresponding to the local RO2/RO1/HDO/Y1		R
Analog input 1	300CH	0.00–10.00V(Unit: 0.01V)		R
Analog input 2	300DH	0.00–10.00V(Unit: 0.01V)		R
Analog input 3	300EH	-10.00–10.00V(Unit: 0.01V)		R
Analog input 4	300FH			R
Read input of high-speed pulse 1	3010H	0.00–50.00kHz(Unit: 0.01Hz)		R
Read input of high-speed pulse 2	3011H			R
Read current step of	3012H	0–15		R

Function	Address	Data description		R/W
multi-step speed				
External length	3013H	0–65535		R
External count value	3014H	0–65535		R
Torque setting	3015H	-300.0–300.0%(Unit: 0.1%)		R
Identification code	3016H			R
Fault code	5000H			R

The Read/Write (R/W) characteristics indicate whether a function can be read and written. For example, "Communication-based control command" can be written, and therefore the command code 6H is used to control the VFD. The R characteristic indicates that a function can only be read, and W indicates that a function can only be written.

Note: Some parameters in the preceding table are valid only after they are enabled. Take the running and stop operations as examples, you need to set "Running command channel" (P00.01) to "Communication", and set "Communication running command channel" (P00.02) to the Modbus communication channel. For another example, when modifying "PID setting", you need to set "PID reference source" (P09.00) to Modbus communication.

The following table describes the encoding rules of device codes (corresponding to the identification code 2103H of the VFD).

8 MSBs	Meaning	8 LSBs	Meaning
01	GD	0x08	GD35 vector VFD
		0x09	GD35-H1 vector VFD
		0x0a	GD300 vector VFD
		0xa0	GD350 vector VFD

10.4.6 Fieldbus scale

In practical applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. For example, 50.12 Hz cannot be represented in the hexadecimal form. In such cases, we can multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H (5012 in the decimal form) in the hexadecimal form.

In the process of multiplying a non-integer by a multiple to obtain an integer, the multiple is referred to as a fieldbus scale.

The fieldbus scale depends on the number of decimals in the value specified in "Detailed parameter description" or "Default value". If there are *n* decimals in the value, the fieldbus scale m is the n^{th}-power of 10. Take the following table as an example, m is 10.

Function code	Name	Description	Default value
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid when P01.19 is 2)	0.0s
P01.21	Restart after power cut	0: Restart is disabled 1: Restart is enabled	0

The value specified in "Detailed parameter description" or "Default value" contains one decimal, so the fieldbus scale is 10. If the value received by the upper computer is 50, the value of "Wake-up-from-sleep delay" of the VFD is 5.0 (5.0=50/10).

To set the "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 transmit 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 the upper computer transmits 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, so 5.0 is obtained based on the fieldbus scale (50/10=5.0). In this case, the master identifies that the "Wake-up-from-sleep delay" is 5.0s.

10.4.7 Error message response

Operation errors may occur in communication-based control. For example, some parameters can only be read, but a write command is transmitted. In this case, the VFD returns an error message response.

Error message responses are transmitted by the VFD to the master. The following table describes the codes and definitions of the error message responses.

Code	Name	Definition
01H	Invalid command	The command code received by the upper computer is not allowed to be executed. The possible causes are as follows: • The function code is applicable only on new devices and is not implemented on this device. • The slave is in the faulty state when processing this request.
02H	Invalid data address	For the VFD, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and the number of the to-be-transmitted bytes is invalid.
03H	Invalid data bit	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 is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Password error	The password entered in the password verification address is different from that set in P03.00.
06H	Data frame error	The length of the data frame transmitted by the upper computer is incorrect, 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 upper computer is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the upper computer cannot be modified during the running of the VFD.
09H	Password protection	A user password is set, and the upper computer does not provide the password to unlock the system when performing a read or write operation. The error of "system locked" is reported.

When returning a response, the device uses a function code domain and fault address to indicate whether it is a normal response (no error) or exception response (some errors occur). In a normal response, the device returns the corresponding function code and data address or sub-function code. In an exception response, the device returns a code that is equal to a normal code, but the first bit is logic 1.

For example, if the master device transmits a request message to a slave device for reading a group of function code address data, the code is generated as follows:

0 0 0 0 0 0 1 1 (03H in the hexadecimal form)

For a normal response, the same code is returned.

For an exception response, the following code is returned:

1 0 0 0 0 0 1 1 (83H in the hexadecimal form)

In addition to the modification of the code, the slave returns a byte of exception code that describes the cause of the exception. After receiving the exception response, the typical processing of the master device is to transmit the request message again or modify the command based on the fault information.

For example, to set the "Running command channel" (P00.01, the parameter address is 0001H) of the VFD whose address is 01H to 03, the command is as follows:

01	**06**	**00 01**	**00 03**	**98 0B**
VFD address	Write command	Parameter address	Parameter data	CRC

But the setting range of the "Running command channel" is 0 to 2. The value 3 exceeds the setting range. In this case, the VFD returns an error message response as shown in the following:

01	**86**	**04**	**43 A3**
VFD address	Exception response code	Error code	CRC

The exception response code 86H (generated based on the MSB "1" of the write command 06H) indicates that it is an exception response to the write command (06H). The error code is 04H. From the preceding table, we can see that it indicates the error "Operation failure", which means "The parameter is set to an invalid value in the write operation".

10.4.8 Read/Write operation example

For the formats of the read and write commands, see sections 10.4.1 and 10.4.2.

10.4.8.1 Read command 03H examples

Example 1: Read status word 1 of the VFD whose address is 01H. From the table of other function parameters, we can see that the parameter address of status word 1 of the VFD is 2100H.

The read command transmitted to the VFD is as follows:

01	03	21 00	00 01	8E 36
VFD address	Read command	Parameter address	Data quantity	CRC

Assume that the following response is returned:

01	03	02	00 03	F8 45
VFD address	Read command	Number of bytes	Data content	CRC

The data content returned by the VFD is 0003H, which indicates that the VFD is in the stopped state.

Example 2: View information about the VFD whose address is 03H, including "Type of current fault" (P07.27) to "Type of last but four fault" (P07.32) of which the parameter addresses are 071BH to 0720H (contiguous 6 parameter addresses starting from 071BH).

The command transmitted to the VFD is as follows:

03	03	07 1B	00 06	B5 59
VFD address	Read command	Start address	6 parameters in total	CRC

Assume that the following response is returned:

03	03	0C	00 23	00 23	00 23	00 23	00 23	00 23	5F D2
VFD address	Read command	Number of bytes	Type of current fault	Type of last fault	Type of last but one fault	Type of last but two fault	Type of last but three fault	Type of last but four fault	CRC

From the returned data, we can see that all the fault types are 0023H, that is, 35 in the decimal form, which means the maladjustment fault (STo)

10.4.8.2 Write command 06H examples

Example 1: Set the VFD whose address is 03H to be forward running. Refer to the table of other function parameters, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running, as shown in the following figure.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	

Function	Address	Data description	R/W
		0005H: Stop	
		0006H: Coast to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	

The command transmitted by the master is as follows:

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

If the operation is successful, the following response is returned (same as the command transmitted by the master):

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

Example 2: Set the "Max. output frequency" of the VFD whose address is 03H to 100 Hz.

Function code	Name	Description	Default value	Modify
P00.03	Max. output frequency	Used to set the maximum output frequency of the VFD. It is the basis of frequency setup and the acceleration/deceleration. Setting range: Max (P00.04, 10.00) –630.00Hz	50.00Hz	◎

From the number of decimals, we can see that the fieldbus scale of the "Max. output frequency" (P00.03) is 100. Multiply 100 Hz by 100. The value 10000 is obtained, and it is 2710H in the hexadecimal form.

The command transmitted by the master is as follows:

03	06	00 03	27 10	62 14
VFD address	Write command	Parameter address	Parameter data	CRC

If the operation is successful, the following response is returned (same as the command transmitted by the master):

03	**06**	**00 03**	**27 10**	**62 14**
VFD address	Write command	Parameter address	Parameter data	CRC

Note: In the preceding command description, spaces are added to a command just for explanatory purposes. In practical applications, no space is required in the commands.

10.4.8.3 Continuously write command 10H examples

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10 Hz. Refer to the table of other function parameters, the address of "Communication-based control command" is 2000H, 0001H indicates forward running, and the address of "Communication-based value setting" is 2001H, as shown in the following figure. 10 Hz is 03E8H in the hexadecimal form.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	
Communication-based value setting	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01 Hz)	R/W
	2002H	PID setting, range (0–1000, 1000 corresponding to 100.0%)	

In the actual operation, set P00.01 to 2 and P00.06 to 8.

The command transmitted by the master is as follows:

01	**10**	**20 00**	**00 02**	**04**	**00 01**	**03 E8**	**3B 10**
VFD address	Continuous write command	Parameter address	Parameter quantity	Number of bytes	Froward running	10 Hz	CRC

If the operation is successful, the following response is returned:

01	**10**	**20 00**	**00 02**	**4A 08**
VFD address	Continuous write command	Parameter address	Parameter quantity	CRC

Example 2: Set "Acceleration time" of the VFD whose address is 01H to 10s, and "Deceleration time" to 20s.

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P00.11</td><td>Acceleration time 1</td><td rowspan="2">Acceleration time is the time needed for accelerating from 0Hz to Max. output frequency (P00.03).
Deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz.
Goodrive350-19 series VFD defines four groups of acceleration and deceleration time, which can be selected via multi-function digital input terminals (P05 group). The acceleration/deceleration time of the VFD is the first group by default.
Setting range of P00.11 and P00.12: 0.0–3600.0s</td><td>Model depended</td><td>○</td></tr>
<tr><td>P00.12</td><td>Deceleration time 1</td><td>Model depended</td><td>○</td></tr>
</table>

The address of P00.11 is 000B, 10s is 0064H in the hexadecimal form, and 20s is 00C8H in the hexadecimal form.

The command transmitted by the master is as follows:

01	**10**	**00 0B**	**00 02**	**04**	**00 64**	**00 C8**	**F2 55**
VFD address	Continuous write command	Parameter address	Parameter quantity	Number of bytes	10s	20s	CRC

If the operation is successful, the following response is returned:

01	**10**	**00 0B**	**00 02**	**30 0A**
VFD address	Continuous write command	Parameter address	Parameter quantity	CRC

Note: In the preceding command description, spaces are added to a command just for explanatory purposes. In practical applications, no space is required in the commands.

10.4.8.4 Modbus communication commissioning example

A PC is used as the host, an RS232-RS485 converter is used for signal conversion, and the PC serial port used by the converter is COM1 (an RS232 port). The upper computer commissioning software is the serial port commissioning assistant Commix, which can be downloaded from the Internet. Download a version that can automatically execute the CRC check function. The following figure shows the interface of Commix.

First, set the serial port to **COM1**. Then, set the baud rate consistently with P14.01. The data bits, check bits, and end bits must be set consistently with P14.02. If the RTU mode is selected, you need to select the hexadecimal form **Input HEX**. To set the software to automatically execute the CRC function, you need to select **ModbusRTU**, select **CRC16 (MODBU SRTU)**, and set the start byte to **1**. After the auto CRC check function is enabled, do not enter CRC information in commands. Otherwise, command errors may occur due to repeated CRC check.

The commissioning command to set the VFD whose address is 03H to be forward running is as follows:

03	**06**	**20 00**	**00 01**	**42 28**
VFD address	Write command	Parameter address	Forward running	CRC

Note:

1. Set the address (P14.00) of the VFD to 03.
2. Set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to the Modbus communication channel.
3. Click **Send**. If the line configuration and settings are correct, a response transmitted by the VFD is received as follows:

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

10.5 Common communication faults

Common communication faults include the following:

- No response is returned.
- The VFD returns an exception response.

Possible causes of no response include the following:

- The serial port is set incorrectly. For example, the converter uses the serial port COM1, but COM2 is selected for the communication.
- The settings of the baud rates, data bits, end bits, and check bits are inconsistent with those set on the VFD.
- The positive pole (+) and negative pole (-) of the RS485 bus are connected reversely.
- The resistor connected to 485 terminals on the terminal block of the VFD is set incorrectly.

Appendix A Extension cards

A.1 Model description

EC-PG 5 01-05

① ② ③ ④ ⑤

Field	Description	Example
①	Product category	EC: Extension card
②	Card category	PG: PG card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: Incremental PG card + Frequency-division output
		02: Sine/Cosine PG card + Pulse direction setting + Frequency-division output
		03: UVW PG interface + Pulse direction setting + Frequency-division output
		04: Resolver PG interface + Pulse direction setting + Frequency-division output
		05: Incremental PG card + Pulse direction setting + Frequency-division output
		06: Absolute PG interface + Pulse direction setting + Frequency-division output
		07: Simplified incremental PG card
⑤	Working power	00: Passive
		05: 5V
		12: 12–15 V
		24: 24 V

EC-TX 5 01

① ② ③ ④

Field	Description	Example
①	Product category	EC: Extension card
②	Card category	TX: Communication extension card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: Bluetooth communication card
		02: WIFI communication card
		03: PROFIBUS communication card
		05: Canopen communication card
		06: DeviceNet communication card
		07: BACnet communication card
		08: EtherCat communication card
		09: PROFINET communication card
		10: Ethernet/IP communication card
		11: CAN master/slave control communication card

EC-IO 5 01-00

① ② ③ ④ ⑤

Field identifier	Field description	Naming example
①	Product category	EC: Extension card
②	Card category	IO: I/O extension card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: Multifunction I/O extension card (4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and 2 relay outputs)
		02: Digital I/O extension card (4 digital inputs, 2 relay outputs, 1 PT100, and 1 PT1000)
		03: Analog I/O card
		04: Reserved 1
		05: Reserved 2
⑤	Special requirement	

The following table lists extension cards that Goodrive350-19 series VFDs support. The extension cards are optional and need to be purchased separately.

Name	Model	Specification
I/O extension card 1	EC-IO501-00	• 4 digital inputs • 1 digital output • 1 analog input • 1 analog output • 2 relay outputs: 1 double-contact output, and 1

Name	Model	Specification
		single-contact output
I/O extension card 2	EC-IO502-00	• 4 digital inputs • 1 PT100 • 1 PT1000 • 2 relay outputs: single-contact NO output **Note:** The extension card has been built into the 7.5kW and higher VFD models but it is optional for the VFD models of lower than 7.5kW. For details, see section 4.4.3.
Bluetooth communication card	EC-TX501-1 EC-TX501-2	• Supporting Bluetooth 4.0 • With INVT mobile app, you can set the parameters and monitor the states of the VFD through Bluetooth • The maximum communication distance in open environments is 30 m. • EC-TX501-1 is equipped with a built-in antenna and applicable to molded case machines. • EC-TX501-2 is configured with an external sucker antenna and applicable to sheet metal machines.
WIFI communication card	EC-TX502-1 EC-TX502-2	• Meeting IEEE802.11b/g/n • With INVT mobile app, you can monitor the VFD locally or remotely through WIFI communication • The maximum communication distance in open environments is 30 m. • EC-TX501-1 is equipped with a built-in antenna and applicable to molded case machines. • EC-TX502-2 is configured with an external sucker antenna and applicable to sheet metal machines.
PROFIBUS-DP communication card	EC-TX503	• Supporting the PROFIBUS-DP protocol
Ethernet communication card	EC-TX504	• Supporting Ethernet communication with INVT internal protocol • Can be used in combination with INVT upper computer monitoring software INVT Studio
CANopen	EC-TX505	• Based on the CAN2.0A physical layer

Name	Model	Specification
communication card		• Supporting the CANopen protocol
CAN master/slave control communication card	EC-TX511	• Based on the CAN2.0B physical layer • Adopting INVT proprietary master/slave control protocol
PROFINET communication card	EC-TX509	• Supporting the PROFINET protocol
Sin/Cos PG card	EC-PG502	• Applicable to Sin/Cos encoders with or without CD signals • Supporting A, B, Z frequency-divided output • Supporting pulse string reference input
UVW incremental PG card	EC-PG503-05	• Applicable to differential encoders of 5 V • Supporting the orthogonal input of A, B, and Z • Supporting pulse input of phases U, V, and W • Supporting frequency-divided output of A, B, and Z • Supporting the input of pulse string reference
Resolver PG card	EC-PG504-00	• Applicable to resolver encoders • Supporting frequency-divided output of resolver-simulated A, B, Z
Multifunction incremental PG card	EC-PG505-12	• Applicable to OC encoders of 5 V or 12 V • Applicable to push-pull encoders of 5 V or 12 V • Applicable to differential encoders of 5 V • Supporting the orthogonal input of A, B, and Z • Supporting the frequency-divided output of A, B, and Z • Supporting pulse string setting
Simplified incremental PG card	EC-PG507-12	• Applicable to 5V or 24V OC encoders • Applicable to 5V or 12V push-pull encoders • Applicable to 5 V differential encoders

Name	Model	Specification
24V incremental PG card	EC-PG507-24	• Applicable to 24V OC encoders • Applicable to 24V push-pull encoders • Applicable to 24V differential encoders


I/O extension card 1
EC-IO501-00


I/O extension card 2
EC-IO502-00


Bluetooth/WIFI
communication card
EC-TX501/502


PROFIBUS-DP
communication card
EC-TX503


Ethernet
communication card
EC-TX504


CANopen/CAN
master/slave control
communication card
EC-TX505/511


PROFINET
communication card
EC-TX509


Sin/Cos PG card
EC-PG502

UVW incremental PG card
EC-PG503-05

Resolver PG card
EC-PG504-00

Multifunction incremental PG card
EC-PG505-12

Simplified incremental PG card
EC-PG507-12

24V simplified incremental PG card
EC-PG507-24

A.2 Dimensions and installation

All of the extension cards are the same in dimensions (108 mm × 39 mm) and can be installed in the same way.

Conform to the following rule when installing or removing an extension card:

1. Ensure that no power is applied before installing the extension card.
2. The extension card can be installed into any of the card slots SLOT1, SLOT2, and SLOT3.
3. The 5.5 kW and lower VFD models can be configured with two extension cards at the same time,

and the 7.5 kW and higher VFD models can be configured with three extension cards.

4. If interference occurs on the external wires after extension cards are installed, change their installation card slots flexibly to facilitate the wiring. For example, the connector of the connection cable of the DP card is large, so you are recommended to install the card in the SLOT1 card slot.
5. 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 shielded cable, that is, connect the shield layer on the motor side to the housing of the motor, and connect the shield layer on the PG card side to the PE terminal.

The following shows the diagrams of installing extension cards into different VFD models.

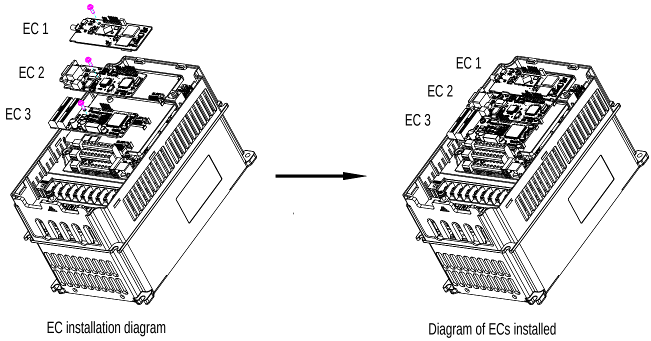


Figure A.1 7.5 kW and higher VFD models with extension cards installed

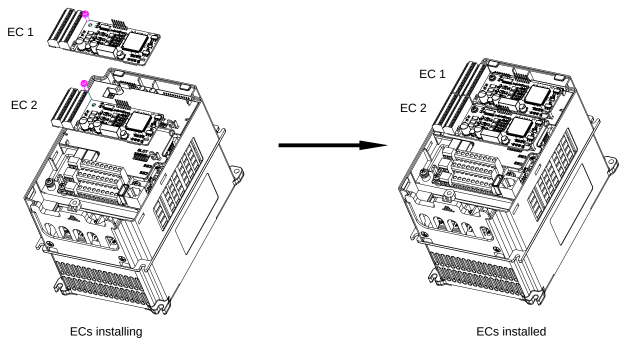


Figure A.2 5.5 kW and lower VFD models with extension cards installed

Extension card installation procedure:

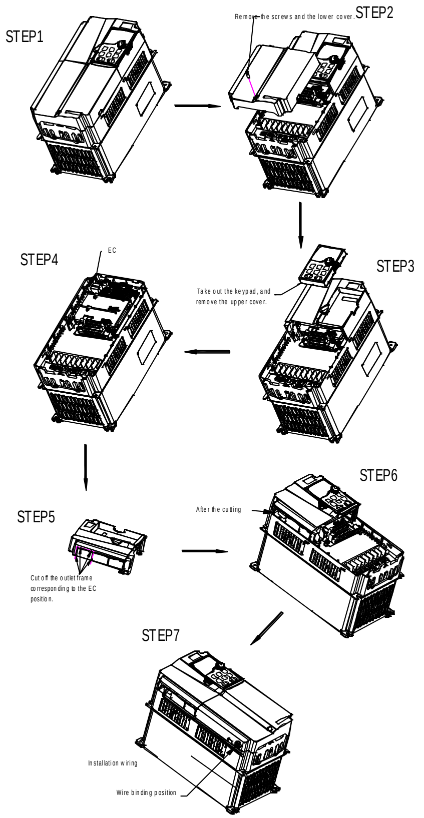


Figure A.3 Extension card installation procedure

A.3 Wiring

1. Ground a shielded cable as follows:

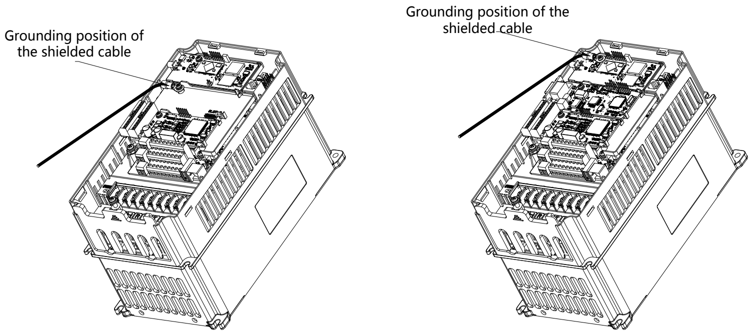
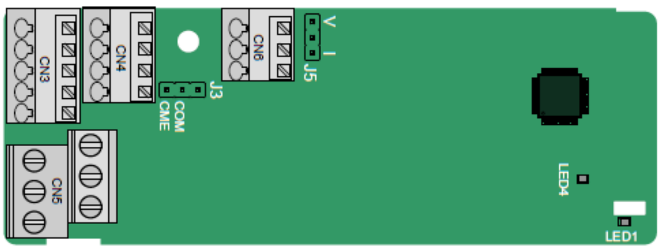


Figure A.4 Extension card grounding diagram

A.4 Function description of I/O extension card 1 (EC-IO501-00)



The terminals are arranged as follows:

CME and COM are short connected through J3 before delivery, and J5 is the jumper for selecting the output type (voltage or current) of AO2.

AI3	AO2	GND

COM	CME	Y2	S5	
PW	+24V	S6	S7	S8

RO3A	RO3B	RO3C	
	RO4A		RO4C

Indicators are described as follows:

Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED4	Power indicator	This indicator is on after the I/O extension card is powered on by the control board.

The EC-IO501-00 extension card can be used in scenarios where the I/O interfaces of Goodrive350-19 VFD cannot meet the application requirements. It can provide 4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and two relay outputs. It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

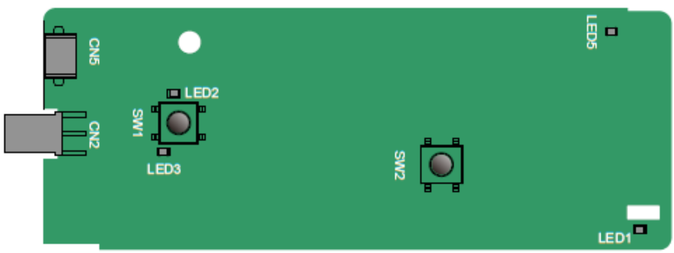
EC-IO501-00 terminal function description

Category	Symbol	Name	Function
Power	PW	External power supply	The working power of digital input is provided by an external power supply. Voltage range: 12–24 V The terminals PW and +24V are shorted before delivery.
Analog input/output	AI3—GND	Analog input 1	1. Input range: 0–10 V, 0–20 mA 2. Input impedance: 20 kΩ for voltage input; 250 Ω for current input 3. Set it to be voltage or current input through the corresponding function code. 4. Resolution: When 10 V corresponds to 50 Hz, the minimum resolution is 5 mV. 5. Deviation: ±0.5%; input of 5 V or 10 mA or higher at the temperature of 25°C
	AO2—GND	Analog output 1	1. Output range: 0–10 V, 0–20 mA 2. Whether it is voltage or current output can be set through J5. 3. Deviation: ±0.5%; input of 5 V or 10 mA or higher at the temperature of 25°C
Digital input/output	S5—COM	Digital input 1	1. Internal impedance: 6.6 kΩ 2. Power input range: 12–30 V 3. Bidirectional input terminal 4. Max. input frequency: 1 kHz
	S6—COM	Digital input 2	
	S7—COM	Digital input 3	
	S8—COM	Digital input 4	
	Y2—CME	Digital output	1. Switch capacity: 200 mA/30 V

Category	Symbol	Name	Function
			2. Output frequency range: 0–1 kHz 3. The terminals CME and COM are short connected through J3 before delivery.
Relay output	R03A	NO contact of relay 3	1. Contact capacity: 3A/AC 250 V, 1 A/DC 30 V 2. Do not use them as high-frequency digital outputs.
	R03B	NC contact of relay 3	
	RO3C	Common contact of relay 3	
	RO4A	NO contact of relay 4	
	RO4C	Common contact of relay 4	

A.5 Function description of communication cards

A.5.1 Bluetooth communication card (EC-TX501) and WIFI communication card (EC-TX502)



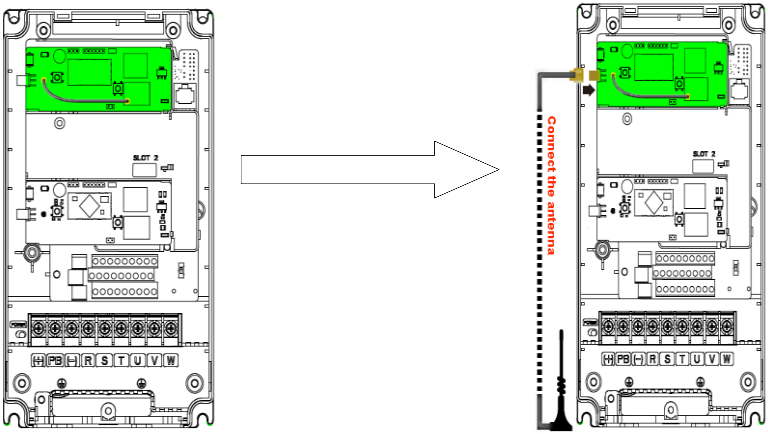
The indicators and function buttons are described as follows:

Indicator/Button No.	Name	Function
LED1/LED3	Bluetooth/WIFI status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the

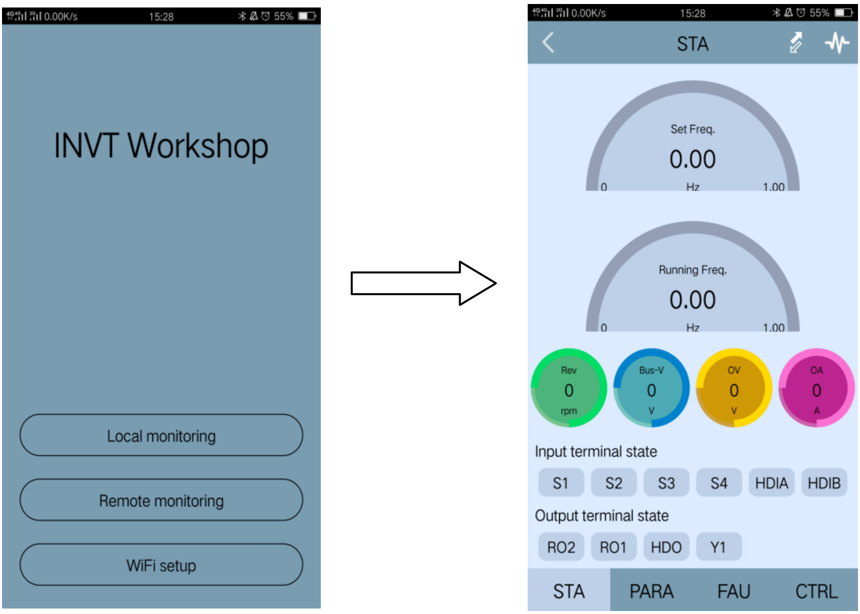
Indicator/Button No.	Name	Function
		other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Bluetooth communication status indicator	This indicator is on when Bluetooth communication is online and data exchange can be performed. It is off when Bluetooth communication is not in the online state.
LED5	Power indicator	This indicator is on after the control board feeds power to the Bluetooth card.
SW1	WIFI factory restoration button	It is restored to default values and returned to the local monitoring mode.
SW2	WIFI hardware reset button	It is used to reboot the extension card.

The wireless communication card is especially useful for scenarios where you cannot directly use the keypad to operate the VFD due to the restriction of the installation space. With a mobile app, you can operate the VFD in a maximum distance of 30 m. You can choose a PCB antenna or an external sucker antenna. If the VFD is located in an open space and is a molded case machine, you can use a built-in PCB antenna; and if it is a sheet metal machine and located in a metal cabinet, you need to use an external sucker antenna.

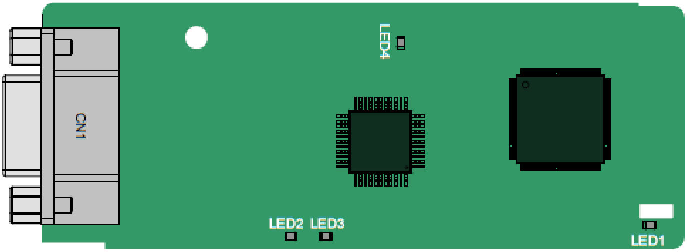
When installing a sucker antenna, install a wireless communication card on the VFD first, and then lead the SMA connector of the sucker antenna into the VFD and screw it to CN2, as shown in the following figure. Place the antenna base on the chassis and expose the upper part. Try to keep it unblocked.



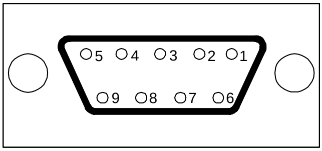
The wireless communication card must be used with the INVT VFD app. Scan the QR code of the VFD nameplate to download it. For details, see the wireless communication card manual provided with the extension card. The main interface is shown as follows.



A.5.2 PROFIBUS-DP communication card (EC-TX503)



CN1 is a 9-pin D-type connector, as shown in the following figure.



Connector pin		Description
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 shield layer

+5V and GND_BUS are bus terminators. Some devices, such as the optical transceiver (RS485), may need to obtain power through these pins.

On some devices, the transmission and receiving directions are determined by RTS. In normal applications, only A-Line, B-Line, and the shield layer need to be used.

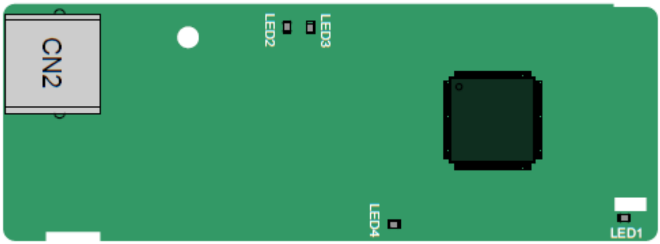
The indicators are described as follows:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Online indicator	This indicator is on when the communication card is online and data exchange can be performed. It is off when the communication card is not in the online state.
LED3	Offline/Fault indicator	This indicator is on when the communication card is offline and data exchange cannot be performed. It blinks when the communication card is not in the offline state. It blinks at the frequency of 1 Hz when 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. It blinks at the frequency of 2 Hz when 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. It blinks at the frequency of 4 Hz when an error occurs in the ASIC initialization of PROFIBUS communication. It is off when the diagnosis function is disabled.
LED4	Power indicator	This indicator is on after the control board feeds

Indicator No.	Definition	Function
		power to the communication card.

For details about the operation, see the *Goodrive350 Series VFD Communication Extension Card Operation Manual*.

A.5.3 Ethernet communication card (EC- X504)



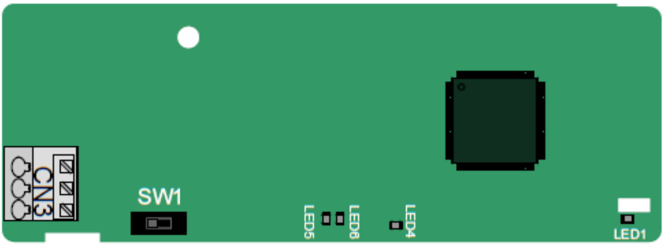
The EC-TX504 communication card adopts standard RJ45 terminals.

The indicators are described as follows:

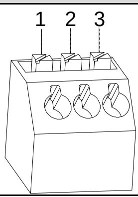
Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Network connection status indicator	This indicator is on when the physical connection between the extension card network interface and upper computer network interface is successful. It is off when the physical connection between the extension card network interface and upper computer network interface fails.
LED3	Network communication status indicator	This indicator is on when the physical connection between the extension card network interface and upper computer network interface is successful, and there is interaction between the extension card and upper computer. It is off when the physical connection between

Indicator No.	Name	Function
		the extension card network interface and upper computer network interface is successful, but there is no interaction between the extension card and upper computer.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.

A.5.4 CANopen communication card (EC-TX505) and CAN master/slave control communication card (EC-TX511)



EC-TX505/511 communication cards are user-friendly, adopting spring terminals.

3-pin spring terminal	Pin	Function	Description
	1	CANH	CANopen bus high level signal
	2	CANG	CANopen bus shielding
	3	CANL	CANopen bus low level signal

The terminal resistor switch is described as follows:

Terminal resistor switch	Position	Function	Description
	Left	OFF	CAN_H and CAN_L are not connected to a terminal resistor.
	Right	ON	CAN_H and CAN_L are connected to a terminal resistor of 120 Ω.

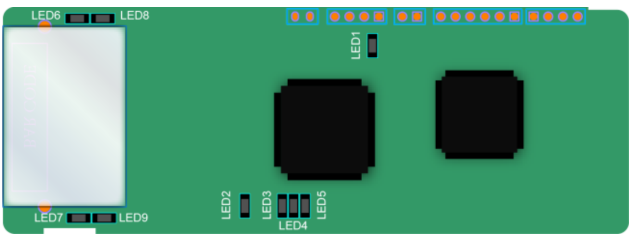
The indicators are described as follows:

Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board;

Indicator No.	Name	Function
		it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.
LED5	Running indicator	This indicator is on when the communication card is in the working state. It is off when a fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected. It blinks when the communication card is in the pre-operation state. It blinks once when the communication card is in the stopped state.
LED6	Error indicator	This indicator is on when the CAN controller bus is off or a fault occurs on the VFD. It is off when the communication card is in the working state. It blinks when the address setting is incorrect. It blinks once when a received frame is missed or an error occurs during frame receiving.

For details, see the *Goodrive350 Series VFD Communication Extension Card Operation Manual*.

A.5.5 PROFINET communication card (EC-TX509)



The terminal CN2 adopts a standard RJ45 interface, where CN2 is the dual RJ45 interface, and these two RJ45 interfaces are not distinguished from each other and are interchangeably swappable. They are arranged as follows:

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

The indicators are described as follows:

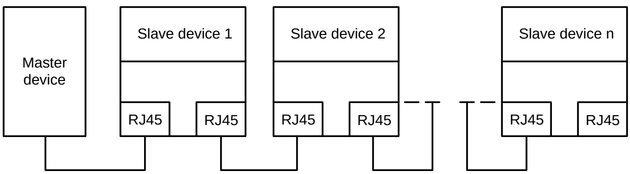
The PROFINET communication card has 9 indicators, of which LED1 is the power indicator, LED2–5 are the communication status indicators of the communication card, and LED6–9 are the status indicators of the network port.

<table>
<tr><th>LED</th><th>Color</th><th>State</th><th>Description</th></tr>
<tr><td>LED1</td><td>Green</td><td></td><td>3.3V power indicator</td></tr>
<tr><td rowspan="3">LED2
(Bus status indicator)</td><td rowspan="3">Red</td><td>On</td><td>No network connection</td></tr>
<tr><td>Blinking</td><td>The connection to the network cable between the Profinet controller is OK, but the communication is not established.</td></tr>
<tr><td>Off</td><td>Communication with the Profinet controller has been established</td></tr>
<tr><td rowspan="2">LED3
(System fault indicator)</td><td rowspan="2">Green</td><td>On</td><td>Profinet diagnosis exists</td></tr>
<tr><td>Off</td><td>No Profinet diagnosis</td></tr>
<tr><td rowspan="3">LED4
(Slave ready indicator)</td><td rowspan="3">Green</td><td>On</td><td>TPS-1 protocol stack has started</td></tr>
<tr><td>Blinking</td><td>TPS-1 waits for MCU initialization</td></tr>
<tr><td>Off</td><td>TPS-1 protocol stack does not start</td></tr>
<tr><td>LED5
(Maintenance status</td><td>Green</td><td></td><td>Manufacturer-specific - depending on the characteristics of the device</td></tr>
</table>

LED	Color	State	Description
indicator)			
LED6/7 (Network port status indicator)	Green	On	PROFINET communication card and PC/PLC have been connected via a network cable
		Off	PROFINET communication card and PC/PLC have not been connected yet
LED8/9 (Network port communication indicator)	Green	Blinking	PROFINET communication card and PC/PLC are communicating
		Off	PROFINET communication card and PC/PLC are not yet communicating

The electrical connection is described as follows:

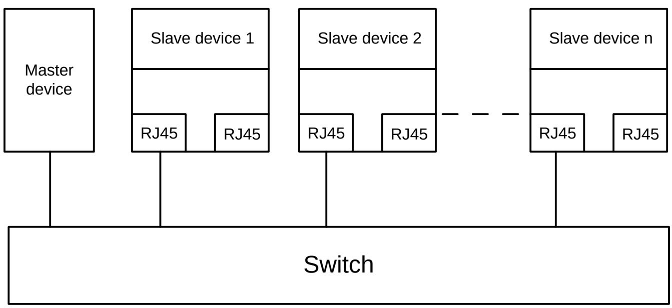
The Profinet communication card adopts a standard RJ45 interface, which can be used in a linear network topology and a star network topology. The linear network topology electrical connection diagram is shown as follows.



Linear network topology electrical connection diagram

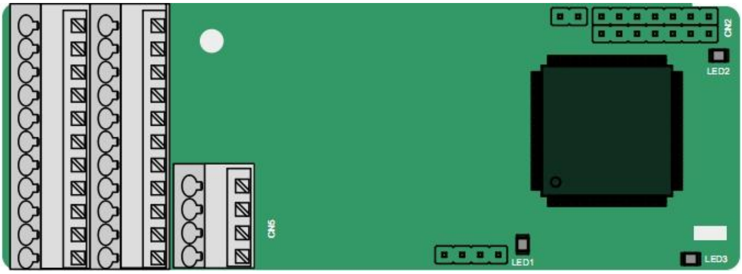
Note: For the star network topology, you need to prepare Profinet switches.

The star network topology electrical connection diagram is shown as follows:



A.6 Function description of PG extension cards

A.6.1 Sin/Cos PG card (EC-PG502)



The terminals are arrange as follows:

							C1+	C1-	D1+	D1-
PE	AO+	BO+	ZO+	A1+	B1+	R1+	A2+	B2+	Z2+	PWR
GND	AO-	BO-	ZO-	A1-	B1-	R1-	A2-	B2-	Z2-	GND

The indicators are described as follows:

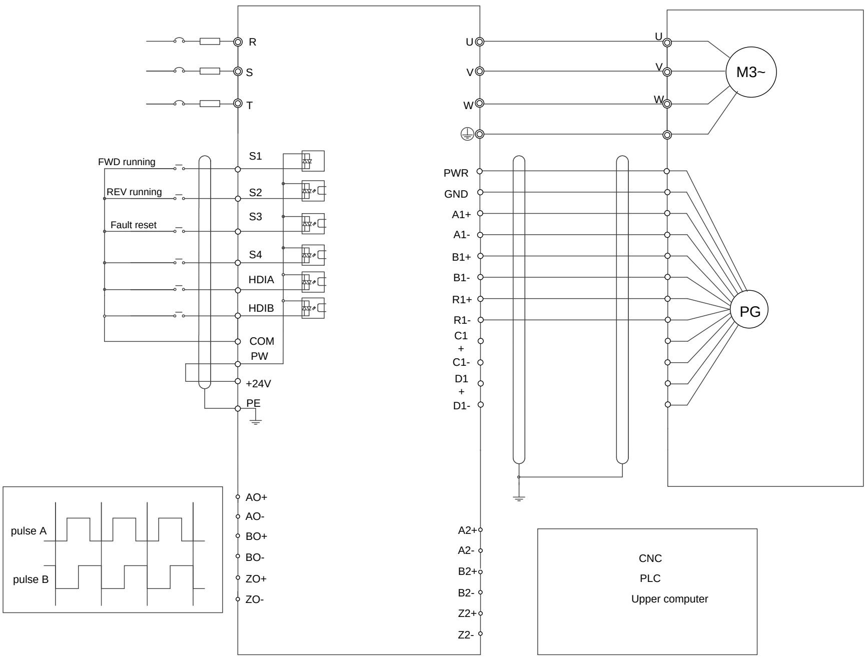
Indicator No.	Name	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Power indicator	This indicator is on after the control board feeds power to the PG card.
LED3	Disconnection indicator	This indicator is off when A1 and B1 of the encoder are disconnected; it blinks when C1 and D1 of the encoder are disconnected; and it is on the encoder signals are normal.

EC-PG502 terminals are described as follows:

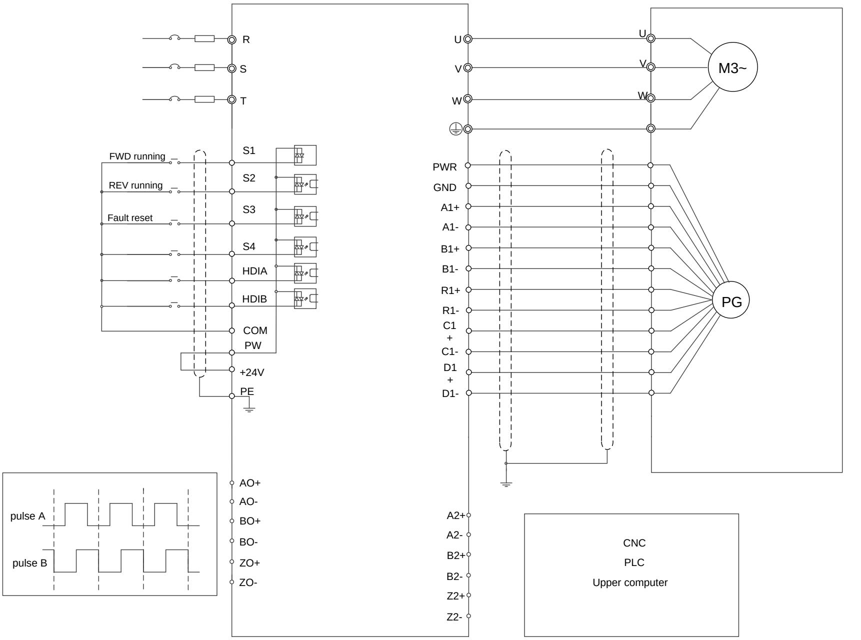
Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
PWR	Encoder power	Voltage: 5 V ± 5% Max. output current: 150 mA
GND		
A1+	Encoder interface	1. Supporting Sin/Cos encoders 2. SINA/SINB/SINC/SIND 0.6–1.2Vpp; SINR 0.2–0.85Vpp 3. Max. frequency response of A/B signals: 200 kHz Max. frequency response of C/D signals: 1 kHz
A1-		
B1+		
B1-		
R1+		
R1-		
C1+		
C1-		
D1+		
D1-		
A2+	Pulse reference	1. Differential input of 5 V 2. Frequency response: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Supporting frequency division of 2^N, which can be set through P20.16 or P24.16; Max. output
AO-		
BO+		

Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
BO-		frequency: 200 kHz
ZO+		
ZO-		

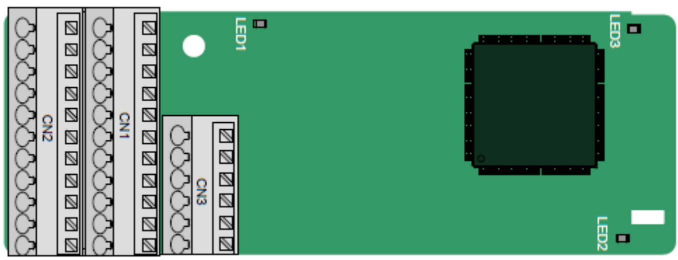
The following figure shows the external wiring of the PG card when it is used in combination with an encoder without CD signals.



The following figure shows the external wiring of the PG card when it is used in combination with an encoder with CD signals.



A.6.2 UVW incremental PG card (EC-PG503-05)



The terminals are arrange as follows:

					A2+	A2-	B2+	B2-	Z2+	Z2-
PE	AO+	BO+	ZO+	A1+	B1+	Z1+	U+	V+	W+	PWR
GND	AO-	BO-	ZO-	A1-	B1-	Z1-	U-	V-	W-	PGND

The indicators are described as follows:

Indicator No.	Name	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when A1 and B1 of the encoder is disconnected; and it is on when the pulses are normal.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

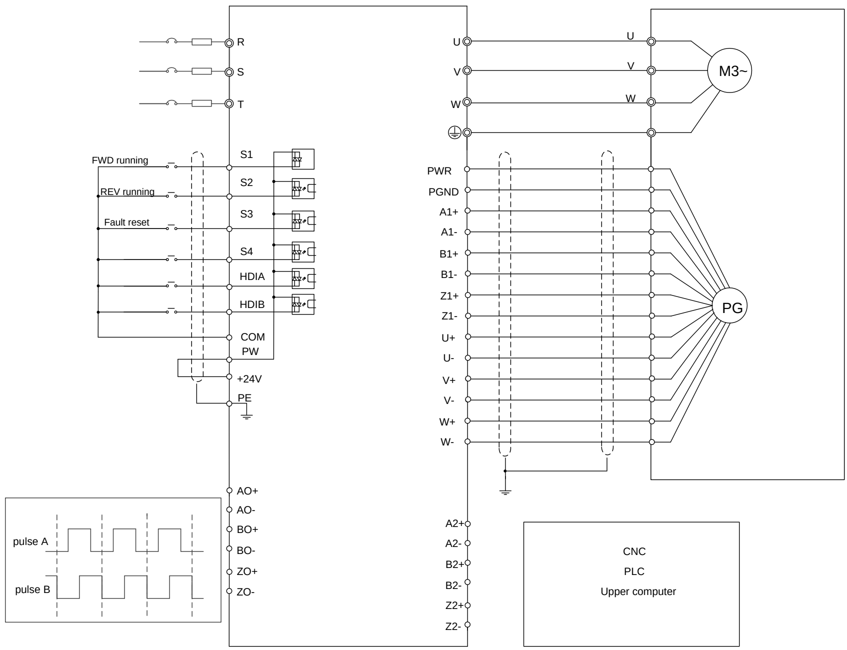
The EC-PG503-05 extension card supports the input of absolute position signals and integrates the advantages of absolute and incremental encoders. It is user-friendly, adopting spring terminals.

EC-PG503-05 terminals are described as follows:

Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
GND	Ground	Ground of the PCB internal power.
PWR	Encoder power	Voltage: 5 V±5% Max. current: 200 mA (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	1. Differential incremental PG interface of 5 V 2. Response frequency: 400 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	1. Differential input of 5 V 2. Response frequency: 200 kHz
A2-		
B2+		

Signal	Port	Terminal function
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		
U+	UVWEncoder interface	1. Absolute position (UVW information) of the hybrid encoder, differential input of 5 V 2. Response frequency: 40 kHz
U-		
V+		
V-		
W+		
W-		

The following figure shows the external wiring of the EC-PG503-05 extension card.



A.6.3 Resolver PG card (EC-PG504-00)

PE	AO+	BO+	ZO+	EX+	SI+	CO+	A2+	B2+	Z2+	PWR
GND	AO-	BO-	ZO-	EX-	SI-	CO-	A2-	B2-	Z2-	GND

The indicators are described as follows:

Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when the encoder is disconnected; it is on when the encoder signals are normal; and it blinks when the encoder signals are not stable.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

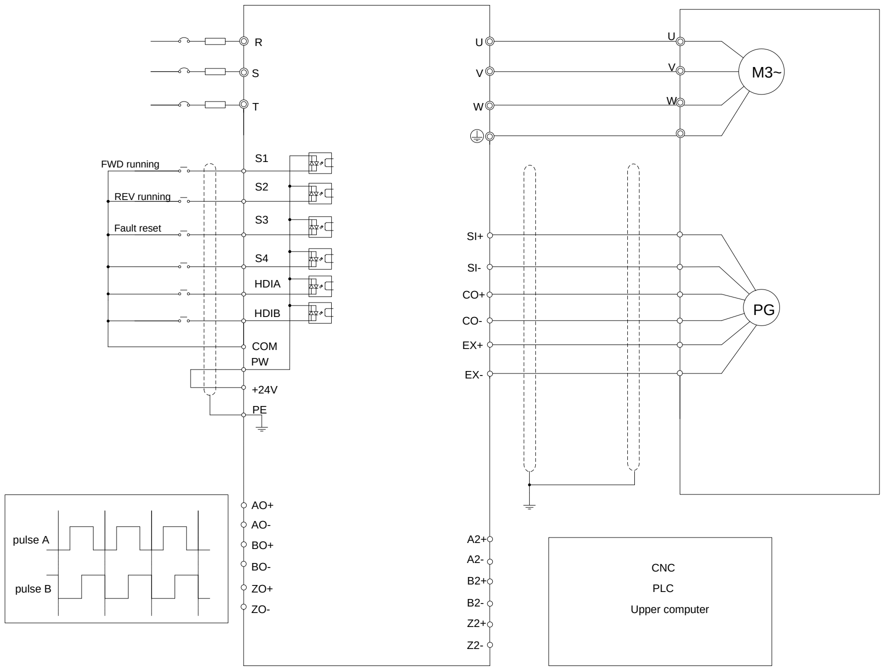
The EC-PG504-00 extension card can be used in combination with a resolver of excitation voltage 7 Vrms. It is user-friendly, adopting spring terminals.

EC-PG504-00 terminals are described as follows:

Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
PWR	Output power	Voltage: 5V±5%

Signal	Port	Terminal function
GND		
SI+	Encoder signal input	Recommended resolver transformation ratio: 0.5
SI-		
CO+		
CO-		
EX+	Encoder excitation signal	1. Factory setting of excitation: 10 kHz 2. Supporting resolvers with an excitation voltage of 7 Vrms
EX-		
A2+	Pulse reference	1. Differential input of 5 V 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Frequency-divided output of resolver simulated A1, B1, and Z1, equal to an incremental PG card of 1024 PPR, supporting frequency division of 2^N, which can be set through P20.16 or P24.16; Max. output frequency: 200 kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

The following figure shows the external wiring of the EC-PG504-00 extension card.



A.6.4 Multifunction incremental PG card (EC-PG505-12)

The terminals are arranged as follows:

The dual in-line package (DIP) switch SW1 is used to set the voltage class (5 V or 12 V) of the power supply of the encoder. The DIP switch can be operated with an auxiliary tool.

PE	AO+	BO+	ZO+	A1+	B1+	Z1+	A2+	B2+	Z2+	PWR
GND	AO-	BO-	ZO-	A1-	B1-	Z1-	A2-	B2-	Z2-	PGND

The indicators are described as follows:

Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when A1 and B1 of the encoder is disconnected; and it is on when the pulses are normal.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

The EC-PG505-12 extension card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring terminals.

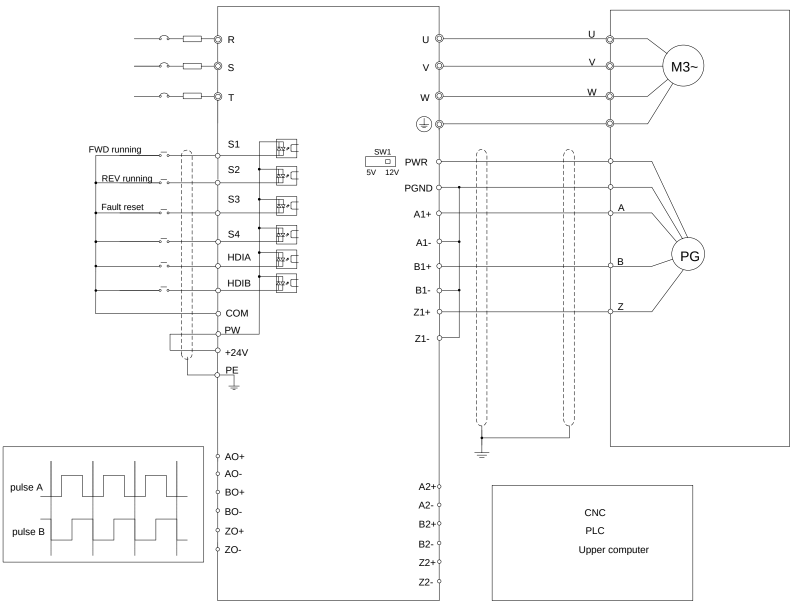
EC-PG505-12 terminal function description

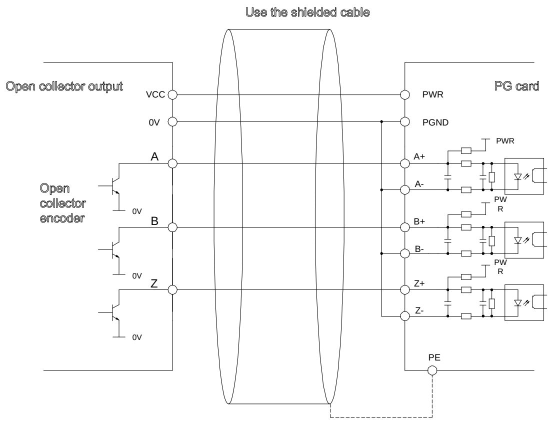
EC-PG505-12 terminals are described as follows:

Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
GND	Ground	Ground of the PCB internal power.
PWR	Encoder power	Voltage: 5V/12V ± 5% Max. current: 150 mA The voltage class can be selected through SW1, depending on the encoder voltage class. (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	1. Supporting push-pull interfaces of 5 V/12 V 2. Supporting open collector interfaces of 5 V/12 V 3. Supporting differential interfaces of 5 V 4. Response frequency: 200 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		

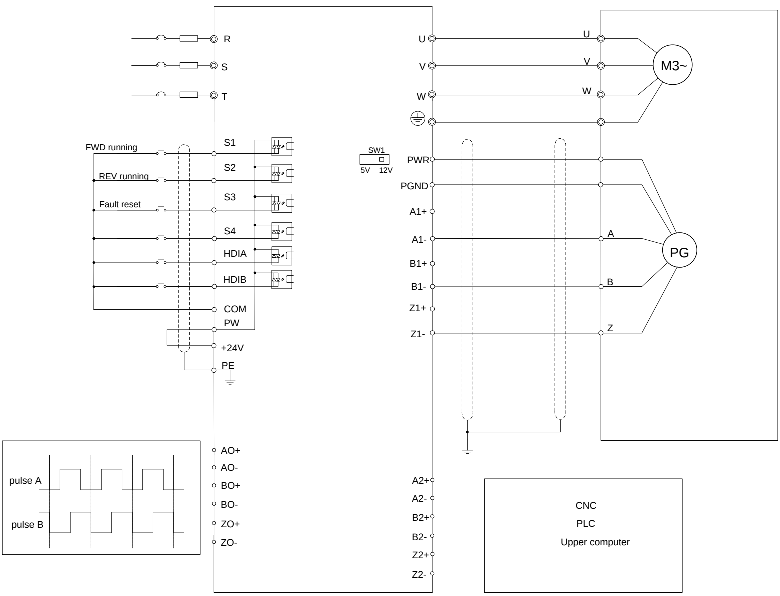
Signal	Port	Terminal function
A2+	Pulse reference	1. Supporting the same signal types as the encoder signal types 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		

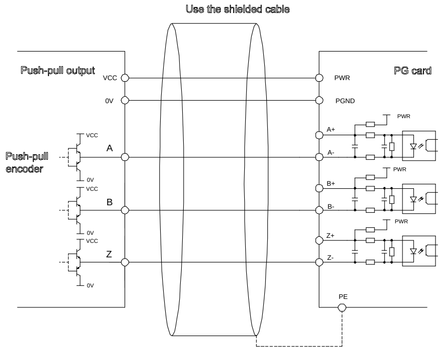
The following figure shows the external wiring of the extension card used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



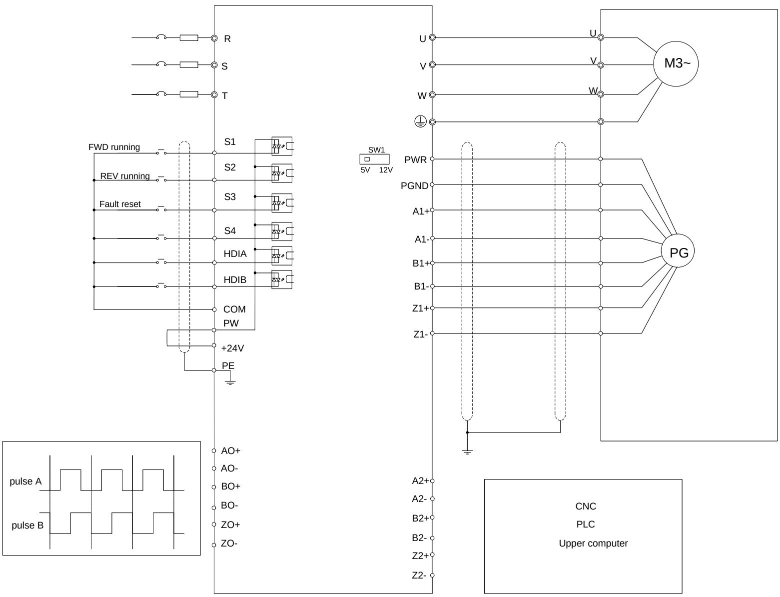


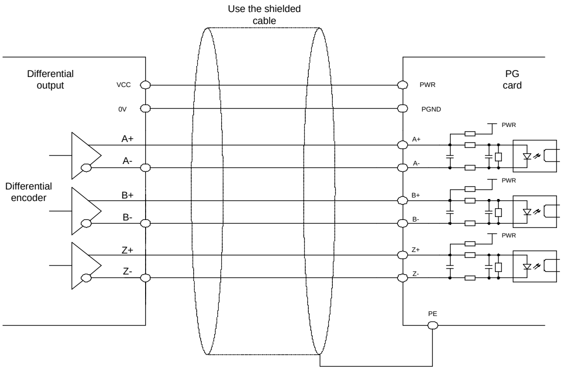
The following figure shows the external wiring of the extension card used in combination with a push-pull encoder.



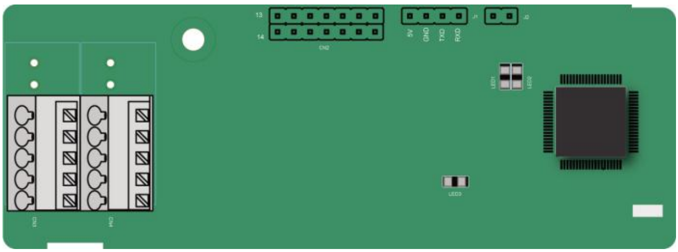


The following figure shows the external wiring of the extension card used in combination with a differential encoder.





A.6.5 Simplified incremental PG card (EC-PG507-12)



The terminals are arranged as follows:

The DIP switch SW1 is used to set the voltage class (5 V or 12 V) of the power supply of the encoder. The DIP switch can be operated with an auxiliary tool.

PE	A1+	B1+	Z1+	PWR
PGND	A1-	B1-	Z1-	PGND

The indicators are described as follows:

Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when A1 and B1 of the encoder are disconnected; it is on when the encoder pulses are normal.

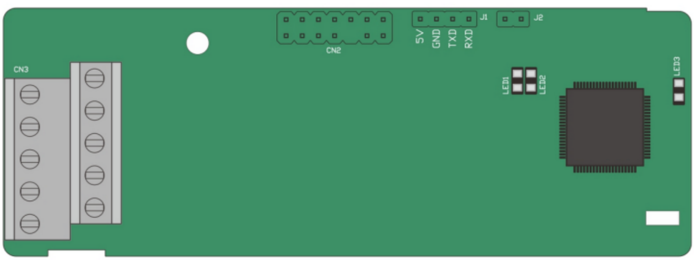
Indicator No.	Name	Function
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

EC-PG507-12 can work in combination with multiple types of incremental encoders through various external wiring modes, which are similar to the wiring modes of EC-PG505-12.

EC-PG507-12 terminals are described as follows:

Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
PWR	Encoder power	Voltage: 5V/12V ± 5% Max. current: 150 mA The voltage class can be selected through SW1, depending on the encoder voltage class. (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	1. Supporting push-pull interfaces of 5 V/12 V 2. Supporting open collector interfaces of 5 V/12 V 3. Supporting differential interfaces of 5 V 4. Response frequency: 400 kHz 5. Support the encoder cable length of up to 50 m
A1-		
B1+		
B1-		
Z1+		
Z1-		

A.6.6 24V simplified incremental PG card (EC-PG507-24)



The terminals are arranged as follows:

PE	A1+	B1+	Z1+	PWR
PGND	A1-	B1-	Z1-	PGND

The indicators are described as follows:

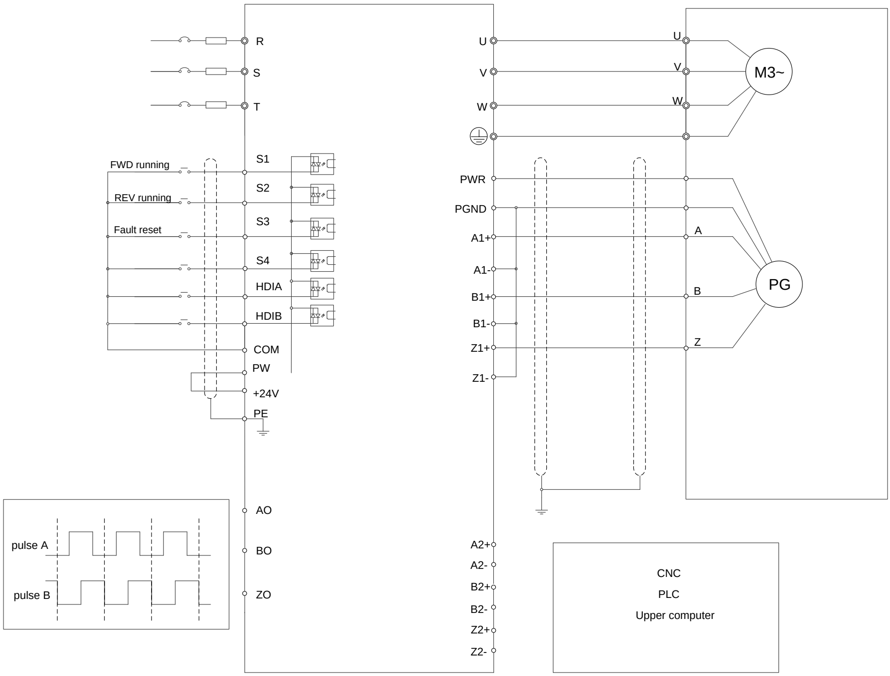
Indicator No.	Name	Function
LED1	Status indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when A1 and B1 of the encoder are disconnected; it is on when the encoder pulses are normal
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

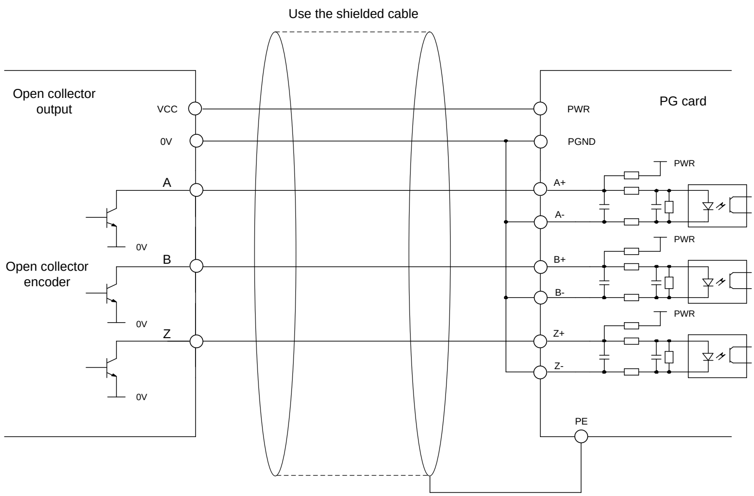
EC-PG505-24 can work in combination with multiple types of incremental encoders through various external wiring modes. It is user-friendly, adopting spring terminals.

EC-PG505-24 terminals are described as follows:

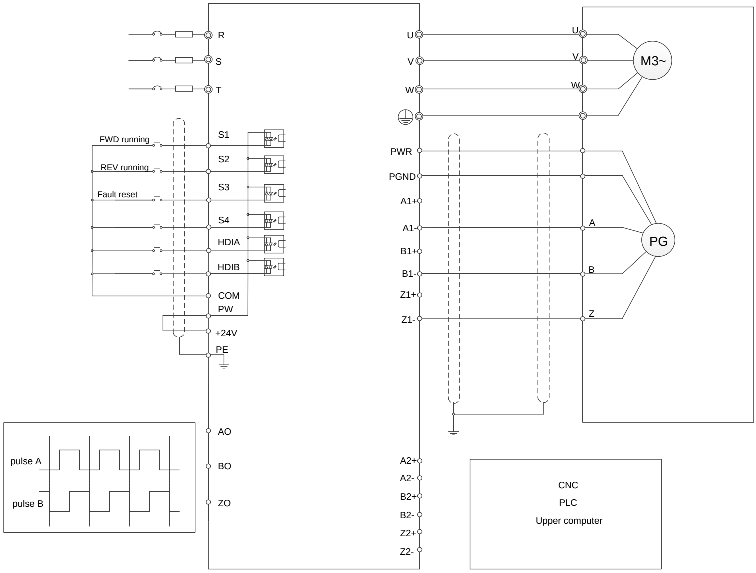
Signal	Port	Terminal function
PE	Protective earth terminal	Connected to the ground to enhance anti-interference performance.
GND	Ground	Ground of the PCB internal power.
PWR	Encoder power	Voltage: 24V ± 5% Max. current: 150 mA (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	1. Supporting push-pull interfaces of 24V 2. Supporting open collector interfaces of 24V 3. Supporting differential interfaces of 24V 4. Response frequency: 200 kHz 5. Support the encoder cable length of up to 50m
A1-		
B1+		
B1-		
Z1+		
Z1-		
Z2-		

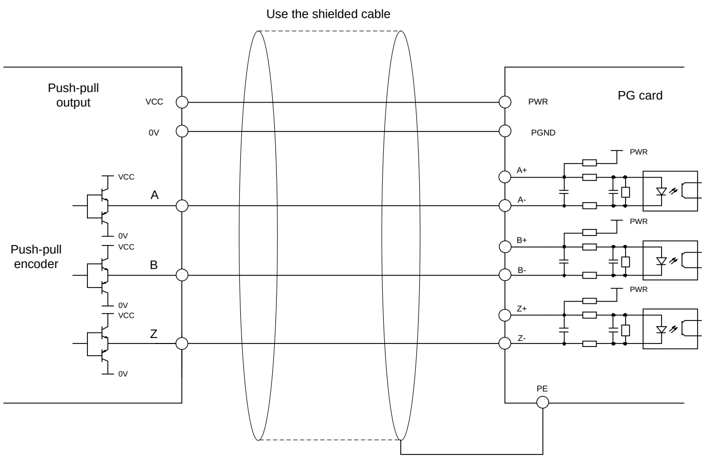
The following figure shows the external wiring of the PG card when it is used in combination with an open-drain collector encoder. A pull-up resistor is configured in the PG card.



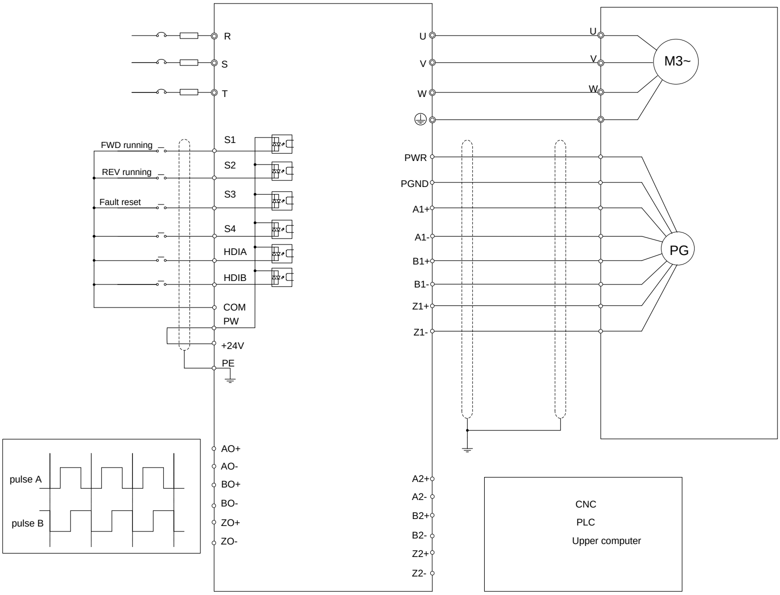


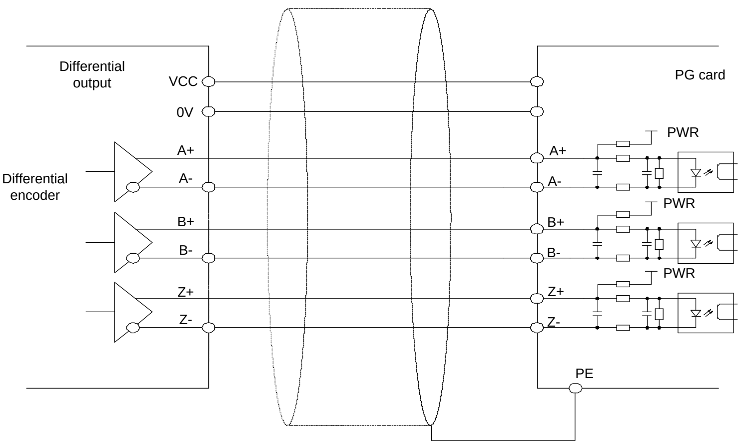
The following figure shows the external wiring of the PG card when it is used in combination with a push-pull encoder.





The following figure shows the external wiring of the PG card when it is used in combination with a differential encoder.


R
S
T
U
V
W
M3~
FWD running
REV running
Fault reset
S1
S2
S3
S4
HDIA
HDIB
COM
PW
+24V
PE
PWR
PGND
A1+
A1-
B1+
B1-
Z1+
Z1-
PG
pulse A
pulse B
AO+
AO-
BO+
BO-
ZO+
ZO-
A2+
A2-
B2+
B2-
Z2+
Z2-
CNC
PLC
Upper computer


Use the shielded cable
Differential output
VCC
0V
A+
A-
B+
B-
Z+
Z-
Differential encoder
PG card
PWR
PE

Appendix B Technical data

B.1 What this chapter contains

This chapter describes the technical data of the VFD and its compliance to CE and other quality certification systems.

B.2 Derated application

B.2.1 Capacity

Choose a VFD model based on the rated current and power of the motor. To ensure the rated power of the motor, the rated output current of the VFD must be greater or equal to the rated current of the motor. The rated power of the VFD must be higher or equal to that of the motor.

Note:

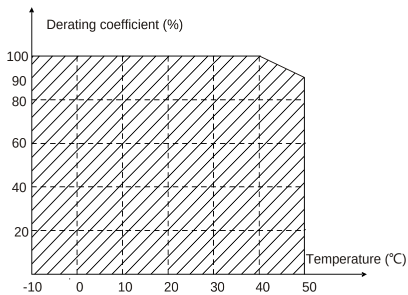
- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protect the input shaft against overload.
- The rated capacity is the capacity at the ambient temperature of 40°C.
- You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

B.2.2 Derating

If the ambient temperature on the site where the VFD is installed exceeds 40°C, the altitude exceeds 1000 m, or the switching frequency is changed from 4 kHz to 8, 12, or 15 kHz, the VFD needs to be derated.

B.2.2.1 Derating due to temperature

When the temperature ranges from +40°C to +50°C, the rated output current is derated by 1% for each increased 1°C. For the actual derating, see the following figure.



Note: It is not recommended to use the VFD at a temperature higher than 50°C. If you do, you shall be held accountable for the consequences caused.

B.2.2.2 Derating due to altitude

When the altitude of the site where the VFD is installed is lower than 1000 m, 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 the local INVT dealer or local INVT office for details.

B.2.2.3 Derating due to carrier frequency

The power of Goodrive350-19 series VFDs varies according to carrier frequencies. The VFD rated power is defined based on the carrier frequency set in factory. If the carrier frequency exceeds the factory setting, the power of the VFD is derated by 10% for each increased 1 kHz.

B.3 Grid specifications

Grid voltage	AC 3PH 380V(-15%)–440V(+10%) AC 3PH 520V(-15%)–690V(+10%)
Short-circuit capacity	According to the definition in IEC 60439-1, the maximum 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 100 kA when the VFD runs at the maximum rated voltage.
Frequency	50/60 Hz ± 5%, with a maximum change rate of 20%/s

B.4 Motor connection data

Motor type	Asynchronous induction motor or permanent magnetic synchronous motor
Voltage	0–U1 (rated voltage of the motor), 3PH symmetrical, Umax (rated voltage of the VFD) at the field-weakening point
Short-circuit protection	The short-circuit protection for the motor output meets the requirements of IEC 61800-5-1.
Frequency	0–400 Hz
Frequency resolution	0.01 Hz
Current	See the rated current.
Power limit	1.5 times of the rated power of the motor
Field-weakening point	10–400 Hz
Carrier frequency	4, 8, 12, or 15 kHz

B.4.1 EMC compatibility and motor cable length

The following table describes the maximum motor cable lengths that meet the requirements of the EU EMC directive (2004/108/EC) when the carrier frequency is 4 kHz.

All models (with external EMC filters)	Maximum motor cable length (m)
Environment category II (C3)	30
Environment category I (C2)	30

You can learn the maximum length of the motor cable through the running parameters of the VFD. To understand the accurate maximum cable length for using an external EMC filter, contact the local INVT office.

For description about the environments categories I (C2) and II (C3), see section "EMC regulations".

B.5 Application standards

The following table describes the standards that the VFDs comply with.

EN/ISO 13849-1:2008	Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
IEC/EN 60204-1:2006	Safety of machinery—Electrical equipment of machines. Part 1: General requirements
IEC/EN 62061:2005	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
IEC/EN 61800-3:2004	Adjustable speed electrical power drive systems—Part 3:EMC requirements and specific test methods
IEC/EN 61800-5-1:2007	Adjustable speed electrical power drive systems—Part 5-1: Safety requirements—Electrical, thermal and energy
IEC/EN 61800-5-2:2007	Adjustable speed electrical power drive systems—Part 5-2: Safety requirements—Function
GB/T 30844.1-2014	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 1: Technical conditions
GB/T 30844.2-2014	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 2: Test methods
GB/T 30844.3-2017	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 3: Safety regulations

B.5.1 CE marking

The CE marking on the VFD nameplate indicates that the VFD is CE-compliant, meeting the regulations of the European low-voltage directive (2006/95/EC) and EMC directive (2004/108/EC).

B.5.2 EMC compliance declaration

European union (EU) stipulates that the electric and electrical devices sold in Europe cannot generate electromagnetic disturbance that exceeds the limits stipulated in related standards, and can work properly in environments with certain electromagnetic interference. The EMC product standard (EN 61800-3:2004) describes the EMC standards and specific test methods for adjustable speed electrical power drive systems. Products must strictly follow these EMC regulations.

B.6 EMC regulations

The EMC product standard (EN 61800-3:2004) describes the EMC requirements on VFDs.

Application environment categories

Category I: Civilian environments, including application scenarios where VFDs are directly connected to the civil power supply low-voltage grids without intermediate transformers

Category II: All environments except those in Category I.

VFD categories

C1: Rated voltage lower than 1000 V, applied to environments of Category I.

C2: Rated voltage lower than 1000 V, non-plug, socket, or mobile devices; power drive systems that must be installed and operated by specialized personnel when applied to environments of Category I

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of VFDs, but it specifies their use, installation, and commissioning. 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.

C3: Rated voltage lower than 1000 V, applied to environments of Category II. They cannot be applied to environments of Category I.

C4: Rated voltage higher than 1000 V, or rated current higher or equal to 400 A, applied to complex systems in environments of Category II.

B.6.1 VFD category of C2

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix D and install it following the description in the EMC filter manual.
2. Select the motor and control cables according to the description in the manual.
3. Install the VFD according to the description in the manual.
4. For the maximum length of the motor cable when the switching frequency is 4 kHz, see section "EMC compatibility and motor cable length".

	✧ Currently in environments in China, the VFD may generate radio interference, you need to take measures to reduce the interference.

B.6.2 VFD category of C3

The anti-interference performance of the VFD meets the requirements of environments Category II in the IEC/EN 61800-3 standard.

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix D and install it following the description in the EMC filter manual.
2. Select the motor and control cables according to the description in the manual.
3. Install the VFD according to the description in the manual.
4. For the maximum length of the motor cable when the switching frequency is 4 kHz, see section "EMC compatibility and motor cable length".

	✧ VFDs of C3 category cannot be applied to civilian low-voltage common grids. When applied to such grids, the VFD may generate radio frequency electromagnetic interference.

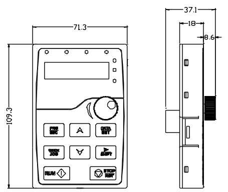
Appendix C Dimensional drawings

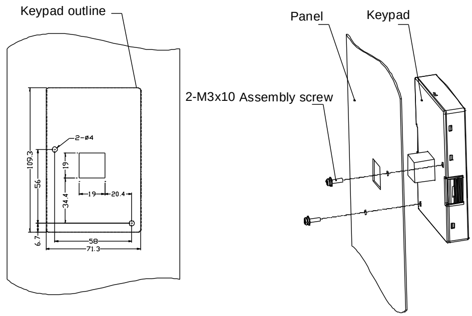
C.1 What this chapter contains

This chapter describes the dimension drawings of Goodrive350-19 series VFD. The dimension unit used in the drawings is mm.

C.2 LED keypad

C.2.1 Structural diagram

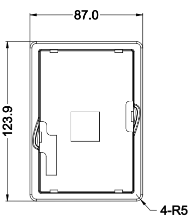




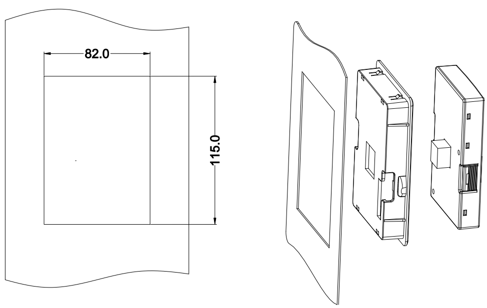
Opening sizes for installing the keypad without a braket

C.2.2 Keypad installation bracket

Note: You can directly use M3 threaded screws or an installation bracket to externally connect the keypad to the VFD. The installation bracket is optional for 380V 1.5–30 kW VFD models and 500V 4–18.5 kW VFD models. The installation bracket is a standard part for 380V 37–500 kW VFD models, 500V 22–500 kW VFD models, and all 660V VFD models.

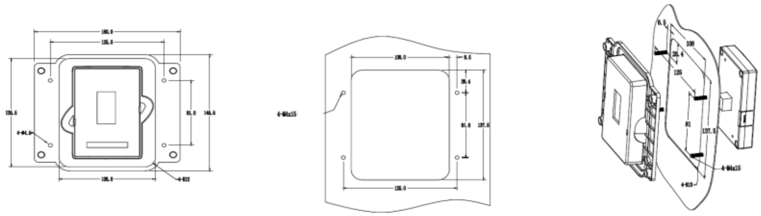


Keypad installation bracket



Installation dimensions

Figure C.1 (Optional) Installation bracket for 380V 1.5–315kW and 660V 22–630kW models

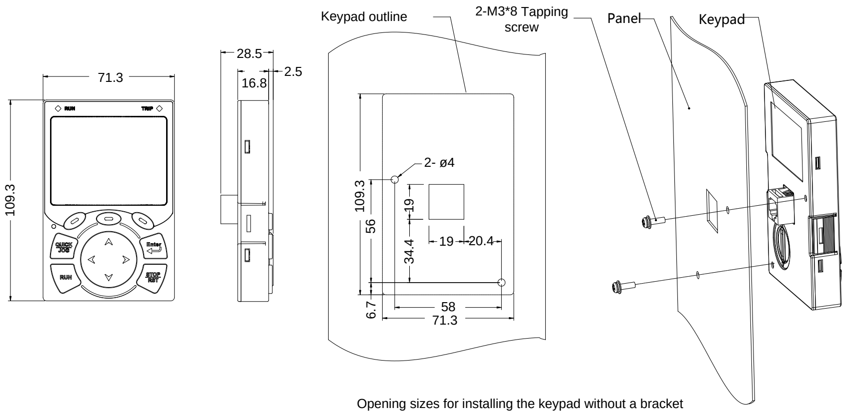


Keypad installation bracket Installation dimensions

Figure C.2 (Standard) Installation bracket for 380V 37–315kW and 660V 22–630kW models

C.3 LCD keypad

C.3.1 Structural diagram



Opening sizes for installing the keypad without a bracket

Figure C.3 Keypad structure

C.3.2 Keypad installation bracket

Note: You can directly use M3 threaded screws or an installation bracket to externally connect the keypad to the VFD. The installation bracket is optional for 380V 1.5–30 75 VFD models. The installation bracket is also optional for 380V 90–500 kW VFD models and 660V 22–630kW VFD models but the keypads for these models can be externally mounted.

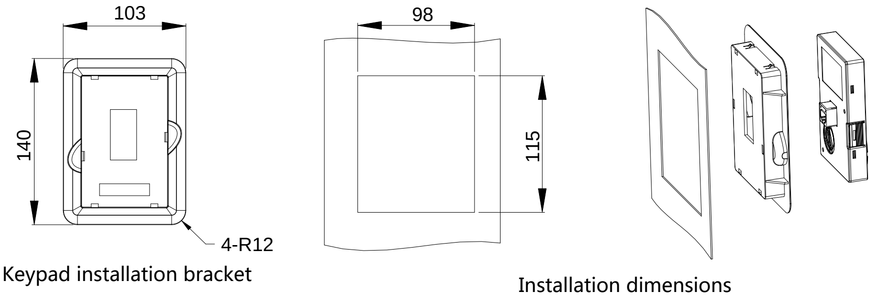


Figure C.4 (Optional) Installation bracket for 380V 1.5–500kW and 660V 22–630kW models

C.4 VFD structure

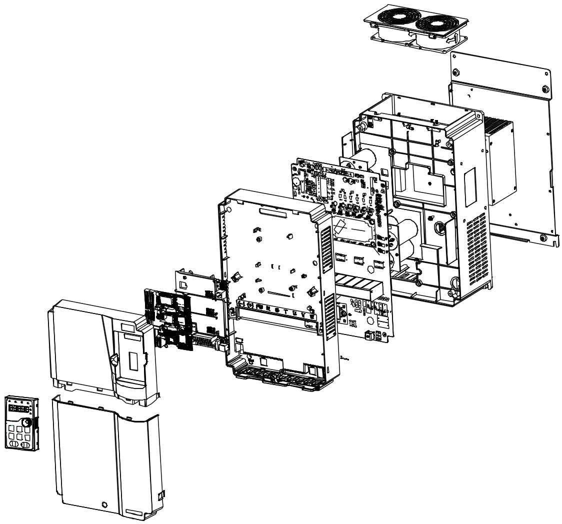


Figure C.5 VFD structure

C.5 AC 3PH 380V(-15%)–440V(+10%) VFD dimensions

C.5.1 Wall-mounting dimensions

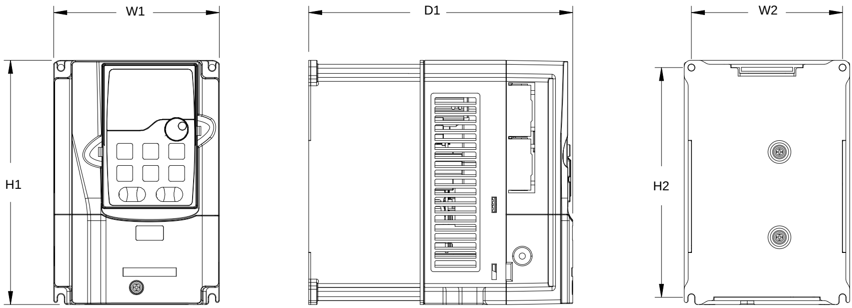


Figure C.6 380V 1.5–37kW VFD wall mounting diagram

VFD model	Outline dimensions (mm)			Hole distance (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
1.5kW–2.2kW	126	186	185	115	175	5	M4	2	3
4kW–5.5kW	126	186	201	115	175	5	M4	2.5	3.5
7.5kW	146	256	192	131	243.5	6	M5	3	4
11kW–15kW	170	320	220	151	303.5	6	M5	6	7
18.5kW–22kW	200	340.6	208	185	328.6	6	M5	8.5	10.5
30kW–37kW	250	400	223	230	380	6	M5	16	17

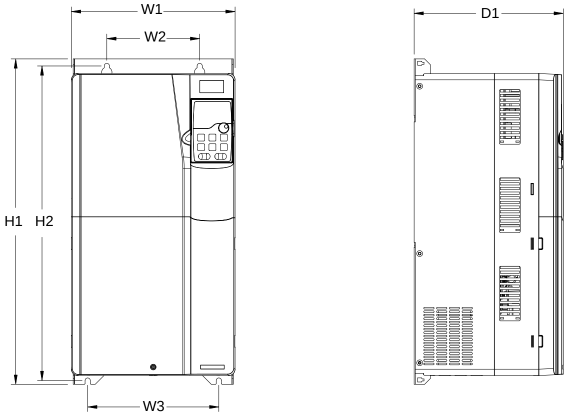


Figure C.7 380V 45–75kW VFD wall mounting diagram

VFD model	Outline dimensions (mm)			Hole distance (mm)			Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	W3	H2				
45kW–75kW	282	560	258	160	226	542	9	M8	25	29

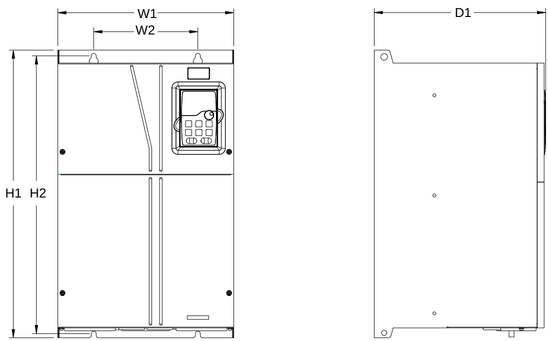


Figure C.8 380V 90–110kW VFD wall mounting diagram

VFD model	Outline dimensions (mm)			Hole distance (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
90kW–110kW	338	554	330	200	535	10	M8	41	52

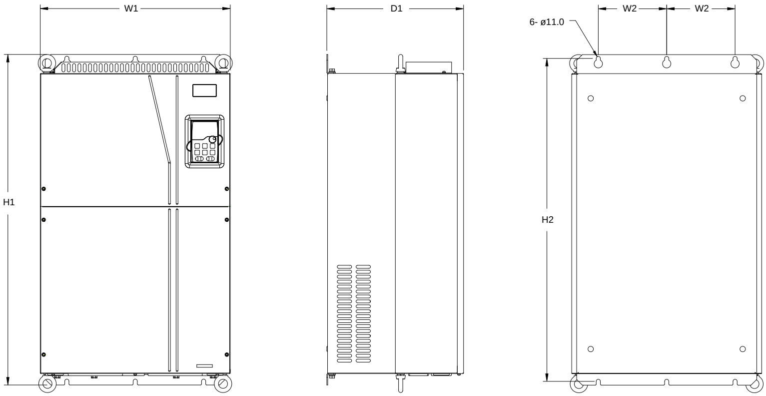


Figure C.9 380V 132–200kW VFD wall mounting diagram

VFD model	Outline dimensions (mm)			Hole distance (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
132kW–200kW	500	870	360	180	850	11	M10	85	110

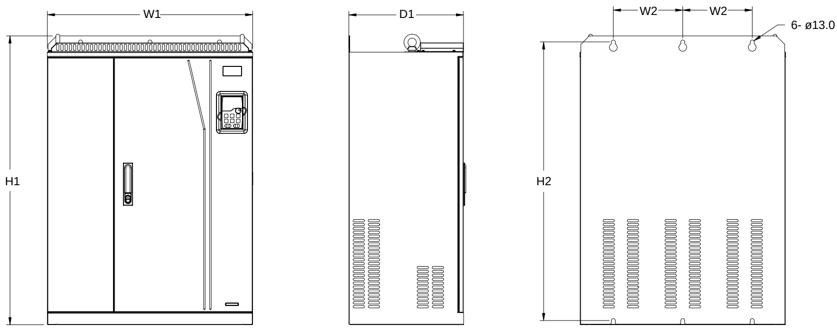


Figure C.10 380V 220–315kW VFD wall mounting diagram

VFD model	Outline dimensions (mm)			Hole distance (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
220kW–315kW	680	960	380	230	926	13	M12	135	165

C.5.2 Flange installation dimensions

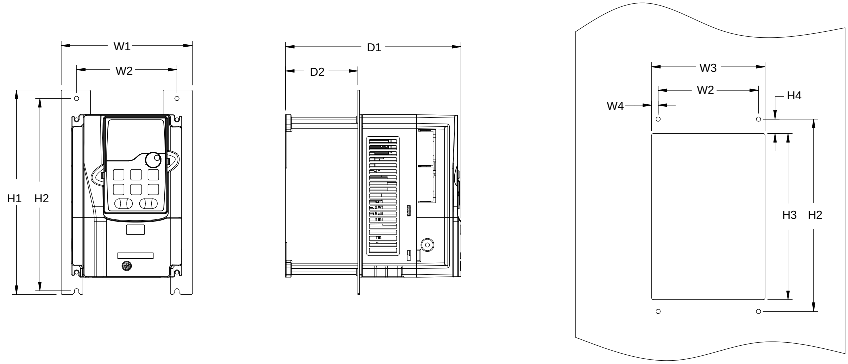


Figure C.11 380V 1.5–75kW VFD flange installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)		Hole distance (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4			
1.5kW–2.2kW	150.2	234	185	115	220	65.5	130	190	7.5	13.5	5	M4	2	3
4kW–5.5kW	150.2	234	201	115	220	83	130	190	7.5	13.5	5	M4	2.5	3.5
7.5kW	170.2	292	192	131	276	84.5	150	260	9.5	6	6	M5	3	4
11kW–15kW	191.2	370	220	151	351	113	174	324	11.5	12	6	M5	6	7
18.5kW–22kW	266	371	208	250	250	104	224	350.6	13	20.3	6	M5	8.5	10.5
30kW–37kW	316	430	223	300	300	118.3	274	410	13	55	6	M5	16	17
45kW–75kW	352	580	258	332	400	133.8	306	570	12	80	9	M8	25	29

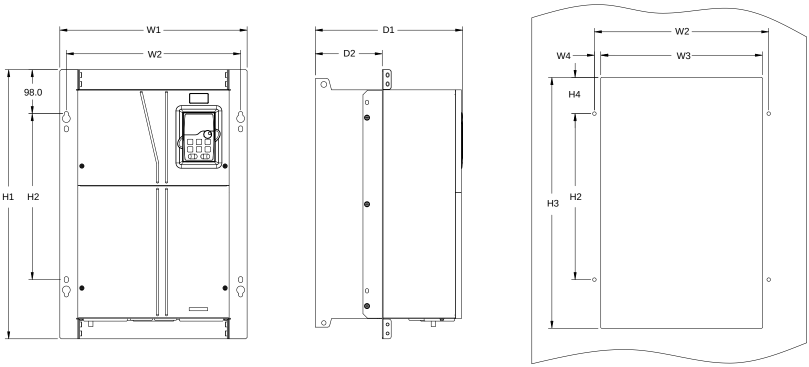


Figure C.12 380V 90–110kW VFD flange installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)			Hole distance (mm)			Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	H3	W4	H4				
90kW–110kW	418.5	600	330	389.5	370	149.5	559	14.2	108.5	10	M8	41	52

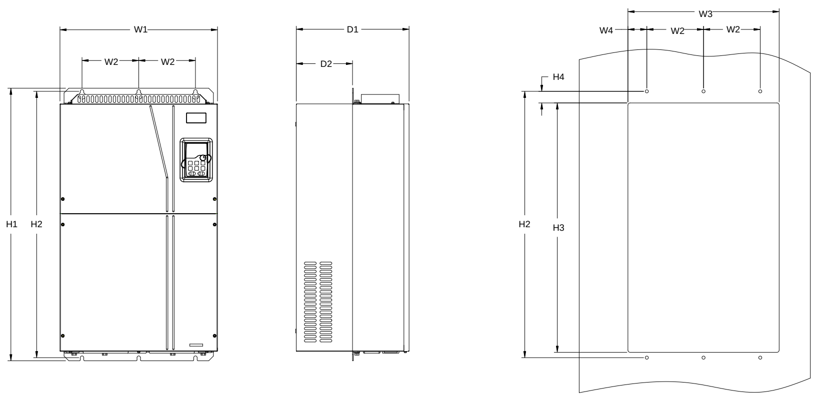


Figure C.13 380V 132–200kW VFD flange installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)			Hole distance (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4				
132kW–200kW	500	870	360	180	850	178.5	480	796	60	37	11	M10	85	110

C.5.3 Floor installation dimensions

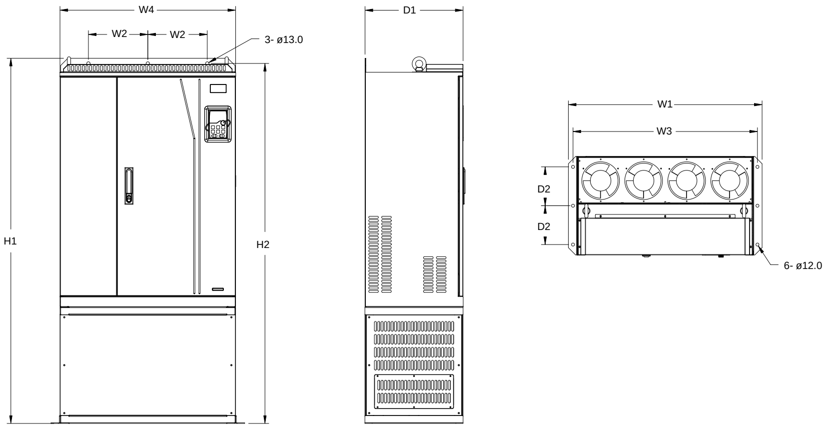


Figure C.14 380V 220–315kW VFD floor installation diagram

VFD model	Outline dimensions (mm)				Mount dimensions (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W4	W2	W3	H2	D2				
220kW–315kW	750	1410	380	680	230	714	1390	150	13/12	M12/ M10	135	165

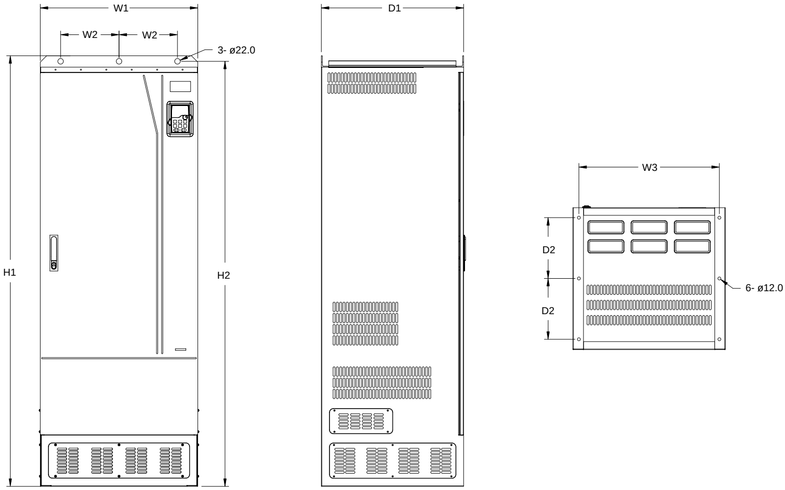


Figure C.15 380V 355–500kW VFD floor installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	W3	H2	D2				
355kW–500kW	620	1700	560	230	572	1678	240	22/12	M20/ M10	350	407

C.6 AC 3PH 520V(-15%)–690V(+10%) VFD dimensions

C.6.1 Wall-mounting dimensions

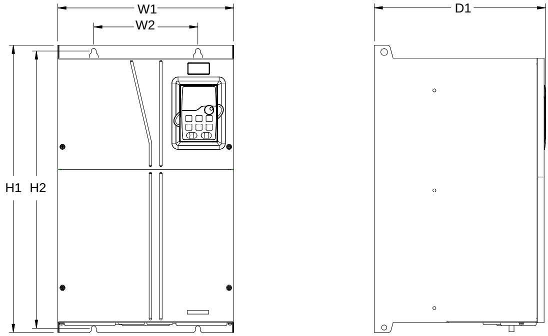


Figure C.16 660V 22–132kW VFD wall-mounting diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
22kW–45kW	270	555	325	130	540	7	M6	30	32
55kW–132kW	325	680	365	200	661	9.5	M8	47	67

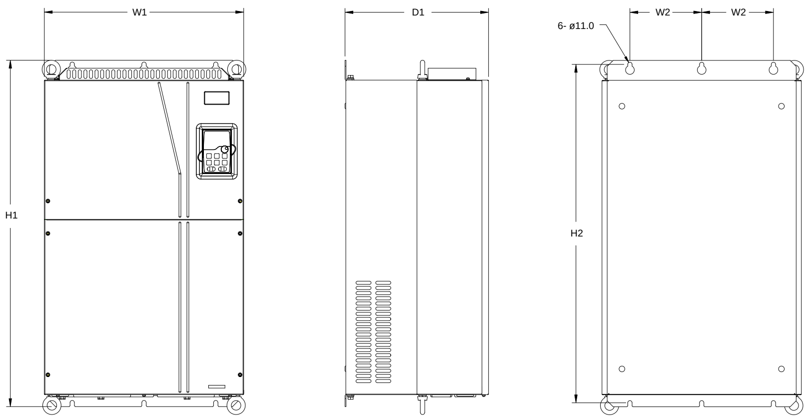


Figure C.17 660V 160–220kW VFD wall-mounting diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
160kW–220kW	500	870	360	180	850	11	M10	85	110

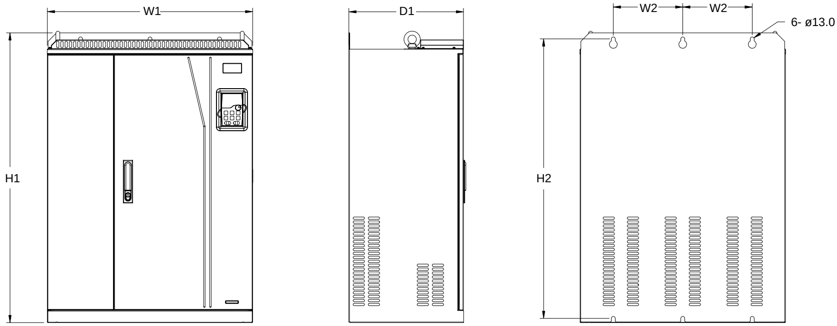


Figure C.18 660V 250–355kW VFD wall-mounting diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)		Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
250kW–355kW	680	960	380	230	926	13	M12	135	165

C.6.2 Flange installation dimensions

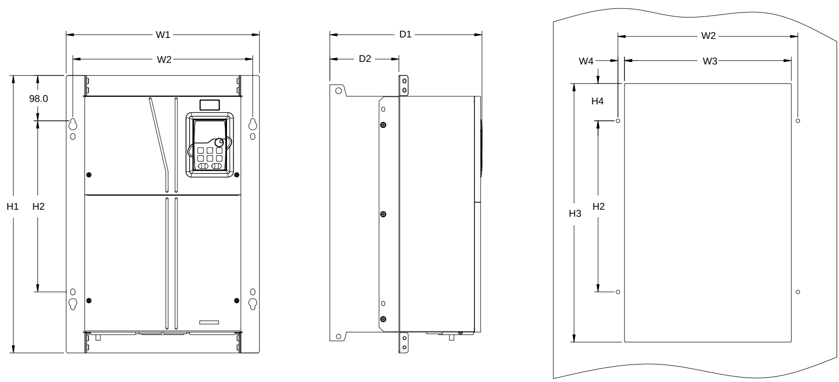


Figure C.19 660V 22–132kW VFD flange installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)			Hole distance (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4				
22kW–45kW	270	555	325	130	540	167	261	516	65.5	17	7	M6	30	32
55kW–132kW	325	680	363	200	661	182	317	626	58.5	23	9.5	M8	47	67

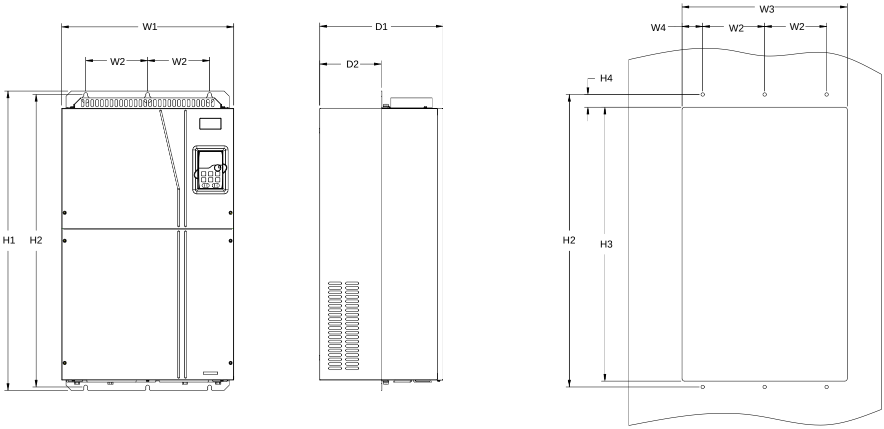


Figure C.20 660V 160–220kW VFD flange installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)			Hole distance (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4				
160kW–220kW	500	870	358	180	850	178.5	480	796	60	37	11	M10	85	110

C.6.3 Floor installation dimensions

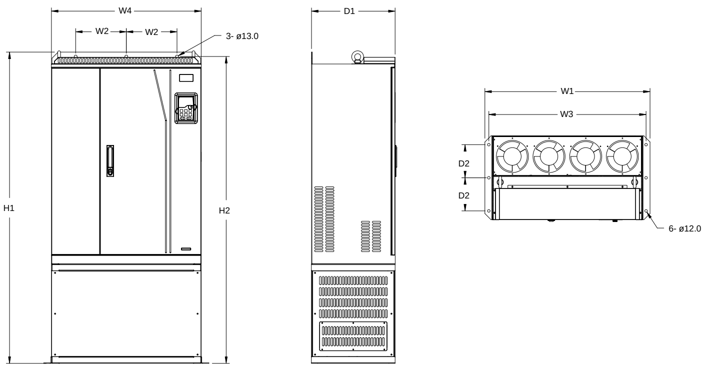


Figure C.21 660V 250–355kW VFD floor installation diagram

VFD model	Outline dimensions (mm)				Mount dimensions (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W4	W2	W3	H2	D2				
250kW–355kW	750	1410	380	680	230	714	1390	150	13/12	M12/M10	135	165

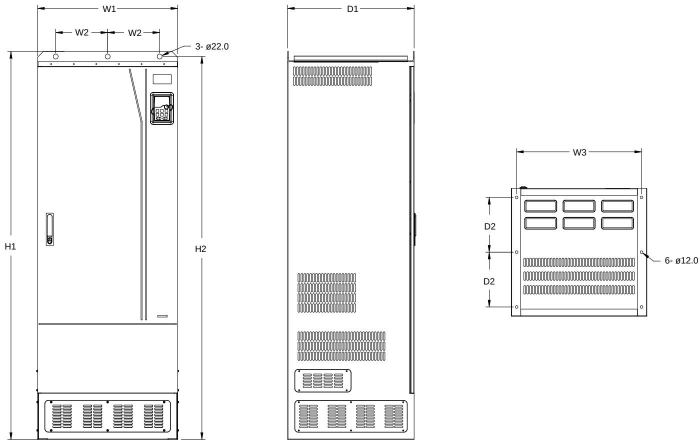


Figure C.22 660V 400–630kW VFD floor installation diagram

VFD model	Outline dimensions (mm)			Mount dimensions (mm)				Hole diameter (mm)	Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	W3	H2	D2				
400kW–630kW	620	1700	560	230	572	1678	240	22/12	M20/M10	350	407

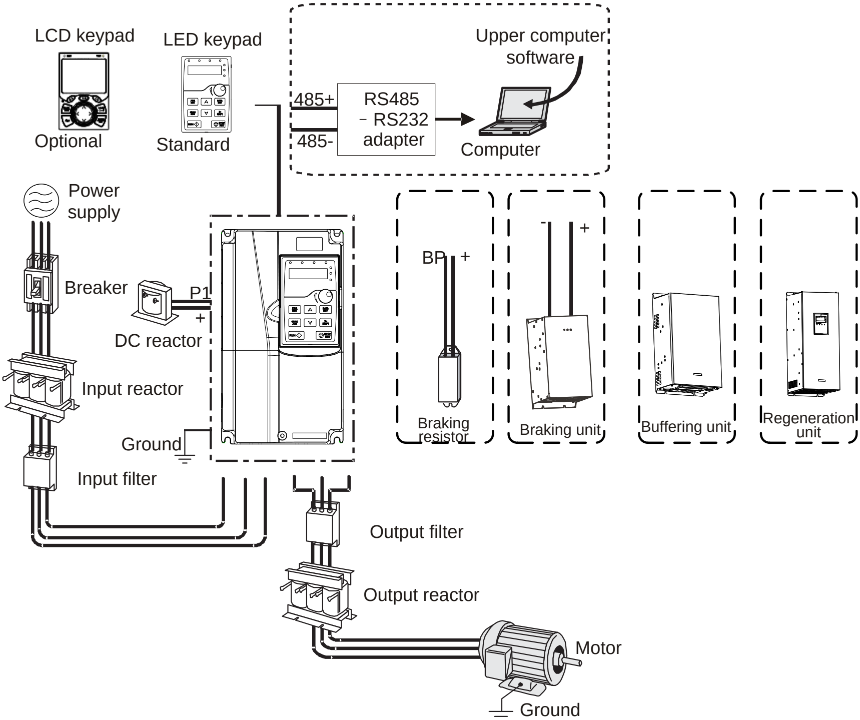
Appendix D Optional peripheral accessories

D.1 What this chapter contains

This chapter describes how to select optional accessories of Goodrive350-19 series VFDs.

D.2 Wiring of peripheral accessories

The following figure shows the external wiring of Goodrive350-19 series VFD.



Note:

- The 380V 110kW and lower VFD models are equipped with built-in braking units.
- The 380V 18.5–110kW VFD models are equipped with built-in DC reactors.
- P1 terminals are equipped for the 380V 132 kW and higher VFD models and therefore these VFD models can be directly connected to external DC reactors.
- P1 terminals are equipped for 660V VFD models and therefore these VFD models can be directly connected to external DC reactors.
- The braking units are INVT DBU series standard braking units. For details, see the DBU

operation manual.

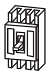
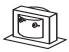
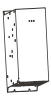
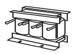
Image	Name	Description
	Cable	Accessory for signal transmission
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30 mA.
	Input reactor	Accessories used to improve the current adjustment coefficient on the input side of the VFD, and thus restrict high-order harmonic currents. Reactors have been built in the 380V 18.5–110kW VFD models as standard configuration. The 380V, 132kW or higher VFD models and 660V models can be directly connected to external DC reactors.
	DC reactor	
	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.
 or 	Braking unit or braking resistor	Accessories used to consume the regenerative energy of the motor to reduce the deceleration time. The 380V 37kW and lower VFD models need only to be configured with braking resistors, in addition to which the 380V 132kW and higher VFD models and 660V models also need to be configured with braking units, and the 380V 45–110kW VFD models can be configured with optional built-in braking units.
	Output filter	Accessory used to restrict interference generated in the wiring area on the output side of the VFD. Try to install the output filter near the output terminal side of the VFD.

Image	Name	Description
	Output reactor	Accessory used to lengthen the valid transmission distance of the VFD, which effectively restrict the transient high voltage generated during the switch-on and switch-off of the IGBT module of the VFD.

D.3 LCD keypad

You can configure the LCD keypad and LCD keypad installation bracket (which are optional parts) for the VFD.

Item	Model	Oder No.
LCD keypad	KEY-LCD01-ZY-350	11022-00118
Bracket	GD350 compatible keypad bracket	19005-00149
3 m keypad cable	Keypad cable; L=3M(CHV-SE)	37005-00022

D.4 Power supply

See "Installing".

	✧ Ensure that the voltage class of the VFD is consistent with that of the grid.

D.5 Cables

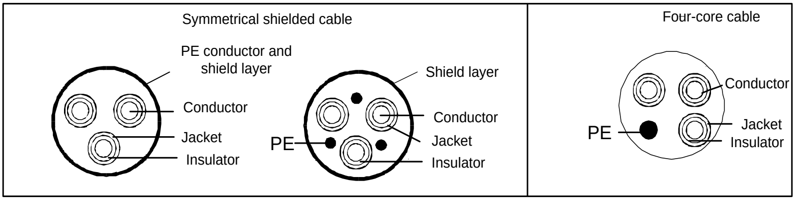
D.5.1 Power cables

The sizes of the input power cables and motor cables must meet the local regulation.

- 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 VFD models of higher than 30kW, the cross sectional area of the PE grounding conductor can be slightly less than the recommended area.
- For details about the EMC requirements, see Appendix B "Technical data."

To meet the EMC requirements stipulated in the CE standards, you must use symmetrical shielded cables as motor cables (as shown in the following figure).

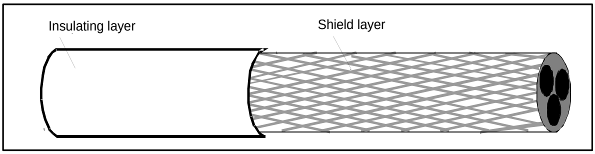
Four-core cables can be used as input cables, but symmetrical shielded cables are recommended. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.



Note: If the conductivity of the shield layer of the motor cables cannot meet the requirements, separate PE conductors must be used.

To protect the conductors, the cross-sectional area of the shielded cables must be the same as that of the phase conductors if the cable and conductor are made of materials of the same type. This reduces grounding resistance, and thus improves impedance continuity.

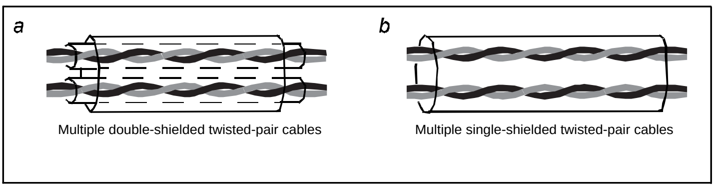
To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must at least be 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum requirement on motor cables of a VFD. The cable must consist of a layer of spiral-shaped copper strips. The denser the shield layer is, the more effectively the electromagnetic interference is restricted.



Cross-section of the cable

D.5.2 Control cables

All analog control cables and cables used for frequency input must be shielded cables. Analog signal cables need to be double-shielded twisted-pair cables (as shown in figure a). Use one separate shielded twisted pair for each signal. Do not use the same ground wire for different analog signals.



Power cable arrangement

For low-voltage digital signals, double-shielded cables are recommended, but shielded or unshielded twisted pairs (as shown in figure b) also can be used. For frequency signals, however, only shielded cables can be used.

Relay cables need to be those with metal braided shield layers.

Keypads need to be connected by using network cables. In complicated electromagnetic environments, shielded network cables are recommended.

Note: Analog signals and digital signals cannot use the same cables, and their cables must be arranged separately.

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

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

D.5.3 Recommended cable sizes

Table D.1 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Recommended cable size (mm^2)		Connectable cable size (mm^2)				Terminal screw specs.	Tightening torque (Nm)
	RST UVW	PE	RST UVW	P1 (+)	PB (+), (-)	PE		
GD350-19-1R5G-4-B	2.5	2.5	2.5~6	2.5~6	2.5~6	2.5~6	M4	1.2~1.5
GD350-19-2R2G-4-B	2.5	2.5	2.5~6	2.5~6	2.5~6	2.5~6	M4	1.2~1.5
GD350-19-004G-4-B	2.5	2.5	2.5~6	2.5~6	2.5~6	2.5~6	M4	1.2~1.5
GD350-19-5R5G-4-B	2.5	2.5	2.5~6	2.5~6	2.5~6	2.5~6	M4	1.2~1.5
GD350-19-7R5G-4-B	4	4	2.5~6	4~6	4~6	2.5~6	M4	1.2~1.5
GD350-19-011G-4-B	6	6	4~10	4~10	4~10	4~10	M5	2.3
GD350-19-015G-4-B	6	6	4~10	4~10	4~10	4~10	M5	2.3
GD350-19-018G-4-B	10	10	10~16	10~16	10~16	10~16	M5	2.3
GD350-19-022G-4-B	16	16	10~16	10~16	10~16	10~16	M5	2.3
GD350-19-030G-4-B	25	16	25~50	25~50	25~50	16~25	M6	2.5
GD350-19-037G-4-B	25	16	25~50	25~50	25~50	16~25	M6	2.5
GD350-19-045G-4-B	35	16	35~70	35~70	35~70	16~35	M8	10
GD350-19-055G-4-B	50	25	35~70	35~70	35~70	16~35	M8	10
GD350-19-075G-4-B	70	35	35~70	35~70	35~70	16~35	M8	10
GD350-19-090G-4-B	95	50	70~120	70~120	70~120	50~70	M12	35

VFD model	Recommended cable size (mm^2)		Connectable cable size (mm^2)				Terminal screw specs.	Tightening torque (Nm)
	RST UVW	PE	RST UVW	P1 (+)	PB (+), (-)	PE		
GD350-19-110G-4-B	120	70	70~120	70~120	70~120	50~70	M12	35
GD350-19-132G-4	185	95	95~300	95~300	95~300	95~240	Terminals use nuts, and therefore you are recommended to use a wrench or sleeve.	
GD350-19-160G-4	240	120	95~300	95~300	95~300	120~240		
GD350-19-185G-4	95*2P	95	95~150	70~150	70~150	35~95		
GD350-19-200G-4	95*2P	120	95*2P ~150*2P	95*2P ~150*2P	95*2P ~150*2P	120~240		
GD350-19-220G-4	150*2P	150	95*2P ~150*2P	95*2P ~150*2P	95*2P ~150*2P	150~240		
GD350-19-250G-4	95*4P	95*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-280G-4	95*4P	95*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-315G-4	95*4P	95*4P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-355G-4	95*4P	95*4P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-400G-4	150*4P	150*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-450G-4	150*4P	150*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-500G-4	150*4P	150*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		

Note:

- Cables of the sizes 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 100 m, and the current is the rated current.
- The terminals P1, (+), PB, and (-) are used to connect to DC reactors and braking accessories.

Table D.2 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Recommended cable size (mm^2)		Connectable cable size (mm^2)				Terminal screw specs.	Tightening torque (Nm)
	RST UVW	PE	RST UVW	P1 (+)	PB (+), (-)	PE		
GD350-19-022G-6	10	10	10~16	6~16	6~10	10~16	M8	9~11
GD350-19-030G-6	10	10	10~16	6~16	6~10	10~16	M8	9~11
GD350-19-037G-6	16	16	16~25	16~25	6~10	16~25	M8	9~11
GD350-19-045G-6	16	16	16~25	16~35	16~25	16~25	M8	9~11
GD350-19-055G-6	25	16	16~25	16~35	16~25	16~25	M10	18~23
GD350-19-075G-6	35	16	35~50	25~50	25~50	16~50	M10	18~23
GD350-19-090G-6	35	16	35~50	25~50	25~50	16~50	M10	18~23
GD350-19-110G-6	50	25	50~95	50~95	25~95	25~95	M10	18~23
GD350-19-132G-6	70	35	70~95	70~95	25~95	35~95	M10	18~23
GD350-19-160G-6	95	50	95~150	95~150	25~150	50~150	Terminals use nuts, and therefore you are recommended to use a wrench or sleeve.	
GD350-19-185G-6	95	50	95~150	95~150	25~150	50~150		
GD350-19-200G-6	120	70	120~300	120~300	35~300	70~240		
GD350-19-220G-6	185	95	120~300	120~300	35~300	95~240		
GD350-19-250G-6	185	95	185~300	185~300	35~300	95~240		
GD350-19-280G-6	240	120	240~300	240~300	70~300	120~240		
GD350-19-315G-6	95*2P	120	95*2P ~150*2P	95*2P ~150*2P	95*2P ~150*2P	120~300		
GD350-19-355G-6	95*2P	150	95*2P ~150*2P	95*2P ~150*2P	95*2P ~150*2P	150~300		
GD350-19-400G-6	150*2P	150	150*2P ~300*2P	95*2P ~150*2P	95*2P ~150*2P	150~300		
GD350-19-450G-6	95*4P	95*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-500G-6	95*4P	95*2P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*2P ~150*2P		
GD350-19-560G-6	95*4P	95*4P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P	95*4P ~150*4P		

VFD model	Recommended cable size (mm^2)		Connectable cable size (mm^2)				Terminal screw specs.	Tightening torque (Nm)
	RST UVW	PE	RST UVW	P1 (+)	PB (+), (-)	PE		
GD350-19-630G-6	150*4P	150*2P	150*4P ~300*4P	150*4P ~300*4P	150*4P ~300*4P	150*4P ~240*4P		

Note:

- Cables of the sizes 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 100 m, and the current is the rated current.
- The terminals P1, (+), PB, and (-) are used to connect to DC reactors and braking accessories.

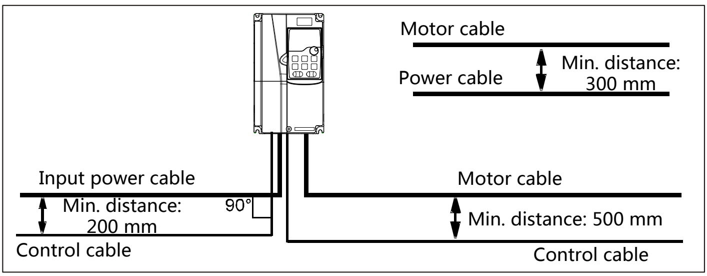
D.5.4 Cable arrangement

Motor cables must be arranged away from 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. The output dU/dt of the VFDs may increase electromagnetic interference on other cables. Do not arrange other cables and the motor cables in parallel.

If a control cable and power cable must cross each other, ensure that the angle between them is 90 degrees.

The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential.

The following figure shows the cable arrangement distance requirements.



Cable arrangement distances

D.5.5 Insulation inspection

Check the motor and the motor cable insulation conditions before running the motor.

1. 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.

2. Use a megameter of 500 V 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: The insulation resistance is reduced if it is damp inside the motor. If it may be damp, you need to dry the motor and then measure the insulation resistance again.

D.6 Breakers and electromagnetic contactors

You need to add a fuse to prevent overload.

You need to configure a manually manipulated molded case circuit breaker (MCCB) between the AC power supply and VFD. The breaker must be locked in the open state to facilitate installation and inspection. The capacity of the breaker needs to be 1.5 to 2 times the rated current of the VFD.

	✧ According to the working principle and structure of breakers, if the manufacturer's regulation is not followed, hot ionized gases may escape from the breaker enclosure when a short-circuit occurs. To ensure safe use, exercise extra caution when installing and placing the breaker. Follow the manufacturer's instructions.

To ensure safety, you can configure an electromagnetic contactor on the input side to control the switch-on and switch-off of the main circuit power, so that the input power supply of the VFD can be effectively cut off when a system fault occurs.

Table D.3 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Fuse (A)	Breaker (A)	Contactor rated current (A)
GD350-19-1R5G-4-B	15	16	10
GD350-19-2R2G-4-B	17.4	16	10
GD350-19-004G-4-B	30	25	16
GD350-19-5R5G-4-B	45	25	16
GD350-19-7R5G-4-B	60	40	25
GD350-19-011G-4-B	78	63	32
GD350-19-015G-4-B	105	63	50
GD350-19-018G-4-B	114	100	63
GD350-19-022G-4-B	138	100	80
GD350-19-030G-4-B	186	125	95
GD350-19-037G-4-B	228	160	120
GD350-19-045G-4-B	270	200	135
GD350-19-055G-4-B	315	200	170
GD350-19-075G-4-B	420	250	230
GD350-19-090G-4-B	480	315	280

VFD model	Fuse (A)	Breaker (A)	Contactor rated current (A)
GD350-19-110G-4-B	630	400	315
GD350-19-132G-4	720	400	380
GD350-19-160G-4	870	630	450
GD350-19-185G-4	1110	630	580
GD350-19-200G-4	1110	630	580
GD350-19-220G-4	1230	800	630
GD350-19-250G-4	1380	800	700
GD350-19-280G-4	1500	1000	780
GD350-19-315G-4	1740	1200	900
GD350-19-355G-4	1860	1280	960
GD350-19-400G-4	2010	1380	1035
GD350-19-450G-4	2445	1630	1222
GD350-19-500G-4	2505	1720	1290

Note: The accessory specifications described in the preceding table are ideal values. You can select accessories based on the actual market conditions, but try not to use those with lower values.

Table D.4 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Fuse (A)	Breaker (A)	Contactor rated current (A)
GD350-19-022G-6	105	63	50
GD350-19-030G-6	105	63	50
GD350-19-037G-6	114	100	63
GD350-19-045G-6	138	100	80
GD350-19-055G-6	186	125	95
GD350-19-075G-6	270	200	135
GD350-19-090G-6	270	200	135
GD350-19-110G-6	315	200	170
GD350-19-132G-6	420	250	230
GD350-19-160G-6	480	315	280
GD350-19-185G-6	480	315	280
GD350-19-200G-6	630	400	315
GD350-19-220G-6	720	400	380
GD350-19-250G-6	720	400	380
GD350-19-280G-6	870	630	450

VFD model	Fuse (A)	Breaker (A)	Contactor rated current (A)
GD350-19-315G-6	1110	630	580
GD350-19-355G-6	1110	630	580
GD350-19-400G-6	1230	800	630
GD350-19-450G-6	1470	960	735
GD350-19-500G-6	1500	1000	780
GD350-19-560G-6	1740	1200	900
GD350-19-630G-6	2010	1380	1035

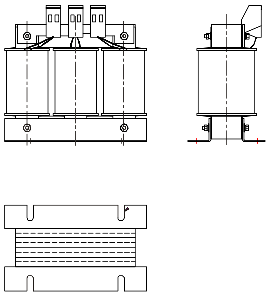
Note: The accessory specifications described in the preceding table are ideal values. You can select accessories based on the actual market conditions, but try not to use those with lower values.

D.7 Reactors

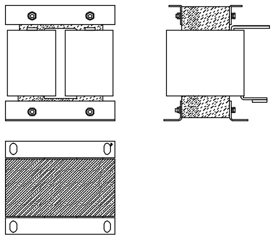
When the grid voltage is high, the transient large current that flows into the input power circuit may damage rectifier components. You need to configure an AC reactor on the input side, which can also improve the current adjustment coefficient on the input side.

When the distance between the VFD and motor is longer than 50 m, the parasitic capacitance between the long cable and ground may cause large leakage current, and overcurrent protection of the VFD may be frequently triggered. To prevent this from happening and avoid damage to the motor insulator, compensation must be made by adding an output reactor. When a VFD is used to drive multiple motors, take the total length of the motor cables (that is, sum of the lengths of the motor cables) into account. When the total length is longer than 50 m, an output reactor must be added on the output side of the VFD. If the distance between the VFD and motor is 50 m to 100 m, select the reactor according to the following table. If the distance is longer than 100 m, contact INVT technical support.

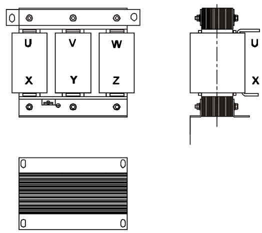
External DC reactors can be connected to VFDs of 380 V 132 kW or higher, and of 660V series. DC reactors can improve the power factor, avoid damage to bridge rectifiers caused due to large input current of the VFD when large-capacity transformers are connected, and also avoid damage to the rectification circuit caused due to harmonics generated by grid voltage transients or phase-control loads.



Input reactor



DC reactor



Output reactor

Table D.5 Reactor model selection for AC 3PH 380V(-15%)–440V(+10%) VFD models

VFD model	Input reactor	DC reactor	Output reactor
GD350-19-1R5G-4-B	ACL2-1R5-4	/	OCL2-1R5-4
GD350-19-2R2G-4-B	ACL2-2R2-4	/	OCL2-2R2-4
GD350-19-004G-4-B	ACL2-004-4	/	OCL2-004-4
GD350-19-5R5G-4-B	ACL2-5R5-4	/	OCL2-5R5-4
GD350-19-7R5G-4-B	ACL2-7R5-4	/	OCL2-7R5-4
GD350-19-011G-4-B	ACL2-011-4	/	OCL2-011-4
GD350-19-015G-4-B	ACL2-015-4	/	OCL2-015-4
GD350-19-018G-4-B	ACL2-018-4	/	OCL2-018-4
GD350-19-022G-4-B	ACL2-022-4	/	OCL2-022-4
GD350-19-030G-4-B	ACL2-037-4	/	OCL2-037-4
GD350-19-037G-4-B	ACL2-037-4	/	OCL2-037-4
GD350-19-045G-4-B	ACL2-045-4	/	OCL2-045-4
GD350-19-055G-4-B	ACL2-055-4	/	OCL2-055-4
GD350-19-075G-4-B	ACL2-075-4	/	OCL2-075-4
GD350-19-090G-4-B	ACL2-110-4	/	OCL2-110-4
GD350-19-110G-4-B	ACL2-110-4	/	OCL2-110-4
GD350-19-132G-4	ACL2-160-4	DCL2-132-4	OCL2-200-4
GD350-19-160G-4	ACL2-160-4	DCL2-160-4	OCL2-200-4
GD350-19-185G-4	ACL2-200-4	DCL2-200-4	OCL2-200-4
GD350-19-200G-4	ACL2-200-4	DCL2-220-4	OCL2-200-4
GD350-19-220G-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD350-19-250G-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD350-19-280G-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD350-19-315G-4	ACL2-350-4	DCL2-315-4	OCL2-350-4

VFD model	Input reactor	DC reactor	Output reactor
GD350-19-355G-4	Standard part	DCL2-400-4	OCL2-350-4
GD350-19-400G-4	Standard part	DCL2-400-4	OCL2-400-4
GD350-19-450G-4	Standard part	DCL2-500-4	OCL2-500-4
GD350-19-500G-4	Standard part	DCL2-500-4	OCL2-500-4

Note:

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the VFD is higher than 90% after a DC reactor is configured.
- The rated output voltage drop of output reactors is 1%±15%.
- The preceding table lists external accessories. You need to specify the ones you choose when purchasing accessories.

Table D.6 Reactor model selection for AC 3PH 520V(-15%)–690V(+10%) VFD models

VFD model	Input reactor	DC reactor	Output reactor
GD350-19-022G-6	ACL2-030-6	DCL2-030-6	OCL2-030-6
GD350-19-030G-6	ACL2-030-6	DCL2-030-6	OCL2-030-6
GD350-19-037G-6	ACL2-055-6	DCL2-055-6	OCL2-055-6
GD350-19-045G-6	ACL2-055-6	DCL2-055-6	OCL2-055-6
GD350-19-055G-6	ACL2-055-6	DCL2-055-6	OCL2-055-6
GD350-19-075G-6	ACL2-110-6	DCL2-110-6	OCL2-110-6
GD350-19-090G-6	ACL2-110-6	DCL2-110-6	OCL2-110-6
GD350-19-110G-6	ACL2-110-6	DCL2-110-6	OCL2-110-6
GD350-19-132G-6	ACL2-185-6	DCL2-185-6	OCL2-185-6
GD350-19-160G-6	ACL2-185-6	DCL2-185-6	OCL2-185-6
GD350-19-185G-6	ACL2-185-6	DCL2-185-6	OCL2-185-6
GD350-19-200G-6	ACL2-250-6	DCL2-250-6	OCL2-250-6
GD350-19-220G-6	ACL2-250-6	DCL2-250-6	OCL2-250-6
GD350-19-250G-6	ACL2-250-6	DCL2-250-6	OCL2-250-6
GD350-19-280G-6	ACL2-350-6	DCL2-350-6	OCL2-350-6
GD350-19-315G-6	ACL2-350-6	DCL2-350-6	OCL2-350-6
GD350-19-355G-6	ACL2-350-6	DCL2-350-6	OCL2-350-6
GD350-19-400G-6	Standard part	DCL2-400-6	OCL2-400-6
GD350-19-450G-6	Standard part	DCL2-560-6	OCL2-560-6
GD350-19-500G-6	Standard part	DCL2-560-6	OCL2-560-6
GD350-19-560G-6	Standard part	DCL2-560-6	OCL2-560-6

VFD model	Input reactor	DC reactor	Output reactor
GD350-19-630G-6	Standard part	DCL2-630-6	OCL2-630-6

Note:

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the VFD is higher than 90% after a DC reactor is configured.
- The rated output voltage drop of output reactors is 1%±15%.
- The preceding table lists external accessories. You need to specify the ones you choose when purchasing accessories.

D.8 Filters

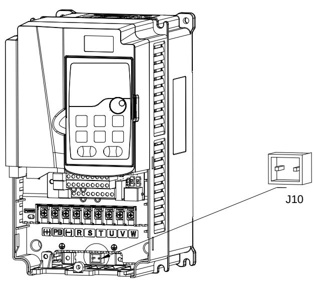
J10 is not connected in factory for the 380V 110kW and lower VFD models. Connect the J10 packaged with the manual if the requirements of level C3 need to be met.

J10 is connected in factory for the 380V 132kW and higher VFD models, all of which meet the requirements of level C3.

Note:

Disconnect J10 in the following situations:

- The EMC filter is applicable to the neutral-grounded grid system. If it is used for the IT grid system (that is, non-neutral grounded grid system), disconnect J10.
- If leakage protection occurs during configuration of a residual-current circuit breaker, disconnect J10.



Note: Do not connect C3 filters in IT power systems.

Interference filters on the input side can reduce the interference of VFDs (when used) on the surrounding devices.

Noise filters on the output side can decrease the radio noise caused by the cables between VFDs and motors and the leakage current of conducting wires.

INVT provides filters for you to choose.

D.8.1 Filter model description

FLT - P 04 045 L - B

A B C D E F

Field	Description
A	FLT: Name of the VFD filter series
B	Filter type P: Power input filter L: Output filter
C	Voltage class 04: AC 3PH 380V (-15%)–440V (+10%) 06: AC 3PH 520V (-15%)–690V (+10%)
D	3-digit code indicating the rated current. For example, 015 indicates 15 A.
E	Filter performance L: General H: High-performance
F	Filter application environment A: Environment Category I, C1 (EN 61800-3:2004) B: Environment Category I, C2 (EN 61800-3:2004) C: Environment Category II, C3 (EN 61800-3:2004)

D.8.2 Filter models

Table D.7 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Input filter	Output filter
GD350-19-1R5G-4-B	FLT-P04006L-B	FLT-L04006L-B
GD350-19-2R2G-4-B		
GD350-19-004G-4-B	FLT-P04016L-B	FLT-L04016L-B
GD350-19-5R5G-4-B		
GD350-19-7R5G-4-B	FLT-P04032L-B	FLT-L04032L-B

VFD model	Input filter	Output filter
GD350-19-011G-4-B		
GD350-19-015G-4-B	FLT-P04045L-B	FLT-L04045L-B
GD350-19-018G-4-B		
GD350-19-022G-4-B	FLT-P04065L-B	FLT-L04065L-B
GD350-19-030G-4-B		
GD350-19-037G-4-B	FLT-P04100L-B	FLT-L04100L-B
GD350-19-045G-4-B		
GD350-19-055G-4-B	FLT-P04150L-B	FLT-L04150L-B
GD350-19-075G-4-B		
GD350-19-090G-4-B	FLT-P04240L-B	FLT-L04240L-B
GD350-19-110G-4-B		
GD350-19-132G-4		
GD350-19-160G-4	FLT-P04400L-B	FLT-L04400L-B
GD350-19-185G-4		
GD350-19-200G-4		
GD350-19-220G-4	FLT-P04600L-B	FLT-L04600L-B
GD350-19-250G-4		
GD350-19-280G-4		
GD350-19-315G-4	FLT-P04800L-B	FLT-L04800L-B
GD350-19-355G-4		
GD350-19-400G-4		
GD350-19-450G-4	FLT-P041000L-B	FLT-L041000L-B
GD350-19-500G-4		

Note:

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table lists external accessories. You need to specify the ones you choose when purchasing accessories.

Table D.8 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Input filter	Output filter
GD350-19-022G-6	FLT-P06050H-B	FLT-L06050H-B
GD350-19-030G-6		
GD350-19-037G-6		
GD350-19-045G-6	FLT-P06100H-B	FLT-L06100H-B
GD350-19-055G-6		

VFD model	Input filter	Output filter
GD350-19-075G-6		
GD350-19-090G-6		
GD350-19-110G-6	FLT-P06200H-B	FLT-L06200H-B
GD350-19-132G-6		
GD350-19-160G-6		
GD350-19-185G-6		
GD350-19-200G-6	FLT-P06300H-B	FLT-L06300H-B
GD350-19-220G-6		
GD350-19-250G-6		
GD350-19-280G-6		
GD350-19-315G-6	FLT-P06400H-B	FLT-L06400H-B
GD350-19-355G-6		
GD350-19-400G-6	FLT-P061000H-B	FLT-L061000H-B
GD350-19-450G-6		
GD350-19-500G-6		
GD350-19-560G-6		
GD350-19-630G-6		

Note:

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table lists external accessories. You need to specify the ones you choose when purchasing accessories.

D.9 Braking system

D.9.1 Braking component selection

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.

✧ The design, installation, commissioning, and operation of the device must be performed by trained and qualified professionals.

✧ Follow all the "Warning" instructions during the operation. Otherwise, major physical injuries or property loss may be caused.

	✧ Only qualified electricians are allowed to perform the wiring. Otherwise, damage to the VFD or brake components may be caused. ✧ Read the braking resistor or unit instructions carefully before connecting them to the VFD. ✧ Connect braking resistors only to the terminals PB and (+), and braking units only to the terminals (+) and (-). Do not connect them to other terminals. Otherwise, damage to the brake circuit and VFD and fire may be caused.
⚠	✧ Connect the brake components to the VFD according to the wiring diagram. If the wiring is not properly performed, damage to the VFD or other devices may be caused.

The 380V 110kW and lower VFD models are equipped with built-in braking units, and the 380V 132kW and higher VFD models need to be configured with external braking units. Select braking resistors according to the actual situation.

Table D.9 Braking unit models for AC 3PH 380V(-15%)–440V(+10%) VFD models

VFD model	Braking unit			Braking resistor			
	Model	Rated continuous braking current (A)	Max. peak braking current (A)	Resistance applicable to 100% braking torque (Ω)	Recommended min. power in lifting (kW)	Recommended min. power in horizontal moving (kW)	Min. allowable resistance (Ω)
GD350-19-1R5G-4-B	Built-in braking unit	4	4.8	326	≥0.75	≥0.4	170
GD350-19-2R2G-4-B		5.4	6.5	222	≥1.1	≥0.5	130
GD350-19-004G-4-B		8.8	10.5	122	≥2	≥1	80
GD350-19-5R5G-4-B		11.6	14	89	≥2.8	≥1.4	60
GD350-19-7R5G-4-B		14.9	17.8	65	≥3.8	≥1.9	47
GD350-19-011G-4-B		22.6	27	44	≥5.5	≥2.8	31
GD350-19-015G-4-B		30.4	36.5	32	≥7.5	≥3.8	23
GD350-19-018G-4-B		36.8	44.2	27	≥9	≥4.5	19
GD350-19-022G-4-B		41	49.4	22	≥11	≥5.5	17
GD350-19-030G-4-B		54	65	17	≥15	≥7.5	13
GD350-19-037G-4-B		63.6	76.4	13	≥18.5	≥9	11
GD350-19-045G-4-B		80	96	10	≥22.5	≥11	8.8
GD350-19-055G-4-B		100	120	8	≥27.5	≥13	7
GD350-19-075G-4-B		110	132	6.5	≥37	≥18	6.4
GD350-19-090G-4-B		160	190	5.4	≥45	≥22	4.4

VFD model	Braking unit			Braking resistor			
	Model	Rated continuous braking current (A)	Max. peak braking current (A)	Resistance applicable to 100% braking torque (Ω)	Recommended min. power in lifting (kW)	Recommended min. power in horizontal moving (kW)	Min. allowable resistance (Ω)
GD350-19-110G-4-B		220	260	4.5	≥55	≥27	3.2
GD350-19-132G-4	DBU100H-220-4			3.7	≥66	≥33	3.2
GD350-19-160G-4	DBU100H-320-4			3.1	≥80	≥40	2.2
GD350-19-185G-4				2.8	≥92	≥46	
GD350-19-200G-4				2.5	≥100	≥50	
GD350-19-220G-4	DBU100H-400-4			2.2	≥110	≥55	1.8
GD350-19-250G-4				2	≥125	≥62	
GD350-19-280G-4	Two DBU100H-320-4			3.6*2	≥70*2	≥35*2	2.2*2
GD350-19-315G-4				3.2*2	≥80*2	≥40*2	
GD350-19-355G-4				2.8*2	≥90*2	≥45*2	
GD350-19-400G-4				2.4*2	≥100*2	≥50*2	
GD350-19-450G-4	Two DBU100H-400-4			2.0*2	≥125*2	≥62*2	1.8*2
GD350-19-500G-4							

Note:

- Select braking resistors according to the resistance and power data provided by our company, but the resistance cannot be less than the min. allowable resistance in the table. Otherwise, braking units may be damaged. In addition to the motor electricity generation power, braking resistors are related to inertia, DEC time, and potential energy, that is, greater inertia, shorter DEC time, and more frequent braking require braking resistors with higher power and smaller resistance.
- When grid voltages are different, you can adjust energy consumption braking threshold voltage. For example, if the threshold voltage needs to be increased, you need to increase the braking resistance.
- The recommended min. power of a braking resistor indicates the rated power of the resistor that can run in a long period of time in nature cooling condition. If air cooling fans are used, the braking resistance can be decreased slightly.
- 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.
- In hoisting applications, the resistor resistance needs to be less than the braking resistance applicant to 100% torque but greater than the min. allowable resistance.

⚠	✧ Do not use braking resistors whose resistance is lower than the specified minimum resistance for specific VFDs. VFDs do not provide protection against overcurrent caused by resistors with low resistance.

The 660V VFD models need to be configured with external braking units. Select braking resistors according to the actual situation.

Table D.10 Braking unit models for AC 3PH 520V(-15%)–690V(+10%) VFD models

VFD model	Braking unit model	Rated continuous braking current (A)	Max. peak braking current (A)	Resistance applicable to 100% braking torque (Ω)	Recommended min. power in lifting (kW)
GD350-19-022G-6	DBU100H-110-6	55	11	5.5	10
GD350-19-030G-6		40.3	15	7.5	
GD350-19-037G-6		32.7	18.5	9	
GD350-19-045G-6		26.9	23	11.5	
GD350-19-055G-6		22	27.5	13.5	
GD350-19-075G-6		16.1	37.5	19	
GD350-19-090G-6		13.4	45	22	
GD350-19-110G-6		11	55	27.5	
GD350-19-132G-6	DBU100H-160-6	9.2	66	33	6.9
GD350-19-160G-6		7.6	80	40	
GD350-19-185G-6	DBU100H-220-6	6.5	93	46	5
GD350-19-200G-6		6.1	100	50	
GD350-19-220G-6		5.5	110	55	
GD350-19-250G-6	DBU100H-320-6	4.8	125	62	3.4
GD350-19-280G-6		4.3	140	70	
GD350-19-315G-6		3.8	158	78	
GD350-19-355G-6	DBU100H-400-6	3.5	178	89	2.8
GD350-19-400G-6		3	200	100	
GD350-19-450G-6	两台 DBU100H-320-6	4.8*2	125*2	63*2	3.4*2
GD350-19-500G-6					
GD350-19-560G-6		4.3*2	140*2	70*2	
GD350-19-630G-6		3.8*2	315*2	158*2	

Note:

- Select braking resistors according to the resistance and power data provided by our company, but the resistance cannot be less than the min. allowable resistance in the table. Otherwise, braking units may be damaged. In addition to the motor electricity generation power, braking resistors are related to inertia, DEC time, and potential energy, that is, greater inertia, shorter

DEC time, and more frequent braking require braking resistors with higher power and smaller resistance.

- When grid voltages are different, you can adjust energy consumption braking threshold voltage. For example, if the threshold voltage needs to be increased, you need to increase the braking resistance.
- The recommended min. power of a braking resistor indicates the rated power of the resistor that can run in a long period of time in nature cooling condition. If air cooling fans are used, the braking resistance can be decreased slightly.
- 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.
- In hoisting applications, the resistor resistance needs to be less than the braking resistance applicant to 100% torque but greater than the min. allowable resistance.

	✧ Do not use braking resistors whose resistance is lower than the specified minimum resistance for specific VFDs. VFDs do not provide protection against overcurrent caused by resistors with low resistance.

D.9.2 Braking resistor cable selection

Braking resistor cables need to be shielded cables.

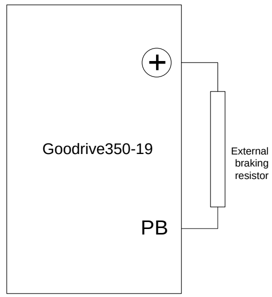
D.9.3 Braking resistor installation

All resistors need to be installed in places with good cooling conditions.

	✧ The materials near the braking resistor or braking unit must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. Prevent any materials from coming into contact with the resistor.

Installation of braking resistors

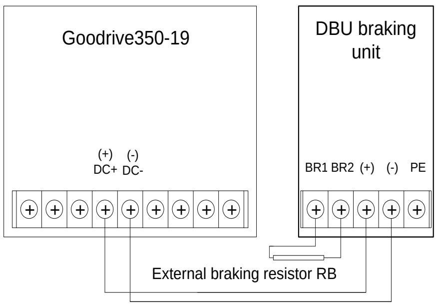
	✧ The 380V 110 kW and lower VFD models need only external braking resistors. ✧ PB and (+) are the terminals for connecting braking resistors.



Installation of braking units

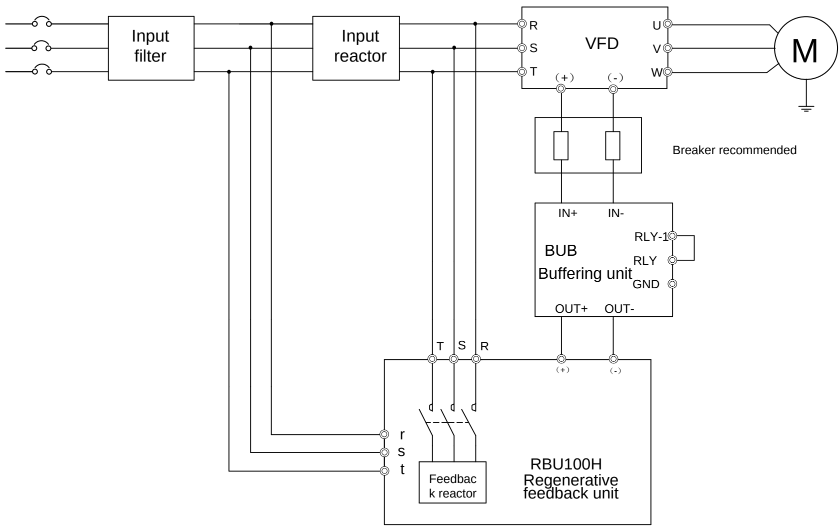
⚠	✧ All the 660V VFD models need external braking units. ✧ (+) and (-) are the terminals for connecting braking units. ✧ The connection cables between the (+) and (-) terminals of a VFD and those of a brake unit must be shorter than 5 m, and the connection cables between the BR1 and BR2 terminals of a brake unit and the terminals of a brake resistor must be shorter than 10 m.

The following figure shows the connection of one VFD to a dynamic braking unit.



D.10 Regenerative feedback unit

D.10.1 Installation wiring for regenerative feedback unit



Note: For how to select input filter, input reactor, and feedback reactor models, see the RBU100H regenerative feedback unit operation manual.

D.10.2 Regenerative feedback unit model selection

The following lists the mapping between the 380V VFD models, buffering unit models, and regenerative feedback unit models.

VFD model	Buffering unit	Regenerative feedback unit
GD350-19-022G-4-B		RBU100H-022-4
GD350-19-030G-4-B		RBU100H-030-4
GD350-19-037G-4-B		RBU100H-045-4
GD350-19-045G-4-B	BUB-110-4	RBU100H-045-4
GD350-19-055G-4-B		RBU100H-055-4
GD350-19-075G-4-B		RBU100H-090-4
GD350-19-090G-4-B		RBU100H-090-4
GD350-19-110G-4-B		RBU100H-110-4
GD350-19-132G-4	BUB-250-4	RBU100H-132-4
GD350-19-160G-4		RBU100H-160-4
GD350-19-185G-4		RBU100H-200-4
GD350-19-200G-4	Two BUB-250-4	RBU100H-200-4
GD350-19-220G-4		RBU100H-250-4

VFD model	Buffering unit	Regenerative feedback unit
GD350-19-250G-4		RBU100H-250-4
GD350-19-280G-4		Two RBU100H-160-4
GD350-19-315G-4		Two RBU100H-160-4
GD350-19-355G-4		Two RBU100H-200-4
GD350-19-400G-4	Three BUB-250-4	Two RBU100H-200-4
GD350-19-450G-4		Two RBU100H-250-4
GD350-19-500G-4		Two RBU100H-250-4

The following lists the mapping between the 660V VFD models, buffering unit models, and regenerative feedback unit models.

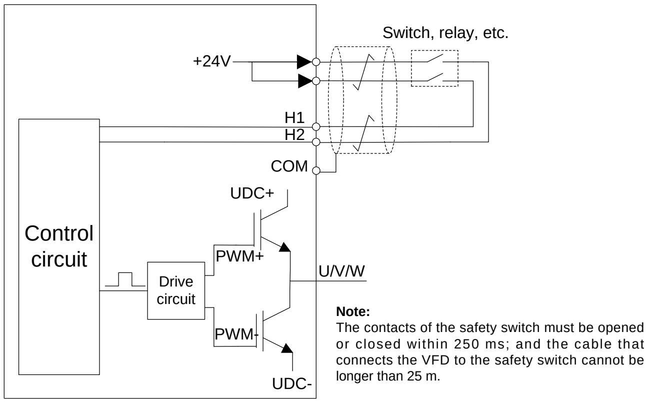
VFD model	Buffering unit	Regenerative feedback unit
GD350-19-022G-6	BUB-160-6	RBU100H-055-6
GD350-19-030G-6		RBU100H-055-6
GD350-19-037G-6		RBU100H-055-6
GD350-19-045G-6		RBU100H-055-6
GD350-19-055G-6		RBU100H-055-6
GD350-19-075G-6		RBU100H-090-6
GD350-19-090G-6		RBU100H-090-6
GD350-19-110G-6		RBU100H-160-6
GD350-19-132G-6		RBU100H-160-6
GD350-19-160G-6		RBU100H-160-6
GD350-19-185G-6	BUB-400-6	RBU100H-200-6
GD350-19-200G-6		RBU100H-200-6
GD350-19-220G-6		RBU100H-315-6
GD350-19-250G-6		RBU100H-315-6
GD350-19-280G-6		RBU100H-315-6
GD350-19-315G-6		RBU100H-315-6
GD350-19-355G-6		RBU100H-400-6
GD350-19-400G-6	Two BUB-400-6	RBU100H-400-6
GD350-19-450G-6		Two RBU100H-315-6
GD350-19-500G-6		Two RBU100H-315-6
GD350-19-560G-6		Two RBU100H-315-6
GD350-19-630G-6		Two RBU100H-315-6

Note: For details about how to use buffering units and regenerative feedback units, see the BUB series buffering unit operation manual and RBU100H regenerative feedback unit operation manual.

Appendix E STO function description

Reference standards: IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, IEC 62061, ISO 13849-1, and IEC 61800-5-2

You can enable the safe torque off (STO) function to prevent unexpected startup 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 motor startup (see the following figure). After the STO function is enabled, you can perform short-time operations (such as non-electrical cleaning in the lathe industry) and maintain the non-electrical components of the device without powering off the drive.



E.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 H1 and H2 opened, and the other closed	The STL1, STL2, or STL3 fault occurs. Fault code: 41: Channel H1 exception (STL1) 42: Channel H2 exception (STL2) 43: Channel H1 and H2 exceptions (STL3)

E.2 STO channel delay description

The following table lists the trigger and instruction delay of the STO channels.

STO mode	STO trigger delay[1] and instruction delay [2]
STO fault: STL1	Trigger delay < 10 ms Instruction delay < 280 ms
STO fault: STL2	Trigger delay < 10 ms Instruction delay < 280 ms
STO fault: STL3	Trigger delay < 10 ms Instruction delay < 280 ms
STO fault: STO	Trigger delay < 10 ms Instruction delay < 100 ms

1. STO trigger delay: Time interval between triggering the STO function and switching off the drive output
2. STO instruction delay: Time interval between triggering the STO function and instructing STO output status

E.3 STO function installation checklist

Before installing the STO function, check the items listed 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 shield layer of the STO input cable is connected to the +24 V reference ground COM.
☐	Connect the power supply.
☐	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. Ensure that the motor coasts to stop rotating. • Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.

Appendix F Further information

F.1 Product and service queries

If you have any queries about the product, contact the local INVT office. Provide the model and serial number of the product you query about. You can visit www.invt.com to find a list of INVT offices.

F.2 Feedback on INVT VFD manuals

Your comments on our manuals are welcome. Visit www.invt.com, directly contact online service personnel or choose **Contact Us** to obtain contact information.

F.3 Documents on the Internet

You can find manuals in the PDF format and other product documents on the Internet. Visit www.invt.com and choose **Service and Support** > **Data Download**.

Service line: 86-755-23535967 E-mail: overseas@invt.com.cn Website: www.invt.com

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Two companies are commissioned to manufacture: (For product code, refer to the 2nd/3rd place of S/N on the name plate.)

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