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User Manual

Frequency Inverter ST300

Preface

Overview

Thank you for choosing a Sourcetronic ST300 Series variable-frequency drive (VFD). If not otherwise specified, the VFD mentioned in this manual will refer to this device. The product's flexiblity allows for a wide range of application in various industries such as woodworking, textiles, food, printed bags, plastics, logistics and transportation equipment.

This manual primarily outlines the methods of mechanical and electrical installation, various operation modes and settings, commissioning, maintenance and troubleshooting of the device. Please make sure to read the manual carefully before installing and using the VFD.

Readers

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

Change History

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

No.	Change Description	Version	Release Date
1	First release.	v1.0	November 2023

Contents

1 Safety Precautions

1.1 Safety Declaration

Please read the user manual and carefully follow all safety precautions before moving, installing, operating and servicing the VFD. Otherwise, equipment damage, physical injury or even death may result.

We accept no liability or responsibility for any equipment damage, physical injury or death caused by the user's failure to follow the safety precautions.

1.2 Safety Level Definition

To ensure personal safety and avoid property damage, you must pay close attention to the warning symbols and additional notes given in the manual.

Warning Symbols	**Name**	**Description**
	Danger	Severe personal injury or even death may result if you do not follow these instructions.
	Electric Shock	Severe personal injury or even death may result if you do not follow these instructions. As there is still high voltage present in the bus capacitor after power-off, wait for at least **5 minutes** (depending on the warning symbols on the machine) after power-off to avoid an electric shock.
	Warning	Personal injury or equipment damage may result if you do not follow these instructions.
	Electrostatic Discharge	Equipment damage or internal component damage may result if you do not follow these instructions.
	Hot Sides	Burns may result if you do not follow these instructions.
Note	Note	Slight personal injury or equipment damage may result if you do not follow these instructions.

1.3 Personnel Requirements

Trained and qualified professionals: People operating the equipment must have received professional electrical and safety training and obtained the corresponding certificates. They must be familiar with all steps and requirements of safe installation, commissioning, running and maintaining the device, as well as able to prevent any emergencies according to their own experiences.

1.4 Safety Guidelines

	General Principles
	• Only trained and qualified professionals are allowed to carry out operations on the device. • Do not perform wiring, inspection or component replacement while the power supply is switched on. Before carrying out any of these operations, always ensure that all input power supplies have been disconnected, and wait for at least the time marked on the VFD (never any less than **5 minutes** on any model).
	• Do not modify the VFD unless authorized; otherwise you are risking a fire, electric shock or other injury. • The VFD cannot be used as an emergency-stop device. • The VFD cannot act as an emergency brake for the motor; it is a must to install a separate mechanical braking device. • Make sure that no screws, cables and other conductive parts can fall into the VFD.
	The base may get hot while the VFD is running and take a while to cool down after the device stops. Do not touch! Otherwise you may get burnt.
	The electrical parts and components inside the VFD are electrostatically sensitive. Take appropriate measures to avoid electrostatic discharge when carrying out such work.

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

	Installation
	• Do not install the VFD on flammable surfaces, and prevent the VFD from contacting or adhering to flammable materials. • Do not install the VFD if it is damaged or missing components. • Do not touch the VFD with damp objects or body parts. Otherwise, electric shock may result.
	• The installation site must be out of the reach of children and away from public places (See 3.1.3 Installation Environment and Site for details).

	• Connect the optional braking parts (such as braking resistors, braking units or feedback units) according to the wiring diagrams. • As VFD leakage current caused during running may exceed 3.5 mA, ground properly and ensure the grounding resistance is less than 10 Ω. The conductivity of the PE grounding conductor is the same as that of the phase conductor. • R, S, and T are the power input terminals, while U, V, and W are the output motor-connection terminals. Connect the input power cables and motor cables properly; otherwise equipment damage may result. • When the VFD is installed in a confined space (such as cabinet), you must provide protective measures (such as fireproof housing, electrical protective housing, mechanical protective housing, etc.) that meet the IP rating. The IP rating must comply with the relevant IEC standards and local regulations.

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

Operation	

	• Close the VFD front cover before start-up; otherwise you are risking an electric shock.
	• High voltage is present inside the VFD while it is running. Do not carry out any operation on the VFD while it is running except for keypad setup.
	• The control terminals of the VFD form extra-low voltage (ELV) circuits. Therefore, you must prevent the control terminals from being connected to accessible terminals of other devices.
	• While driving a synchronous motor, you must additionally ensure the following, besides the above-mentioned items:
	  • You have disconnected all input power supplies, including the main power and control power.
	  • You have stopped the synchronous motor, and the voltage on the output end of the VFD is lower than 36 V.

	• After the synchronous motor has stopped, wait for at least the time marked on the VFD (minimum **5 minutes**). • During operation, you must ensure that the synchronous motor cannot restart due to the effect of an external load; it is recommended to install an effective external braking device or to interrupt the direct electrical connection between the synchronous motor and the VFD.

Maintenance	
	• Do not perform VFD maintenance or component replacement while the power is on. Otherwise you may receive an electric shock. • Keep the VFD and its parts and components away from flammable materials and ensure there are no flammable materials adhering to it.
	During maintenance and component replacement, take proper anti-static measures on the VFD and its internal parts.
	Do not carry out insulation voltage-endurance testing on the VFD, and do not measure the control circuits of the VFD with a megohmmeter.
Note	Use the appropriate torque to tighten the screws.

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

2 Product Overview

2.1 Product Nameplate and Model

Each VFD comes with a nameplate containing the basic product information and relevant certification marks such as, for example, the CE mark.

Each VFD also comes with inbuilt STO (see Appendix E STO Function) and an EMC C3 filter.

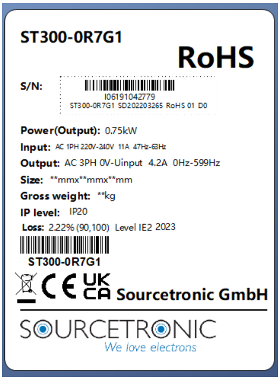


Figure 2-1 Product Nameplate

2.2 Product Specifications

Item		Specifications
Input	Input Voltage (V)	AC 1PH 200–240V AC 3PH 380–480V
	Input Current (A)	See 2.3 Product Ratings.
	Input Frequency (Hz)	50Hz or 60Hz; Allowed range: 47–63Hz
Output	Output Voltage (V)	0V–Input voltage
	Output Current (A)	See 2.3 Product Ratings.
	Output Power (Kw)	See 2.3 Product Ratings.
	Output Frequency (Hz)	0–599Hz
Control Performance	Control Mode	Space voltage vector control, and sensorless vector control (SVC)
	Motor	Motor type: Asynchronous (AM) and synchronous (SM)
	Speed Ratio	For AMs: 1:100 (SVC) For SMs: 1:20 (SVC)
	Speed Control Accuracy	±0.2% (SVC)

	Speed Fluctuation	±0.3% (SVC)
	Torque Response	<10ms (SVC)
	Torque Control Accuracy	5% (SVC)
	Starting Torque	For AMs: 0.25Hz or 150% (SVC) For SMs: 2.5Hz or 150% (SVC)
	Overload Capacity	150% of the rated current for 60s 180% of the rated current for 10s
Peripheral Interface	Terminal Analog Input Resolution	Max. 20mV
	Terminal Digital Input Resolution	Max. 2ms
	Analog Input	Two inputs. AI1: 0–10V or 0–20mA; AI2: 0–10V
	Analog Output	One output. AO1: 0–10V or 0–20mA
	Digital Input	Four regular inputs. Max. frequency: 1kHz One high-speed input. Max. frequency: 50kHz
	Digital Output	One Y terminal open collector output
	Relay Output	One programmable relay output RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A / AC 250V; 1A / DC 30V
Environment Requirement	Environmental Temperature	-10°C–50°C, no need for derating **Note:** Derating is required when the ambient temperature exceeds 50°C. For details, see A.1 Derating Due to Temperature**.**
	Ingress Protection (IP) Rating	IP20
	Pollution Degree	Degree 2
Installation Method		Wall mounting and DIN rail mounting
Cooling Method		• 220V voltage class: natural cooling for 0.75kW and lower • 380V voltage class: natural cooling for 1.5kW and lower • Others: Forced air cooling
Certification Standard		The device meets CE certification requirements.

2.3 Product Ratings

Product Model	Apparent Power (kVA)	Output Power (kW)	Input Current (A)	Output Current (A)	Max. Working Temperature	Rated Power Frequency
AC 1PH 200–240 V						
ST300-0R4G1	0.9	0.4	6.5	2.5	50°C	50 Hz or 60 Hz Allowed Range: 47–63 Hz
ST300-0R7G1	1.6	0.75	11	4.2		
ST300-1R5G1	2.8	1.5	18	7.5		
ST300-2R2G1	3.8	2.2	24.3	10		
AC 3PH 380–480 V						
ST300-0R7G3	1.6	0.75	4.5	2.5	50°C	50 Hz or 60 Hz Allowed Range: 47–63 Hz
ST300-1R5G3	2.5	1.5	6.5	3.7		
ST300-2R2G3	3.9	2.2	8.8	5.5		
ST300-003G3	5.1	3	12.2	7.5		
ST300-004G3	6.4	4	15.6	9.5		
ST300-5R5G3	9.2	5.5	22.3	14		
ST300-7R5G3	12.1	7.5	28.7	18.5		

Note: The VFD input current is measured while the input voltage is 220 V or 380 V without additional reactors.

2.4 Product Heat Dissipation

Product Model	Entire Machine Standby Power Dissipation (W)	Entire Machine Full Load Power Dissipation (W)	Heat Dissipation (BTU/hr)	Air Rate (m^3/h)	Air Rate (CFM) (ft^3/min)
AC 1PH 200–240 V					
ST300-0R4G1	5	30	101	–	–
ST300-0R7G1	5	46	155	–	–
ST300-1R5G1	5	51	172	26	15
ST300-2R2G1	5	77	264		
AC 3PH 380–480 V					
ST300-0R7G3	7	37	125	–	–
ST300-1R5G3	7	48	162	–	–

ST300-2R2G3	8	61	209	26	15
ST300-003G3	8	78	266		
ST300-004G3	8	103	350		
ST300-5R5G3	9	168	573	71	42
ST300-7R5G3	9	243	829		

2.5 Product Dimensions and Weight

VFD Model	Frame	Outline Dimensions WxHxD (mm)	Package Outline Dimensions WxHxD (mm)	Net Weight (kg)	Gross Weight (kg)
AC 1PH 200–240V					
ST300-0R4G1	A	60x190x155	238x98x205	0.99	1.19
ST300-0R7G1					
ST300-1R5G1	B	70x190x155	238x98x205	1.25	1.36
ST300-2R2G1					
AC 3PH 380–480V					
ST300-0R7G3	A	60x190x155	238x98x205	0.99	1.19
ST300-1R5G3					
ST300-2R2G3	B	70x190x155	238x98x205	1.25	1.36
ST300-003G3					
ST300-004G3					
ST300-5R5G3	C	90x235x155	298x128x213	1.95	2.2
ST300-7R5G3					

Note: The product exterior structures are divided into three frame categories: A, B, and C.

2.6 Product Structure

Warning!	
	• The micro USB interface is a software upgrade interface which requires the use of a special adapter and connection cable, but not a universal USB cable. • After switching on the VFD, the micro USB interface on the drive board is energised and therefore cannot be used!

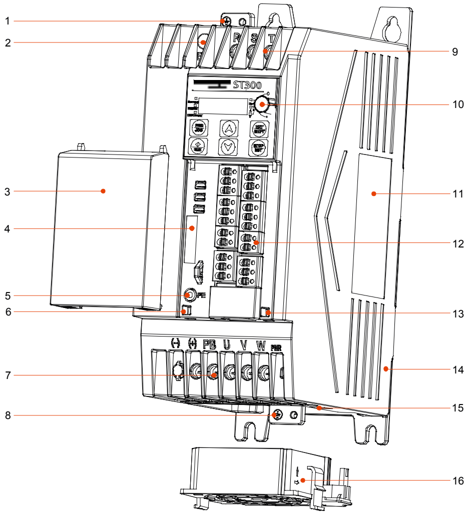


Figure 2-2 Product Components (using the VFD model 7R5G3 as an example)

No.	Component	No.	Component
1	Grounding terminal for safety protection at the input	9	Input terminal
2	EMC screw	10	Potentiometer knob
3	Cover	11	Nameplate
4	Model bar code	12	Control board terminal
5	Signal grounding terminal (PE)	13	RJ45 network port
6	Micro USB interface (on the control board)	14	Housing
7	Output terminal	15	Micro USB interface (on the drive board)
8	Grounding terminal for safety protection at the output	16	Cooling fan

2.7 System Configuration

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

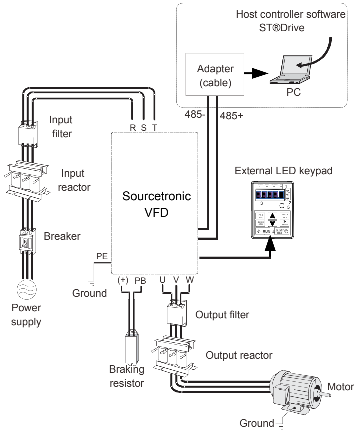


Figure 2-3 System Composition

Table 2-1 System Configuration

Component		Position	Description
	Breaker	Between the power supply and the VFD input side	Device for electric shock prevention and protection against a 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	At the VFD input side	Accessories used to improve the power factor on the input side of the VFD, and thus restrict high-order harmonic currents.
	Output Reactor	Between the VFD output side and the motor, adjacent to the VFD	(Optional) Accessory used to lengthen the valid transmission distance of the VFD, which effectively restricts the transient high voltage generated during the switch-on and switch-off of the IGBT module.
	Input Filter	At the VFD input side	(Optional) Input filter: Accessory that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Try to install the input filter near the input terminal side of the VFD.
	Output Filter	Adjacent to the VFD output terminals	

			(Optional) Output filter: Accessory used to restrict interference generated in the wiring area on the output side of the VFD. All the product series can meet the conductivity and transmission requirements of IEC/EN 61800-3:2018 C3 electrical drive systems. Optional external filters can be used in addition to also meet the conductivity and transmission requirements of IEC/EN 61800-3:2018 C2 electrical drive systems. **Note**: Please comply with the technical requirements specified in the appendix of the manual for the assembly of motors, motor cables, and filters.
	Braking Resistor	Between the VFD main circuit terminals (+) and PB	Accessories used to consume the regenerative energy of the motor to reduce the DEC time. • Braking unit: Built-in (only external braking resistor required) • Braking resistor: Optional and can be externally connected on all models
	Host Controller Software	Installed on the host controller for VFD management	The software ST®Drive is used to configure and monitor VFDs. You can use it to… • …monitor multiple VFDs. • …set and monitor function parameters; upload and download function parameters in batches. • …view modified function codes, compare default values, and follow up and query for function codes. • …query for and follow up status parameters. • …view current and past errors. • …display function codes in configuration mode. • …control device startup, stop, forward and reverse running, as well as other operations. • …view oscillographic curves, save and replay waveform data, operate waveforms through cursor, and simulate waveform data. Please visit www.sourcetronic.com to download the software.

For details about option model selection, see Appendix D Peripheral Accessories.

2.8 Quick Startup

1) Inspect the device upon unpacking.
   → see 3.1 Unpacking Inspection

2) Ensure that the load connected to the VFD matches the power supply.
   → see 2.1 Product Nameplate and Model

3) Check the installation environment.
   → see 3.1.3 Installation Environment and Site

4) Install the VFD on the wall or in the cabinet.
   → see 3.2 Installation and Uninstallation

5) Connect the wiring.
   → see 4 Electrical Installation

6) Commission the VFD.
   → see 6 Commissioning

3 Mechanical Installation

3.1 Unpacking Inspection

Upon receiving the product, please perform the following steps to ensure safety of use.

3.1.1 Check the Package

Before unpacking, check whether the product package is intact–i.e. whether the package is damaged, dampened, soaked, deformed, etc. After unpacking, check whether the interior surface of the packing box is normal, or whether it is, for example, wet.

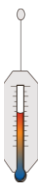
3.1.2 Check the Machine and Parts

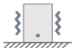
After unpacking, check whether the equipment enclosure is damaged or cracked, whether the order (including the VFD and manual) inside the packing box is complete, and whether the nameplate and label on the product body are consistent with the model you've purchased.

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

Warning	
	• Carry out operations according to instructions presented in 1.4 Safety Guidelines. Ensure the VFD power has been disconnected before installation. If the VFD has been powered on, disconnect the VFD and wait for at least the time designated on the VFD, and ensure the POWER indicator is off. • The VFD installation must be designed and done according to applicable local laws and regulations. Sourcetronic does not assume any liability whatsoever for any VFD installation which breaches local laws or regulations.

3.1.3 Installation Environment and Site

Environment	**Requirement**	
Temperature		• -10°C–50°C • The temperature must not change rapidly. • If the VFD is installed in an enclosed space, such as a control cabinet, use a cooling fan or air conditioner for temperature adjustment if necessary. • If the temperature is too low when you want to recommission a VFD that has been idle for a long time, install an external heating device before use to make sure no components inside the VFD are frozen. Otherwise the device may be damaged.
Relative Humidity (RH)		• The relative humidity (RH) of the air must be less than 90%, and there should be no condensation.

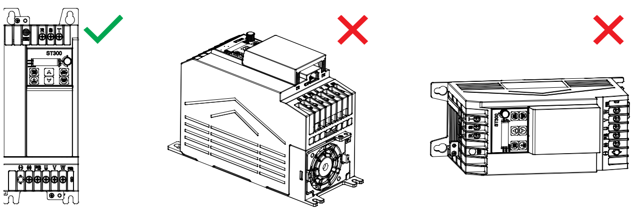
		• The RH cannot exceed 60% in an environment where there are corrosive gases.
Altitude		• Lower than 1000 m • When the altitude exceeds 1000 m, derate by one percent for every increase of 100 m. • When the altitude exceeds 3000 m, consult our customer support for assistance.
Vibration		Max. vibration ACC: 5.8 m/s^2(0.6g)

3.1.4 Location Requirements

Location	**Requirement**	
Indoors		No electromagnetic radiation sources and direct sunlight. **Note:** Install the VFD in a clean and well-ventilated environment based on the housing IP rating.
		No foreign objects such as oil mist, metal powder, conductive dust, and water.
		No radioactive, corrosive, hazard, flammable or explosive substances. **Note:** Do not install the VFD on flammable objects or surfaces.
		Low salt content

3.1.5 Installation Direction

You can install the VFD vertically on a wall or in a cabinet. It cannot be installed in other directions such as horizontal (lying), horizontal (lateral), or upside-down.



Vertical installation | Horizontal installation | Transverse installation

Figure 3-1 Installation direction diagram

3.1.6 Installation Space

3.1.6.1 Single VFD

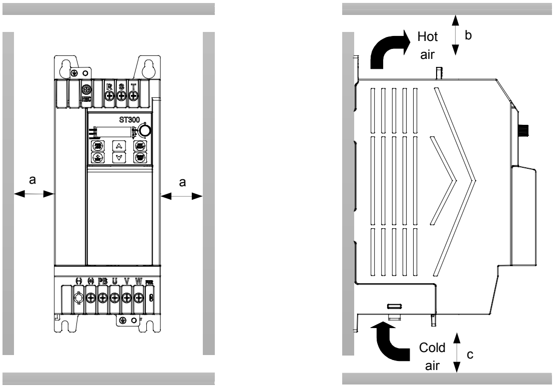


Figure 3-2 Installation space diagram of a single VFD

Table 3-1 Installation dimensions of a single VFD

Frame	Dimensions (mm)		
	a	b	c
A, B, C	≥40	≥100	≥100

3.1.6.2 Multiple VFDs

When installing multiple VFDs, you can install them in parallel. When you install VFDs in different sizes, we recommend you align the top of each VFD before installation to make future maintenance work easier.

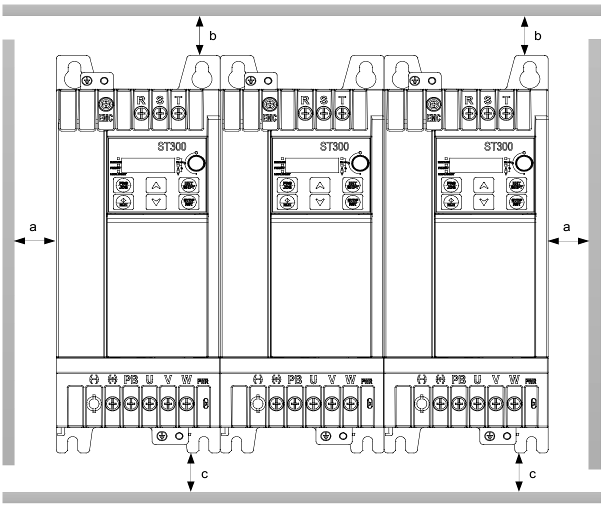


Figure 3-3 Installation space diagram of multiple VFDs

Table 3-2 Installation dimensions of multiple VFDs

Frame	Dimensions (mm)		
	a	b	c
A, B, C	≥40	≥100	≥100

3.2 Installation and Uninstallation

The available installation methods vary with the VFD external structures (frames). Please choose the appropriate installation method from the following table based on your specific model and the applicable environment. (✓ indicates an installation method that can be used, – indicates one that cannot be used.)

Table 3-3 Installation method selection

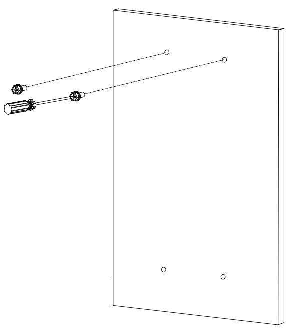
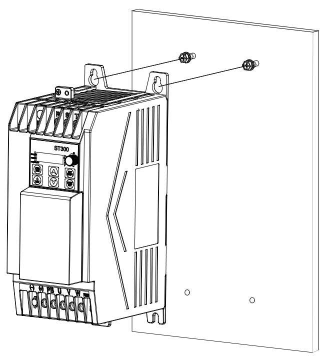
Frame	Installation Method	
	Wall Mounting	DIN Rail Mounting
A	✓	✓
B	✓	✓
C	✓	–

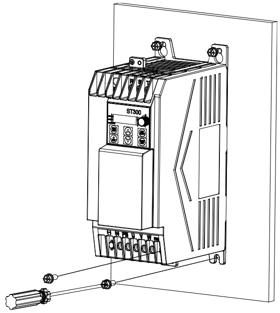
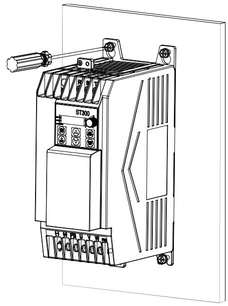
Note: When selecting the DIN rail mounting method for the models in structure frames A and B, you must select a rail mounting bracket.

3.2.1 Installation

3.2.1.1 Wall Mounting

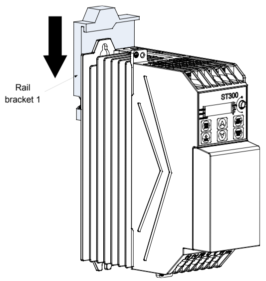
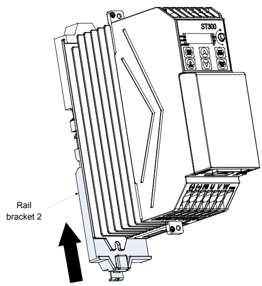
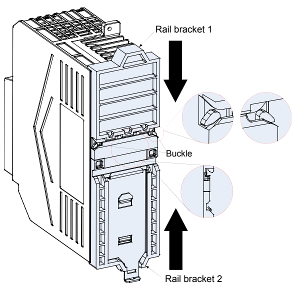
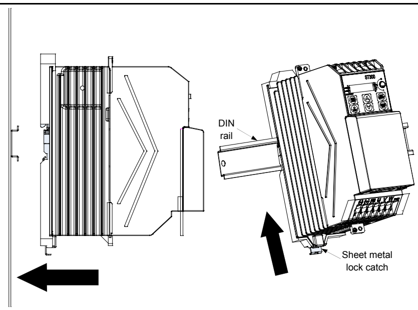
The wall mounting procedure is as follows:

1) Mark the mounting hole positions, and preload the two screws at the top. For details about the mounting hole positions, see C.1 VFD Overall Dimensions.	2) Fasten the VFD end with the holes onto the two preloaded screws.
	

3) Preload the two screws at the bottom.	4) Tighten the four preloaded screws.
	

3.2.1.2 DIN Rail Mounting

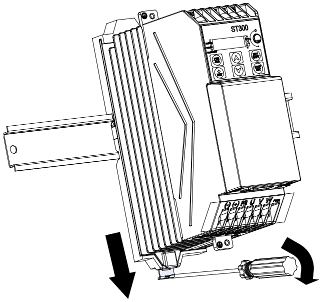
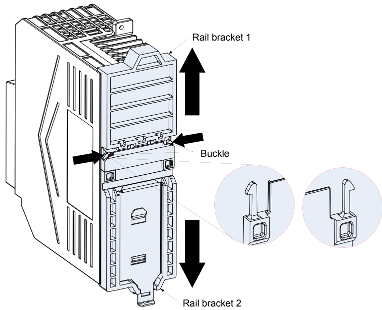
The DIN rail mounting procedure is as follows:

1) Insert rail bracket 1 from the VFD top and tighten the upper lugs.	2) Insert rail bracket 2 from the VFD bottom and tighten the lower lugs.
	
3) Fasten rail brackets 1 and 2. (Ensure that the buckle clicks into place and the sheet metal lock is in the pull-down position.)	4) Place the VFD with the brackets vertically on the DIN rail, and push the sheet metal lock catch upwards to make it firmly engage in the rail.
	

3.2.2 Dismounting

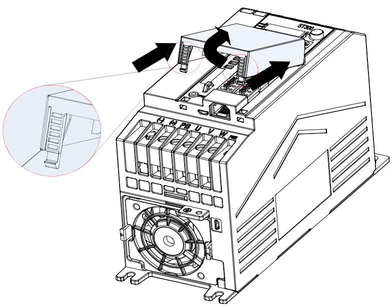
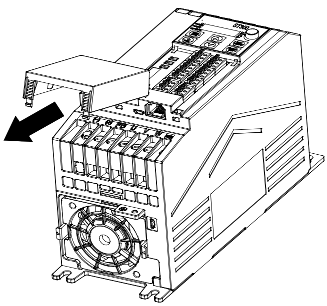
3.2.2.1 DIN Rail Dismounting

The DIN rail dismounting procedure is as follows:

1) Use a tool to pull out the sheet metal lock catch downwards until it is fixed, and take out the VFD with the rail bracket from the DIN rail.	2) Press the buckle in the middle of the DIN rail bracket inward, and then pull out rail brackets 1 and 2.
	

3.2.2.2 Cover Removal

You need to remove the VFD cover to access the main circuit and control circuit wiring. The procedure is as follows:

1) Press the elastic buckles on both sides of the bottom of the cover, and lift them up with force until the buckles detach from the slot.	2) Lift the cover and pull it out at a tilt.
	

4 Electrical Installation

4.1 Insulation Testing

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

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

Input Power Cable:

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

Motor Cable:

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

Note: If the motor is damp on the inside, the insulation resistance is reduced. If there is a chance that it may be damp, you must first dry the motor and then measure the insulation resistance again.

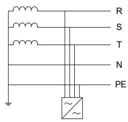
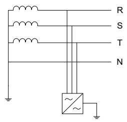
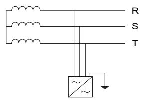
4.2 Checking Compatible Grounding Systems

The devices have been equipped with embedded EMC filters as standard parts and therefore they can be installed both on symmetric grounding systems and asymmetric grounding systems. When the VFD is used in an asymmetric grounding system, the EMC screw *must be removed* to avoid connection between the VFD internal EMC filter capacitor and the grounding potential, which may cause VFD tripping or damage.

Your device supports TN, TT, and IT grounding systems.

System		Course of Action
Symmetric Grounding System	Neutral grounded TN system	No need to remove EMC screws
	Neutral grounded TT system	
Asymmetric Grounding System	Phase grounded TN system	Remove EMC screws
	TT system without neutral grounding	
	IT system	

Table 4-1 Asymmetric grounding system description

System	Description	Systematic Diagram	Notes
TN	The power neutral point is grounded. The exposed con-ductive part of device is directly electrically connected to the power neutral point.		• The TN system also carries a grounding phase cable, for example grounding phase cable R. • The TN system supports the N line and E line are com-bined but also the lines are separated.
TT	The power neutral point is grounded. The exposed con-ductive part of electrical device is directly grounded.		TT system with the N line.
IT	The power neutral point is not grounded or the power is grounded with a high resistor. The exposed con-ductive part of electrical device is directly grounded.		TT system without the N line.

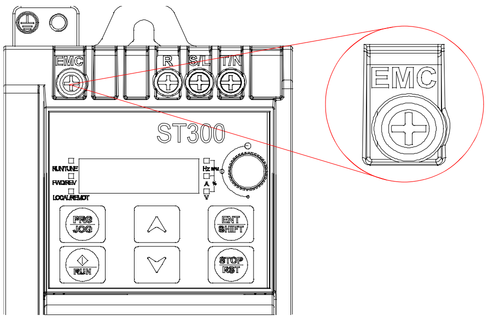


Figure 4-1 EMC screw

Note:

- Do not remove the EMC screw while the VFD is powered on.
- Disconnecting the EMC filter will reduce the VFD electromagnetic compatibility, which may cause the device to no longer meet the EMC specification requirements.
- The common-mode capacitor circuit is grounded to the heat sink via the EMC screw, forming a loop path for high-frequency noise and releasing high-frequency interference. If leakage protection is ap-plied during startup—providing a leakage circuit breaker has been configured—disconnect the EMC screw.

4.3 Cable Selection and Routing

4.3.1 Cable Selection

Power Cable:

Power cables include input power cables and motor cables. Comply with local regulations to select cables.

To meet the EMC requirements stipulated in the CE standards, it is recommended to use symmetrical shielded cables as input motor cables and power cables, as shown in Figure 4-2. In contrast to four-core cables, symmetrically shielded cables can reduce electromagnetic radiation as well as the current and losses of the motor cables.

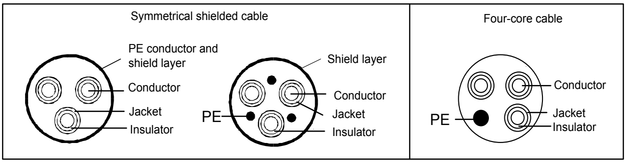


Figure 4-2 Symmetrical shielded cable and four-core cable

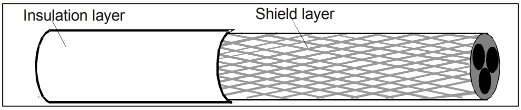


Figure 4-3 Cable cross section

Note:

- The input power cables and motor cables must be able to carry the corresponding load currents.
- Figure 4-3 shows the minimum requirements of motor cables. The cable must consist of a layer of spiral-shaped copper strips; the denser the shield layer, the more effectively the electromagnetic interference is restricted.
- The standard cable conductor temperature limit is 70°C. If you use a cable with a conductor temperature limit of 90°C, the cable must comply with relevant national standards and specifications.
- If the electrical conductivity of the motor cable shield layer does not meet the requirements, a separate PE conductor must be used.
- 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.
- To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must be at least 10% of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer.

Control Cable:

Control cables mainly include analog signal control cables and digital signal control cables. Analog signal control cables use twisted-pair double shielded cables, with a separate shielded twisted pair for each signal and different ground wires for different analog signals. For digital signal control cables, we recommend double-shielded cables, but you can also use single-shielded or unshielded twisted pairs. For details, see D.1.2 Control Cable.

4.3.2 Cable Arrangement

Figure 4-4 shows the cable routing and wiring distance.

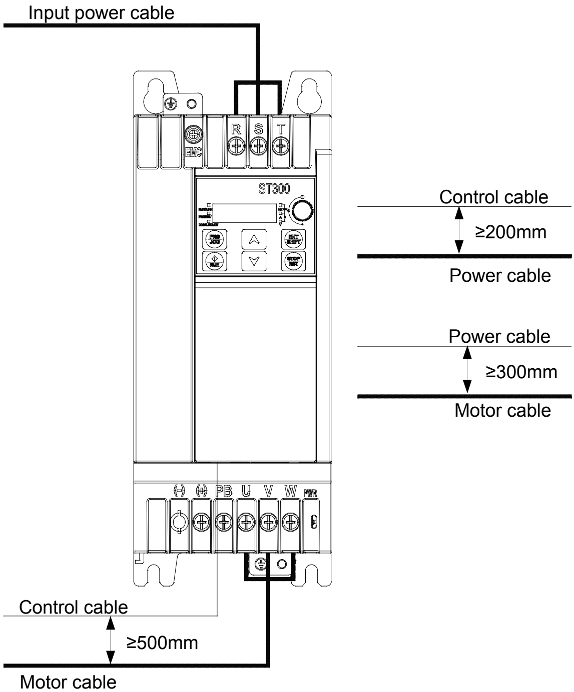


Figure 4-4 Cable routing distance

Note:

- Arrange motor cables away from other cables. The du/dt of the VFD output may increase electromagnetic interference on other cables.
- Motor cables cannot be routed with other cables in parallel for long distances.
- If a control cable and power cable must cross each other, ensure that the angle between them is 90°.
- The motor cables of several VFDs can be arranged in parallel. We recommend that you arrange the motor cables, input power cables, and control cables separately in different trays.
- Ensure the cable trays are properly connected and well grounded.
- Other cables must not cross the VFD.

4.4 Main Circuit Wiring

4.4.1 Main Circuit Wiring

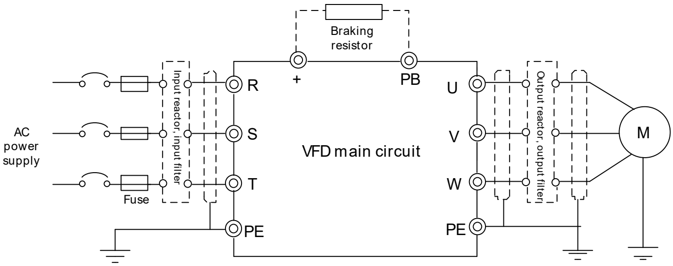
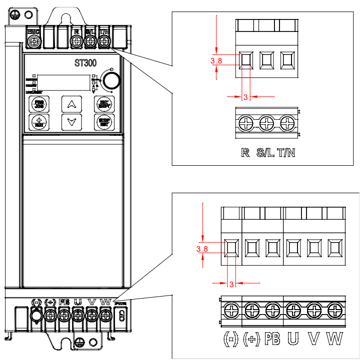
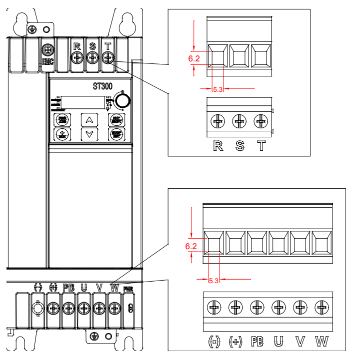


Figure 4-5 Main circuit wiring diagram

Note: The fuse, input reactor, input filter, output reactor, and output filter are optional parts. For details, see Appendix D Peripheral Accessories.

4.4.2 Main Circuit Terminals

Main Circuit Terminal Diagram for • **VFD Models 0R4G1–2R2G1** • **VFD Models 0R7G3–004G3**	**Main Circuit Terminal Diagram for** **VFD Models 5R5G3–7R5G3**
	

Terminal Symbol	**Function Description**
R/L, S, T/N	3PH (or 1PH) AC input terminals, connected to the grid.
U, V, W	3PH AC output terminals, connected to the motor usually.
PB, (+)	Connected to the external braking resistor terminals.
	Grounding terminal for safe protection; each machine must carry two PE terminals and proper grounding is required.

Note: We recommend you use a symmetrical motor cable. Please ground the grounding conductor in the motor cable at the frequency converter end and the motor end.

4.4.3 Wiring Procedure

1) Connect the yellow and green grounding line of the input power cable to the VFD grounding terminal ⏚, then connect the 3PH input cable to the R, S, and T terminals and tighten up.

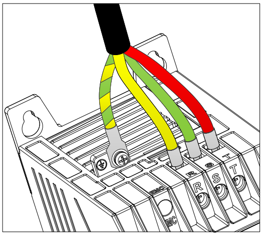


Figure 4-6 Wiring diagram of input power cables

2) Connect the yellow and green grounding line of the motor cable to the VFD PE terminal, then connect the motor 3PH cable to the U, V, and W terminals and tighten up.

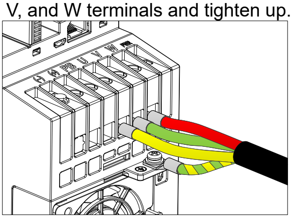


Figure 4-7 Wiring diagram of motor cables

3) Connect optional parts such as the braking resistor that carries cables to their designated positions. For details, see 4.4.1 Main Circuit Wiring.

4) Fasten all the cables outside the VFD mechanically if possible.

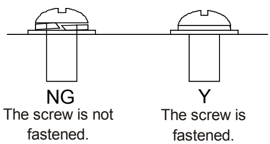


Figure 4-8 Screw installation diagram

4.5 Control Circuit Wiring

4.5.1 Control Circuit Wiring

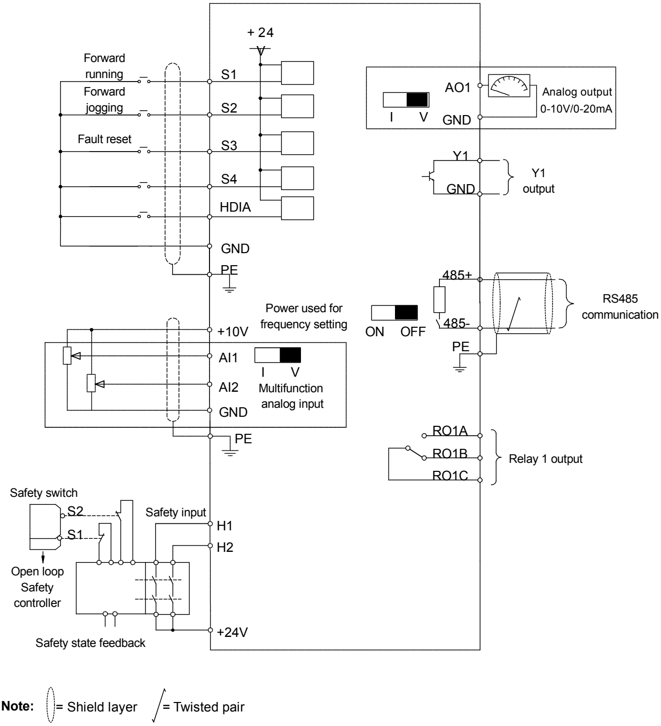


Figure 4-9 Control circuit wiring diagram

4.5.2 Control Circuit Terminals

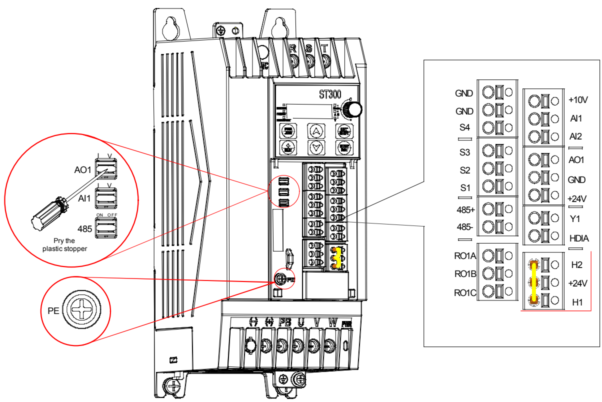


Figure 4-10 Control circuit terminal diagram

Terminal	Function
+10V	Locally provided +10V power supply
AI1	Analog input. Range: 0–10V or 0–20mA. You can use the DIP switch to select whether voltage or current is used for input.
AI2	Analog input. Range: 0–10V
AO1	Analog output. Range: 0–10V or 0–20mA. You can use the DIP switch to select whether voltage or current is used for input.
RO1A RO1B RO1C	Relay output. RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A or AC 250V; 1A or DC 30V
GND	Power reference ground
Y1	Switch capacity: 50mA or 30V. Output frequency range: 0–1kHz
485+ 485-	RS485 differential signal communication port. The standard RS485 communication interface should use shielded twisted pair wiring. Use the DIP switch to select whether to connect the 120Ω terminal matching resistor of the RS485 communication.
+24V	User power supply provided by the VFD. Max. output current: 100mA
S1–S4	High level input range: 10–30V Low level input range: 0–5V Max. input frequency: 1kHz Programmable digital input terminals, the functions of which can be selected through specific parameters.
HDIA	Channel for both high-speed pulse input and digital input Max. input frequency: 50kHz Duty ratio: 30%–70%
H1 H2	Safe torque off (STO) inputs STO redundant input, connected to the external NC contact. When the contact opens, the STO function acts and the VFD stops output. Safety input signal wires use shielded cables of a length within 25m. The H1 and H2 terminals are short connected to +24V by default. Remove the jumper from the terminals before using the STO function.

4.5.3 Input/Output Signal Wiring

4.5.3.1 Digital Input Signal Wiring

The VFD supports only the NPN wiring method.

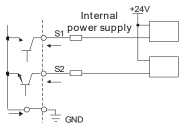


Figure 4-11 NPN mode

4.5.3.2 Digital Output Signal Wiring

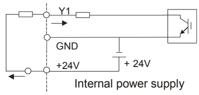


Figure 4-12 Y1 terminal wiring

4.5.3.3 Analog Input Signal Wiring

When the analog voltage signal connection is weak, it is prone to external noise interference. Therefore, shielded twisted pair cables are generally used, and the wiring distance should be within 20m. The lead line of the shield layer should be as short as possible and needs to be fixed to the VFD signal grounding ⏚ with screws.

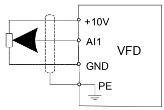


Figure 4-13 Analog input terminal wiring

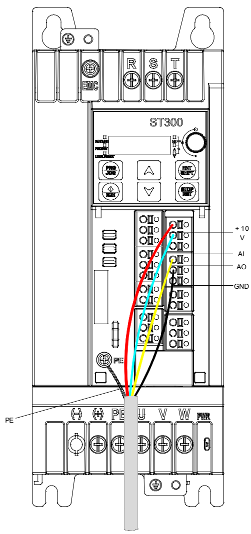
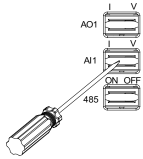


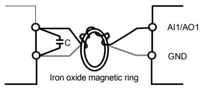
Figure 4-14 PE shielding layer wiring

Note:

- When selecting the current signal input for AI1, pry the plastic stopper and turn the AI1 switch to "I".
- The method for AO1 current output type and RS485 matching resistor selection is similar.



- In some cases where the analog signal is severely disturbed, you need to install a filtering capacitor or magnetic ring on the analog signal source side. At least 3 turns are required to pass through the same phase.



4.6 Power Distribution Protection

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

Power cable and VFD protection:

In case of a short circuit, the fuse protects input power cables to avoid damage to the VFD; if an internal short-circuit occurs to the VFD, it can also protect neighboring equipment from being damaged. Figure 4-15 shows the wiring.

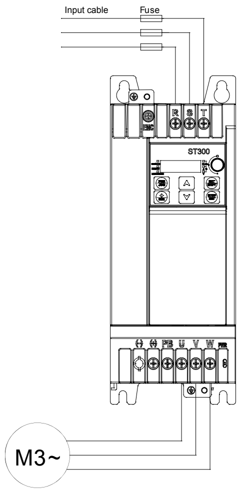


Figure 4-15 Fuse configuration

Note: Select the fuse according to D.2 Breaker and Electromagnetic Contactor.

Motor and motor cable short-circuit protection:

As long as the motor cable is selected based on the VFD's rated current, the device can protect the motor cable and motor without any other protective devices in case of a short circuit.

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

Motor thermal overload protection:

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

Bypass connection protection:

In scenarios which require the system to continue to operate normally even in the event of VFD failure, you need to configure the power/variable frequency conversion circuit.

If the VFD is only used for soft start, power frequency operation follows directly after start-up, which requires a bypass connection.

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

5 Keypad Operation Guidelines

5.1 Keypad Panel Display

The VFD has been equipped with an LED film keypad as a standard configuration part. You can use the keypad to start and stop the device, read status data, and set various parameters.

Figure 5-1 Standard LCD keypad

Note:

- When mounting a keypad (including parameter copying keyboard and common keyboard) externally, use a standard RJ45 crystal head network cable as the keyboard extension cable, and mount it on the front door panel of the cabinet by using M3 screws or an optional keyboard mounting bracket.
- When an external parameter copying keypad is active, the local LED film keypad is switched off; when an external common keypad is active, both the external common keypad and the local LED film keypad are switched on.

5.1.1 Status Indicator

Indicator	Status	Definition
RUN/TUNE	ON	The VFD is running.
	Blinking	The VFD is in parameter autotuning.
	OFF	The VFD is stopped.
FWD/REV	ON	The VFD runs in reverse direction.
	OFF	The VFD runs in regular (forward) direction.
LOCAL/REMOT	ON	The VFD uses modbus communication as its command channel.

	Blinking	The VFD uses the terminals as its command channel.	
	OFF	The VFD uses the keypad as its command channel.	
RUN/TUNE FWD/REV LOCAL/REMOT	ON, displaying an error code	The VFD is in error state.	
	Blinking at the same time	The VFD is in pre-alarm state.	
Unit indicator	ON: Unit displayed on the keypad currently		
	HZ RPM A % V	Hz	Frequency unit (Hertz)
	HZ RPM A % V	RPM	Rotation speed unit (Rotations per minute)
	HZ RPM A % V	A	Current unit (Ampere)
	HZ RPM A % V	%	Percentage
	HZ RPM A % V	V	Voltage unit (Volt)

Note: The unit indicator blinking and turning on is generally used to distinguish different stop and running parameter display.

5.1.2 Display Area

The display area displays a 5-digit value, including error alarm code, set frequency, output frequency, and functional status data.

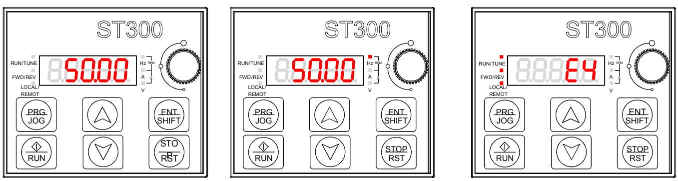
Display	Means	Display	Means	Display	Means	Display	Means
	0		1		2		3
	4		5		6		7
	8		9		A		b
	C		d		E		F
	H		I		L		N
	n		O		P		r
	S		t		U		v
	.		-				

5.1.3 Key

Key		Function
	Programming/ Multifunction shortcut key	Press this key to enter or exit level-1 menus or to delete a parameter. Press and hold this key (at least 1s) to implement the function defined by the ones digit of P07.02, which is jogging by default.
	Confirmation/ Shifting key	Press this key to enter menus in cascading mode or to confirm the setting of a parameter. Press this key to select display parameters in the interface for the VFD in stopped or running state. Press and hold it (at least 1s) or to select digits to change during parameter setting.
	Up key	Press this key to increase a value or to move upward.
	Down key	Press this key to decrease a value or to move downward.
	Run key	Press this key to run the VFD or to perform autotuning in keypad operation mode.
	Stop/Reset key	P07.04 specifies the applicability of this key's function in various states. Press this key to stop running or to stop autotuning in running state. Press this key to reset when the device is in error alarm state.
	Potentiometer (AI3)	When mounting the parameter copying keypad externally, the input source of AI3 is the potentiometer of this external keypad. When using the local LED film keypad or mounting a common keypad externally, the input source of AI3 is specified by P05.53.

5.2 Keypad Display

What information the keypad displays varies between different states that the VFD is in. The following describes the display content in different states.



Stopped-state homepage   Running-state homepage   Fault state homepage

Figure 5-2 Status interface display

5.2.1 Displaying Stopped-State Parameters

When the VFD is in stopped state and the keypad is not in the function code viewing or editing state, the keypad displays stopped-state parameters. By setting P07.07, you can select different stopped-state parameters to display. Press ENT/SHIFT to switch parameters.

5.2.2 Displaying Running-State Parameters

When the VFD is in running state and the keypad is not in the function code viewing or editing state, the keypad displays running-state parameters. By setting P07.05 and P07.06, you can select different running-state parameters to display. Press ENT/SHIFT to switch parameters.

5.2.3 Error Display

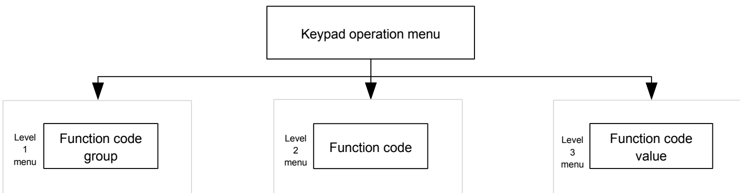
When the VFD is in error state, and the keypad is not in the function code viewing or editing state, the keypad displays the error code in blinking way. You can perform an error reset by using the STOP/RST key, the control terminals, or the corresponding modbus communication commands. If the error persists, both the VFD error state and error code display remain.

When the VFD is in error display state and the keypad is in the function code viewing or editing state, the keypad then automatically returns to the error state display if there is no operation within 20 seconds. When there is no error with the VFD, after entering the third-level menu of changing a function code with the attribute "●", the value of the function code will be displayed continuously. In other cases, if there is no operation on the keypad within one minute, the keypad then automatically returns to the stopped-state or running-state parameter display from the function code viewing or editing state.

5.3 Operation Procedure

5.3.1 Modifying Function Parameters

The keypad contains three levels of menus according to operation editing settings.



When the VFD is in stopped, running, or error display state:

Press PRG/JOG to enter a level-one menu (if a user password has been set, see the description of P07.00).

In the level-two menu, press ENT/SHIFT to enter the next-level menu.

In the level-three menu, press ENT/SHIFT to save the current function code value and enter the level-two menu of the next function code.

Note: In various levels of menus, press PRG/JOG to return to the previous level, press ∧ or ∨ to increase or decrease the value of the currently selected (blinking) bit, and press and hold ENT/SHIFT to select the next bit clockwise.

The following takes P03.20 as an example to describe how to modify a function parameter in the stopped-state parameter display interface:

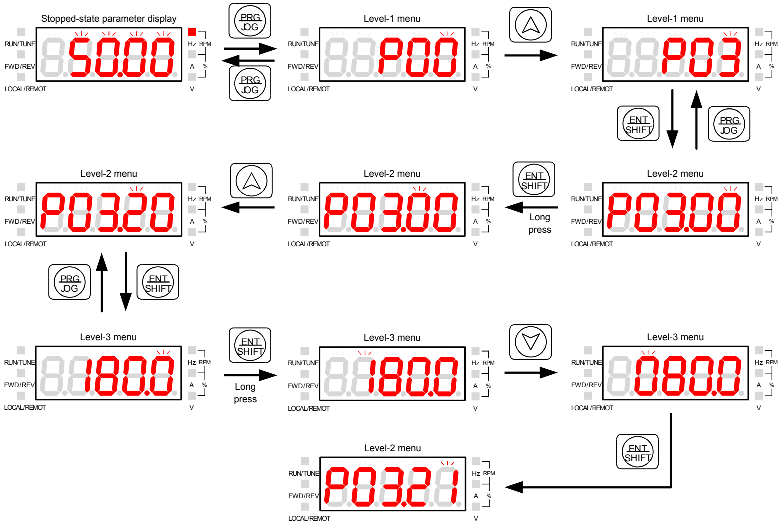


Figure 5-3 Modifying a parameter

Note: When P00.18 is set to 3, no function code value is selected (blinking), and no function code value can be modified.

5.3.2 Setting a Password for the VFD

The VFD provides a user password protection function. When P07.00 is set to a non-zero value, the function code editing state is exited, and password protection will take effect within one minute. After the password takes effect, you need to type the user password after pressing the PRG/JOG key when the VFD is in stopped, running, or error display state to be able to view and edit function codes.

The following diagram uses the user password 10001 as an example to illustrate how to set a password for the VFD, starting from the stopped-state parameter display interface:

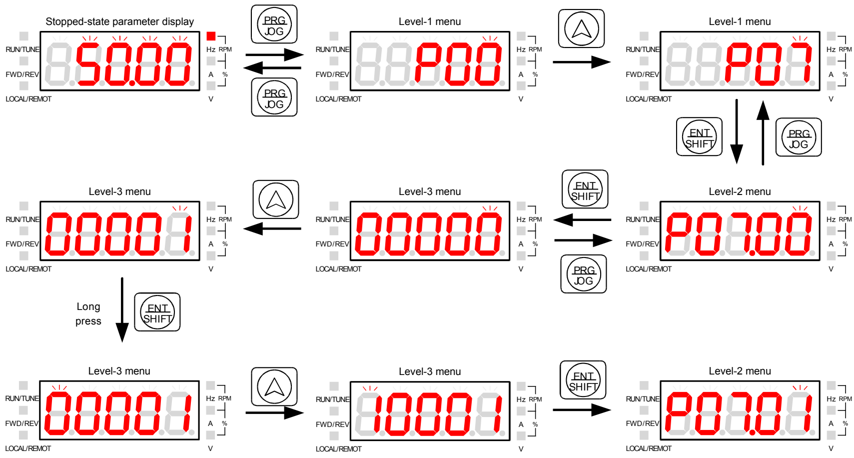


Figure 5-4 Setting a password

5.3.3 Viewing Function Parameters

You can view the current status of various function codes. The following describes how to access this in the stopped-state parameter display interface when the password is 10001:

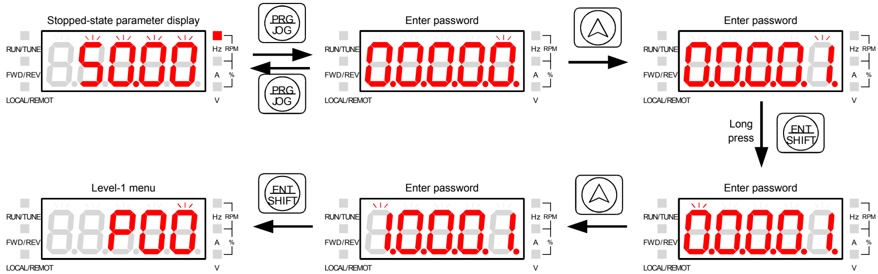
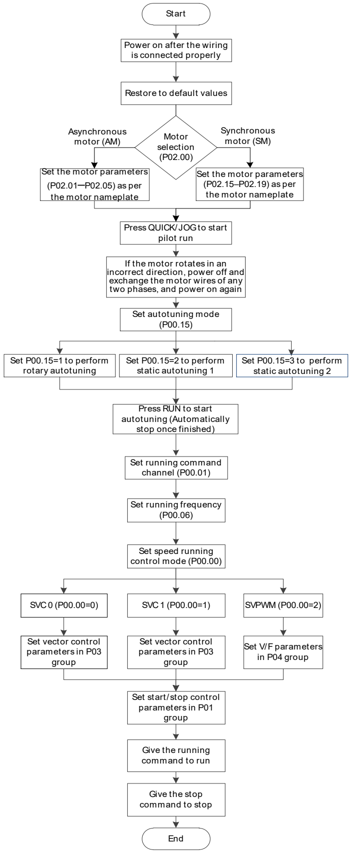


Figure 5-5 Viewing a function code

6 Commissioning

The simplified VFD commissioning flowchart is as follows:



6.1 Motor Parameter Setting

Your VFD supports the control of three-phase AC asynchronous motors and permanent magnet synchronous motors. You can use a set of motor parameters, namely those in the P02 group, for motor control.

6.1.1 Motor Type

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

Function Code	Name	Default	Setting Range	Description
P02.00	Type of Motor 1	0	0–1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)

Note: Motors driven at the same time must be of the same type.

6.1.2 Rated Motor Parameters

Set the rated parameters of three-phase AC asynchronous motors according to the motor nameplate:

Parameters P02.01–P02.05 are the parameters corresponding to an asynchronous motor 1.

Function Code	Name	Default	Setting Range	Description
P02.01	Rated Power of AM 1	Model-dependent	0.1–3000.0 kW	–
P02.02	Rated Frequency of AM 1	50.00 Hz	0.01 Hz–P00.03	P00.03 specifies the max. output frequency.
P02.03	Rated Speed of AM 1	Model-dependent	1–60 000 RPM	–
P02.04	Rated Voltage of AM 1	Model-dependent	0–1200 V	–
P02.05	Rated Current of AM 1	Model-dependent	0.08–600.00 A	–

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

Parameters P02.15–P02.19 are the parameters corresponding to a synchronous motor 1.

Function Code	Name	Default	Setting Range	Description
P02.15	Rated Power of SM 1	Model-dependent	0.1–3000.0 kW	–
P02.16	Rated Frequency of SM 1	50.00 Hz	0.01 Hz–P00.03	–
P02.17	Number of Pole Pairs of SM 1	2	1–128	–
P02.18	Rated Voltage of SM 1	Model-dependent	0–1200 V	–
P02.19	Rated Current of SM 1	Model-dependent	0.08–600.00 A	–

6.2 Motor Parameter Autotuning

To improve motor control, we recommend you set the corresponding motor parameters according to the motor nameplate after first power-on, and then conduct parameter autotuning. You can select an autotuning mode based on the conditions of your use case.

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

After setting motor parameters, you can set P00.15 to select the autotuning method:

1) Set P00.01 to 0 to select the keypad.

2) Set P00.15 to select one of three autotuning modes.

3) Press RUN to give the start command. The motor now enters autotuning.

Function Code	Name	Default	Setting Range	Description
P00.15	Motor Parameter Autotuning	0	0–3	0: Disable 1: Rotary autotuning 1 2: Static autotuning 1 (Comprehensive) 3: Static autotuning 2 (Partial autotuning)

Note:

- When P00.15=1, disconnect the motor from the load to put the motor in static and no-load state.
- When P00.15=2 or P00.15=3, there is no need to disconnect the motor from the load.

Table 6-1 Obtained motor parameters in different autotuning methods

Set Value of P00.15	Autotuning Parameters	
	AM 1	SM 1
1	P02.06–P02.14	P02.20–P02.23
2	P02.06–P02.10	P02.20–P02.22
3	P02.06–P02.08	

Note: The counter-EMF constant P02.23 of the synchronous motor can also be calculated based on the parameters on the motor nameplate. There are three calculation methods:

A) If the counter-EMF coefficient K_e is marked on the nameplate:

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

B) If the counter-EMF E' (unit: V/1000r/min) is marked on the nameplate:

$$E = E' \cdot n_N/1000$$

C) If neither of the two preceding parameters is marked on the nameplate:

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

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

6.3 Operating Commands

Operating commands are used to control the device start and stop, the running direction (forward or reverse), and the jogging function. The available channels to issue operating commands include the keypad, terminals, and modbus communication. Set P00.01 to select which channel you would like to use.

Function Code	Name	Default	Setting Range	Description
P00.01	Channel of Operating Commands	0	0–2	0: Keypad 1: Terminal 2: Modbus communication

Keypad:

When P00.01=0, you can control the start and stop through the keys RUN and STOP/RST on the keypad. After pressing RUN, the VFD starts up and the RUN indicator turns on. When you press STOP/RST as the device is running, it stops and the RUN indicator turns off. For further information on keypad operation, see 5 Keypad Operation Guidelines.

Terminals:

When P00.01=1, you can control the start and stop through the VFD terminals. The setting procedure is as follows:

1) Set P05.01–P05.09 to the required operating commands. For example, to set S2 to reverse running, set P05.02 to 2.

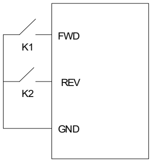
Function Code	Name	Default	Setting Range	Description
P05.01–P05.09	Function Selection of Multifunction Digital Input Terminals (S1–S8 and HDIA)	P05.01: 1 P05.02: 4 P05.03: 7 P05.04–P05.09: 0	0–95	1: Run forward (FWD) 2: Run reversely (REV) 3: Three-wire operation control (Sin) 4: Jog forward 5: Jog reversely 6: Coast to stop 7: Reset errors

2) Set P05.13 (Terminal control mode).

Function Code	Name	Default	Setting Range	Description
P05.13	Terminal Control Mode	0	0–3	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2

Two-wire control mode 1: P05.13=0

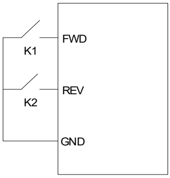
Function enabling takes place in accordance with the direction. This mode is widely used. The defined terminal command FWD/REV determines the direction the motor rotates in.



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

Two-wire control mode 2: P05.13= 1

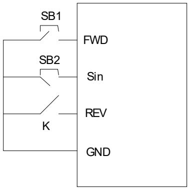
Function enabling is separated from the direction. In this mode, FWD is the enabling terminal. The direction depends on the defined REV state.



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

Three-wire control mode 1: P05.13= 2

This mode defines Sin as the enabling terminal. The operating command is generated by FWD, while the direction is controlled by REV. During operation, the Sin terminal needs to 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 needs to be stopped by disconnecting terminal Sin.

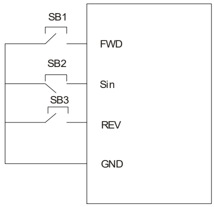


The direction control functions as follows:

Sin	REV	Previous Direction	Present Direction
ON	OFF→ON	Forward running	Reverse running
		Reverse running	Forward running
ON	ON→OFF	Reverse running	Forward running
		Forward running	Reverse running
ON→OFF	ON	Decelerate to stop	
	OFF		

Three-wire control mode 2: P05.13= 3

This mode defines Sin as the enabling terminal. The operating command is generated by either FWD or REV, but the direction is controlled by both FWD and REV. During operation, the Sin terminal needs to be closed, and either terminal FWD or REV generates a rising edge signal to control the operation and direction of the VFD; the VFD needs to be stopped by disconnecting the terminal Sin.



The direction control functions as follows:

Sin	**FWD**	**REV**	**Running Direction**
ON	OFF→ON	ON	Forward running
		OFF	Forward running
ON	ON	OFF→ON	Reverse running
	OFF		Reverse running
ON→OFF			Decelerate to stop

Note: When the FWD/REV terminal is active in two-wire control mode, if the VFD stops due to a stop command given by another source, it will not run again after the stop command disappears even if the control terminal FWD/REV is still active. To make the VFD resume operation, you must trigger FWD/REV again, for example: PLC single-cycle stop, fixed-length stop, or a valid STOP/RST key stop in terminal control mode (see P07.04).

Modbus communication:

When P00.01=2, you can control the start and stop by giving commands through Modbus communication. For details, see 7 Modbus Communication.

6.4 Setting the Frequency

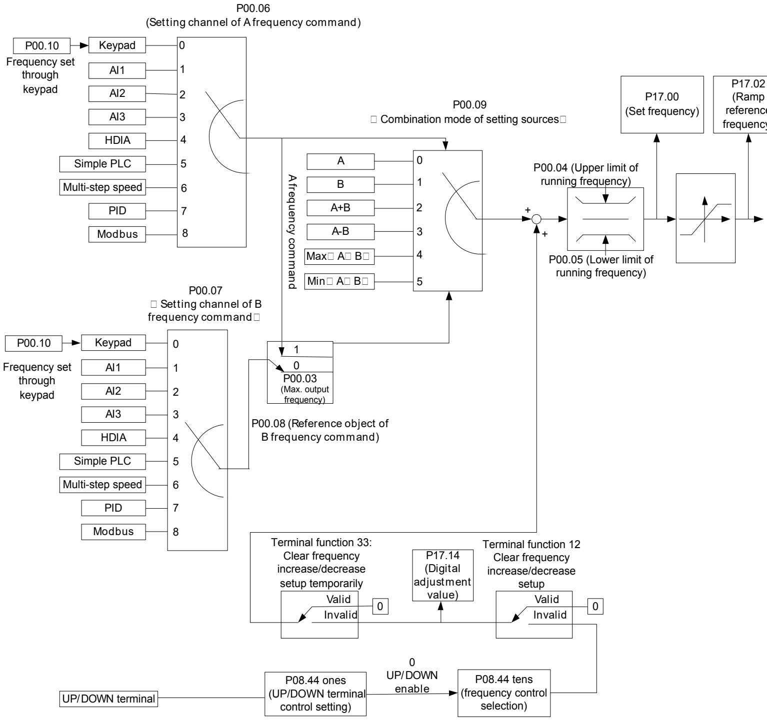
The VFD supports multiple different modes to set frequency references, which can be categorized into two types: main reference channels and the auxiliary reference channel.

There are two main reference channels, referred to here as frequency reference channel A and frequency reference channel B. These two channels support simple arithmetical operations between each other, and they can be switched dynamically.

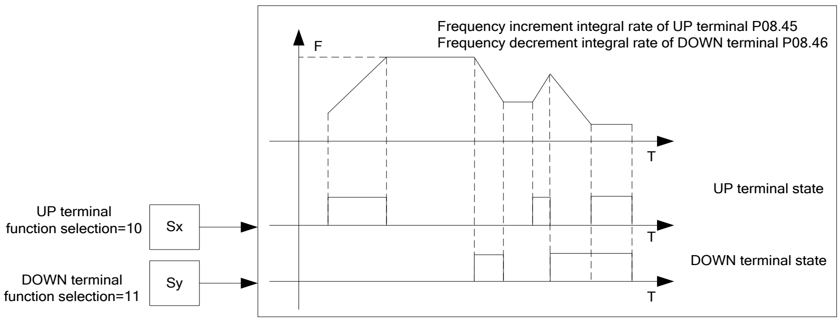
There is also one auxiliary reference channel, namely the UP/DOWN terminal. You can use P08.44 to adjust the UP/DOWN terminal's corresponding settings.

The final frequency reference is comprised of both the main reference channels and auxiliary reference channel.

See the following schematic diagram:



When setting the auxiliary frequency inside the VFD by selecting function 10 or 11 for one of the function codes from P05.01 to P05.09, you can increase or decrease the frequency quickly by setting P08.45 (Frequency (increment) integral rate of the UP terminal) or P08.46 (Frequency (decrement) integral rate of the DOWN terminal), as illustrated in the following figure:



6.4.1 Combination of Frequency Reference Channels

6.4.1.1 Combination Mode of Reference Values

Set P00.09 to select how you wish to combine the different frequency setting sources.

Function Code	Name	Default	Setting Range	Description
P00.09	Combination Mode of Frequency Reference Values	0	0–5	0: A 1: B 2: (A+B) 3: (A–B) 4: Max (A, B) 5: Min (A, B)

6.4.1.2 Frequency Channel Switchover

You can set any of the function codes P05.01–P05.09 to any of the functions 13–15 to switch frequency channels. The setting procedure is as follows:

1) Select any of multifunction digital input terminals S1–S8 or HDIA as an external input terminal.

2) Set the corresponding parameter P05.01–P05.09 to any of the functions 13–15.

Function Code	Name	Default	Setting Range	Description
P05.01–P05.09	Function Selection of Multifunction Digital Input Terminals (S1–S8 and HDIA)	P05.01: 1 P05.02: 4 P05.03: 7 P05.04–P05.09: 0	0–95	13: Switch between settings A and B 14: Switch between combination setting and setting A 15: Switch between combination setting and setting B

The combinations are described in the following table:

Present Reference Channel P00.09	Multifunction Digital Input Terminal Function 13 (Switch between settings A and B)	Multifunction Digital Input Terminal Function 14 (Switch between combination setting and setting A)	Multifunction Digital Input Terminal Function 15 (Switch between combination setting and setting B)
A	B	–	–
B	A	–	–
A+B	–	A	B
A–B	–	A	B
Max (A, B)	–	A	B
Min (A, B)	–	A	B

6.4.2 Methods to Set the Frequency

The VFD provides multiple frequency setting methods, including setting P00.06 (channel for frequency reference A) and setting P00.07 (channel for frequency reference B).

Function Code	Name	Default	Setting Range	Description
P00.06	Channel for Frequency Reference A	0	0–8	0: Keypad (P00.10) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Simple PLC program 6: Multi-step speed operation 7: PID control 8: Modbus communication
P00.07	Channel for Frequency Reference B	1		

6.4.2.1 Setting the Frequency Through the Keypad

When P00.06 or P00.07 (channel for frequency reference A or B) is set to 0 (defining the keypad as the setting channel), P00.10 specifies the original value of the digital frequency setting.

Function Code	Name	Default	Setting Range	Description
P00.10	Setting Frequency Through the Keypad	50.00Hz	0.00Hz–P00.03	Specifies the initial VFD frequency value when reference values A and B are set to be defined via the keypad.

6.4.2.2 Setting the Frequency Through Analog Input Terminals

You can set P00.06 or P00.07 to 1, 2, or 3 (setting frequency through analog input terminals AI1–AI3). For details, see 6.9.2 Analog Input and Output Terminal Functions.

6.4.2.3 Setting the Frequency Through HDIA

You can set P00.06 or P00.07 to 4 (setting frequency through HDIA).

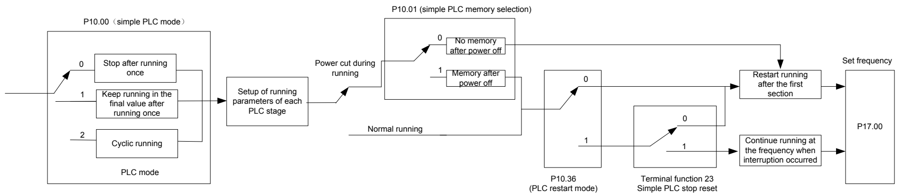
6.4.2.4 Setting the Frequency Through Simple PLC

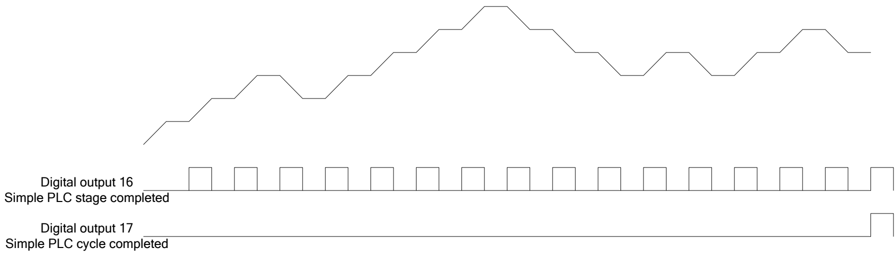
You can set P00.06 or P00.07 to 5 (setting frequency through simple PLC).

Simple PLC is a multi-step speed generator that allows the VFD to change its operating frequency and direction automatically based on the operating time to fulfill different process requirements. The VFD can realize 16-step speed control and provides four groups of acceleration/deceleration time to choose from.

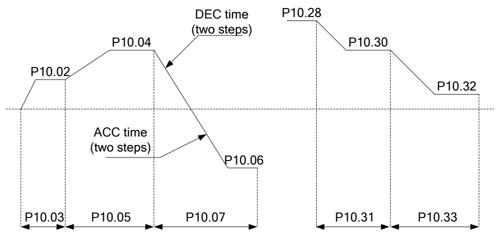
After the set PLC completes one cycle (or one step), one ON signal can be output by the multifunction relay.

See the following figure:





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



Note: The mathematical sign of multi-step speed determines the running direction of simple PLC; a negative value means reverse running. ACC time refers to the time needed for the VFD to speed up from 0 Hz to the max. output frequency (P00.03); DEC time refers the time needed for the VFD to slow down from the max. output frequency (P00.03) to 0Hz. Select the corresponding acceleration/deceleration time, then convert the 16-bit binary number into hexadecimal number. Finally, set the corresponding function codes accordingly. For details, see the following table.

Function Code	Name	Default	Setting Range	Description
P00.11	ACC Time 1	Model-dependent	0.0–3600.0 s	The VFD has four groups of ACC/DEC time, which can be selected within the parameter group P05.
P00.12	DEC Time 1	Model-dependent		

P08.00	ACC Time 2	Model-dependent		The factory default ACC/DEC time used is the first group.
P08.01	DEC Time 2	Model-dependent		
P08.02	ACC Time 3	Model-dependent		
P08.03	DEC Time 3	Model-dependent		
P08.04	ACC Time 4	Model-dependent		
P08.05	DEC Time 4	Model-dependent		
P10.34	ACC/DEC Time for Steps 0–7 of Simple PLC	0x0000	0x0000–0xFFFF	Select the corresponding acceleration/deceleration time, then convert the 16-bit binary number into hexadecimal number. Finally, set the corresponding function codes accordingly. For details, see the table below.
P10.35	ACC/DEC Time for Steps 8–15 of Simple PLC	0x0000		

Function Code	Binary		Step	ACC/DEC Time 1	ACC/DEC Time 2	ACC/DEC Time 3	ACC/DEC Time 4
P10.34	BIT1	BIT0	0	00	01	10	11
	BIT3	BIT2	1	00	01	10	11
	BIT5	BIT4	2	00	01	10	11
	BIT7	BIT6	3	00	01	10	11
	BIT9	BIT8	4	00	01	10	11
	BIT11	BIT10	5	00	01	10	11
	BIT13	BIT12	6	00	01	10	11
	BIT15	BIT14	7	00	01	10	11
P10.35	BIT1	BIT0	8	00	01	10	11
	BIT3	BIT2	9	00	01	10	11
	BIT5	BIT4	10	00	01	10	11
	BIT7	BIT6	11	00	01	10	11
	BIT9	BIT8	12	00	01	10	11
	BIT11	BIT10	13	00	01	10	11
	BIT13	BIT12	14	00	01	10	11
	BIT15	BIT14	15	00	01	10	11

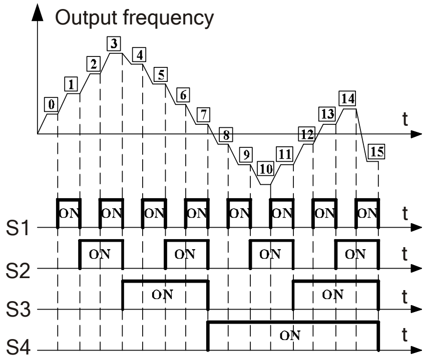
6.4.2.5 Setting the Frequency Through Multi-Step Speed Commands

You can set P00.06 or P00.07 to 6 (setting frequency through multi-step speed commands), which works well in scenarios where the operating frequency does not need to be adjusted continuously and only a set number of frequency values are needed.

The VFD supports the setting of 16 speed steps, which are set by combined codes of multi-step terminals 1–4 (set by S terminals, corresponding to function codes P05.01–P05.09) and which correspond to multi-step speed 0 to multi-step speed 15.

When terminal 1, terminal 2, terminal 3, and terminal 4 are inactive, the frequency input method is specified by P00.06 or P00.07. When terminal 1, terminal 2, terminal 3, and terminal 4 are not all inactive, setting frequency through multi-step speed commands will take precedence. In simpler terms, the priority of multi-step commands as a frequency setting channel is higher than that of the keypad, analog, high-speed pulse, PID and modbus communication as frequency setting channels.

Note: The mathematical symbol of a multi-step speed determines the running direction of simple PLC; a negative value means reverse running. For details, see 6.4.2.4 Setting the Frequency Through Simple PLC.



T1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
T2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
T3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
T4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Step	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
T1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
T2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
T3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
T4	ON	ON	ON	ON	ON	ON	ON	ON
Step	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

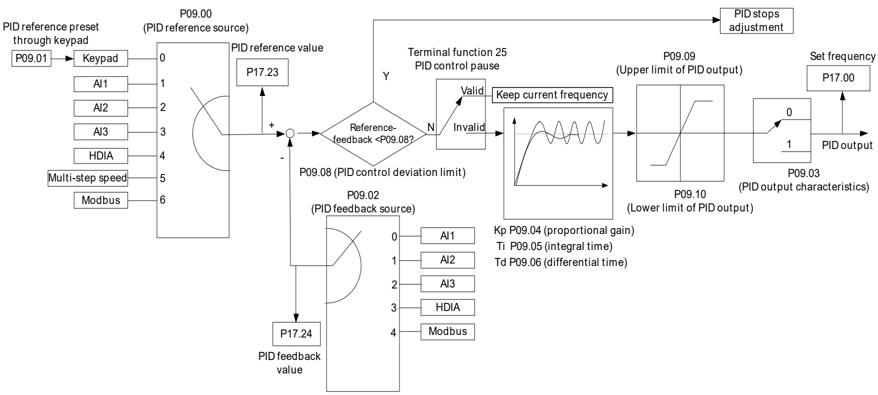
Function Code	Name	Default	Setting Range	Description
P05.01–P05.09	Function Selection of Multi-function Digital Input Terminals (S1–S8 and HDIA)	P05.01: 1 P05.02: 4 P05.03: 7 P05.04–P05.09: 0	0–95	16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Pause multi-step speed operation
P10.02–P10.32	Multi-Step Speeds 0–15 and Corresponding Running Times	0.0%	Frequency: -300.0%–300.0%	
		0.0s (min)	Time: 0.0–6553.5s (min)	The time unit is specified by P10.37.

6.4.2.6 Setting the Frequency Through PID Control

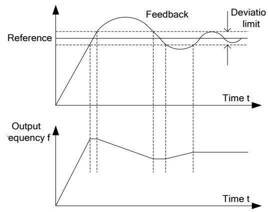
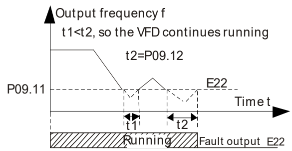
Set P00.06 or P00.07 to 7 to select PID control as the VFD's frequency reference channel.

PID control is a common control mode which is mainly used to adjust the VFD output frequency or output voltage, thus forming a negative feedback system to keep the controlled variables above their target values. This mode is suitable for moderating things like flow, pressure, temperature, etc.

The following is the basic schematic block diagram for the output frequency regulation employed in PID control mode:



Function Code	Name	Default	Setting Range	Description
P09.00	Channel for PID Reference Value	0	0–6	So long as P00.06 or P00.07 (channel of frequency reference A) is 7 or P04.27 (voltage setting channel) is 6, the VFD is PID-controlled. This function code specifies the channel through which the device will receive its reference values during the PID process. 0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step speed operation 6: Modbus communication Any reference value given for the PID process is a relative value, of which 100% refers to 100% of the controlled system's feedback signal. The system always calculates a value in relation to this (0.0%–100.0%).
P09.01	Setting PID Reference Through the Keypad	0.0%	-100.0%–100.0%	This function code is mandatory when P09.00=0. The base value of P09.01 is the system feedback.
P09.02	Channel for PID Feedback	0	0–4	0: AI1 1: AI2 2: AI3 3: HDIA 4: Modbus communication **Note:** The reference channel and feedback channel cannot be assigned twice, otherwise PID control cannot work properly.
P09.03	PID Output Characteristics	0	0–1	0: PID output is positive. When the feedback signal is lower than the PID reference value, the output frequency of the VFD will decrease to balance the PID.

				1: PID output is negative. When the feedback signal is higher than the PID reference value, the output frequency of the VFD will increase to balance the PID.
P09.07	Sampling Cycle (T)	0.100s	0.000–1.000s	Specifies the feedback sampling cycle. The regulator calculates in each sampling cycle. A longer sampling cycle indicates a slower response.
P09.08	PID Control Deviation Limit	0.0%	0.0%–100.0%	Used to adjust the accuracy and stability of the PID system. The output value of the PID system is relative to the max. deviation of the closed loop reference. As shown in the following figure, the PID regulator stops regulating in the range of deviation limit. 
P09.09	PID Output Upper Limit	100.0%	P09.10–100.0% (Max. frequency or voltage)	Specifies the upper limit of the PID output values.
P09.10	PID Output Lower Limit	0.0%	-100.0%–P09.09 (Max. frequency or voltage)	Specifies the lower limit of the PID output values.
P09.11	Feedback Offline Detection Value	0.0%	0.0%–100.0%	When the feedback value is smaller than or equal to P09.11 and remains this way for longer than the value specified by P09.12, the VFD reports "PID feedback offline error" and the keypad displays "E22". 
P09.12	Feedback Offline Detection Time	1.0s	0.0–3600.0s	

P09.13	PID Control Settings	0x0001	0x0000–0x1111	*Ones digit:* 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit *Tens digit:* 0: Same as the main reference direction 1: Contrary to the main reference direction *Hundreds digit:* 0: Limit as per the max. frequency 1: Limit as per A frequency *Thousands digit:* 0: Frequency A+B. ACC/DEC of main reference A frequency source buffering is invalid. 1: Frequency A+B. ACC/DEC of main reference A frequency source buffering is valid. The ACC/DEC is determined by P08.04 (ACC time 4).
P09.14	Low Frequency Proportional Gain (Kp)	1.00	0.00–100.00	Low-frequency switching point: 5.00Hz; High-frequency switching point: 10.00Hz P09.04 corresponds to the high-frequency parameter, and the middle is the linear interpolation between two points.
P09.15	ACC/DEC Time of PID Command	0.0s	0.0–1000.0s	–
P09.16	PID Output Filter Time	0.000s	0.000–10.000s	–
P09.18	Low Frequency Integral Time (Ti)	0.90s	0.00–10.00s	–
P09.19	Low Frequency Differential Time (Td)	0.00s	0.00–10.00s	–
P09.20	Low Frequency Point for PID Parameter Switching	5.00Hz	0.00Hz–P09.21	–
P09.21	High Frequency Point for PID Parameter Switching	10.00Hz	P09.20–P00.03	–

P17.00	Set frequency	0.00Hz	0.00Hz–P00.03	–
P17.23	PID Reference Value	0.0%	-100.0%–100.0%	–
P17.24	PID Feedback Value	0.0%	-100.0%–100.0%	–

Introduction to the Working Principles and Control Methods for PID Control Mode

Proportional Regulation (Kp):

Proportional control can respond to feedback changes rapidly, however, it cannot eliminate the static difference by itself. A larger proportional gain indicates a faster regulating speed, but a too large gain will result in oscillation. To solve this problem, set the integral time to a large value and the differential time to 0 to run the system, and then change the reference to observe the static difference between the feedback signal and reference.

If the static difference occurs in the direction of reference change (such as reference increase, meaning the feedback is always below the reference after the system stabilizes), continue increasing the proportional gain; otherwise, decrease the proportional gain. Repeat this process until you cannot minimize the static difference any further.

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

Integral Time (Ti):

The integral time parameter can also be used to eliminate static difference, but changing it too drastically may lead to system oscillation. This parameter is generally regulated gradually from large to small until the stabilized system speed fulfills your requirements.

Function Code	Name	Default	Setting Range	Description
P09.05	Integral Time (Ti)	0.90s	0.01–10.00s	Specifies the speed of integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation is 100%, the integral regulator works continuously the entire time to achieve the max. output frequency (P00.03) or the max. voltage (P04.31). A shorter integral time indicates a more drastic adjustment.

Differential Time (Td):

The differential time parameter is used to control the feedback signal variation based on the change trend. Exercise caution before using this particular regulator as it may increase system interferences, especially those with high change frequency.

When P00.06 or P00.07 (channel for frequency reference A or B) is set to 7 or P04.27 (voltage setting channel) is set to 6, the VFD is PID-controlled.

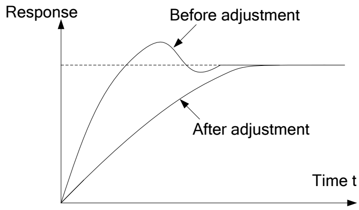
Function Code	Name	Default	Setting Range	Description
P09.06	Differential Time (Td)	0.00s	0.00–10.00s	Used to determine the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. If the PID feedback changes by 100% during the time, the adjustment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

How to Fine-Tune PID Control

After setting the parameters listed above, you can further adjust them by the following means:

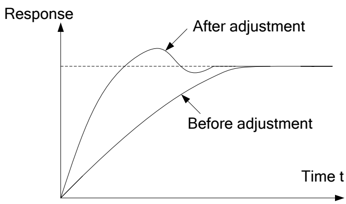
To Control Overshoot:

If overshoot occurred, decrease the differential time (Td) and increase the integral time (Ti).



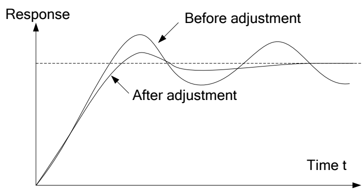
To Stabilize the Feedback Value as Fast as Possible:

If overshoot occurred, decrease the integral time (Ti) and increase the differential time (Td) to stabilize control as quickly as possible.



To Control Long-Term Oscillation:

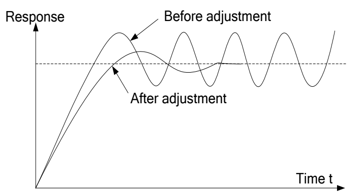
If the cycle of periodic oscillation is longer than the set value of integral time (Ti), it indicates that the integral regulation is too strong. Thus, you can increase the integral time (Ti) to manage these oscillations.



To Control Short-Term Oscillation:

If the oscillation cycle is so short as to almost equal the set value of differential time (Td), it indicates that the differential regulation is too strong. Thus, you can decrease the differential time (Td) to manage these oscillations.

When the differential time (Td) is set to 0.00 (no differential control), and there is no other way to manage oscillation, decrease the proportional gain.



6.4.2.7 Setting the Frequency Through Modbus Communication

Set P00.06 or P00.07 to 8 to select modbus communication as the VFD's frequency reference channel. For details, see 7 Modbus Communication.

6.4.3 Frequency Fine-Tuning

The VFD supports further frequency fine-tuning based on the set frequency. In some specific scenarios, the set frequency parameter can be left at 0, and the frequency fine-tuning function can be used by itself to set the frequency during the whole process.

1) Select any of the multifunction digital input terminals S1–S8 or HDIA as an external input terminal.

2) Set P05.01–P05.09 to 10 or 11.

Function Code	Name	Default	Setting Range	Description
P05.01–P05.09	Function Selection of Multifunction Digital Input Terminals (S1–S8 and HDIA)	P05.01: 1 P05.02: 4 P05.03: 7 P05.04–P05.09: 0	0–95	10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN)
P08.44	UP/DOWN Terminal Control Settings	0x000	0x000–0x221	*Ones digit: Frequency setting selection* 0: Enable use of the setting made via UP/DOWN terminal. 1: Disable use of the setting made via UP/DOWN terminal. *Tens digit: Frequency control selection* 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed operation when multi-step speed operation has priority *Hundreds digit: Stop action* 0: Setting remains valid. 1: Valid during operation, cleared after stop 2: Valid during operation, cleared after a stop command is received
P08.45	Frequency Integral Rate of the UP Terminal	0.50Hz/s	0.01–50.00Hz/s	–
P08.46	Frequency Integral Rate of the DOWN Terminal	0.50Hz/s	0.01–50.00Hz/s	–

6.5 Speed Control Mode

The VFD supports three speed control modes. You can set P00.00 to select a speed control mode based on the conditions and requirements of your specific use case.

Before using a vector control mode (0 or 1), first set the motor nameplate parameters and perform motor parameter autotuning. For details, see 6.1.2 Rated Motor Parameter and 6.2 Motor Parameter Autotuning.

Function Code	Name	Default	Setting Range	Description
P00.00	Speed Control Mode	2	0–2	0: SVC 0 1: SVC 1 2: Space voltage vector control mode

SVC mode 0: P00.00=0

This mode is most applicable to scenarios that prioritize high control accuracy and fast responses. For details, see

P03—Vector Control of Motor 1.

Note: An SM in this mode is more suitable for operation at high power and low frequency than for extremely high speeds.

SVC mode 1: P00.00=1

This mode is most applicable to scenarios where mediocre control accuracy and response speed are sufficient. For details, see

P03—Vector Control of Motor 1.

Space voltage vector control mode: P00.00=2

This mode is most applicable to scenarios where mediocre control accuracy is sufficient, and one VFD needs to drive multiple motors. For details, see

P04—V/F Control.

6.6 Torque Settings

The VFD offers both torque control and speed control.

Speed control aims to stabilize the speed so that the set speed matches the actual operating speed, while the maximum load capacity is limited by the torque limit.

Torque control aims to stabilize the torque so that the set torque matches the actual output torque, while the output frequency is limited by the upper and lower limit values.

6.6.1 How to Set the Torque Value

You can set P03.11 to select your preferred torque setting method.

The torque setting uses a relative value within the range of -300.0%–300.0%, with 100% corresponding to the motor's rated current.

Upon receiving a start command, the VFD will run forward if the torque reference value you set is positive, or backward if it's negative.

Function Code	Name	Default	Setting Range	Description
P03.11	Torque Setting Channel	0	0–7	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: HDIA 6: Multi-step torque 7: Modbus communication **Note:** • For AMs, 100% corresponds to the motor rated torque current when the value 0 or 1 is selected (i.e. when the keypad is selected). Otherwise, 100% instead corresponds to triple the motor rated torque current. • For SMs, 100% corresponds to the motor rated current when the value 0 or 1 is selected (i.e. when the keypad is selected). Otherwise 100% instead corresponds to triple the motor rated current.
P03.12	Setting the Torque Through the Keypad	20.0%	-300.0%–300.0%	Specifies the torque value when it's set to be defined via the keypad. **Note:** For AMs, 100% corresponds to the motor rated torque current; for SMs, 100% corresponds to the motor rated current.
P03.13	Torque Reference Filter Time	0.010s	0.000–10.000s	–

6.6.2 Switching Between Speed Control and Torque Control

There are two different methods to switch between speed control and torque control:

A) Switch directly via torque control function: Set P03.32 to 0 for speed control or 1 for torque control.

B) Switch by selecting the according function for one of the multifunction digital input terminals.

1) Select any of multifunction digital input terminals S1–S8 and HDIA as an external input terminal.

2) Set P05.01–P05.09 to 29.

When function 29 is selected, the settings of the torque control function are essentially inverted, meaning you must set P03.32 to 0 for torque control or 1 for speed control, instead of vice versa.

Function Code	Name	Default	Setting Range	Description
P03.32	Torque Control	0	0–1	0: Disable 1: Enable
P05.01–P05.09	Function Selection of Multifunction Digital Input Terminals (S1–S8 and HDIA)	P05.01: 1 P05.02: 4 P05.03: 7 P05.04–P05.09: 0	0–95	29: Switch between speed control and torque control

6.7 Start/Stop Settings

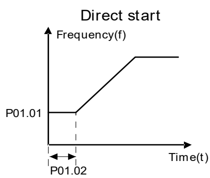
6.7.1 Start Settings

Depending on your specific motor type and use case, you can select an appropriate start mode by setting P01.00.

Function Code	Name	Default	Setting Range	Description
P01.00	Start Mode	0	0–1	0: Direct start 1: Start after DC braking

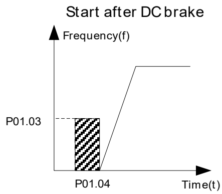
Direct start: P01.00=0

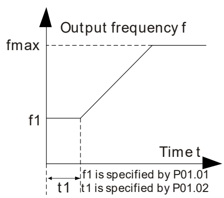
If the DC braking time before start-up is set to 0, the VFD runs using the starting frequency at direct start P01.01. This is often applicable to start-up from a still state. See the following figure:



Start after DC braking: P01.00= 1

If the DC braking time set to any value other than 0, allow the motor to hold its position via DC braking, and then perform an ACC start. This is applicable to any scenarios where the motor is already in a state of slight rotation before start-up. See the following figure:



Function Code	Name	Default	Setting Range	Description
P01.01	Starting Frequency at Direct Start	0.50Hz	0.00–50.00Hz	Specifies the initial frequency to be used upon VFD direct start. See P01.02 (Starting frequency hold time) for more detailed information.
P01.02	Hold Time of Starting Frequency	0.0s	0.0–50.0s	Setting a suitable start frequency can increase the torque when starting the VFD. During the start frequency hold time, the output frequency of the VFD corresponds to the start frequency. The VFD then runs from the start frequency to the set frequency. If the set frequency is lower than the start frequency, the VFD stops and remains in standby mode. The start frequency is not limited by the lower frequency limit. 
P01.03	Braking Current Before Start-Up	0.0%	0.0%–100.0%	The VFD performs DC braking with the braking current specified by P01.03 before starting and then accelerates after the DC braking time (P01.12). If the set DC braking time is 0, DC braking is inactive and the VFD brakes to a standstill within the specified time in regular braking mode.
P01.04	Braking Time Before Start-Up	0.00s	0.00–50.00s	

				A higher braking current means a higher braking power. The DC braking current before starting is a percentage of the rated output current.
P01.23	Start Delay	0.0s	0.0–600.0s	Upon receiving a start command, the VFD remains in standby mode and re-starts with a delay to allow the brake to be released.
P01.30	Hold Time of Short-Circuit Braking at Start-Up	0.00s	0.0–50.0s	If the VFD starts in direct start mode (P01.00=0), set P01.30 to a value other than zero to activate short-circuit brak-ing.

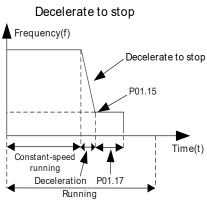
6.7.2 Stop Settings

You can select your preferred stop mode by setting P01.08.

Function Code	Name	Default	Setting Range	Description
P01.08	Stop Mode	0	0–1	0: Decelerate to stop 1: Coast to stop

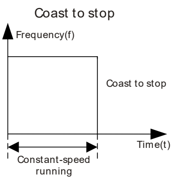
Decelerate to stop: P01.08=0

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



Coast to stop: P01.08=1

Once a stop command takes effect, the VFD stops output immediately, allowing the load to coast to a gradual stop based on its mechanical inertia.



Note: If the set frequency is changed from one above the frequency lower limit to one below it, the VFD will react as you specify via P01.19.

Function Code	Name	Default	Setting Range	Description
P01.19	Action Selected when Operating Frequency is Below Frequency Lower Limit	0x00	0x00–0x12	Specifies the status of the VFD when the operating frequency drops below the lower limit (valid only when a frequency lower limit greater than 0 has been set). *Ones digit: Action selection* 0: Continue to run at the lower limit 1: Stop 2: Sleep *Tens digit: Stop mode* 0: Coast to stop 1: Decelerate to stop

P01.09≠0

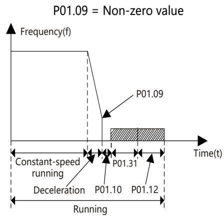
Short-circuit braking and DC braking can only be selected with this setting.

If the operating frequency of the VFD during braking is lower than the starting frequency of DC braking (P01.09), the VFD waits for the demagnetization time P01.10 and checks the value of P01.31. If this value is not zero, the VFD switches to short-circuit braking.

The VFD then checks the value of P01.12. If this value is not zero, the VFD performs DC braking with the time specified in P01.12. As soon as the DC braking time is reached, the VFD coasts to a standstill.

If the value of P01.31=0, short-circuit braking is not available.

If the value of P01.12=0, DC braking is not available.

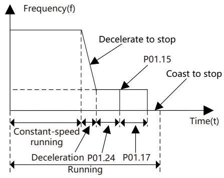


P01.09=0

The VFD brakes to a standstill according to the normal procedure. If the ramp frequency is less than P01.15, the VFD executes the stop command with a delay defined by P01.24 according to the mode defined by P01.16.

If P01.16=0, the VFD simply coasts to a stop.

If P01.16 = 1, the VFD must first check whether the output frequency of the motor is below P01.15. If yes, the VFD will coast to a stop without delay. If not, it will only do so once the delay time specified by P01.17 has passed.



Possible methods to brake quickly for an abrupt stillstand include:

A) Increase the VFD power to improve its braking capability.

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

C) Enable magnetic flux braking via P08.50.

D) Add braking resistors.

E) Set the S-curve deceleration parameters.

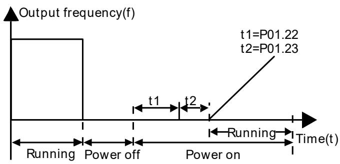
Function Code	Name	Default	Setting Range	Description
P01.09	Starting Frequency of DC Braking	0.00 Hz	0.00 Hz–P00.03	During deceleration, the VFD starts DC braking when the operating frequency reaches the frequency set in P01.09.
P01.10	Demagnetization Time	0.00 s	0.00–30.00 s	The VFD blocks the output before it initiates DC braking. The VFD starts DC braking after the time defined by this setting in order to prevent an overcurrent caused by DC braking at high speed.
P01.11	DC Braking Current	0.0%	0.0%–100.0%	Percentage of the VFD rated output current. A stronger current indicates more efficient DC braking.
P01.12	DC Braking Time	0.00 s	0.0–50.0 s	Duration of DC braking. If this value is zero, DC braking is not available and the VFD brakes to a standstill within the specified time.
P01.15	Stop Speed	0.50 Hz	0.00–100.00 Hz	–
P01.16	Stop Speed Detection Mode	0	0–1	0: Detect by the set speed (unique to space voltage vector control mode) 1: Detect by the feedback speed

P01.17	Stop Speed Detection Time	0.50s	0.00–100.00s	–
P01.24	Stop Speed Delay	0.0s	0.0–600.0s	–
P01.29	Short-Circuit Braking Current	0.0%	0.0%–150.0%	100% corresponds to the VFD's rated current.
P01.31	Hold Time of Short-Circuit Braking	0.00s	0.0–50.0s	–

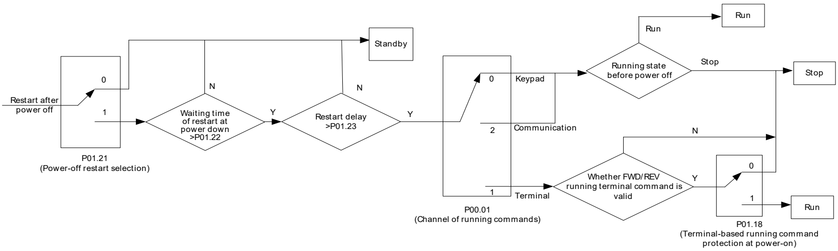
6.7.3 Power-Off Restart

If P01.21=1, the VFD saves the operating status for all command channels when it is switched off. If the VFD is in operation before it is switched off, the VFD starts up automatically with a delay specified by P01.22 the next time it is switched on if the start conditions are met.

If the terminals are used as a command channel, you must set P01.18 to 1. The following figure shows the waiting time for the power-off restart:



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



Function Code	Name	Default	Setting Range	Description
P01.21	Restart After Power-Off	0	0–1	0: Disable 1: Enable
P01.22	Wait Time for Restart After Power-Off	1.0s	0.0–3600.0s	Specifies the wait time before the VFD automatically resumes operation after power is restored (valid only when P01.21=1).

P01.23	Start Delay	0.0s	0.0–600.0s	Upon receiving a start command, the VFD remains in standby mode and restarts with a delay to allow the brake to be released.
P01.18	Terminal-Based Operating Command Protection at Power-On	0	0–1	Specifies whether terminal-based operating commands will be registered at power-on. 0: Terminal-based operating commands are invalid at power-on. 1: Terminal-based operating commands are valid at power-on. **Note:** Exercise caution before using this function; careless use may result in serious consequences.

Terminal-based operating commands are invalid at power-on: P01.18=0

Although a terminal-based operating command is considered valid at power-on, the VFD does not run and retains the protection status until the terminal is deactivated and reactivated.

Terminal-based operating commands are valid at power-on: P01.18=1

If a terminal-based operating command is considered valid at power-on, the VFD is started automatically after initialization.

6.8 Control Performance Regulation

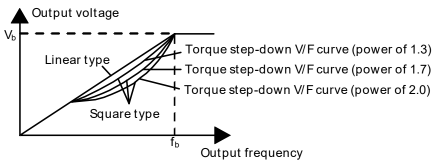
6.8.1 Space Vector Control Performance Optimization

6.8.1.1 V/F Curve Setting

The VFD offers several V/F curve modes to meet different requirements. You can select given V/F curves or set them individually as required.

For loads with constant torque, such as conveyors running in a straight line, it is recommended to use the straight V/F curve, as the entire operation requires consistent torque.

For loads with decreasing torque, such as fan and water pumps, it is recommended to use a V/F curve corresponding to the power functions of 1.3, 1.7 or 2.0, as there is a corresponding relationship (square or cubic) between the actual torque and the speed.



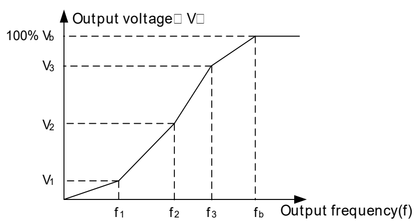
Note: In the figure above, V_b indicates the motor rated voltage and f_b indicates the motor rated frequency.

Function Code	Name	Default	Setting Range	Description
P04.00	V/F Curve of Motor 1	0	0–5	0: Straight-line V/F curve, applicable to consistent torque loads 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) Curves 2–4 are applicable to torque loads such as fans and water pumps. You can adjust according to the characteristics of your required loads to achieve best performance. 5: Custom V/F (V/F separation) In this mode, V is separated from F. This way, F can be adjusted through the frequency setting channel specified by P00.06 or the voltage setting channel specified by P04.27 to change the characteristics of the curve.

Your VFD also offers the option of using multi-point V/F curves. You can change the VFD output V/F curves by setting the voltage and frequency of the three points in the middle. A complete curve consists of five points starting at 0 Hz; 0 V and ending at motor base frequency; motor rated voltage. The following rules must be observed when setting:

- $0 \le f_1 \le f_2 \le f_3 \le$ motor base frequency;
- $0 \le V_1 \le V_2 \le V_3 \le$ rated motor voltage.

Too high a voltage for too low a frequency will lead to overheating or damage to the motor and cause an overcurrent shutdown or tripping of the VFD's overcurrent protection. If P04.00 is set to 1 (multi-point V/F curve), you can set the V/F curve via P04.03 to P04.08.



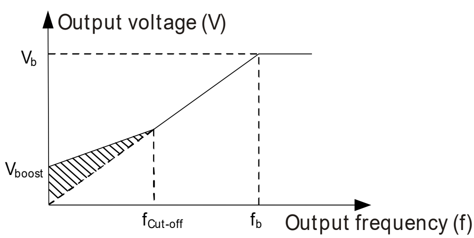
Function Code	Name	Default	Setting Range	Description
P04.03	V/F Frequency Point 1 of Motor 1	0.00Hz	0.00Hz–P04.05	–
P04.04	V/F Voltage Point 1 of motor 1	0.0%	0.0%–110.0%	100% corresponds to the rated voltage of motor 1.
P04.05	V/F Frequency Point 2 of Motor 1	0.00Hz	P04.03–P04.07	–
P04.06	V/F Voltage Point 2 of Motor 1	0.0%	0.0%–110.0%	100% corresponds to the rated voltage of motor 1.
P04.07	V/F Frequency Point 3 of Motor 1	0.00Hz	P04.05–P02.02 (Rated Frequency AM 1) or P04.05–P02.16 (Rated Frequency SM 1)	–
P04.08	V/F Voltage Point 3 of Motor 1	0.0%	0.0%–110.0%	100% corresponds to the rated voltage of motor 1.

6.8.1.2 Torque Boost

The torque boost compensation of the output voltage can significantly improve the torque performance at low speeds/low frequencies in V/F control. The limit value of the manual torque boost frequency is a percentage of the rated motor frequency f_b.

You must select the torque boost depending on the load. The load must be proportional to the gain while the gain must not be too high. If the torque gain is too high, the motor will run with overexcitation, which can lead to increased output current and overheating of the motor, in turn reducing efficiency. The standard torque gain is 0.0%, which corresponds to automatic torque boost. At this setting, the VFD can regulate the torque boost based on the actual load.

Set P04.01 to determine the torque boost of motor 1 and P04.02 to determine the torque boost cut-off frequency of motor 1. The torque boost is active below this frequency threshold; it switches off when this threshold is exceeded. See the following figure:



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

6.8.1.3 V/F Slip Compensation Gain

V/F control is an open-loop mode, where a sudden change in motor load causes a fluctuation in motor speed. In situations where strict speed requirements must be met, you can set the slip compensation gain via P04.09 to change the internal VFD output adjustment method to compensate for the speed change caused by load fluctuations and improve the mechanical rigidity of the motor.

The formula for calculating the rated motor slip frequency is as follows:

$$\triangle f=f_b-n\cdot p/60$$

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

Function Code	Name	Default	Setting Range	Description
P04.09	V/F Slip Compensation Gain of Motor 1	100.0%	0.0%–200.0%	100% corresponds to the rated slip frequency.

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

6.8.1.4 Oscillation Control

In high power situations, the use of space voltage vector control mode results in motor vibration, which can be eliminated by adjusting P04.10 and P04.11, while the vibration control threshold of motor 1 is set by P04.12.

Function Code	Name	Default	Setting Range	Description
P04.10	Low-Frequency Oscillation Control Factor of Motor 1	10	0–100	Setting a larger value means a better control effect. However, if the value is

P04.11	High-Frequency Oscillation Control Factor of Motor 1	10	0–100	too large, the VFD output current may also become too high.
P04.12	Oscillation Control Threshold of Motor 1	30.00Hz	0.00Hz–P00.03	

6.8.1.5 Reactive Current Regulation in SM V/F Control

When SM V/f control mode is enabled, you can configure P04.36 to set the frequency threshold for switching between pick-up current 1 and pick-up current 2. If the output frequency is less than P04.36, the motor reactive current is determined by P04.34; if the output frequency is greater than P04.36, the motor reactive current is determined by P04.35.

Function Code	Name	Default	Setting Range	Description
P04.34	Pull-in Current 1 in SM V/F control	20.0%	-100.0%–100.0%	–
P04.35	Pull-in Current 2 in SM V/F control	10.0%	-100.0%–100.0%	–
P04.36	Frequency Threshold to Switch Pull-In Currents in SM V/F control	20.0%	0.0%–200.0%	–
P04.37	Reactive Current Closed-Loop Proportional Coefficient in SM V/F Control	50	0–3000	While SM VF control mode is enabled, this function code specifies the proportional coefficient of the reactive current closed-loop control..
P04.38	Reactive Current Closed-Loop Integral Coefficient in SM V/F Control	30	0–3000	While SM VF control mode is enabled, this function code specifies the integral coefficient of the reactive current closed-loop control.

6.8.1.6 Flux Weakening for Performance Optimization in V/F Control Mode

If the AM needs to run with flux weakening, configure P04.33 in V/F control mode to increase the output voltage and maximize the bus voltage utilization, which improves the motor acceleration time.

Function Code	Name	Default	Setting Range	Description
P04.33	Weakening Coefficient in Constant Power Zone	1.00	1.00–1.30	–

6.8.2 Vector Control Performance Optimization

6.8.2.1 Torque Upper Limit

Speed control and torque control in vector control mode are restricted by the torque upper limits. If you set P03.18 (channel for electromotive torque upper limit) to 0 (keypad), the upper limit of the torque is determined by P03.20. Similarly, if you set P03.19 (channel for braking torque upper limit) to 0 (keypad), the upper limit of the torque is determined by P03.21.

Function Code	Name	Default	Setting Range	Description
P03.18	Channel for Electromotive Torque Upper Limit	0	0–5	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus communication **Note:** • For AMs, 100% corresponds to the motor rated torque current when the value 0 is selected, and corresponds to triple the motor rated torque current when a value from 1 to 5 is selected. • For SMs, 100% corresponds to the motor rated current when the value 0 or 1 is selected, and corresponds to triple the motor rated current when a value from 2 to 5 is selected.
P03.19	Channel for Braking Torque Upper Limit	0	0–5	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus communication **Note:** • For AMs, 100% corresponds to the motor rated torque current when the value 0 is selected, and corresponds to triple the motor rated torque current

				when a value from 1 to 5 is selected. • For SMs, 100% corresponds to the motor rated current when the value 0 or 1 is selected, and corresponds to triple the motor rated current when a value from 2 to 5 is selected.
P03.20	Setting Electromotive Torque Upper Limit Through the Keypad	180.0%	0.0%–300.0%	Specifies the electromotive/braking torque limit when they're set to be defined via the keypad. **Note:** For AMs, 100% corresponds to the motor rated torque current; for SMs, 100% corresponds to the motor rated current.
P03.21	Setting Braking Torque Upper Limit Through the Keypad	180.0%	0.0%–300.0%	

6.8.2.2 Frequency Upper Limit Settings in Torque Control

In torque control, the VFD outputs the torque according to the set torque command.

If the set torque is greater than the load torque, the VFD output frequency increases to the upper frequency limit; if it's smaller, the VFD output frequency decreases to the lower frequency limit. If the VFD output frequency is limited, the output torque no longer corresponds to the set torque.

If you set P03.14 to specify the keypad as the channel for the upper limit frequency of forward rotation, the torque limit is determined by P03.16. Analogous to this, if you set P03.15 to specify the keypad as the channel for the upper limit frequency of reverse rotation, the torque limit is determined by P03.17.

Function Code	Name	Default	Setting Range	Description
P03.14	Channel for Forward Rotation Frequency Upper Limit in Torque Control	0	0–6	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step setting 6: Modbus communication **Note:** 100% corresponds to the max. frequency.
P03.15	Channel for Reverse Rotation Frequency Upper Limit in Torque Control	0	0–6	0: Keypad (P03.17) 1: AI1 2: AI2 3: AI3 4: HDIA

				5: Multi-step setting 6: Modbus communication **Note:** 100% corresponds to the max. frequency.
P03.16	Setting Forward Rotation Frequency Upper Limit Through the Keypad in Torque Control	50.00 Hz	0.00 Hz–P00.03	These function codes specify the frequency limits when they're set to be defined via the keypad.
P03.17	Setting Reverse Rotation Frequency Upper Limit Through the Keypad in Torque Control			

6.8.2.3 Speed Loop

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

The dynamic response of the speed regulator can be accelerated by increasing the proportional gain or by shortening the integral time. However, a dynamic response of the speed controller that is too fast can lead to oscillations.

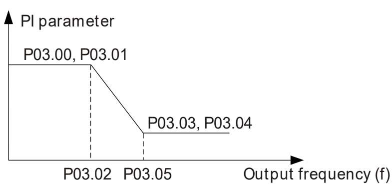
Recommended adjustment method:

If the default settings do not meet the requirements, adjust the settings slightly. First increase the proportional gain to ensure that the system does not oscillate, and then reduce the integral time so that the system reacts quickly and with little overshoot.

Note: Improper PI parameter settings will cause large speed overshoot.

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

See the following figure:



Function Code	Name	Default	Setting Range	Description
P03.00	Speed-Loop Proportional Gain 1	20.0	0.0–200.0	The PI parameters of the speed regulator are divided into a group for low speeds and a group for high speeds. If the operating frequency is lower than P03.02, the PI parameters of the speed regulator are P03.00 and P03.01. If the operating frequency is greater than P03.05 (high point frequency for switching), the PI parameters of the speed regulator are P03.03 and P03.04.
P03.01	Speed-loop Integral Time 1	0.200s	0.000–10.000s	
P03.02	Low-Point Frequency for Switching	5.00Hz	0.00Hz–P03.05	
P03.03	Speed-Loop Proportional Gain 2	20.0	0.0–200.0	
P03.04	Speed-Loop Integral Time 2	0.200s	0.000–10.000s	–
P03.05	High-Point Frequency for Switching	10.00Hz	P03.02–P00.03	–
P03.06	Speed-Loop Output Filter	0	0–8	–
P03.36	Speed-Loop Differential Time	0.00s	0.00–10.00s	–

6.8.2.4 Current Loop

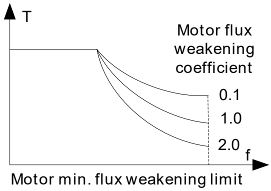
Generally, there is no need to adjust it. If the current waveform is not sinusoidal, the current loop band width can be reduced.

Function Code	Name	Default	Setting Range	Description
P03.10	Current-Loop Band Width	400	0–2000	**Note:** Most of the time you will not need to modify this parameter.

6.8.2.5 Flux Weakening for Performance Optimization in Vector Control Mode

If the AM runs at a higher speed than the rated speed, it switches to the flux weakening state. You can adjust P03.22 to change the flux weakening curve. A large control coefficient means a steep curve. AM flux weakening control uses the weakening coefficient in the constant power zone, while the corresponding proportional and integral gain are set by P03.26 and P03.33, respectively. The max. VFD output voltage is determined by P03.24.

If the motor is pre-excited upon VFD start-up, a magnetic field builds inside the motor to improve the torque performance during the start-up process. The pre-excitation time is specified by P03.25.



Function Code	Name	Default	Setting Range	Description
P03.23	Lowest Weakening Point in Constant Power Zone	5%	10%–100%	Used when the AM is in flux weakening control; the lowest weakening point in constant power zone is specified by P03.23.
P03.24	Max. Voltage Limit	100.0%	0.0%–120.0%	Specifies the max. VFD output voltage, which is a percentage of the motor rated voltage. Set the value according to onsite conditions.
P03.25	Pre-Excitation Time	0.300s	0.000–10.000s	Pre-excitation is performed for the motor when the VFD starts up. A magnetic field is built up inside the motor to improve the torque performance during the start process.
P03.26	Flux Weakening Proportional Gain	1000	0–8000	–
P03.33	Flux Weakening Integral Gain	30.0%	0.0%–300.0%	–

6.8.2.6 SM Start Control Optimization

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

Function Code	Name	Default	Setting Range	Description
P13.01	Detection Mode of Initial Pole	2	0–2	0: No detection 1: Reserved 2: Pulse superimposition

No detection: P13.01=0

The specified start command is a direct start command. In this operating mode, set P13.02 to a large value to increase the starting torque, which causes a start reversal with average load capacity.

Reserved: P13.01=1

Pulse superimposition: P13.01=2

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

Function Code	Name	Default	Setting Range	Description
P13.02	Pull-In Current 1	30.0%	0.0%–100.0% (of the motor rated current)	Specifies the pole position orientation current which can be set within the lower limit of the pull-in current switch-over frequency threshold. If you need to increase the start torque, increase the value of this function parameter accordingly.
P13.03	Pull-In Current 2	0.0%	-100.0%–100.0% (of the motor rated current)	Specifies the pole position orientation current which can be set within the upper limit of the pull-in current switch-over frequency threshold. Generally speaking, you will not need to change this value.
P13.04	Switch-Over Frequency of Pull-In Current	20.0%	0.0%–200.0% (of the motor rated frequency)	–
P13.06	High-Frequency Superposition Voltage	80.0%	0.0%–300.0% (of the motor rated voltage)	Specifies the pulse current threshold when the initial magnetic pole position is detected in pulse mode.

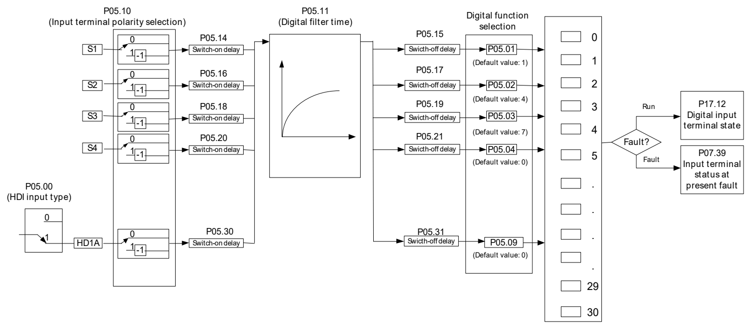
6.9 Input and Output

6.9.1 Digital Input and Output

6.9.1.1 Digital Input

The VFD carries four programmable digital input terminals and one HDI input terminal. The functions of all the digital input terminals can be programmed through function codes.

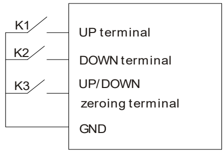
The HDI input terminal can be set to act as a high-speed pulse input terminal or common digital input terminal; if it is set to act as a high-speed pulse input terminal, you can also set HDIA high-speed pulse input to serve as the frequency reference input.



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

P05.01–P05.09 are used to configure the functions of digital multifunction input terminals. You can choose from the following list of possible functions:

Setting	Function	Description
0	No Function	The VFD does not respond even if a signal is present. Set unused terminals to "no function" to avoid malfunctions.
1	Run Forward (FWD)	The terminal is used to control the forward/reverse operation of the VFD.
2	Run Backward (Reverse Mode, REV)	
3	Three-Wire Control Mode	The terminal is used to determine the VFD's three-wire control mode. For details, see the description for P05.13.
4	Jog Forward	You can find details on the frequency and ACC/DEC time of the jogging run in the descriptions of P08.06, P08.07 and P08.08.
5	Jog Backward	
6	Coast to Stop	The VFD blocks the output and the motor coasts to a stop by itself without the VFD controlling the braking. This mode can be used in scenarios with high inertia loads and no stop time requirements. The definition of this setting is the same as that of P01.08; it is mainly used in remote control.
7	Error Reset	External error reset; works the same as the reset function of the STOP/RST key on the keypad. You can use this function to reset errors remotely.
8	Pause Running	The VFD decelerates to a stop, but all operating parameters are saved, such as PLC parameters, sweep frequency and PID parameters. After this signal clears, the VFD returns to its state before the stop.
9	External Error Input	When an external error signal is transmitted, the VFD outputs an error alarm and stops.

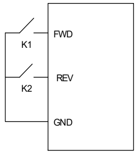
<table>
<tr><td>10</td><td>Increase Frequency Setting (UP)</td><td rowspan="3">Used to change the frequency increase/decrease command when the frequency is set to be given via external terminals.


The terminal you use to delete the frequency increase/decrease setting can delete the frequency value of the auxiliary channel set with UP/DOWN and thus reset the reference frequency to that specified by the main reference channel.</td></tr>
<tr><td>11</td><td>Decrease Frequency Setting (DOWN)</td></tr>
<tr><td>12</td><td>Clear the Frequency Increase/Decrease Setting</td></tr>
<tr><td>13</td><td>Switch Between Setting A and Setting B</td><td rowspan="3">The function is used to switch between the frequency setting channels. Function 13 switches between frequency reference channel A and frequency reference channel B, function 14 switches between the combination setting specified by P00.09 and frequency reference channel A; and function 15 switches between the combination setting and frequency reference channel B.</td></tr>
<tr><td>14</td><td>Switch Between Combination Setting and Setting A</td></tr>
<tr><td>15</td><td>Switch Between Combination Setting and Setting B</td></tr>
<tr><td>16</td><td>Multi-Step Speed Terminal 1</td><td rowspan="4">A total of 16 speed steps can be set by combining digital states of these four terminals.
Note: Multi-step speed 1 is the LSB, and multi-step speed 4 is the MSB.
<table><tr><th>Multi-Step Speed 4</th><th>Multi-Step Speed 3</th><th>Multi-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>
<tr><td>20</td><td>Pause Multi-Step Speed Operation</td><td>The multi-step speed selection function can be screened to keep the set value in the current state.</td></tr>
<tr><td>21</td><td>ACC/DEC Time Selection 1</td><td rowspan="2">The status of the two terminals can be combined to select four groups of ACC/DEC time.
<table><tr><th>T1</th><th>T2</th><th>ACC/DEC Time</th><th>Parameter</th></tr><tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td><td>P00.11/P00.12</td></tr><tr><td>ON</td><td>OFF</td><td>ACC/DEC time 2</td><td>P08.00/P08.01</td></tr><tr><td>OFF</td><td>ON</td><td>ACC/DEC time 3</td><td>P08.02/P08.03</td></tr><tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td><td>P08.04/P08.05</td></tr></table></td></tr>
<tr><td>22</td><td>ACC/DEC Time Selection 2</td></tr>
<tr><td>23</td><td>Simple PLC Stop/Reset</td><td>Clears the previous PLC state memory information and restart the simple PLC process.</td></tr>
<tr><td>24</td><td>Pause Simple PLC</td><td>Pauses the simple PLC process. When the signal is cleared, it resumes.</td></tr>
</table>

25	Pause PID Control	PID is temporarily inactive, and the VFD maintains its current frequency output.
26	Pause Wobbling Frequency (Stop at Current Frequency)	The VFD pauses at its current output. When this signal is cleared, wobbling-frequency operation continues at the current frequency.
27	Reset Wobbling Frequency (Back to Center Frequency)	The set frequency reverts back to the center frequency.
28	Reset the Counter	The counter is cleared.
29	Switch Between Speed Control and Torque Control	The VFD switches from torque control mode to speed control mode, or vice versa.
30	Disable ACC/DEC	Ensures the VFD is not impacted by external signals (except for stop commands), and maintains the present output frequency.
31	Trigger the Counter	Enables the counter to count pulses.
33	Clear the Frequency Increase/Decrease Setting Temporarily	When the terminal is closed, the frequency value set by UP/DOWN can be cleared to reset the frequency reference to that specified by the frequency reference channel; when the terminal is opened, the value is restored according to the frequency increase/decrease setting.
34	DC Braking	The VFD initiates DC braking immediately.
36	Switch the Operating Command Channel to Keypad	When this function is enabled, the operating command channel is switched to keypad. When it's disabled, the operating command channel is restored to its previous setting.
37	Switch the Operating Command Channel to Terminal	When this function is enabled, the operating command channel is switched to terminal. When it's disabled, the operating command channel is restored to its previous setting.
38	Switch the Operating Command Channel to Modbus Communication	When this function is enabled, the operating command channel is switched to modbus communication. When it's disabled, the operating command channel is restored to its previous setting.
39	Pre-Excitation Command	When the function is enabled, motor pre-excitation is initiated and will last until the signal is cleared.
40	Clear Power Consumption Quantity	Zeroes out the power consumption quantity of the VFD.
41	Keep Power Consumption Quantity	When this function is enabled, the present operation of the VFD does not impact the power consumption quantity.
42	Switch the Channel for Braking Torque Upper Limit to Keypad	When this function is enabled, the torque upper limit is set through the keypad.
61	Switch PID Polarities	Used to switch the PID output polarity. This function is used in conjunction with P09.03.

Related parameters are listed in the following table:

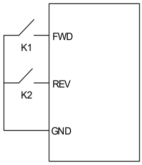
Function Code	Name	Default	Setting Range	Description
P05.00	HDI Input Type	0	0–1	0: Defines HDIA as a high-speed pulse input 1: Defines HDIA as a digital input
P05.01	S1 Function	1	0–95	For details, see the preceding table. S1–S4 and HDIA are the terminals on the control board, while S5–S8 are accessed through the virtual terminal functions set by P05.12.
P05.02	S2 Function	4		
P05.03	S3 Function	7		
P05.04	S4 Function	0		
P05.05	S5 Function			
P05.06	S6 Function			
P05.07	S7 Function			
P05.08	S8 Function			
P05.09	HDIA Function			
P05.10	Input Terminal Polarity	0x000	0x000–0x1FF	Specifies the input terminal polarity. When a bit is 0, the input terminal is positive; when a bit is 1, the input terminal is negative.
P05.11	Digital Filter Time	0.010s	0.000–50.000s	Specifies the sampling filter time of the S1–S8 and HDIA terminals. In cases of strong interference, increase the value to avoid malfunction.
P05.12	Enable Virtual Terminals	0x000	0x000–0x1FF	Bit 0: S1 virtual terminal Bit 1: S2 virtual terminal Bit 2: S3 virtual terminal Bit 3: S4 virtual terminal Bit 4: S5 virtual terminal Bit 5: S6 virtual terminal Bit 6: S7 virtual terminal Bit 7: S8 virtual terminal Bit 8: HDIA virtual terminal
P05.13	Terminal Control Mode	0	0–3	Specifies the terminal control mode. 0: Two-wire control 1. The enabling takes place in accordance with the direction. This mode is widely used. The defined FWD/REV terminal command determines the direction of motor rotation.



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

1: Two-wire control 2

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

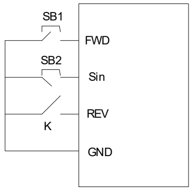


FWD	REV	Running command
OFF	OFF	Stop
ON	OFF	Forward running
OFF	ON	Stop
ON	ON	Reverse running

2: Three-wire control 1

In this mode, Sin is defined as an enabling terminal and the operating command is generated by FWD, while the direction is controlled by REV.

During operation, the Sin terminal must be closed. The FWD terminal generates a rising edge signal, then the VFD starts to run in the direction defined by the state of the REV terminal; the VFD must be stopped by disconnecting the Sin terminal.



Sin	REV	Previous Direction	Present Direction
ON	OFF→ ON	FWD	REV
		REV	FWD
ON	ON→ OFF	REV	FWD
		FWD	REV
ON→ OFF	ON	Decelerate to stop	
	OFF		

Sin: Three-wire control;

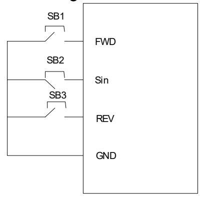
FWD: Forward running;

REV: Reverse running

3: Three-wire control 2

In this mode, Sin is defined as an enabling terminal, and the operation command is generated by FWD or REV, but the direction is controlled by both FWD and REV.

During operation, the Sin terminal must be closed, and the FWD or REV terminal generates a rising edge signal to control the operation and direction of the VFD; the VFD must be stopped by disconnecting the Sin terminal.



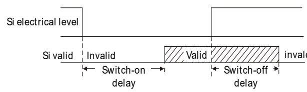
Sin	FWD Terminal	REV Terminal	Running Direction
ON	OFF→ ON	ON	FWD
		OFF	FWD
ON	ON	OFF→ ON	REV
	OFF		REV
ON→ OFF	–	–	Decelerate to stop

Sin: Three-wire control;

FWD: Forward running;

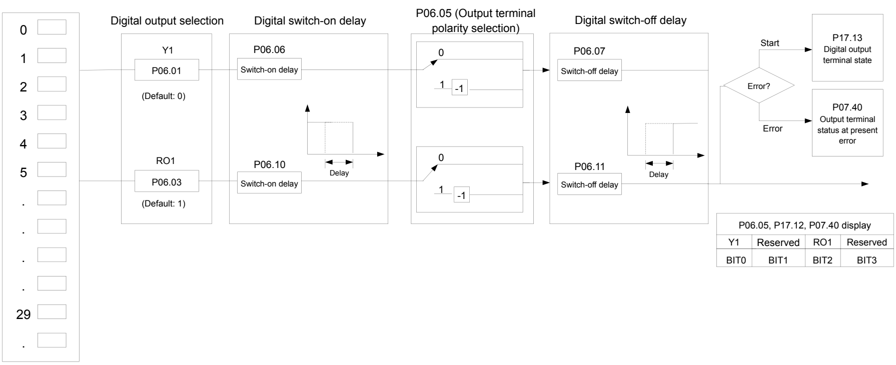
REV: Reverse running

Note: If the VFD stops due to a stop command given from another source while in two-wire control mode and while the FWD/REV terminal is active, the VFD will not restart after the stop command has been cleared, even if the FWD/REV control terminal is still active. To get the VFD running, FWD/REV must be triggered again, e.g. by PLC single cycle stop, fixed length stop and STOP/RST stop during terminal control. (See P07.04.)

P05.14	S1 Switch-On Delay	0.000s	0.000–50.000s	These function codes specify the delay time corresponding to the electrical level changes when the programmable input terminals switch on or switch off.  **Note:** The modbus communication address is 0x200A.
P05.15	S1 Switch-Off Delay			
P05.16	S2 Switch-On Delay			
P05.17	S2 Switch-Off Delay			
P05.18	S3 Switch-On Delay			
P05.19	S3 Switch-Off Delay			
P05.20	S4 Switch-On Delay			
P05.21	S4 Switch-Off Delay			
P05.22	S5 Switch-On Delay			
P05.23	S5 Switch-Off Delay			
P05.24	S6 Switch-On Delay			
P05.25	S6 Switch-Off Delay			
P05.26	S7 Switch-On Delay			
P05.27	S7 Switch-Off Delay			
P05.28	S8 Switch-On Delay			
P05.29	S8 Switch-Off Delay			
P05.30	HDIA Switch-On Delay			
P05.31	HDIA Switch-Off Delay			
P07.39	Input Terminal Status at Present Error	0x0000	0x0000–0xFFFF	–
P17.12	Digital Input Terminal State	0x000	0x000–0x1FF	–

6.9.1.2 Digital Output

The VFD has one set of relay output terminals and an open collector Y output terminal. All functions of the digital output terminals can be defined by function codes.

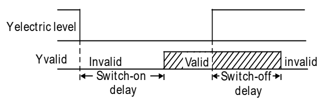


The following table lists the options of function parameters P06.01–P06.04. A same output terminal function can be repeatedly selected.

Setting	Function	Description
0	No Function	The output terminal does not have any function.
1	Running	The ON signal is output when there is frequency output during running.
2	Forward Running	The ON signal is output when there is frequency output during forward running.
3	Reverse Running	The ON signal is output when there is frequency output during reverse running.
4	Jogging	The ON signal is output when there is frequency output during jogging.
5	Error	The ON signal is output when a VFD error has occurred.
6	Frequency Level Detection FDT1	Refer to the descriptions of P08.32 and P08.33.
7	Frequency Level Detection FDT2	Refer to the descriptions of P08.34 and P08.35.
8	Frequency reached	Refer to the description of P08.36.
9	Running at Zero Speed	The ON signal is output when the VFD output frequency and reference frequency are both zero.
10	Upper Frequency Limit Reached	The ON signal is output when the operating frequency reaches the upper limit.
11	Lower Frequency Limit Reached	The ON signal is output when the operating frequency reaches the lower limit.
12	Ready for Operation	The ON signal is output when the main circuit and the control circuit are supplied with power, no protective functions are interfering, and the VFD is ready for operation.
13	Pre-Excitation	The ON signal is output when the VFD is in motor pre-excitation mode.
14	Overload Pre-Alarm	The ON signal is output when the pre-alarm time elapsed based on the set pre-alarm threshold; for details, see descriptions for P11.08–P11.10.
15	Underload Pre-Alarm	The ON signal is output after the pre-alarm time elapsed based on the pre-alarm threshold; for details, see the descriptions for P11.11–P11.12.
16	Simple PLC Stage Completed	The ON signal is output when the present stage of the simple PLC is complete.
17	Simple PLC Cycle Completed	The ON signal is output when the present cycle of the simple PLC is complete.
18	Set Counting Value Reached	The ON signal is output when the counting value reaches the value specified by P08.25 (providing the counting function is enabled).

19	Designated Counting Value Reached	The ON signal is output when the counting value reaches the value specified by P08.26 (providing the counting function is enabled).
20	External Error	The ON signal is output when the error is an external error (E17).
22	Running Time Reached	The ON is output when the single operation time of VFD reaches the time specified by P08.27.
23	Modbus Communication Virtual Terminal Output	A signal is output based on the virtual output terminal of Modbus communication (communication address 0x200B). When the value is 1, the ON signal is output; when it is 0, the OFF signal is output instead.
26	DC Bus Voltage Established	The ON signal is output when the bus voltage is above the inverter undervoltage.
29	STO Error	The ON signal is output when an STO error occurs.
37	Any Frequency Reached	The ON signal is output if the ramp reference frequency is greater than the value specified in P06.33 and this state lasts for at least the time specified in P06.34.

Related parameters are listed in the following table.

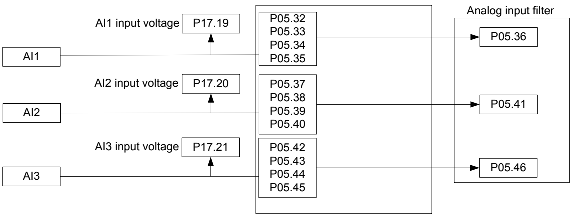
<table>
<tr><th>Function Code</th><th>Name</th><th>Default</th><th>Setting Range</th><th>Description</th></tr>
<tr><td>P06.01</td><td>Y1 Output</td><td>0</td><td rowspan="2">0–63</td><td rowspan="2">For details, see the preceding table.</td></tr>
<tr><td>P06.03</td><td>RO1 Output</td><td>1</td></tr>
<tr><td>P06.05</td><td>Output Terminal Polarity</td><td>0x00</td><td>0x00–0x0F</td><td>Specifies the output terminal polarity.
When a bit is 0, the output terminal is positive.
When a bit is 1, the output terminal is negative.
<table><tr><th>BIT3</th><th>BIT2</th><th>BIT1</th><th>BIT0</th></tr><tr><td>Reserved</td><td>RO1</td><td>Reserved</td><td>Y1</td></tr></table></td></tr>
<tr><td>P06.06</td><td>Y Switch-On Delay</td><td>0.000s</td><td>0.000–50.000s</td><td>-</td></tr>
<tr><td>P06.07</td><td>Y Switch-Off Delay</td><td rowspan="3">0.000s</td><td rowspan="3">0.000–50.000s</td><td rowspan="3">Used to specify the delay time corresponding to the electrical level changes when the programmable output terminals switch on or switch off.

</td></tr>
<tr><td>P06.10</td><td>RO1 Switch-On Delay</td></tr>
<tr><td>P06.11</td><td>RO1 Switch-Off Delay</td></tr>
</table>

P06.33	Detection Value for Frequency Being Reached	1.00Hz	0Hz–P00.03	The "Any frequency reached" signal is output when the ramp reference frequency is greater than the value specified by P06.33 and this situation lasts the time specified by P06.34.
P06.34	Detection Time for Frequency Being Reached	0.5s	0–3600.0s	–
P07.40	Output Terminal Status at Present Error	0x0000	0x0000–0xFFFF	–
P17.13	Digital Output Terminal State	0x00	0x00–0x0F	Displays the present digital output terminal state of the VFD. The bits correspond to RO1, (reserved), and Y1, respectively.

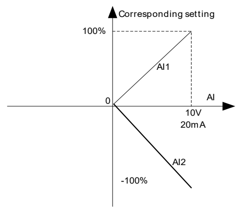
6.9.2 Analog Input and Output Terminal Functions

6.9.2.1 Analog Input

The VFD has two analog input terminals, AI1 and AI2. The input range of AI1 is 0 V to 10 V; 0 mA to 20 mA. Whether AI1 uses a voltage or current input can be defined with P05.52. The input range of AI2 is 0 V to 10 V. The input source of AI3 is the potentiometer of the keypad. Each input can be filtered separately and the corresponding reference curve can be set by adjusting the reference values according to the maximum and minimum values.



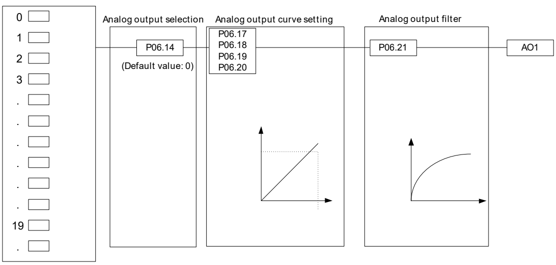
Function Code	Name	Default	Setting Range	Description
P00.06	Channel for Frequency Reference A	0	0–8	1: AI1 2: AI2 3: AI3
P00.07	Channel for Frequency Reference B	1		
P03.11	Torque Setting Channel	0	0–7	2: AI1 3: AI2 4: AI3

P03.14	Channel for Forward Rotation Frequency Upper Limit in Torque Control	0	0–6	1: AI1 2: AI2 3: AI3
P03.15	Channel for Reverse Rotation Frequency Upper Limit in Torque Control	0	0–6	1: AI1 2: AI2 3: AI3
P03.18	Channel for Electromotive Torque Upper Limit	0	0–5	1: AI1 2: AI2 3: AI3
P03.19	Channel for Braking Torque Upper Limit	0	0–5	1: AI1 2: AI2 3: AI3
P04.27	Voltage Setting Channel	0	0–7	1: AI1 2: AI2 3: AI3
P05.32	AI1 Input Lower Limit	0.00V	0.00V–P05.34	Used to define the relationship between the analog input voltage and the corresponding setting. If the analog input voltage exceeds the range between the upper and lower limit values, the upper or lower limit value is used. If the analog input is a current input, a current of 0–20mA corresponds to a voltage of 0–10V. For different applications, 100.0% of the analog setting corresponds to different nominal values. Details can be found in the descriptions of the individual areas of application. The following figure illustrates the cases of different settings: 
P05.33	Corresponding Setting of AI1 Lower Limit	0.0%	-300.0%–300.0%	
P05.34	AI1 Input Upper Limit	10.00V	P05.32–10.00V	
P05.35	Corresponding Setting of AI1 Upper Limit	100.0%	-300.0%–300.0%	
P05.36	AI1 Input Filter Time	0.030s	0.000–10.000s	
P05.37	AI2 Input Lower Limit	0.00V	0.00V–P05.39	
P05.38	Corresponding Setting of AI2 Lower Limit	0.0%	-300.0%–300.0%	
P05.39	AI2 Input Upper Limit	10.00V	P05.37–10.00V	
P05.40	Corresponding Setting of AI2 Upper Limit	100.0%	-300.0%–300.0%	
P05.41	AI2 Input Filter Time	0.030s	0.000–10.000s	

P05.42	AI3 Input Lower Limit	0.00V	0.00V–P05.44	Input filter time: For setting the sensitivity of the analog input. Increasing the value can improve the interference immunity of the analog input, but can reduce the sensitivity of the analog input. **Note:** AI1 supports both the 0–10V and the 0–20mA input. When AI1 selects the 0–20mA input, the corresponding voltage of 20mA is 10V. AI2 supports only the 0–10V input.
P05.43	Corresponding Setting of AI3 Lower Limit	0.0%	-300.0%–300.0%	
P05.44	AI3 Input Upper Limit	10.00V	P05.42–10.00V	
P05.45	Corresponding Setting of AI3 Upper Limit	100.0%	-300.0%–300.0%	
P05.46	AI3 Input Filter Time	0.030s	0.000–10.000s	
P05.52	AI1 Input Signal Type	0	0–1	0: Voltage 1: Current
P05.53	Channel for AI3 Input Signal	0	0–1	0: Local potentiometer 1: External potentiometer
P09.00	Channel for PID Reference Value	0	0–6	1: AI1 2: AI2 3: AI3
P09.02	Channel for PID Feedback	0	0–4	0: AI1 1: AI2 2: AI3

6.9.2.2 Analog Output

The VFD carriers one analog output terminal (supporting the output of 0–10V/0–20mA). The analog output signal can be filtered separately, and the proportional ratio can be adjusted by setting the maximum value, minimum value and percentage of the corresponding output. The analog output signal can output motor speed, output frequency, output current, motor torque and motor power in a certain ratio.



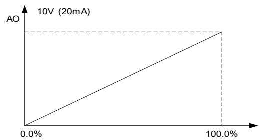
AO output relationship description:

The minimum and maximum values of the output correspond to 0.00% and 100.00% of the standard analog output, respectively. The actual output voltage corresponds to the actual percentage that can be set via function codes.

Output functions are as follows.

Setting	Function	Description
0	Operating Frequency	0 Hz–P00.03
1	Set Frequency	0 Hz–P00.03
2	Ramp Reference Frequency	0 Hz–P00.03
3	Rotational Speed	0–Synchronous speed corresponding to P00.03
4	Output Current (relative to the VFD)	0–Twice the VFD rated current
5	Output Current (relative to the motor)	0–Twice the motor rated current
6	Output Voltage	0–1.5 times the VFD rated voltage
7	Output Power	0–Twice the motor rated power
8	Set Torque Value (bipolar)	0–Twice the motor rated current **Note:** A negative value corresponds to 0.0% by default.
9	Output Torque (Absolute Value)	0–Twice the motor rated torque or -(Twice the motor rated torque)–0
10	AI1 Input	0–10 V; 0–20 mA
11	AI2 Input	0–10 V **Note:** A negative value corresponds to 0.0% by default.
12	AI3 Input	0–10 V
13	HDIA Input	0.00–50.00 Hz
14	Value 1 Set Through Modbus Communication	0–1000
15	Value 2 Set Through Modbus Communication	0–1000
22	Torque Current (Bipolar)	0–Three times the motor rated current. **Note:** A negative value corresponds to 0.0% by default.
23	Exciting current	0–Three times the motor rated current. **Note:** A negative value corresponds to 0.0% by default.
24	Set frequency (bipolar)	0 Hz–P00.03 **Note:** A negative value corresponds to 0.0% by default.
25	Ramp reference frequency (bipolar)	0 Hz–P00.03 **Note:** A negative value corresponds to 0.0% by default.
26	Rotational speed (bipolar)	0–Synchronous rotation speed corresponding to P00.03. **Note:** A negative value corresponds to 0.0% by default.
30	Rotational Speed	0–Twice the motor rated synchronous rotation speed
31	Output Torque (bipolar)	0–Twice the motor rated torque. **Note:** A negative value corresponds to 0.0% by default.

Related parameters are listed in the following table.

<table>
<tr><th>Function Code</th><th>Name</th><th>Default</th><th>Setting Range</th><th>Description</th></tr>
<tr><td>P06.14</td><td>AO1 Output</td><td>0</td><td>0–63</td><td>0–31. For details, see the preceding table.
32–63: Reserved</td></tr>
<tr><td>P06.17</td><td>AO1 Output Lower Limit</td><td>0.0%</td><td>-300.0%–P06.19</td><td rowspan="5">Used to define the relationship between the output value and the analog output. If the output value exceeds the permissible range, the output uses the lower or upper limit value. If the analog output is a current output, 1 mA corresponds to 0.5V.
In various cases, the corresponding analog output is different from 100% of the output value.
</td></tr>
<tr><td>P06.18</td><td>AO1 Output Corresponding to Lower Limit</td><td>0.00V</td><td>0.00–10.00V</td></tr>
<tr><td>P06.19</td><td>AO1 Output Upper Limit</td><td>100.0%</td><td>P06.17–300.0%</td></tr>
<tr><td>P06.20</td><td>AO1 Output Corresponding to Upper Limit</td><td>10.00V</td><td>0.00–10.00V</td></tr>
<tr><td>P06.21</td><td>AO1 Output Filter Time</td><td>0.000s</td><td>0.000–10.000s</td></tr>
</table>

6.10 RS485 communication

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

There are four methods for processing transmission errors, which can be selected via P14.05.

Option 2 (Stop in enabled stop mode without reporting an alarm) only applies to Modbus communication mode.

Function Code	Name	Default	Setting Range	Description
P14.00	Local Communication Address	1	1–247	The communication address of a slave cannot be set to 0.
P14.01	Communication Baud Rate Setting	4	0–7	Specifies the rate of data transmission between the host controller and the VFD. 0: 1200bps 1: 2400bps

				2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 115200 bps **Note:** The baud rate set on the VFD must match that of the host controller. Otherwise, communication will fail. A higher baud rate means faster communication.
P14.02	Data Bit Check Setting	1	0–5	The data format set on the VFD must be consistent with that on the host controller. Otherwise, communication will fail. 0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU
P14.03	Communication Response Delay	5 ms	0–200 ms	This function code specifies the communication response delay, i.e. the interval between the completion of data reception by the VFD and the sending of the response data to the host controller. If the response delay is shorter than the processing time of the rectifier, the rectifier sends the response data to the host controller after the data has been processed. If the delay is longer than the processing time of the rectifier, the rectifier does not send any response data to the host controller until the delay is reached, even though the data has been processed.
P14.04	RS485 Communication Timeout Period	0.0 s	0.0–60.0 s	When P14.04 is set to 0.0 s, the communication timeout function is effectively disabled. If P14.04 is set to a value other than zero, the system reports the “Modbus communication error” (E18) if the communication interval exceeds the value.

				If continuous communication is required, you can configure the function code to monitor the communication status.
P14.05	Transmission Error Processing	0	0–3	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)
P14.06	Modbus Communication Processing Action	0x000	0x000–0x111	*Ones digit:* 0: Responds to write operations 1: Does not respond to write operations *Tens digit:* 0: Modbus communication password protection is inactive. 1: Modbus communication password protection is active. *Hundreds digit: (applies to communication mode only)* 0: User-defined addresses specified by P14.07 and P14.08 are invalid. 1: User-defined addresses specified by P14.07 and P14.08 are valid.
P14.07	User-Defined Operating Command Address	0x2000	0x0000–0xFFFF	–
P14.08	User-Defined Frequency Setting Address	0x2001	0x0000–0xFFFF	–

6.11 Monitoring Parameters

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

Group	Type	Monitored Content
Group P07	HMI	• VFD information • Module temperature • Run time • Power usage • Error history • Software version
Group P17	Basic Status Viewing	• Frequency information • Current information • Voltage information • Torque and power information • Input terminal information • Output terminal information • PID regulator information • Control word and status word information

6.11.1 Group P07—Human-Machine Interface (HMI)

Function Code	Name	Default	Setting Range	Description
P07.11	Control Board Software Version	Version-Dependent	1.00–655.35	–
P07.12	Inverter Temperature	0.0°C	-20.0°C–120.0°C	–
P07.13	Drive Board Software Version	Version-Dependent	1.00–655.35	–
P07.14	Local Accumulative Running Time	0h	0–65535h	–
P07.15	VFD Electricity Consumption High Bit	0kWh	0–65535kWh (·1000)	Displays the electricity consumption of the VFD. Electricity consumption = P07.15·1000 + P07.16
P07.16	VFD Electricity Consumption Low Bit	0.0kWh	0.0–999.9kWh	
P07.18	VFD Rated Power	Model-Dependent	0.4–3000.0kW	–
P07.19	VFD Rated Voltage	Model-Dependent	50–520V	–

<table>
<tr><td>P07.20</td><td>VFD Rated Current</td><td>Model-Dependent</td><td>0.01–600.00A</td><td>–</td></tr>
<tr><td>P07.27</td><td>Present Error Type</td><td>0</td><td rowspan="6">0–46</td><td rowspan="6">0: No error
1–3: Reserved
4: Overcurrent during ACC (E4)
5: Overcurrent during DEC (E5)
6: Overcurrent during constant speed running (E6)
7: Overvoltage during ACC (E7)
8: Overvoltage during DEC (E8)
9: Overvoltage during constant speed running (E9)
10: Bus undervoltage error (E10)
11: Motor overload (E11)
12: VFD overload (E12)
13: Phase loss on input side (E13)
14: Phase loss on output side (E14)
15: Reserved
16: Inverter module overheat (E16)
17: External error (E17)
18: Modbus communication error (E18)
19: Current detection error (E19)
20: Motor autotuning error (E20)
For full error information, see the function parameter list.</td></tr>
<tr><td>P07.28</td><td>Last Error Type</td><td>0</td></tr>
<tr><td>P07.29</td><td>2nd-Last Error Type</td><td>0</td></tr>
<tr><td>P07.30</td><td>3rd-Last Error Type</td><td>0</td></tr>
<tr><td>P07.31</td><td>4th-Last Error Type</td><td>0</td></tr>
<tr><td>P07.32</td><td>5th-Last Error Type</td><td>0</td></tr>
<tr><td>P07.33</td><td>Operating Frequency at Present Error</td><td>0.00Hz</td><td>0.00Hz–P00.03</td><td>–</td></tr>
<tr><td>P07.34</td><td>Ramp Reference Frequency at Present Error</td><td>0.00Hz</td><td>0.00Hz–P00.03</td><td>–</td></tr>
<tr><td>P07.35</td><td>Output Voltage at Present Error</td><td>0V</td><td>0–1200V</td><td>–</td></tr>
<tr><td>P07.36</td><td>Output Current at Present Error</td><td>0.00A</td><td>0.00–630.00A</td><td>–</td></tr>
<tr><td>P07.37</td><td>Bus Voltage at Present Error</td><td>0.0V</td><td>0.0–2000.0V</td><td>–</td></tr>
<tr><td>P07.38</td><td>Temperature at Present Error</td><td>0.0°C</td><td>-20.0°C–120.0°C</td><td>–</td></tr>
<tr><td>P07.39</td><td>Input Terminal Status at Present Error</td><td>0x0000</td><td>0x0000–0xFFFF</td><td>–</td></tr>
</table>

P07.40	Output Terminal Status at Present Error	0x0000	0x0000–0xFFFF	–
P07.41	Operating Frequency at Last Error	0.00 Hz	0.00 Hz–P00.03	–
P07.42	Ramp Reference Frequency at Last Error	0.00 Hz	0.00 Hz–P00.03	–
P07.43	Output Voltage at Last Error	0 V	0–1200 V	–
P07.44	Output Current at Last Error	0.00 A	0.00–630.00 A	–
P07.45	Bus Voltage at Last Error	0.0 V	0.0–2000.0 V	–
P07.46	Temperature at Last Error	0.0°C	-20.0°C–120.0°C	–
P07.47	Input Terminal Status at Last Error	0	0x0000–0xFFFF	–
P07.48	Output Terminal Status at Last Error	0	0x0000–0xFFFF	–
P07.49	Operating Frequency at 2nd-Last Error	0.00 Hz	0.00 Hz–P00.03	–
P07.50	Ramp Reference Frequency at 2nd-Last Error	0.00 Hz	0.00 Hz–P00.03	–
P07.51	Output Voltage at 2nd-Last Error	0 V	0–1200 V	–
P07.52	Output Current at 2nd-Last Error	0.00 A	0.00–630.00 A	–
P07.53	Bus Voltage at 2nd-Last Error	0.0 V	0.0–2000.0 V	–
P07.54	Temperature at 2nd-Last Error	0.0°C	-20.0°C–120.0°C	–
P07.55	Input Terminal Status at 2nd-Last Error	0	0x0000–0xFFFF	–
P07.56	Output Terminal Status at 2nd-Last Error	0	0x0000–0xFFFF	–

6.11.2 Group P17—Status Viewing

6.11.2.1 Basic Status Viewing

Function Code	Name	Default	Setting Range	Description
P17.40	Motor Control Mode	0x000	0x000–0x122	*Ones digit: Control mode* 0: Open-loop vector control 1: Reserved 2: VF control *Tens digit: Open-loop vector control mode* 0: SVC0 1: SVC1 2: Reserved *Hundreds digit: Motor type* 0: Asynchronous motor (AM) 1: Synchronous motor (SM)
P17.12	Digital Input Terminal Status	0x000	0x000–0x1FF	Displays the present digital input terminal state of the VFD. The bits correspond to HDIA, S8, S7, S6, S5, S4, S3, S2, and S1 respectively.
P17.13	Digital Output Terminal Status	0x000	0x00–0x0F	Displays the present digital output terminal state of the VFD. The bits correspond to Reserved, RO1, Reserved, and Y1 respectively.

6.11.2.2 Frequency Related Information

Function Code	Name	Default	Setting Range	Description
P17.00	Set Frequency	50.00Hz	0.00Hz–P00.03	Displays the present set frequency of the VFD.
P17.01	Output Frequency	0.00Hz	0.00Hz–P00.03	Displays the present output frequency of the VFD.
P17.02	Ramp Reference Frequency	0.00Hz	0.00Hz–P00.03	Displays the present ramp reference frequency of the VFD.
P17.05	Motor Rotation Speed	0RPM	0–65535RPM	Displays the current motor speed.
P17.10	Estimated Motor Frequency	0.00Hz	0.00Hz–P00.03	Displays the estimated motor rotor frequency under the open-loop vector condition.

P17.14	Digital Adjustment Value	0.00Hz	0.00Hz–P00.03	Displays the adjustment on the VFD through the UP/DOWN terminal.
P17.16	Linear Speed	0	0–65535	–
P17.22	HDIA Input Frequency	0.000kHz	0.000–50.000kHz	Displays HDIA input frequency.
P17.43	Forward Rotation Frequency Upper Limit in Torque Control	50.00Hz	0.00Hz–P00.03	–
P17.44	Reverse Rotation Frequency Upper Limit in Torque Control	50.00Hz	0.00Hz–P00.03	–
P17.49	Frequency Set by Source A	0.00Hz	0.00Hz–P00.03	–
P17.50	Frequency Set by Source B	0.00Hz	0.00Hz–P00.03	–

6.11.2.3 Voltage Related Information

Function Code	Name	Default	Setting Range	Description
P17.03	Output Voltage	0V	0–1200V	Displays the present output voltage of the VFD.
P17.11	DC Bus Voltage	0.0V	0.0–2000.0V	Displays the present DC bus voltage of the VFD.
P17.19	AI1 Input Voltage	0.00V	0.00–10.00V	Displays the AI1 input signal.
P17.20	AI2 Input Voltage	0.00V	0.00V–10.00V	Displays the AI2 input signal.
P17.21	AI3 Input Voltage	0.00V	0.00V–10.00V	Displays the AI3 input signal.

6.11.2.4 Current-Related Information

Function Code	Name	Default	Setting Range	Description
P17.04	Output Current	0.00A	0.00–500.00A	Displays the present output current of the VFD.
P17.06	Torque Current	0.00A	-300.00–300.00A	Displays the present torque current of the VFD.
P17.07	Excitation Current	0.00A	-300.00–300.00A	Displays the present excitation current of the VFD.

P17.33	Excitation Current Reference	0.00A	-300.00–300.00A	Displays the excitation current reference value in vector control mode.
P17.34	Torque Current Reference	0.00A	-300.00–300.00A	Displays the torque current reference value in vector control mode.

6.11.2.5 Torque and Power Related Information

Function Code	Name	Default	Setting Range	Description
P17.08	Motor Power	0.0%	-300.0%–300.0% (of the motor's rated power)	Displays the present motor power; 100% is relative to the rated motor power. A positive value indicates the motoring state while a negative value indicates the generating state.
P17.09	Motor Output Torque	0.0%	-250.0%–250.0% (of the motor's rated torque)	Displays the present output torque of the VFD. When running forwards, a positive value indicates the motor status, while a negative value indicates the generator status. When running in reverse, a positive value indicates the generator state, while a negative value indicates the motor state.
P17.15	Torque Reference Value	0.0%	-300.0%–300.0% (of the motor's rated current)	Relative to the percentage of the rated torque of the present motor, displaying the torque reference.
P17.25	Motor Power Factor	1.00	-1.00–1.00	Displays the power factor of the current motor.
P17.36	Output Torque	0.0Nm	-3000.0–3000.0Nm	Displays the output torque value. During forward running, a positive value indicates the motoring state while a negative value indicates the generating state. During reverse running, a positive value indicates the generating state while a negative value indicates the motoring state.
P17.41	Electromotive Torque Upper Limit	180.0%	0.0%–300.0% (of the motor's rated current)	Displays the value set via P03.20 and P03.21.

P17.42	Braking Torque Upper Limit			
P17.45	Inertia Compensation Torque	0.0%	-100.0%–100.0%	–
P17.46	Friction Compensation Torque	0.0%	-100.0%–100.0%	–

6.11.2.6 PID Regulator Information

Function Code	Name	Default	Setting Range	Description
P17.23	PID Reference Value	0.0%	-100.0%–100.0%	Displays the PID reference value.
P17.24	PID Feedback Value	0.0%	-100.0%–100.0%	Displays the PID feedback value.
P17.51	PID Proportional Output	0.00%	-100.0%–100.0%	-
P17.52	PID Integral Output	0.00%	-100.0%–100.0%	-
P17.53	PID Differential Output	0.00%	-100.0%–100.0%	-
P17.54	PID Present Proportional Gain	0.00%	0.00–100.00	-
P17.55	PID Present Integral Time	0.00s	0.00–10.00s	-
P17.56	PID Present Differential Time	0.00s	0.00–10.00s	-
P17.38	Process PID Output	0.00%	-100.0–100.0%	-

6.12 Protection Parameter Setting

6.12.1 Overvoltage Stalling Protection

When the motor is in the power generation state (i.e. the motor speed is greater than the output frequency), the VFD bus voltage increases continuously. When the detected bus voltage exceeds the value of P11.04 (overvoltage cut-off protection voltage), the overvoltage protection function adjusts the output frequency based on the ACC/DEC status of the VFD (more specifically: when the VFD is in ACC or constant speed status, the VFD increases the output frequency; when the VFD is in DEC status, the VFD increases the DEC time). This way, the regenerative energy on the bus can be consumed to prevent overvoltage of the VFD.

If the function does not meet the requirements in the specific application, you can adjust the parameters for the current and voltage loop.

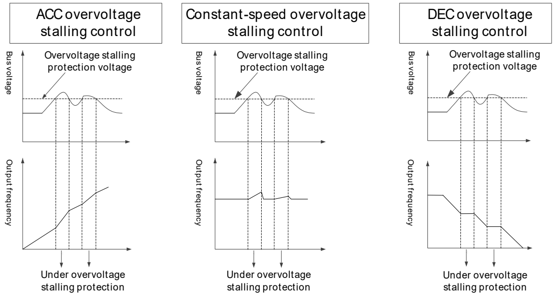


Figure 6-1 Actions taken for protection against overvoltage stalling

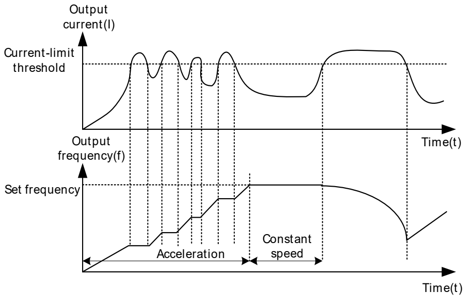
Function Code	Name	Default	Setting Range	Description
P11.03	Overvoltage Stalling Protection	1	0–1	0: Disable 1: Enable **Note:** If you are using a braking resistor or dynamic braking unit, set P11.03 to 0.
P11.04	Overvoltage Stalling Protection Voltage	**For 220V models:** 120% **For 380V models:** 136%	120%–150% (of the standard bus voltage)	–
P11.21	Proportional Coefficient of Voltage Regulator During Overvoltage Stalling	60	0–127	Specifies the proportional coefficient of the bus voltage regulator during overvoltage stalling.
P11.22	Integral Coefficient of Voltage Regulator During Overvoltage Stalling	5	0–1000	Specifies the integral coefficient of the bus voltage regulator during overvoltage stalling.
P11.23	Proportional Coefficient of Current Regulator During Overvoltage Stalling	60	0–1000	Specifies the proportional coefficient of the active current regulator during overvoltage stalling.
P11.24	Integral Coefficient of Current Regulator During Overvoltage Stalling	250	0–2000	Specifies the integral coefficient of the active current regulator during overvoltage stalling.

6.12.2 Current-Limit Protection

During accelerated operation, the actual acceleration rate of the motor is lower than the output frequency due to the excessive load; if no action is taken, the VFD may shut down due to overcurrent during acceleration.

The current limit protection function detects the output current during operation and compares it with the current limit value set in P11.06. If it exceeds the current limit value, the VFD will run at a stable frequency during accelerated operation or at a reduced frequency during constant speed operation; if it exceeds the current limit value continuously, the output frequency of the VFD will drop continuously until the lower frequency limit value is reached. When the output current is below the current limit again, accelerated operation continues.

In some heavy-load scenarios, you can increase the value of P11.06 to improve the output torque of the VFD.

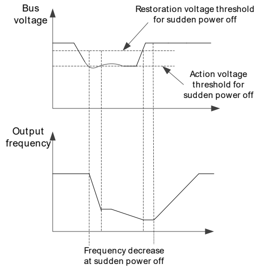


Function Code	Name	Default	Setting Range	Description
P11.05	Current Limit Mode	0x01	0x00–0x11	*Ones digit: Current limit action* 0: Inactive 1: Always active *Tens digit: Hardware current limit overload alarm* 0: Active 1: Inactive
P11.06	Automatic Current Limit Threshold	160.0%	50.0%–200.0% (of the VFD's rated output current)	–
P11.07	Frequency Drop Rate During Current Limit	10.00 Hz/s	0.00–50.00 Hz/s	–

6.12.3 Frequency Decrease at Sudden Power Failure

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

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



Function Code	Name	Default	Setting Range	Description
P11.01	Frequency Drop at Transient Power-Off	0	0–1	0: Disable 1: Enable
P11.17	Proportional Coefficient of Voltage Regulator During Undervoltage Stalling	20	0–127	Specifies the integral coefficient of the bus voltage regulator in the event of undervoltage stalling.
P11.18	Integral Coefficient of Voltage Regulator During Undervoltage Stalling	5	0–1000	Specifies the integral coefficient of the bus voltage regulator in the event of undervoltage stalling.
P11.19	Proportional Coefficient of Current Regulator During Undervoltage Stalling	20	0–1000	Specifies the proportional coefficient of the active current regulator in the event of undervoltage stalling.
P11.20	Integral Coefficient of Current Regulator During Undervoltage Stalling	20	0–2000	Specifies the integral coefficient of the active current regulator in the event of undervoltage stalling.

6.12.4 Cooling Fan Control

There are three cooling fan control modes, which you can choose from by configuring P08.39 accordingly.

Function Code	Name	Default	Setting Range	Description
P08.39	Cooling Fan Operation Mode	0	0–2	0: Normal mode 1: Permanent operation after power-on 2: Operation mode 2

Note: The fan will automatically run (in any mode) if the VFD detects that the rectifier bridge or inverter module temperature reaches or exceeds 50°C.

Normal mode: P08.39=0

The cooling fan runs while the VFD runs and stops 30s after the VFD stops.

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

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

Operation mode 2: P08.39=2

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

6.12.5 Dynamic Braking

If the VFD has to brake abruptly when driving a load with a high moment of inertia, the motor runs in the power generation state and transfers the load-bearing energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a certain value, the VFD reports an overvoltage error. To prevent this, you must configure braking components accordingly.

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

If P08.37=1 and P11.02=1 and the bus voltage exceeds the threshold voltage value for dynamic braking, the brake line is opened, regardless of whether the VFD is running or not. If the bus voltage is below the threshold value minus 10V, the brake line is closed.

If P08.37=1 and P11.02=0 and the bus voltage exceeds the threshold value, the brake line is only opened if the VFD is running. If the bus voltage is below the threshold value minus 10V, the brake line is closed.

Function Code	Name	Default	Setting Range	Description
P08.37	Dynamic Braking	1	0–1	0: Disable 1: Enable
P08.38	Dynamic Braking Threshold Voltage	**For 220V models:** 380.0V **For 380V models:** 700.0V	200.0–1000.0V	Specifies the starting bus voltage for dynamic braking. Adjust this value according to your device's load to achieve optimized braking. The default value varies depending on the voltage class.
P11.02	Energy-Consumption Braking	0	0–1	0: Disable 1: Enable

6.12.6 Safe Torque Off

You can activate the Safe Torque Off (STO) function to prevent the motor from starting unexpectedly if the VFD main power supply is not switched off. The STO function cuts off the VFD output by switching off the drive signals. To use the STO function, set P08.64 to 1; otherwise (with P08.64=0) the function is inactive. For further details see Appendix E STO Function.

Function Code	Name	Default	Setting Range	Description
P08.52	STO Lock	0	0–1	0: Lock upon STO (E40) alarm This indicates that upon an STO alarm occurring, manual resetting is required after the VFD recovers from the error. 1: No lock on STO (E40) alarm This indicates that upon an STO alarm occurring, the alarm disappears automatically after the VFD recovers from the error.
P08.64	STO Function	0	0–1	0: Disable 1: Enable

6.13 Typical Applications

6.13.1 Counting

If photoelectric pulse signals need to be detected, you can use the digital multifunction input terminals to do so, i.e. set any of P05.01–P05.04 or P05.09 to 31 (to trigger the counter). To use the HDI counting function, first set P05.00 to 1.

When P17.18 (acculumative counting value) reaches the value of P08.25 (set counting value), counting starts over. Once P17.18=P08.25, set the digital output function to 18 to output the ON signal.

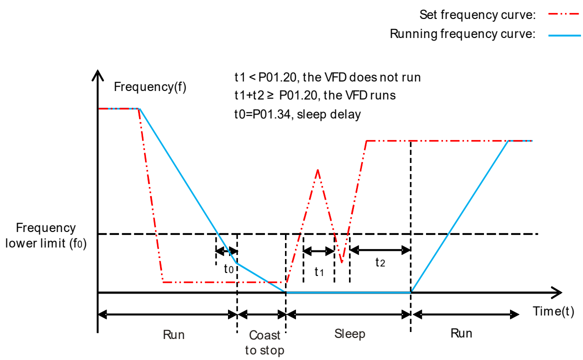
Similarly, once the value of P17.18 corresponds to the value of P08.26, set the digital output function to 19 to output the ON signal.

<table>
<tr><th>Function Code</th><th>Name</th><th>Default</th><th>Setting Range</th><th>Description</th></tr>
<tr><td>P05.00</td><td>HDI Input Type</td><td>0</td><td>0–1</td><td>0: Defines HDIA as a high-speed pulse input
1: Defines HDIA as a digital input</td></tr>
<tr><td>P05.01</td><td>S1 Function</td><td>1</td><td rowspan="5">0–95</td><td rowspan="5">28: Reset the counter (meaning that the counting value is cleared)
31: Trigger the counter (meaning that the counting value is accumulated)</td></tr>
<tr><td>P05.02</td><td>S2 Function</td><td>4</td></tr>
<tr><td>P05.03</td><td>S3 Function</td><td>7</td></tr>
<tr><td>P05.04</td><td>S4 Function</td><td rowspan="2">0</td></tr>
<tr><td>P05.09</td><td>HDIA Function</td></tr>
</table>

P06.01	Y1 Output	0	0–63	0: Disable 18: Set counting value reached 19: Designated counting value reached
P06.03	RO1 Output	1		
P08.25	Set Counting Value	0	P08.26–65535	-
P08.26	Designated Counting Value	0	0–P08.25	-
P17.18	Accumulative Counting Value	0	0–65535	-

6.13.2 Sleep and Wakeup

To save energy, the sleep function can be used in water supply applications. If the motor needs to run effectively, you can adjust the set frequency to wake it up again. The timing diagram is as follows:



If the set frequency is lower than the lower frequency limit and the ones digit of P01.19 is set to sleep mode, the VFD stops according to the tens digit of P01.19 and sleeps as soon as it runs below the limit for the time specified in P01.34. If the set frequency exceeds the lower limit again and stops for the time specified in P01.20, the VFD automatically resumes its operation and increases to the set frequency.

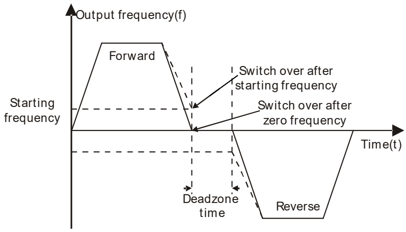
Function Code	Name	Default	Setting Range	Description
P01.19	Action Selected when Operating Frequency is Less Than Frequency Lower Limit	0	0x00–0x12	Specifies the status of the VFD when the operating frequency drops below the lower limit (valid only when a frequency lower limit greater than 0 has been set). *Ones digit: Action selection* 0: Continue to run at the lower limit 1: Stop 2: Sleep *Tens digit: Stop mode*

				0: Coast to stop 1: Decelerate to stop
P01.20	Wake-Up-From-Sleep Delay	0.0s	0.0–3600.0s	Valid when P01.19=2.
P01.34	Sleep Delay	0.0s	0.0–3600.0s	–

6.13.3 Switchover Between FWD Run and REV Run

In scenarios where frequent switching between forward and reverse running is required, you can set P01.14 to increase the torque and stability of the process and reduce the current load.

If P01.14=0, the switching frequency point is zero (P01.15); if P01.14=1, the switching frequency point is the starting frequency (P01.01). See the following figure:



Function Code	Name	Default	Setting Range	Description
P01.14	FWD/REV Switching Mode	1	0–2	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed (with a delay)

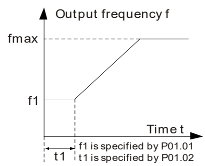
Switch at zero or starting frequency: P01.14=0 or P01.14=1

If P01.14=0 or P01.14=1 and the switchover between forward and reverse is active, the VFD brakes to the switching frequency point. If P01.16=1, check whether the motor output frequency is below the switching frequency point. If yes, wait only for the time specified in P01.13 and start the motor in reverse. If not, first wait for the time specified in P01.17 and then the time specified in P01.13 and only then reverse the motor.

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

If P01.14=2, the DEC process for switching between forward and reverse running is similar to the braking process. In the DEC process, you can set corresponding parameters to determine whether short-circuit braking and DC braking should be activated depending on the working conditions.

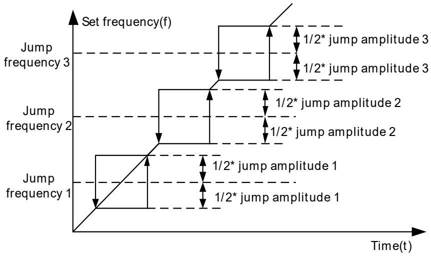
The difference between the two procedures is as follows: When the operating frequency reaches the stopping speed specified in P01.15 or the device comes to a standstill via DC braking, you must wait for the duration of the dead zone time specified in P01.13; only then can you start the motor in reverse.

Function Code	Name	Default	Setting Range	Description
P01.01	Starting Frequency at Direct Start	0.50 Hz	0.00–50.00 Hz	Specifies the initial frequency to be used upon VFD direct start. For details, see the description for P01.02.
P01.02	Hold Time of Starting Frequency	0.0 s	0.0–50.0 s	Setting a suitable starting frequency can increase the torque when starting the VFD. For the duration of the holding time, the output frequency of the VFD corresponds to the starting frequency. The VFD then runs from the starting frequency to the set frequency. If the set frequency is lower than the start frequency, the VFD stops and remains in standby mode. The start frequency is not limited by the lower frequency limit. 
P01.13	FWD/REV Running Deadzone Time	0.0 s	0.0–3600.0 s	Specifies the transition time specified in P01.14 when switching between forward and reverse running.
P01.15	Stop Speed	0.50 Hz	0.00–100.00 Hz	–
P01.16	Stop Speed Detection Mode	0	0–1	0: Detect by the set speed (only in space voltage vector control mode) 1: Detect by the feedback speed
P01.17	Stop Speed Detection Time	0.50 s	0.00–100.00 s	–

6.13.4 Jump Frequency

The VFD can avoid mechanical resonance points by setting jump frequencies. The VFD has three jump frequency parameters P08.09, P08.11 and P08.13. If all jump frequencies are set to 0, this function is inactive. If the set frequency is within the jump frequency range (f = jump frequency ± 1/2 · jump amplitude), the VFD runs at the lower limit (f = jump frequency − 1/2 · jump amplitude) when it is in the ACC phase, and when it is in the DEC phase, it runs at the upper limit (f = jump frequency + 1/2 · jump amplitude).

See the following figure:

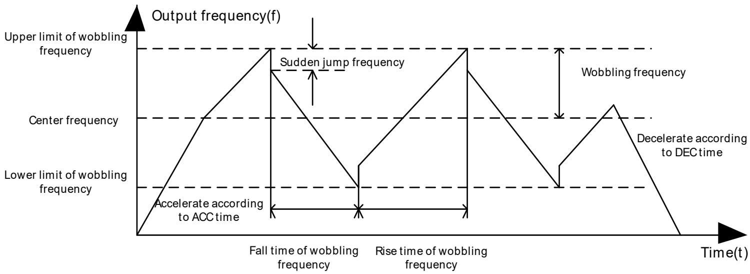


Function Code	Name	Default	Setting Range	Description
P08.09	Jump Frequency 1	0.00Hz	0.00Hz–P00.03	–
P08.10	Jump Frequency Amplitude 1	0.00Hz	0.00Hz–P00.03	Refer to P08.09 to configure this setting.
P08.11	Jump Frequency 2	0.00Hz	0.00Hz–P00.03	–
P08.12	Jump Frequency Amplitude 2	0.00Hz	0.00Hz–P00.03	Refer to P08.11 to configure this setting.
P08.13	Jump Frequency 3	0.00Hz	0.00Hz–P00.03	–
P08.14	Jump Frequency Amplitude 3	0.00Hz	0.00Hz–P00.03	Refer to P08.13 to configure this setting.

6.13.5 Wobbling Frequency

The wobbling frequency is mainly used in scenarios where lateral movements and winding functions are required, such as in the textile and chemical fiber industries. The wobbling frequency function indicates that the VFD output frequency wobbles up/down with the set frequency as its center. The output frequency together with the wobbling frequency is influenced by the upper and lower frequency limits.

The time axis is monitored as shown in the following figure:



Wobbling frequency=center frequency (set frequency)·P08.15 (amplitude of wobbling frequency)

Sudden jump frequency=wobbling frequency·P08.16 (amplitude of sudden jump frequency)

Function Code	Name	Default	Setting Range	Description
P08.15	Amplitude of Wobbling Frequency	0.0%	0.0%–100.0% (of the set frequency)	–
P08.16	Amplitude of Sudden Jump Frequency	0.0%	0.0%–50.0% (of the wobbling frequency)	–
P08.17	Rise Time of Wobbling Frequency	5.0s	0.1–3600.0s	Time required to run from the lowest to the highest point of the wobbling frequency.
P08.18	Fall Time of Wobbling Frequency	5.0s	0.1–3600.0s	Time required to run from the highest to the lowest point of the wobbling frequency.
P05.00	HDI Input Type	0	0–1	0: Defines HDIA as a high-speed pulse input 1: Defines HDIA as a digital input
P05.01	S1 Function	1	0–95	0: No function 26: Pause wobbling frequency (stopped at the present frequency) 27: Reset wobbling frequency (returned to the center frequency)
P05.02	S2 Function	4		
P05.03	S3 Function	7		
P05.04	S4 Function	0		
P05.09	HDIA Function	0		

7 Modbus Communication

7.1 Standard Communication Interface

The VFD provides RS485 communication as a standard configuration. The following table defines the communication terminal function.

Table 7-1 Standard communication terminal

Interface	Network Signal	Signal Description	Description
IO Terminal	485+ 485-	RS485 communication	Terminal for external RS485 communication, supporting the Modbus communication protocol

7.2 Communication Data Address

The communication data includes VFD function parameter data, status parameter data and control parameter data.

7.2.1 Function Parameter Address

The address of a function code consists of two bytes, with the MSB on the left and the LSB on the right. Both the MSB and the LSB range from 00 to ffH. The MSB is the hexadecimal form of the group number to the left of the point marker, and the LSB is that of the number to the right of the point marker.

Take P05.06 as an example. The group number is 05, i.e. the MSB of the parameter address is the hexadecimal form of 05; and the number to the right of the dot marker is 06, i.e. the LSB is the hexadecimal form of 06. Accordingly, the function code address in hexadecimal form is 0506H.

As another example, the parameter address for P10.01 is 0A01H.

Note:

- The parameters in group P29 are set by the manufacturer and cannot be read or modified. Some parameters cannot be modified while the VFD is in operation; some cannot be modified regardless of the device's operating status. Pay attention to the setting range, the unit and the description of a parameter when you change it.
- Frequent writing to the EEPROM will shorten its service life. Some function codes do not need to be saved during communication. The requirements of the application can be met by changing the value of the on-chip RAM, i.e. by changing the most significant bit of the corresponding function code address from 0 to 1.
- If, for example, P00.07 is not to be saved in the EEPROM, you only need to change the value in the RAM, i.e. set the address to 8007H. The address can only be used to write data to the on-chip RAM and is invalid if it is used to read data.

7.2.2 Non-Function Parameter Address

The master can not only change parameters, but also control the VFD, such as starting and stopping as well as monitoring the operating status of the device. The data addresses of the status parameters and the data addresses of the control parameters are described below.

1) Status parameter

Note: Status parameters are read only.

Parameter	Address	Description
VFD Status Word 1	2100H	0001H: Forward running 0002H: Reverse running 0003H: Stopped 0004H: Error 0005H: In POFF state 0006H: In pre-excitation state
VFD Status Word 2	2101H	Bit0 =0: Not ready to run =1: Ready to run Bit2–Bit1: =00: Motor 1 =01: Motor 2 Bit3: =0: AM =1: SM Bit4: = 0: No pre-alarm upon overload =1: Overload pre-alarm Bit6–Bit5 =00: Keypad-based control =01: Terminal-based control =10: Communication-based control Bit7: Reserved Bit8: =0: Speed control =1: Torque control Bit9: Reserved Bit11–Bit10: =0: Vector 0 =1: Vector 1 =2: Space voltage vector
VFD Error Code	2102H	See the description of error types (P07.27–P07.32).
VFD Identification Code	2103H	0x1200
Operating Frequency	3000H	0–F_{max} (Unit: 0.01Hz)
Set Frequency	3001H	0–F_{max} (Unit: 0.01Hz)
Bus Voltage	3002H	0.0–2000.0V (Unit: 0.1V)
Output Voltage	3003H	0–1200V (Unit: 1V)
Output Current	3004H	0.00–300.0A (Unit: 0.01A)
Rotational Speed	3005H	0–65535 (Unit: 1RPM)
Output Power	3006H	-300.0%–300.0% (Unit: 0.1%)
Output Torque	3007H	-250.0%–250.0% (Unit: 0.1%)

Closed-Loop Setting	3008H	-100.0%–100.0% (Unit: 0.1%)
Closed-Loop Feedback	3009H	-100.0%–100.0% (Unit: 0.1%)
Input IO Status	300AH	000–1FF (corresponding to HDIA, S8, S7, S6, S5, S4, S3, S2, and S1, respectively.)
Output IO Status	300BH	000–0F (corresponding to local Reserved, RO1, Reserved, and Y1, respectively.)
Analog Input 1	300CH	0.00–10.00V (Unit: 0.01V)
Analog Input 2	300DH	0.00–10.00V (Unit: 0.01V)
Analog Input 3	300EH	0.00–10.00V (Unit: 0.01V)
Read Input of HDIA High-Speed Pulse	3010H	0.00–50.00kHz (Unit: 0.01Hz)
Read Present Step of Multi-Step Speed	3012H	0–15
External Length Value	3013H	0–65535
External Counting Value	3014H	0–65535
Torque Setting	3015H	-300.0%–300.0% (Unit: 0.1%)
VFD Identification Code	3016H	–
Error Code	5000H	–

2) Control parameter

Note: VFD control parameters can be read and written.

Parameter	Address	Description
Communication-Based Control Command	2000H	0001H: Forward running
		0002H: Reverse running
		0003H: Forward jogging
		0004H: Reverse jogging
		0005H: Stop
		0006H: Coast to stop
		0007H: Error reset
		0008H: Jogging to stop
Communication-Based Setting Address	2001H	Communication-based frequency setting (0–F_{max}; unit: 0.01Hz)
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)
	2003H	PID feedback (0–1000, in which 1000 corresponds to 100.0%)

	2004H	Torque setting (-3000–3000, in which 1000 corresponds to 100.0% of the motor rated current)
	2005H	Upper limit setting of forward operating frequency (0–Fmax; unit: 0.01 Hz)
	2006H	Upper limit setting of reverse operating frequency (0–Fmax; unit: 0.01 Hz)
	2007H	Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
	2008H	Braking torque upper limit (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
	2009H	Special CW Bit1–Bit0: =00: Motor 1 =01: Motor 2 Bit2: =1: Enable speed/torque control switching =0: Disable speed/torque control switching Bit3: =1: Clear electricity consumption data =0: Keep electricity consumption data Bit4: =1: Enable pre-excitation =0: Disable pre-excitation Bit5: =1: Enable DC braking =0: Disable DC braking
	200AH	Virtual input terminal command. Range: 0x000–0x1FF (corresponding to HDIA, S8, S7, S6, S5, S4, S3, S2, and S1, respectively)
	200BH	Virtual output terminal command. Range: 0x00–0x0F (corresponding to local Reserved, RO1, Reserved, and Y1, respectively)
	200CH	Voltage setting (used when V/F separation is implemented) (0–1000, in which 1000 corresponds to 100.0% of the motor's rated voltage)
	200DH	AO setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%)
	200EH	AO setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%)

Note: Some parameters in the preceding table are valid only after they have been specifically enabled.

For example, to control the device's operation start and stop, you must first set "Channel of operating commands" (P00.01) to "Communication".

The following table describes the encoding rules of device codes (corresponding to the identification code 1200H of the VFD).

8 MSBs	Meaning	8 LSBs	Meaning
0x12	General mechanical type	0x00	ST300 Series VFD

7.3 Modbus Networking

A Modbus network is a control network with one master and several slaves, i.e. in a Modbus network there is only one device that serves as the master; all other devices are defined as slaves. The master can communicate with each individual slave or with all slaves. A slave must respond to individual access commands. The slaves do not have to respond to the mere sending of information.

In general, the PC, the industrial control unit or the programmable logic controller (PLC) usually acts as the master, while the VFDs in the system act as slaves.

7.3.1 Network Topology

7.3.1.1 Application to One VFD

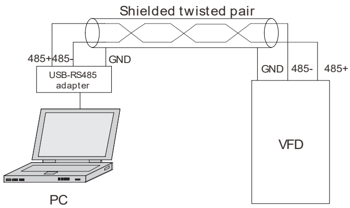


Figure 7-1 Application to one VFD

7.3.1.2 Application to Multiple VFDs

In practical application to multiple VFDs, the daisy chain connection and star connection are commonly used.

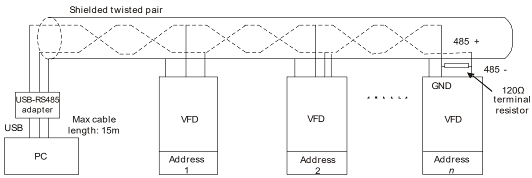


Figure 7-2 Practical daisy chain connection application

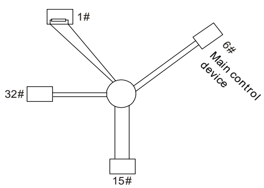


Figure 7-3 Star connection application

Note:

- With this type of connection, the two devices that are furthest apart on the line must be connected with a terminating resistor (in the figure, these are the two devices no. 1 and no. 15).
- If possible, use shielded cables to connect several devices.
- The baud rates, the settings for the data bit check and other basic parameters of all devices on the RS485 line must be set uniformly, and addresses must not be duplicated.

7.3.2 RTU Mode

7.3.2.1 RTU Communication Frame Structure

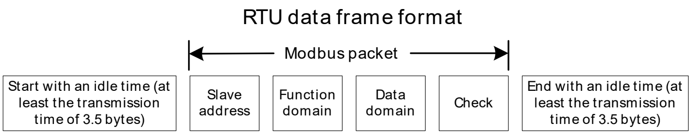
When a controller is set to RTU communication mode on a Modbus network, each byte (including eight bits) in the message contains two hexadecimal characters (each of which comprises four bits). Compared to ASCII mode, RTU mode allows more data to be transmitted at the same baud rate.

In RTU mode, the transmission of a new frame always begins with an idle time (the transmission time of 3.5 bytes). In a network in which the transmission rate is calculated on the basis of the baud rate, the transmission time of 3.5 bytes can be easily determined. After the idle time has elapsed, the data areas are transmitted in the following order:

Slave address, command code, data and CRC check character.

Each byte transmitted in each domain comprises 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 transmission of the last byte, a similar transmission interval (the transmission time of 3.5 bytes) is used to indicate that the transmission of the frame is complete. The transmission of a new frame then begins.

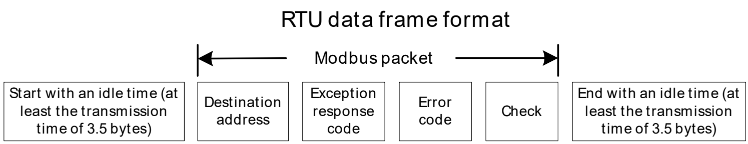


The information of a frame must be transmitted in a continuous data flow.

If the interval until the complete transmission of the entire frame is greater than the transmission time of 1.5 bytes, the receiving device deletes the incomplete information and will confuse the following byte with the address domain of a new frame.

If the transmission interval between two frames is shorter than the transmission time of 3.5 bytes, the receiving device will confuse the data with that of the previous frame. The CRC check value is then incorrect due to the disorder of the frames, resulting in a communication error.

If the slave detects a communication error or a read/write error due to another cause, an error frame is output.



The following table describes the standard structure of an RTU frame:

START (frame header)	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR (slave address domain)	Communication address: 0–247 (decimal system; 0 is the broadcast address)
CMD (function domain)	03H: Read slave parameter; 06H: Write slave parameter
Data domain DATA (N – 1) DATA (0)	Data of 2·N bytes Main content of the communication as well as the core of data exchanging
CRC CHK LSB	Detection value: CRC (16 bits)
CRC CHK MSB	
END (frame tail)	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

7.3.2.2 RTU Communication Frame Error Check Methods

Errors can occur during data transmission due to various factors. Without error checking, the data-receiving device cannot detect data errors and may give an incorrect response. This incorrect response can cause serious problems, so the data must be checked.

The error checking of a frame includes two parts, namely the bit checking of individual bytes (i.e. checking for odd/even numbers using the check bit in the character frame) and the checking of the entire data (CRC check).

7.3.2.3 Bit Checking of Individual Bytes (Odd/Even Check)

You can select the bit check mode as required or choose to not perform the check, which affects the setting of the check bit for each byte.

Even check:

Before the data is transmitted, a parity check bit is added to indicate whether the number of “1s” in the data to be transmitted is odd or even. If it is even, the check bit is set to “0”; if it is odd, the check bit is set to “1”.

Odd check:

Before the data is transmitted, a parity check bit is added to indicate whether the number of “1s” in the data to be transmitted is odd or even. If it is odd, the check bit is set to “0”; if it is even, the check bit is set to “1”.

The data bits to be sent are, for example, “11001110”, including five “1” bits. During the even check, the even check bit is set to “1”, and during the odd check, the odd check bit is set to “0”. During data transmission, the odd/even check bit is calculated and inserted into the check bit of the frame. The receiving device performs the odd/even check after receiving the data. If it detects that the odd/even parity of the data does not match the preset information, it determines that there must have been a communication error.

7.3.2.4 Cyclic Redundancy Check (CRC)

A frame in RTU format contains an error detection area that is based on the cyclic redundancy check (CRC calculation). The CRC area checks the entire content of the frame and consists of two bytes, including 16 binary bits. It is calculated by the sender and added to the frame. The receiver calculates the CRC value of the received frame and compares the result with the value in the received CRC area. If the two CRC values are not the same, errors will occur during transmission.

During CRC, 0xFFFF is stored first, and then a process is launched to process at least 6 contiguous bytes in the frame based on the contents of the current register. CRC is only effective for the 8-bit data in each character, not for the start, stop and parity bits.

When generating the CRC values, the “Exclusive Or” operation (XOR) is performed for each 8-bit character and the content of the register. The result is inserted into the bits from the least significant bit (LSB) to the most significant bit (MSB), and 0 is inserted into the MSB. Then the LSB is recognized. If LSB is 1, the XOR operation is performed with 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 (bit 8) has been recognized and processed, the XOR operation is performed between the next 8-bit byte and the current content of the register. The final values in the register are the CRC values that result after the calculation has been performed on all bytes in the frame.

The calculation is performed according to the international standard CRC check rule. You can refer to the appropriate standard CRC algorithm to compile the CRC calculation program as required.

The following is a simple CRC calculation function (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 ladder logic, CKSM uses the table look-up method to calculate the CRC value according to the contents of the frame. The program for this method is simple and the calculation is fast, but the ROM space occupied is large, so use this program with caution if you have high memory requirements.

7.3.3 RTU Command Code

7.3.3.1 Command Code 03H, Reading *N* words (Continuously up to 16 Words)

The command code 03H is used by the master to read data from the VFD. The number of data to be read depends on the "Number of data" in the command. A maximum of 16 data can be read. The addresses of the parameters read must be contiguous. Each data unit occupies 2 bytes, i.e. one word. The command format is represented in the hexadecimal system (a number followed by an "H" stands for a hexadecimal value). A hexadecimal value occupies one byte.

The 03H command is used to read information including the parameters and operating status of the VFD.

For example, if the master reads two related data (i.e. e.g. the content of data addresses 0004H and 0005H) from the VFD with address 01H, the structure of the command frame is described below.

The RTU master command (from the master to the VFD) is as follows::

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR (address)	01H
CMD (command code)	03H
Start Address MSB	00H
Start Address LSB	04H
Data Count MSB	00H
Data Count LSB	02H
CRC LSB	85H
CRC MSB	CAH
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

“T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)” in START and END indicates that the RS485 communication needs to be idle for at least the transmission time of 3.5 bytes. An idle time is required to distinguish on message from another to ensure that the two messages are not regarded as one.

ADDR is 01H, indicating that the command is sent to the VFD whose address is 01 H. ADDR occupies one byte.

CMD is 03H, indicating that the command is used to read data from the VFD. CMD occupies one byte.

“Start address” indicates the address from which data is read. “Start address” occupies two bytes, with the MSB on the left and LSB on the right.

“Data count” indicates the count of data to be read (unit: word). “Start address” is 0004H and “Data count” is 0002H, which indicates reading data from the addresses 0004H and 0005H.

CRC check occupies two bytes, with the LSB on the left, and MSB on the right.

RTU slave response (from the VFD to the master) is as follows:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
Number of bytes	04H
Address 0004H data MSB	13H
Address 0004H data LSB	88H
Address 0005H data MSB	00H
Address 0005H data LSB	00H
CRC LSB	7EH
CRC MSB	9DH
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

The definition of the response information is described below:

ADDR is 01H, which means that the command is sent by the VFD whose address is 01H. ADDR occupies one byte.

CMD is 03H and indicates that the message is a response from the VFD to the 03H command from the master to read data. CMD occupies one byte.

“Number of bytes” indicates the number of bytes between the byte (not included) and the CRC byte (not included). The value 04 indicates that there are four data bytes between “number of bytes” and “CRC LSB”, i.e. “MSB of data in 0004H”, “LSB of data in 0004H”, “MSB of data in 0005H” and “LSB of data in 0005H”.

A data set consists of two bytes, with the MSB on the left and the LSB on the right. The response shows that the data in 0004H is 1388H and the data in 0005H is 0000H.

The CRC check occupies two bytes, with the LSB on the left and the MSB on the right.

7.3.3.2 Command Code 06H, Writing a Word

This command is used by the master to write data to the VFD. Only part of the data can be written with one command. It is used to change parameters or the operating mode of the VFD.

For example, if the master writes 5000 (1388H) to 0004H of the VFD whose address is 02H, the RTU master command (from the master to the VFD) is as follows:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data content	13H
LSB of data content	88H
CRC LSB	C5H
CRC MSB	6EH
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

RTU slave response (from the VFD to the master) is as follows:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data content	13H
LSB of data content	88H
CRC LSB	C5H
CRC MSB	6EH
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

7.3.3.3 Command Code 08H, Diagnosis

Sub-Function Code	Description
0000	Return data based on query requests

For example, when querying the circuit detection information via VFD with the address 01H, the query and response strings are identical.

RTU master command:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code MSB	00H
Sub-function code LSB	00H
MSB of data content	12H
LSB of data content	ABH
CRC CHK LSB	ADH
CRC CHK MSB	14H
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

RTU slave response:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code MSB	00H
Sub-function code LSB	00H
MSB of data content	12H
LSB of data content	ABH
CRC CHK LSB	ADH
CRC CHK MSB	14H
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

7.3.3.4 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 quantity", and a maximum of 16 pieces of data can be written.

For example: Writing 5000 (1388H) and 50 (0032H) to 0004H and 0005H of the VFD (as the slave) whose address is 02H

RTU master command (from the master to the VFD) is as follows:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H
Number of bytes	04H
MSB of data 0004H content	13H
LSB of data 0004H content	88H
MSB of data 0005H content	00H
LSB of data 0005H content	32H
CRC LSB	C5H
CRC MSB	6EH
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

RTU slave response (from the VFD to the master) is as follows:

START	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H
CRC LSB	C5H
CRC MSB	6EH
END	T_1–T_2–T_3–T_4 (transmission time of 3.5 bytes)

7.3.4 Fieldbus Scale

In practical applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. You can multiply a non-integer by a multiple to obtain an integer, in which the multiple is considered as a fieldbus scale.

The fieldbus scale depends on the number of decimal places in the value specified in "Setting range" or "Default". If there are *n* (for example, 1) decimal places in the value, the fieldbus scale *m* (then *m*=10) is the result of 10 to the power of *n*. For example:

Function Code	Name	Default	Setting Range	Description
P01.20	Wake-Up-From-Sleep Delay	0.0s	0.00–3600.0s	Usable only when the ones digit of P01.19 is set to 2.

The value specified in “Setting Range” or “Default” contains one decimal place, so the fieldbus scale is 10. If the value received from the master is 50, the VFD's wake-up-from-sleep delay is 5.0s (since 5.0=50/10).

To set the wake-up-from-sleep delay to 5.0s via Modbus communication, you must first multiply 5.0 by 10 according to the scale to obtain an integer 50, i.e. 32H in hexadecimal form, and then send the following write command:

01	06	01 14	00 32	49 E7
VFD address	Write command	Parameter address	Parameter data	CRC

After receiving the command, the VFD 50 converts to 5.0, based on the fieldbus scale, and then sets the wake-up-from-sleep delay to 5.0s.

Another example: After sending the read command for the wake-up-from-sleep delay parameter, 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, i.e. 50, and therefore the result is 5.0 based on the fieldbus scale. In this case, the master recognizes that the currently set wake-up-from-sleep delay is 5.0s.

7.3.5 Error Message Response

Responses to error messages are sent from the VFD to the master. The following table lists the codes and definitions of the error message responses:

Code	Name	Definition
01H	Invalid Command	The command code received from the higher-level control system may not be executed. Causes may be: • The function code is only applicable to new devices and is not implemented on this device. • The slave is in an error state when processing this request.
02H	Invalid Data Address	The data address in the request from the higher-level controller is not permitted for the VFD. In particular, the combination of the register address and the number of bytes to be sent is invalid.
03H	Invalid Data Value	The received data area contains an invalid value. The value indicates the error of the remaining structure in the combined request. **Note:** This does not mean that the data transferred for storage in the register contains a value unexpected by the program.

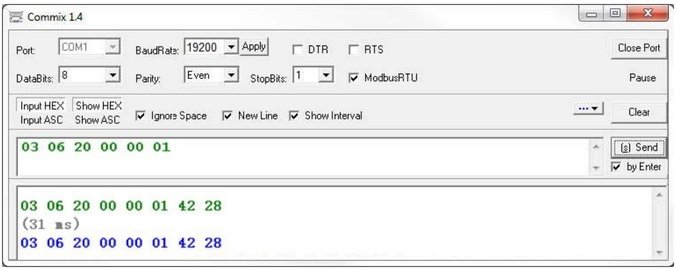
04H	Operation Failure	The parameter setting is invalid during the write process. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect Password	The value entered in the address for checking the password is different from the password defined in P07.00.
06H	Incorrect Data Frame	The length of the data frame sent by the upper computer is incorrect, or in RTU format the value of the CRC check bit does not match the CRC value calculated by the lower computer.
07H	Parameter is Read-Only	The parameter to be changed during the write process of the upper computer is a read-only parameter.
08H	Parameter Cannot Be Modified While Running	The parameter to be changed in the write process of the upper computer cannot be changed during operation of the VFD.
09H	Password Protection	If the upper computer does not enter the correct password to unlock the system for a read or write operation, the error "system locked" will be reported.

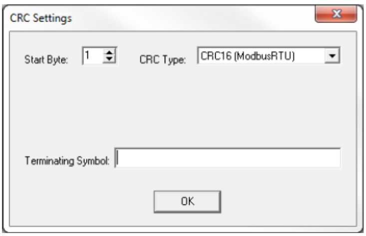
7.3.6 Communication Commissioning

In the following example, a PC is used as the master, an RS232-RS485 converter is used for signal conversion, and the PC serial port used by the converter is COM1 (an RS232 port).

The commissioning software for the host controller is the Commix1.4 serial port commissioning wizard, which can be downloaded from the Internet. Download a version that can perform the CRC check function automatically.

The following figure shows the Commix interface:





Set **Port** to **COM1**. Set **BaudRate** in accordance with P14.01. **DataBits**, **Parity**, and **StopBits** must be set in accordance with P14.02.

If the RTU mode is selected, choose **Input HEX** and **Show HEX**. To implement automatic CRC, you need to choose **ModbusRTU**, and set **Start Byte** to **1** and **CRC Type** to **CRC16 (MODBU SRTU)** in the **CRC Settings** window. After the automatic CRC is enabled, do not enter CRC in commands. Otherwise, command errors may occur due to repeated CRC.

The commissioning command for setting a VFD with address 03H to run forward is as follows:

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

Note:

- The VFD address (P14.00) must be set to 03.
- "Channel of operating commands" (P00.01) must be set to "Communication".
- After you click **Send**, if the line configuration and settings are correct, the 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

8 Error Handling

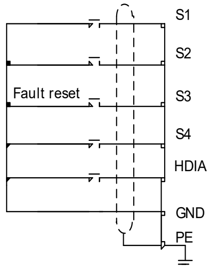
8.1 Error Indication and Reset

When the RUN/TUNE, FWD/REV, and LOCAL/REMOT indicators light up simultaneously, the VFD is in an abnormal state and the keypad displays the error code. For details on the error causes and solutions, see 8.2 Errors and solutions. If the cause of the error cannot be found, please contact our customer support.

There are three different ways to reset VFD errors:

A) Press the STOP/RST key on the keypad to initiate a reset.

B) Set any of P05.01–P05.04 or P05.09 to 7 (fault reset).



C) Cut off the VFD power supply.

8.2 Errors and Solutions

When an error occurred, handle the error as follows:

1) Check whether the keypad display is functional.
   a) If it is not, contact the local Sourcetronic office.
   b) If it is, check the function codes in group P07 to determine the circumstances when the fault occurred.
2) Check the table below for possible errors and their solutions.
3) Rectify the error or ask for help.
4) Once you have confirmed that the error has been rectified, carry out an error reset and start operation.

8.2.1 Common Errors and Solutions

Error Code	Error Type	Possible Cause	Solution
E4	Overcurrent During ACC	• The ACC/DEC time is too short. • The mains voltage is too low. • The power of the VFD is too low.	• Increase the ACC/DEC time. • Increase the mains input voltage. • Select a VFD with higher power.
E5	Overcurrent During DEC		

E6	Overcurrent When Operating at Constant Speed	• Load transient or exception occurred. • Imbalance of the output current at 3PH. • Strong external sources of interference (contactor switching/incorrect grounding).	• Check whether the motor is blocked, whether there is a short-circuit and whether there are exceptions on the load device. • Check whether the 3PH output voltage of the VFD and the 3PH resistance of the motor are unbalanced. • Check for strong interference. (Make sure the motor cable is far away from the contactor and the system is reliably grounded).
E7	Overvoltage During ACC	• The ACC/DEC time is too short. • An error has occurred in the input voltage. • The motor starts during rotation. • The energy recovery of the load is too high. • Dynamic braking is deactivated.	• Increase the ACC/DEC time. • Check the input voltage. • Wait until the motor stops smoothly and then start the VFD. • Install dynamic braking components or regenerative units. • Set the parameters of the dynamic braking function.
E8	Overvoltage During DEC		
E9	Overvoltage When Operating at Constant Speed		
E10	Bus Undervoltage Error	• The mains voltage is too low. • Abnormal voltage display. • Abnormal closing of the buffer contactor.	• Increase the mains input voltage. • Contact the manufacturer. • Contact the manufacturer.
E11	Motor Overload	• The mains voltage is too low. • The rated motor current is set incorrectly. • The motor is stalled or the load suddenly changes too much.	• Increase the mains input voltage. • Reset the rated motor current in the motor parameter group. • Check the load and adjust the value for the torque gain.
E12	VFD Overload	• The ACC is too fast. • Motor restarts while rotating. • The mains voltage is too low.	• Increase the ACC time. • Avoid a restart after a stop. • Increase the mains input voltage.

		• The load is too high. • The power of the VFD is too low.	• Choose a VFD with more power.
E13	Input Phase Loss	• Phase loss or strong fluctuations occur at the RST inputs. • Screws on the input side are loose.	• Check that the input power is normal and that the input cables are secure. • Configure P11.00 to hide the error.
E14	Output Phase Loss	• The output cables are broken or shorted to ground. • UVW phase loss (or the three phases of the load are highly asymmetrical)	• Check whether the output cables are loose or broken and replace them if necessary. • Check for strong load fluctuations or an imbalance in the 3PH resistance of the motor.
E16	Inverter Module Overheating	• The air duct is blocked or the cooling fan is damaged. • The ambient temperature is too high. • Long-term overload operation.	• Ventilate the air duct or replace the cooling fan. • Ensure good ventilation to reduce the ambient temperature. • Select a VFD with more power.
E17	External Error	• External error input signal via terminal S	• Check whether the input of the external device is normal.
E18	RS485 Communication Error	• Incorrect baud rate. • Error in the communication line. • Incorrect communication address. • The communication suffers from severe interference.	• Set a suitable baud rate. • Check the wiring of the communication port. • Set the communication address correctly. • It is recommended to use shielded cables to improve interference suppression.
E19	Current Detection Error	• Faulty motor cable or motor insulation.	• Remove the motor cables for inspection. • Contact the manufacturer.
E20	Motor Autotuning Error	• The power of the motor does not match the power of the VFD.	• Replace the VFD model or use the V/F control mode.

		This error can occur if the difference in performance difference is more than five power classes. • The motor parameters are not set correctly. • Parameters after autotuning deviate greatly from standard parameters. • Autotuning timeout. • Pulse current set too high.	• Check the motor wiring, the motor type and the parameter settings. • Relieve the motor and repeat the auto-tuning. • Check whether the upper frequency limit is greater than 2/3 of the rated frequency. • Reduce the pulse current setting accordingly.
E21	EEPROM Operation Error	• Error when reading/writing the control parameters. • EEPROM damaged.	• Press STOP/RST to reset. • Replace the main control board.
E22	PID Feedback Offline Error	• PID feedback offline. • PID feedback source disappears.	• Inspect the PID feedback signal wires. • Check PID feedback source.
E23	Braking Unit Error	• The brake circuit is faulty or the brake line is damaged. • The resistance of the external brake resistor is too low.	• Check the brake unit and replace it with a new brake line. • Increase the brake resistance.
E24	Running Time Reached	• The actual runtime of the VFD is longer than the internally set runtime.	• Contact the manufacturer.
E25	Electronic Overload Error	• The VFD signals an overload pre-alarm according to the setting.	• Ensure that the overload pre-alarm point is set correctly.
E27	Parameter Upload Error	• The keypad cable is not connected or not connected correctly. • The keypad cable is too long and causes severe interference. • Error in the communication circuit of the keypad or the main board.	• Inspect the keypad cable and reconnect it to determine if the error persists. • Check for external interference sources and remove them. • Replace the hardware and contact a service center.

E28	Parameter Download Error	• The keypad cable is not connected or not connected correctly. • The keypad cable is too long and causes severe interference. • A data storage error occurred on the keypad.	• Check external sources of interference and remove them. • Replace the hardware and seek maintenance services. • Check whether the version of the control board software of the keypad for copying parameters matches the version of the control board software of the VFD.
E32	To-Ground Short-Circuit Error 1	• The output of the VFD is short-circuited to ground. • Current detection circuit is defective. • The actual motor power setting differs greatly from the VFD power.	• Check whether the motor has a short circuit to ground and that the wiring is correct. • Ensure that the motor wiring is correct. • Replace the main control board. • Reset the motor parameters correctly.
E33	To-Ground Short-Circuit Error 2		
E34	Speed Deviation Error	• The load is too heavy or is jammed.	• Check for overload, increase the detection time for speed deviations or increase the ACC/DEC time. • Check the settings of the motor parameters and repeat autotuning of the motor parameters. • Ensure that the parameters for speed loop control are set correctly.
E35	Maladjustment Error	• An error occurred during loading. • The SM parameters are set incorrectly. • The parameters after autotuning are inaccurate. • The VFD is not connected to the motor. • Use of flux weakening.	• Check for overload or stalling. • Check the motor parameters and the settings of the back EMF. • Repeat autotuning of the motor parameters. • Increase the time for detecting adjustment errors.

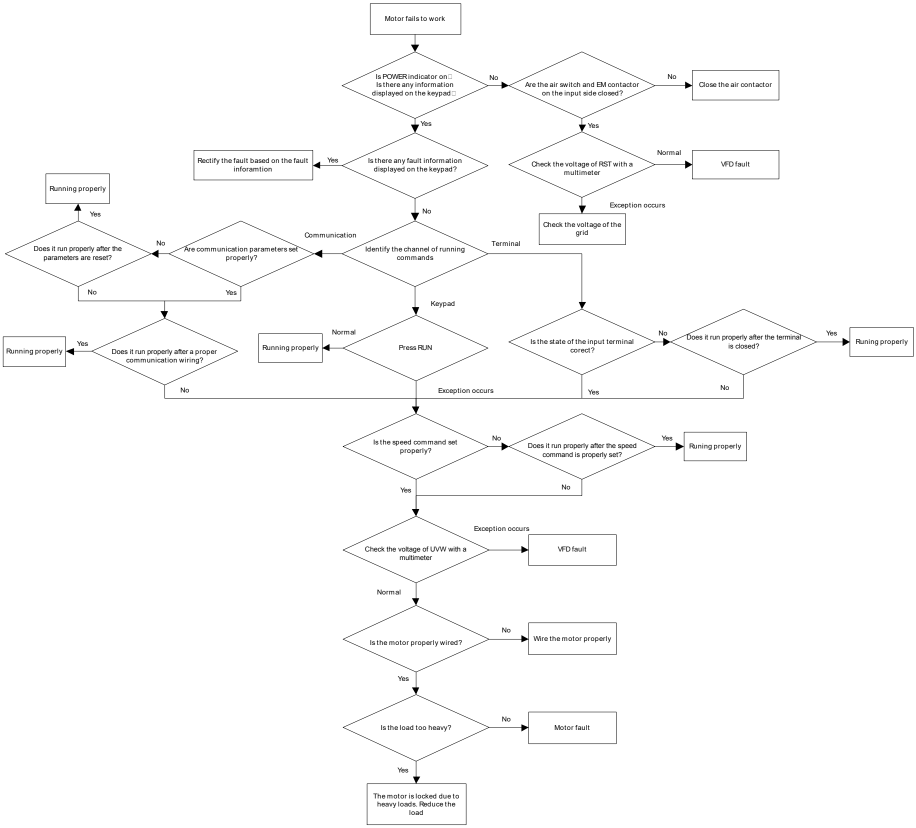
			• Set the flux weakening coefficient and the current loop parameters again.
E36	Electronic Underload Error	• The VFD signals an underload pre-alarm according to the setting.	• Check the pre-alarm points for load and underload.
E40	Safe Torque Off	• The Safe Torque Off (STO) function was triggered by external influences.	–
E41	Exception Occurred to Safety Circuit of Channel 1	• The STO wiring is incorrect. • An error has occurred on the external switch of the STO. • A hardware error has occurred in the safety circuit of the channel.	• Check that the STO terminal wiring is correct and tight enough. • Check whether the external switch of the STO is working properly. • Replace the control board. **Note:** To clear this error message, the device must be restarted.
E42	Exception Occurred to Safety Circuit of Channel 2		
E43	Exception Occurred to Channel 1 and Channel 2	• Hardware error occurred in the STO circuit.	• Replace the control board.
E92	AI1 Disconnection	• AI1 input too low. • AI1 wiring disconnected.	• Connect a 5 V or 10 mA power source to check if the input is correct. • Check if the wiring is correct. If it is, assume an issue with the cable and replace it.
E93	AI2 Disconnection	• AI2 input too low. • AI2 wiring disconnected.	
E94	AI3 Disconnection	• AI3 input too low. • AI3 wiring disconnected.	

8.2.2 Other Status

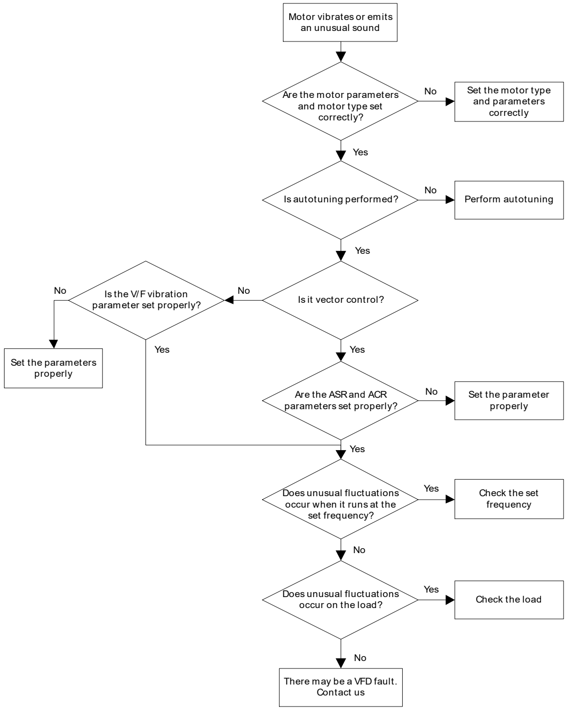
Displayed Code	Status Type	Possible Cause	Solution
PoFF	System Power Failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.

8.3 Analysis on Common errors

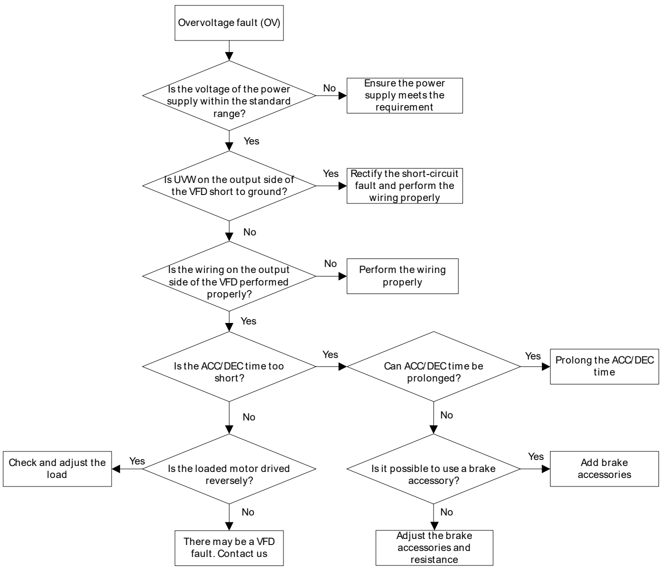
8.3.1 Motor Fails to Work



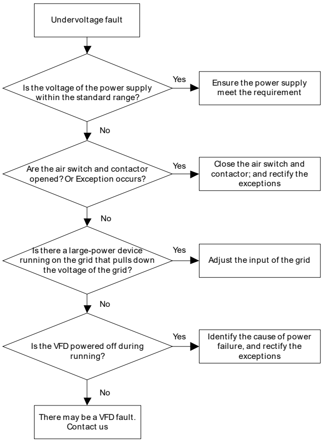
8.3.2 Motor Vibrates



8.3.3 Overvoltage

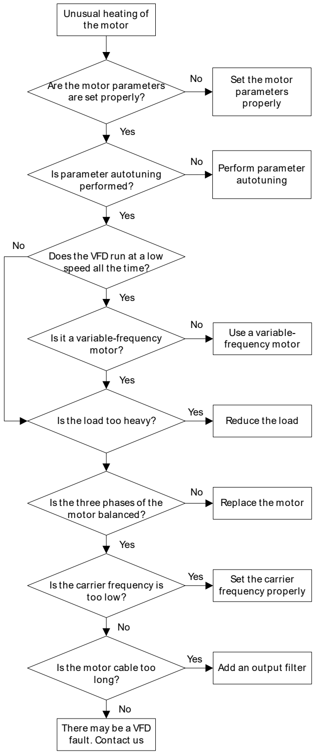


8.3.4 Undervoltage

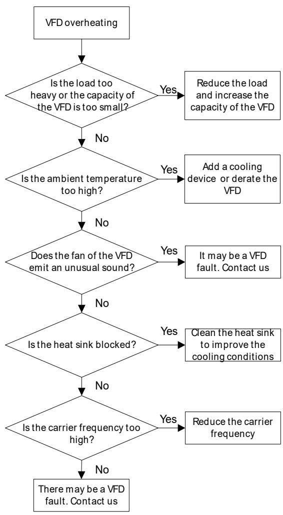


8.3.5 Overcurrent

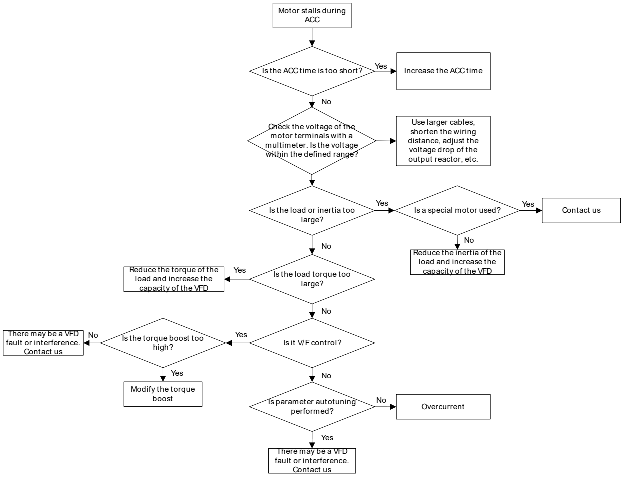
8.3.6 Motor Overheating



8.3.7 VFD Overheating



8.3.8 Motor Stalls During ACC



8.4 Countermeasures on Common Interference

8.4.1 Interference Problems of Meter Switch and Sensors

Symptom	Solution
The upper or lower limit is displayed incorrectly, e.g. as 999 or -999.	• Make sure that the sensor feedback cable is at least 20 cm apart from the motor cable. • Make sure that the ground wire of the motor is connected to the PE terminal of the VFD. (If the ground wire is connected to the ground block of the VFD, you must measure with a multimeter and make sure that the resistance between the ground block and the PE terminal is less than 1.5 Ω.) You must also tighten the EMC screw on the VFD input side. • Try to connect a safety capacitor of 0.1 μF to the signal end of the feedback signal terminal of the sensor. • Try attaching a 0.1 μF safety capacitor to the power side of the sensor measuring device. (Pay attention to the voltage of the power supply and the dielectric strength of the capacitor.) • To avoid interference when connecting the analog VFD output (AO1) to a measuring device: If AO1 uses a 0–20 mA current signal, install a 0.47 μF capacitor between the AO1 and GND terminals; if it uses a 0 V
The display of values jumps (occurs most commonly with pressure transmitters).	
The display of the values is stable, but there is a large deviation, e.g. the temperature is several dozen degrees higher than the usual temperature (which normally occurs with thermocouples).	
A signal detected by a sensor is not displayed, but serves as operational feedback from the drive system. For example, the VFD is expected to decelerate when the upper limit of the compressor pressure is reached, but in actual operation it starts to decelerate before the upper limit is reached.	
All types of measuring devices (e.g. frequency meters and ammeters) connected to the AO terminal (AO1) of the VFD display very inaccurate values.	

The system uses proximity switches. After powering on the VFD, the display of a proximity switch flickers and the output level changes.	to 10 V voltage signal, install a 0.1 μF capacitor between the AO1 and GND terminals. • The signal cable must be shielded and the shield must be reliably grounded to PE or GND.

Note:

- If a decoupling capacitor is required, it must be connected to the terminal of the device that is connected to the sensor. For instance, if a thermocouple is to transmit signals from 0–20 mA to a temperature meter, the capacitor must be connected to the terminal of the temperature meter; if an electronic meter is to transmit signals from 0–30 V to a PLC signal terminal, the capacitor must be connected to the terminal of the PLC.
- If a large number of meters or sensors display errors, it is recommended to install an external C2 filter on the VFD input side. For details, see D.3.2 Filter**.**

8.4.2 Interference on RS485 Communication

<table>
<tr><th>Symptom</th><th>Solution</th></tr>
<tr><td>The RS485 communication bus is not connected or has poor contact.</td><td rowspan="3">• Route the communication and motor cables through separate cable ducts.
• When connecting multiple VFDs, use the Chrysanthemum method to connect the communication cables between the VFDs, which can improve the anti-interference effect.
• When connecting multiple VFDs, ensure that the drive capacity of the master is sufficient.
• When connecting multiple VFDs, you must configure a 120 Ω terminating resistor at each end.
• Make sure that the ground wire of the motor is connected to the PE terminal of the VFD. (If the ground wire is connected to the ground block of the VFD, you must measure with a multimeter and make sure that the resistance between the ground block and the PE terminal is less than 1.5 Ω.) You must also tighten the EMC screw on the VFD input side.
• Do not connect the VFD and the motor to the same ground terminal as the host controller (e.g. the PLC, HMI and touch screen). It is recommended to connect the VFD and the motor to the mains ground and the host controller separately to a ground stud.
• Try to short-circuit the VFD's signal reference ground terminal (GND) to that of the host computer controller to ensure that the ground potential of the communication chip on the VFD's control board matches that of the host controller's communication chip.
• Try shorting GND to its ground terminal (PE).</td></tr>
<tr><td>The two ends of cable A or B are connected in reverse.</td></tr>
<tr><td>The communication protocol (e.g. baud rate, data bits and/or check bit) of the VFD does not match that of the host controller.</td></tr>
</table>

	• Try to install a safety capacitor of 0.1 μF on the power supply side of the host controller (PLC, HMI or touchscreen). Alternatively, you can also use a magnetic ring (Fe-based nanocrystalline magnetic rings are recommended). Feed the L/N cable or the +/- cable of the power supply of the host controller through the magnetic ring in the same direction and wrap it around the ring with 8 turns.

8.4.3 Failure to Stop and Indicator Shimmering Due to Motor Cable Coupling

Symptom	Solution
VFD fails to stop: In a VFD system where an S-clamp is used to control start and stop, the motor cable and the control cable are routed through the same cable duct. Once the system has been started properly, the S-clamp cannot be used to stop the VFD.	• Ensure that the exception signal cable is 20 cm or further away from the motor cable. • Install a safety capacitor of 0.1 μF between the digital input terminal (S) and the GND terminal. • Connect the digital input terminal (S) that controls the start and stop in parallel with other non-active digital input terminals. If, for example, S1 is used to control start and stop and S4 is not assigned, you can try short-circuiting S1 with S4.
The display flickers: Upon VFD power-on, the relay display, the power distribution box display, the PLC display and/or the display buzzer flicker or flash unexpectedly or emit unusual sounds.	

Note: If the controller (e.g. PLC) in the system simultaneously controls more than five VFDs via digital input terminals, this scheme is not applicable.

8.4.4 Leakage Current and Interference on RCD

Working principle:

Frequency converters 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 between the stator and the rotor of a motor will inevitably cause the VFD to generate a high-frequency leakage current to earth. A residual current operated protective device (RCD) is used to detect the high-frequency leakage current when a ground failure occurs in a circuit.

Rules for selecting RCDs:

1) Inverter systems are unique in that they require the rated residual current of common RCDs to be greater than 200 mA at all levels.

2) For RCDs, the time limit of one action must be longer than that of the next action, and the time difference between two actions must be longer than 20 ms, e.g. 1 s, 0.5 s or 0.2 s.

3) We recommend electromagnetic RCDs for VFD circuits. They have a strong anti-interference effect and can thus reduce or prevent the effects of high-frequency leakage currents.

Electronic RCD	Electromagnetic RCD
Low cost, high sensitivity, small volume, susceptible to voltage fluctuations in the grid and ambient temperature, weak anti-interference effect.	Requires a highly sensitive, accurate and stable zero-phase current transformer using high-permeability permalloy materials. A complex process, high cost, insensitive to power supply voltage fluctuations and ambient temperature, powerful anti-interference effect.

<table>
<tr><th>Symptom</th><th>Solution</th></tr>
<tr><td>RCD malfunction upon intermittent VFD power-on</td><td rowspan="2">Possible solutions via the VFD:
• Try removing the EMC screw.
• Try reducing the carrier frequency to 1.5kHz (P00.14=1.5).
• Try changing the modulation method to “3-PH modulation and 2-PH modulation” (Ones digit of P08.40=1).
Solution to RCD misoperation (handling the system power distribution):
• Ensure that the power cable is not immersed in water.
• Ensure that the cables are not damaged or spliced.
• Ensure that the neutral conductor is not secondarily grounded.
• Ensure that the main power cable terminal is in good contact with the air switch or contactor (i.e. all screws are tightened).
• Check 1-PH powered appliances and ensure that no ground wires from these appliances are used as neutrals.
• Do not use shielded cables as VFD power cables or motor cables.</td></tr>
<tr><td>RCD malfunction following VFD operation</td></tr>
</table>

8.4.5 Live Device Housing

When the VFD is powered on, there is a noticeable voltage on the housing, i.e. you may feel an electric shock when you touch it. The chassis, however, is not live when the VFD is powered on *but not running* (or the voltage is much lower than the highest safe voltage for humans).

Symptom	Solution
Live device housing	• If a power distribution grounding or grounding stud is available on site, ground the housing of the VFD via the power grounding or stud. • If there is no grounding on site, you must connect the motor housing to the grounding terminal PE of the VFD and ensure that the EMC screw of the VFD is tightened.

9 Inspection and Maintenance

9.1 Daily Inspection and Regular Maintenance

Over time, the internal components of the VFD will deteriorate due to the influence of ambient temperature, humidity, dust, vibration and other factors, leading to possible failure or shortening of its service life. Daily inspection and regular maintenance are therefore required to extend the device's life and avoid safety risks.

Category	Details	Method
Daily Inspection: Recommended every day.		
Ambient Environment	Check whether the ambient temperature or humidity is too high, whether there is excessive vibration, dust, gas or oil and whether there is condensation or water droplets inside and/or outside the machine.	Visual inspection and use of measuring instruments
	Check for foreign objects such as tools, or hazardous substances in the vicinity.	Visual inspection
Power Supply Voltage	Check that the voltage between the main circuit and the control circuit is normal.	Multimeter or voltage meter
Keypad	Check whether the display is clear.	Visual inspection
	Check that all characters and fields are displayed in full.	Visual inspection
Fan	Check that the cooling fan runs correctly.	Visual inspection
Load	Check whether the motor may be overloaded or overheated, or whether it is producing any unusual noises.	Visual inspection
Regular Maintenance: Recommended quarterly, especially in harsher environments such as with dust, oil or corrosive gases. Before maintenance, switch off the power and wait at least 15 minutes.		
Whole Machine	Check for loose or detached bolts.	Visual inspection
	Check whether the appliance is deformed, cracked or damaged or whether the color is changing due to overheating or aging.	Visual inspection
	Check for excessive dust or dirt.	Visual inspection
	Check for abnormal noises or vibration, odor, discoloration (transformer, reactor and fan)	Odor check, auditory and visual inspection

Motor	Check that the installation is secure, the motor insulation is normal and the cooling fan is running properly.	Measuring instrument or visual inspection
Cable	Check for any discoloration, deformation, or damage to the cables.	Visual inspection
	Check whether any cable connectors or bolts are coming loose.	Visual inspection
Connection Terminal	Check for overheating or damage.	Visual inspection
Electrolytic Capacitor	Check for electrolyte leakage, discoloration, cracks, and housing expansion.	Visual inspection
	Check that the safety valve is switched on.	Visual inspection
External Braking Resistor	Check for any displacement due to overheating.	Odor check and visual inspection
	Check whether the resistor cable is ageing, the sheathing is broken or the wire is damaged.	Visual inspection, or multimeter measure-ment after disconnecting one end of the cable.
Relay	Check for vibrating sounds during operation.	Auditory inspection
Control PCB and Connector	Check whether any screws or connectors are coming loose.	Visual inspection
	Check for any unusual smell or discoloration.	Odor check and visual inspection
	Check for any corrosion or rust stains.	Visual inspection
Ventilation Duct	Check for any foreign objects blocking or adhering to the cooling fan, air inlets, or air outlets.	Visual inspection

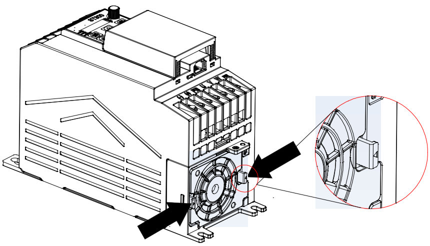
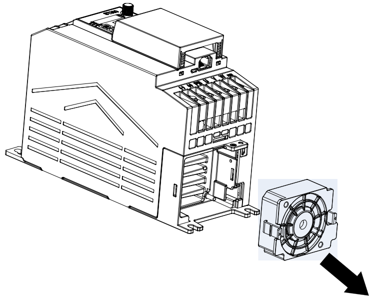
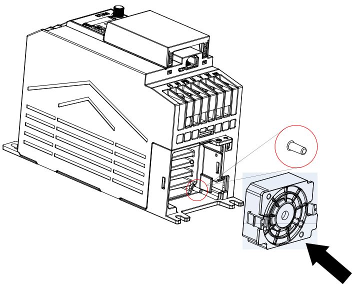
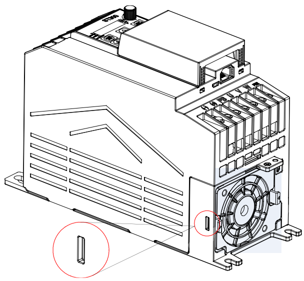
For more details about maintenance, visit our website http://www.sourcetronic.com/shop/en, and choose **FAQ** > **ST300**, or contact us via the website's contact form or by calling customer support.

9.2 Cooling Fan Replacement

The VFD's primary wearing part is the cooling fan, whose service life is closely related to the operating environment and maintenance condition.

Factors such as bearing wear, blade aging, water, oil, dust and other environmental factors may cause circuit board damage.

How to replace the cooling fan:

Disassembly	
1) Press the buckles on both sides of the fan with your hands. 	2) Pull out the fan outward at the same time. 
Reassembly	
1) Align the two fixing holes on the fan with the positioning column. 	2) Push in the fan until you hear a clicking sound. 

Warning!
Before disassembling or installing the fan, stop the VFD, cut off the power, and wait **at least 5 minutes**!

9.3 Recommissioning

If the VFD has not been used in a long time, you must follow the instructions for replacing the intermediate circuit electrolytic capacitor before using it. The storage time is calculated from the date of delivery of the VFD. Please contact us for a detailed operating description.

Storage Time	Operation Principle
Less than 1 year	No charging process is required.
1–2 years	Apply a voltage one class lower than the device's voltage class for one hour before using it again for the first time.

2–3 years	**Use a voltage-controlled power supply to charge the VFD as follows:** 1) Charge the VFD for 30 minutes at 25% of the rated voltage, 2) Charge the VFD for 30 minutes at 50% of the rated voltage, 3) Charge the VFD for 30 minutes at 75% of the rated voltage, 4) Finally, charge the VFD for 30 minutes at 100% of the rated voltage.
More than 3 years	**Use a voltage-controlled power supply to charge the VFD as follows:** 1) Charge the VFD for 2 hours at 25% of the rated voltage, 2) Charge the VFD for 2 hours at 50% of the rated voltage, 3) Charge the VFD for 2 hours at 75% of the rated voltage, 4) Finally, charge the VFD for 2 hours at 100% of the rated voltage.

Using a voltage-controlled power supply to charge the VFD:

The selection of a voltage-controlled power supply unit depends on the power supply of the VFD. For VFDs with an input voltage of 1PH/3PH 230 V AC, you can use a 230 V AC or 2 A voltage regulator. Both 1PH and 3PH VFDs can be charged with a voltage-controlled 1PH power supply (connect L+ to R and N to S or T). All capacitors in the intermediate circuit share a rectifier and are therefore all charged.

With VFDs in the high-voltage class, care must be taken to ensure that the required voltage (e.g. 380 V) is maintained during the charging process. The capacitor change only requires a small amount of current, so you can use a power supply unit with low power (2 A is sufficient).

Using a resistor (incandescent lamp) to charge the VFD:

If you connect the VFD directly to a power supply to charge the DC link capacitor, it must be charged for at least 60 minutes. The charging process must be carried out at normal internal temperature without load and you must connect a resistor in series in the 3PH circuit of the power supply unit.

For a 380V model, use a resistor of 1kΩ / 100W. If the voltage of the power supply is not higher than 380V, you can also use a 100W incandescent lamp. Remember: if an incandescent lamp is used, it may go out or the light may become very dim.

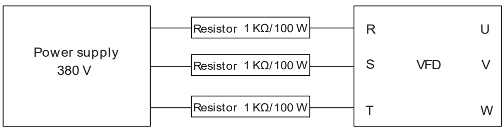


Figure 9-1 380V model VFD charging circuit example

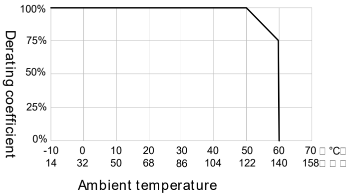
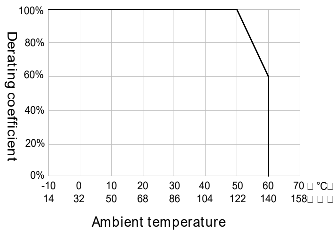
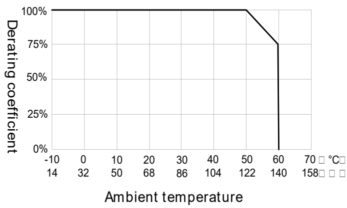
Appendix A Technical Data

If the ambient temperature at the installation site of the VFD exceeds 50°C, the altitude of the installation site of the VFD exceeds 1000 m, you are using a cover with ventilation openings for heat dissipation or the carrier frequency is higher than the recommended frequency (see P00.14), the VFD must be derated.

A.1 Derating Due to Temperature

The operating temperate range is -10°C–50°C. If the temperature exceeds than 50°C, the rated output current of each model is derated as follows:

Table A-1 Derating Due to Temperature

<table>
<tr><th>VFD Model</th><th>Frame</th><th>Derating Coefficient and Temperature</th></tr>
<tr><td>ST300-0R4G1</td><td rowspan="4">A</td><td>
</td></tr>
<tr><td>ST300-0R7G1</td><td rowspan="3">
</td></tr>
<tr><td>ST300-0R7G3</td></tr>
<tr><td>ST300-1R5G3</td></tr>
<tr><td>ST300-1R5G1</td><td rowspan="7">B</td><td rowspan="7">
</td></tr>
<tr><td>ST300-2R2G1</td></tr>
<tr><td>ST300-2R2G3</td></tr>
<tr><td>ST300-003G3</td></tr>
<tr><td>ST300-004G3</td></tr>
<tr><td>ST300-5R5G3</td></tr>
<tr><td>ST300-7R5G3</td></tr>
</table>

Note: It is not recommended to operate the VFD in an environment with a temperature above 60 °C. If you do so, you are responsible for the consequences.

A.2 Derating Due to Altitude

If the altitude of the installation site is below 1000 m, the VFD can be operated at the rated power. If the altitude exceeds 1000 m, reduce the power by 1% per 100 m increase in altitude. If the altitude exceeds 3000 m, please contact our customer support for more information.

A.3 Derating Due to Carrier Frequency

The carrier frequency of the VFD varies depending on the power class. The VFD rated power is defined based on the factory setting of the carrier frequency.

VFD Model	Derating Due to Carrier Frequency				
	4 KHz	6 KHz	8 KHz	10 KHz	12 KHz
AC 1PH 200–240V					
ST300-0R4G1	100%	100%	100%	100%	100%
ST300-0R7G1	100%	100%	100%	90%	85%
ST300-1R5G1	100%	100%	100%	100%	90%
ST300-2R2G1	100%	100%	100%	95%	90%
AC 3PH 380–480V					
ST300-0R7G3	100%	100%	90%	80%	70%
ST300-1R5G3	100%	80%	70%	60%	50%
ST300-2R2G3	100%	90%	80%	75%	70%
ST300-003G3	100%	90%	80%	70%	60%
ST300-004G3	100%	90%	80%	70%	65%
ST300-5R5G3	100%	90%	85%	80%	70%
ST300-7R5G3	100%	90%	85%	80%	70%

A.4 Grid Specifications

Grid Voltage	AC 1PH 200(-15%)–240V(+10%) AC 3PH 200(-15%)–240V(+10%) AC 3PH 380(-15%)–480V(+10%)
Short-Circuit Capacity	According to the definition in IEC 61439-1, the maximum allowable short-circuit current at the incoming end is 100kA. Therefore, the VFD is applicable to scenarios where the transmitted current in the circuit is no larger than 100kA when the VFD runs at the maximum rated voltage.
Frequency	50 or 60Hz±5%, with a maximum change rate of 20%/s

A.5 Motor Connection Data

Motor Type	Asynchronous induction motor or permanent-magnet synchronous motor
Voltage	0–U_1 (motor rated voltage), 3PH symmetrical, U_{max} (VFD rated voltage) at the field-weakening point
Short-Circuit Protection	The motor output short-circuit protection meets the requirements of IEC 61800-5-1.

Frequency	0–599 Hz
Frequency Resolution	0.01 Hz
Current	See 2.3 Product Ratings.
Power Limit	1.5 times the motor's rated power
Field-Weakening Point	10–599 Hz
Carrier Frequency	4, 8, 12, or 15 kHz

A.5.1 Motor Cable Length for Normal Operation

Frame	Max. Motor Cable Length
A	50 m
B	75 m
C	150 m

Note: If the motor cable is too long, electrical resonance may occur due to the influence of the distributed capacitance. This can cause damage to the motor insulation or generate a high leakage current that triggers the device's overcurrent protection. You must configure an AC output reactor near the VFD if the cable length is equal to or greater than the values listed in the table.

A.5.2 Motor Cable Length for EMC

The ST300 series frequency inverters meet the EMC requirements of IEC/EN61800-3:2018. The maximum lengths of the shielded motor cables at a switching carrier frequency of 4 kHz are as follows:

Frame	Max. Motor Cable Length	
	C2	C3
AC 1PH 200–240 V		
A	5 m	10 m
B	5 m	10 m
AC 3PH 380–480 V		
A	–	10 m
B	–	10 m
C	–	10 m

Note: For details about frames, see 2.5 Product Dimensions and Weight.

Appendix B Application Standards

B.1 List of Application Standards

The following table describes the application standards that VFDs comply with.

EN/ISO 13849-1	Safety of machinery—Safety related parts of control systems Part 1: General principles for design
EN/ISO 13849-2	Safety of machinery—Safety related parts of control systems Part 2: Verification
IEC/EN 60204-1	Safety of machinery—Electrical equipment of machines Part 1: General requirements
IEC/EN 62061	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
IEC 61800-3:2018	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
IEC/EN 61800-5-1	Adjustable speed electrical power drive systems Part 5-1: Safety requirements—Electrical, thermal and energy
IEC/EN 61800-5-2	Adjustable speed electrical power drive systems Part 5-2: Safety requirements—Function

B.2 CE/TUV/UL Certification

The CE mark affixed to the device indicates that the VFD is CE-compliant and fulfills the provisions of the European Low Voltage Directive (2014/35/EU) and EMC Directive (2014/30/EU).

The TÜV mark affixed to the device indicates that the VFD is TÜV-compliant. The TÜV certification includes the TÜV-MARK, TÜV-CE, TÜV-CB, GS and VDE certifications, which enjoy a high level of authority and recognition in the field of electronic devices and components.

The UL mark affixed to the device indicates that the VFD is UL-certified. UL certification is voluntary in the United States (but mandatory in some states), and products that have passed this certification and meet the corresponding requirements of the UL standard may be sold on the US market.

Note: The nameplate of a product shows its certifications.

B.3 EMC Compliance Declaration

EMC is short for electromagnetic compatibility, which refers to the ability of a device or system to function correctly in its electromagnetic environment and not to cause excessive electromagnetic interference in said environment. Your VFD complies with the EMC product standard (EN 61800-3:2018) and can be used in both the first and second environmental categories.

B.4 EMC Product Standard

The EMC product standard (EN 61800-3:2018) describes the EMC requirements for VFDs.

Application environment categories:

1) Civilian environment, including application scenarios in which the VFD is connected directly to a low-voltage network that also supplies residential buildings without an intermediate transformer.

2) All locations outside a residential area.

Category C1: VFDs with a rated voltage of less than 1000 V, used in first category environments.

Category C2: VFDs with a rated voltage of less than 1000 V that are neither a non-pluggable nor a movable device and must be installed and commissioned by qualified personnel if used in a first category environment.

> **Note:** The product may cause radio interference in some environments, meaning that you must take appropriate measures to minimize this interference.

Category C3: VFDs with a rated voltage of less than 1000 V that are used in second category environments. They cannot be used in first category environments.

> **Note**: Category C3 VFDs cannot be used on civilian public low-voltage networks. When used in such networks, the VFD can generate high-frequency electromagnetic interference.

Category C4: VFDs with a rated voltage of more than 1000 V or a rated current of at least 400 A that are used in complex systems in second category environments.

> **Note:** The EMC standard IEC/EN 61800-3:2018 no longer restricts the power distribution of the VFD, but it defines the use, installation and commissioning of the VFD. Qualified personnel or appropriately specialized organizations must have the necessary skills (including EMC-related knowledge) for the installation and/or commissioning of the device.

Appendix C Dimension Drawings

C.1 VFD Overall Dimensions

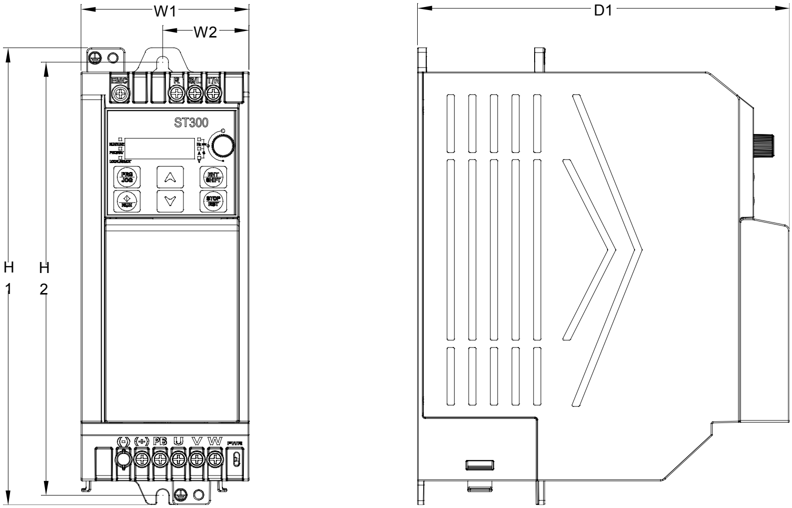


Figure C-1 Dimensions and hole positions for VFDs in frames A and B

Table C-1 Dimensions and hole positions for VFDs in frames A and B

VFD Model	Frame	Outline Dimensions (mm)			Mounting Hole Distance (mm)		Mounting Hole Diameter (mm)
		W1	H1	D1	W2	H2	
ST300-0R4G1	A	60	190	155	36	180	Ø 5
ST300-0R7G1		60	190	155	36	180	Ø 5
ST300-0R7G3		60	190	155	36	180	Ø 5
ST300-1R5G3		60	190	155	36	180	Ø 5
ST300-1R5G1	B	70	190	155	36	180	Ø 5
ST300-2R2G1		70	190	155	36	180	Ø 5
ST300-2R2G3		70	190	155	36	180	Ø 5
ST300-003G3		70	190	155	36	180	Ø 5
ST300-004G3		70	190	155	36	180	Ø 5

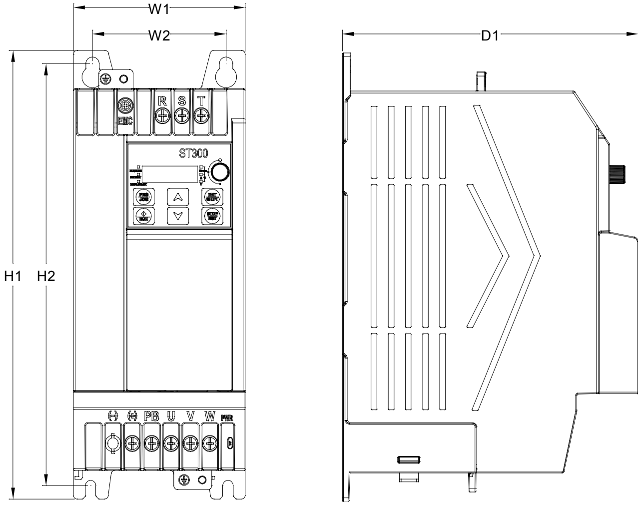


Figure C-2 Dimensions and hole positions for VFDs in frame C

Table C-2 Dimensions and hole positions for VFDs in frame C

VFD Model	Frame	Outline Dimensions (mm)			Mounting Dole Distance (mm)		Mounting Hole Diameter (mm)
		W1	H1	D1	W2	H2	
ST300-5R5G3	C	90	235	155	70	220	Ø 6
ST300-7R5G3		90	235	155	70	220	Ø 6

Appendix D Peripheral Accessories

D.1 Cable

Relevant cables mainly include power cables and control cables. The selection of cable types can be found in the following table:

Cable Type		Symmetrical Shielded cable	Four-Core Cable	Double-Shielded Twisted-Pair Cable	Single-Shielded Twisted-Pair Cable
Power Cable	Input Power Cable	✓	–	–	–
	Motor Cable	✓	–	–	–
Control Cable	Analog Signal Control Cable	–	–	✓	–
	Digital Signal Control Cable	–	–	✓	✓

D.1.1 Power Cables

Table D-1 Motor model selection

VFD Model	R, S, T/U, V, W, PB, (+), (-)		PE		Fastening Torque (Nm)
	Rec. Cable Size (mm^2)	Insulated Wire End Ferrule Crimp Length (mm)	Rec. Cable Size (mm^2)	Insulated Ring Cable Terminal Size	
AC 1PH 200–240V					
ST300-0R4G1	1.5	8	1.5	M5	1.0
ST300-0R7G1	1.5	8	1.5	M5	1.0
ST300-1R5G1	2.5	12	2.5	M5	1.0
ST300-2R2G1	4	12	4	M5	1.0
AC 3PH 380–480V					
ST300-0R7G3	1.5	8	1.5	M5	1.0
ST300-1R5G3	1.5	8	1.5	M5	1.0
ST300-2R2G3	1.5	8	1.5	M5	1.0
ST300-003G3	2.5	12	2.5	M5	1.0
ST300-004G3	2.5	12	2.5	M5	1.0
ST300-5R5G3	2.5	12	2.5	M6	1.2
ST300-7R5G3	4	12	4	M6	1.2

Note: The cables recommended for the main circuit can be used in scenarios where the ambient temperature is below 40°C, the wiring distance is shorter than 100m and the current corresponds to the rated current.

Crimp terminal selection:

Due to, for example, cable length or routing, it may be necessary to increase the cross-section of the cable and replace the appropriate connection terminals (cable lugs).

D.1.2 Control Cable

Control cables include analog and digital signal control cables. For analog signal control cables, twisted, double-shielded cables are used (Figure D-1; a), with a separate shielded twisted pair for each signal and different ground wires for different analog signals. Double shielded cable is preferred for digital signals, but single shielded or unshielded twisted pairs can also be used (Figure D-1; b).

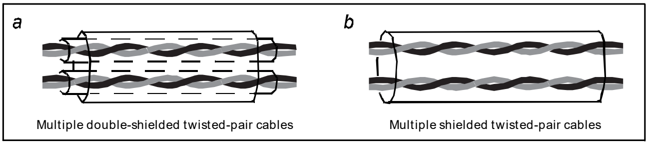


Figure D-1 Control Cables

Note:

- Analog signal cables and communication cables must be independent shielded cables.
- The same cable cannot transmit 24V DC signals and 115V or 230V AC signals at the same time.
- Only shielded cables can be used for frequency signals.
- A relay cable must be provided with a metal braid as a shield.

D.2 Breaker and Electromagnetic Contactor

The circuit breaker is mainly used to prevent accidents caused by electric shock and short circuits to ground, which may lead to a leakage current fire. The electromagnetic contactor is mainly used to switch the main circuit on and off, which can effectively cut off the input power of the VFD in the event of a system failure to ensure safety.

Table D-2 Fuse/breaker/contactor model selection

VFD Model	Fuse (A)	Breaker (A)	Contactor Rated Current (A)
AC 1PH 200–240V			
ST300-0R4G1	10	10	9
ST300-0R7G1	16	16	12
ST300-1R5G1	20	20	18
ST300-2R2G1	35	32	32
AC 3PH 380–480V			
ST300-0R7G3	6	6	9
ST300-1R5G3	10	10	9
ST300-2R2G3	10	10	9

ST300-003G3	16	16	12
ST300-004G3	16	16	12
ST300-5R5G3	25	25	25
ST300-7R5G3	35	32	32

Note: The accessory specifications described in the table are ideal values. You can select the accessories depending on your requirements, but you should try to avoid using accessories with lower values.

D.3 Optional Parts

Reactors, filters, braking components, and mounting brackets are external accessories and need to be specified when purchasing.

D.3.1 Reactors

A reactor is used to improve the power factor on the input side of the VFD and thus to limit high-order harmonic currents.

Due to the interference capacitance between the long cable and the ground, the leakage current is high and the overcurrent protection of the VFD can be triggered frequently. To prevent this and avoid damage to the motor isolator, an output reactor must be installed to compensate.

For the length of the cable between the VFD and the motor, see A.5.1 Motor Cable Length for Normal Operation. If you are unsure about choosing a model, please contact us.

D.3.2 Filters

A filter is used to minimize interference from the environment as well as interference from the VFD during operation. Optional filters can be used to meet the conductivity and transmission requirements of CE/EN 61800-3:2018 C2 electrical drive systems.

D.3.3 Braking Components

Braking elements include braking resistors and braking units that can be used to dissipate the regenerative energy generated by the motor, significantly improving braking and deceleration capabilities.

If a VFD slows down or must decelerate abruptly while driving a load with high inertia, the motor runs in the power generation state and transfers 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 certain value, the device reports an overvoltage error. To prevent this, you must configure braking components.

Table D-3 Braking Component Selection

VFD Model	Braking Unit	Resistance Applicable for 100% Braking Torque (Ω)	Braking Resistor Dissipation Power (kW)			Min. Allowed Braking Resistance (Ω)
			10% Braking Usage	50% Braking Usage	80% Braking Usage	
ST300-0R4G1	Built-in braking unit	361	0.06	0.30	0.48	180
ST300-0R7G1		192	0.11	0.56	0.90	100
ST300-1R5G1		96	0.23	1.10	1.80	60
ST300-2R2G1		65	0.33	1.70	2.64	39
ST300-0R7G3		653	0.11	0.56	0.90	300
ST300-1R5G3		326	0.23	1.13	1.80	170
ST300-2R2G3		222	0.33	1.65	2.64	130
ST300-003G3		122	0.6	3	4.8	100
ST300-004G3		122	0.6	3	4.8	80
ST300-5R5G3		89.1	0.75	4.13	6.6	60
ST300-7R5G3		65	1.13	5.63	9	51

Note:

- Select the brake resistors only according to the resistance and power data specified by Sourcetronic.
- A braking resistor can increase the braking torque of the VFD. The table above describes the resistance and power for 100% braking torque and 10%, 50% and 80% braking application. Select the braking system according to the onsite conditions and requirements of your use case.

Appendix E STO Function

Before using the STO function, please read the following content carefully and observe all safety instructions in this user manual.

E.1 Safety Standards

The product has been integrated with the STO function and complies with the following safety standards.

IEC 61000-6-7	Electromagnetic compatibility (EMC) Part 7: General standards—Immunity requirements for equipment used in industrial sites to perform safety related functions (functional safety)
IEC 61326-3-1	EMC requirements for measurement, control, and laboratory electrical equipment Part 31: Immunity requirements for safety related systems and equipment intended to perform safety related functions (functional safety)—General industrial applications
IEC 61508-1	Functional safety of electrical/electronic/programmable electronic safety related systems Part 1: General requirements
IEC 61508-2	Functional safety of electrical/electronic/programmable electronic safety related systems Part 2: Requirements for electrical/electronic/programmable electronic safety related systems
IEC/EN 61800-5-2	Speed regulation electrical transmission systems Part 5-2: Safety requirements—Functions
IEC/EN 62061	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
EN/ISO 13849-1	Safety of machinery—Safety related parts of control systems Part 1: General principles for design
EN/ISO 13849-2	Safety of machinery—Safety related parts of control systems Part 2: Verification

The following data refers to safety standards:

Code	Definition	Standard	Characteristics
SIL	Safety Integrity Level	IEC 61508 IEC 62061	SIL 3
PFH	Probability of Failure per Hour	IEC 61508	$8.53 \cdot 10^{-10}$
HFT	Hardware Fault Tolerance	IEC 61508	1
SFF	Safe Failure Fraction	IEC 61508	99.39%
PL	Performance Level	ISO 13849-1	e
DC	Diagnosis Coverage	ISO 13849-1	>90%
Cat.	Category	ISO 13849-1	3

E.2 Safety Function Description

The Safe Torque Off (STO) function cuts off the VFD output by switching off the inverter signal, interrupting the power supply to the motor and thus stopping the torque output to the outside.

When enabled, this function prevents the motor from starting accidentally when it is in a static state. If the motor is rotating, it will continue to rotate due to its inertia until it comes to a standstill. If the motor is fitted with a brake, this is applied immediately.

Note:

- In normal working mode, you are not recommended to use the STO function to stop the VFD running. The STO function cannot effectively prevent sabotage or misuse. If the STO function is used to stop a running VFD, the VFD will disconnect the power supply to the motor, and the motor will coast to stop. If the consequences caused by this action are unacceptable, related stop modes should be used to stop the VFD and mechanical equipment.
- When using a permanent magnet, reluctance, or nonsalient pole induction motor, even if the STO function is activated, there is still a possible failure mode (although the possibility is very low) that prevents the two power devices of the VFD from conducting. The drive system can output a uniform torque, which can rotate the permanent magnet motor shaft by a maximum electrical angle of 180°, or the nonsalient pole induction motor or reluctance motor shaft by an electrical angle of 90°. This possible failure mode must be allowed during the design of the machine system. Maximum motor shaft rotation angle = Electrical angle of 360°/Number of motor pole pairs.
- The STO function cannot replace the emergency stop function. When no other measures are taken, the power supply of the VFD cannot be cut off in an emergency.
- The STO function has priority over all other functions of the VFD.
- Although the STO function can reduce known hazardous conditions, it does not eliminate all potential hazards.
- Designing safety related systems requires professional safety knowledge. To ensure the safety of a complete control system, design the system according to the required safety principles. A single sub-system with the STO function, although intentionally designed for safety related applications, it cannot guarantee the safety of the entire system.

Emergency Stop Function:

When the emergency stop function is used in an appliance, it primarily enables the user to take timely action to prevent accidents under unexpected conditions. The design does not necessarily have to be complex, but can use simple electromechanical devices to initiate a controlled emergency stop by interrupting the power supply or other means (such as dynamic or regenerative braking).

E.3 Risk Assessment

1) Before using the STO function, you must carry out a risk assessment of the system to ensure compliance with the required safety standards.
2) There may also be other risks that arise even when the device is operated with safety functions. This is why safety must always be taken into account when conducting risk assessments.

3) If an external force (e.g. the force of gravity on the vertical axis) is applied while the safety function is in operation, the motor will rotate. A separate mechanical brake must be provided to secure the motor.

4) If the drive fails, the motor can be operated in a range of 180° so that safety is guaranteed even in potentially dangerous situations.

5) The number of revolutions and the movement distance of the individual motor types are as follows:

- Rotating motor: can rotate up to 1/6 (of the rotation angle of the motor shaft).
- Drive motor: can rotate up to 1/20 (of the rotation angle of the motor shaft).
- Linear servo motor: can move up to 30 mm.

E.4 STO Function Wiring

The STO function terminals +24V, H1, and H2 are shorted in the factory.

The wiring requirements are as follows:

1) When using the STO function of the VFD, remove the jumpers between +24V and H1 as well as between +24V and H2.

2) When the VFD is in normal operation, close the switches or relays.

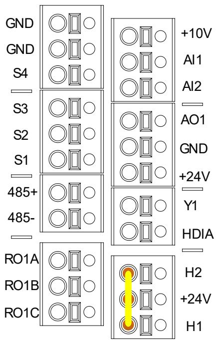


Figure E-1 Shorting +24V to H1 and H2

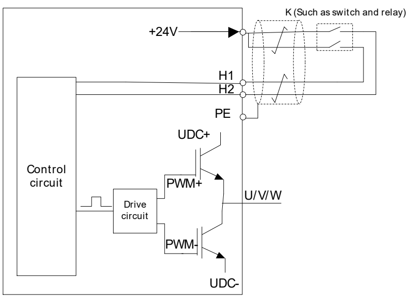


Figure E-2 STO Function Wiring

Note:

- The "K" symbol in the figure above can represent components such as manual switches, emergency stop switches, safety relays and safety PLC contacts.
- The safety switch contact must be opened or closed within 200 ms.
- The maximum length of the double-shielded, twisted cable between VFD and safety switch is 25 m.
- The shielding of the cable should be connected to the PE connection of the VFD.
- If the STO function is enabled, the switch or relay is opened. When the VFD stops output, the keypad displays "E40".

E.5 STO Function Terminals

<table>
<tr><th>Terminal</th><th>Function</th></tr>
<tr><td>+24V</td><td>Voltage range: 24 V±15%
To disable the STO function, short +24 V to H1 and to H2.</td></tr>
<tr><td>H1</td><td rowspan="2">STO action voltage: 0–5V
STO action voltage: 13–30 V
Input current: 5 mA
STO function channel signal input</td></tr>
<tr><td>H2</td></tr>
</table>

E.6 STO Function Logic Table

H1	H2	VFD Status	Keypad Display	Error Description
H1 closed	H2 closed	Normal operation	No exception displayed	–
H1 opened	H2 opened	Torque output off	E40	STO
H1 opened	H2 closed	Torque output off	E41	Problem with H1
H1 closed	H2 opened	Torque output off	E42	Problem with H2

Note: E43 indicates that there is a problem with both H1 and H2 simultaneously.

E.7 STO Trigger Delay

STO Circumstance	STO Trigger Delay[1] and Indication Delay[2]
STO Error: E41	Trigger delay <10 ms; indication delay <280 ms
STO Error: E42	Trigger delay <10 ms; indication delay <280 ms
STO Error: E43	Trigger delay <10 ms; indication delay <280 ms
STO Error: E40	Trigger delay <10 ms; indication delay <100 ms

[1] STO trigger delay: time interval between triggering the STO function and the VFD output shutting down

[2] STO indication delay: time interval between triggering the STO function and display of the STO output state

E.8 Acceptance Test

Warning
• Technical personnel, users, maintenance and repair personnel must receive appropriate training so that they understand the requirements and principles of safety system design and troubleshooting. • <u>Never</u> carry out maintenance work on the frequency inverter or motor before the power supply has been disconnected! • The safety function acceptance test must be carried out by personnel with specialist knowledge of the safety function and must be recorded and signed by test engineers.

The acceptance test must be carried out for the device in all of the following situations:

- Upon initial commissioning of the safety function
- After any modification to the safety function (including circuit board, wiring, components or equipment)
- After any maintenance work related to the safety function

The signed acceptance report must be kept in the machine books. The report should contain the documents of the commissioning activities and test results, the references of the fault reports and the fault solutions. Any new acceptance test carried out due to modifications or maintenance work should be noted in the records.

Acceptance Test Checklist:

Step	Test	Check
1	Ensure that the VFD can run or stop at will during commissioning.	
2	Stop the VFD (if it is running), disconnect the input power supply and isolate the VFD from the power cable using the isolation switch.	
3	Check the circuit connection of the STO function according to the circuit diagram.	
4	Close the isolation switch to connect to the power.	
	Test the STO function as follows when the motor is at a standstill: 1) If the VFD is running, send a stop command to it and wait until the motor shaft stops rotating. 2) Disconnect the STO circuit. The VFD should then switch to “Safe Torque Off” mode and no longer supply voltage. The keypad will display “E40”. 3) Send a VFD start command. The motor should *not* start. 4) Close the STO circuit. 5) Clear the error message, start the VFD and ensure that the motor can run properly.	
	Test the STO function as follows when the motor is running: 1) Start the VFD and ensure that the motor is running.	

	2) Disconnect the STO circuit. The VFD should then switch to “Safe Torque Off” mode and no longer supply voltage. The keypad will display “E40”. The motor should stop. 3) Clear the error message, start the VFD and ensure that the motor remains at a standstill. 4) Close the STO circuit. 5) Clear the error message, start the VFD and ensure that the motor can run properly.	
5	**Test the VFD error messages. For this, the motor may be running or stopped.** 1) Start the VFD and ensure that the motor can run properly. 2) Disconnect H1 and keep H2 closed. If the motor is running, it should coast to a stop and the keypad will display “E41”. 3) Send a VFD start command. The motor should *not* start. 4) Close the STO circuit. 5) The error message cannot be cleared at this time. Turn off and restart the VFD and ensure that the motor can run properly. 6) Disconnect H2 and keep H1 closed. If the motor is running, it should coast to a stop and the keypad will display “E42”. 7) Send a VFD start command. The motor should *not* start. 8) Close the STO circuit. 9) The error message cannot be cleared at this time. Turn off and restart the VFD and ensure that the motor can run properly.	
6	Record and sign the acceptance test report, which shows that the STO function is safe and can be put into operation.	

Note:

- If the steps in the acceptance test checklist can be carried out normally without further exceptions, this means that the STO function circuit is working normally. If the situations differ from the expected results of the previous steps or if “E43” is displayed, this indicates that the STO function circuit is not operating properly. For further details on handling errors, see 8.2 Errors and Solutions.
- The error message “E40” can also be reset manually or automatically by configuring P08.52.

VFD Error	Error Code Displayed	Response Time	Reset Method
Normal operation	–	–	–
Torque output off	E40	≤20ms	Press STOP/RST.
Torque output off	E41	≤20ms	Full machine restart
Torque output off	E42	≤20ms	Full machine restart

Appendix F Energy Efficiency Data

Table F-1 Power Losses and IE Class

VFD Model	Relative Loss (%)								Standby Loss (W)	IE Class
	(0;25)	(0;50)	(0;100)	(50;25)	(50;50)	(50;100)	(90;50)	(90;100)		
ST300-0R4G1	2.2	2.3	2.7	0.8	1.3	1.5	0.9	1.7	5	IE2
ST300-0R7G1	1.5	1.8	2.4	0.8	1.4	2.4	1.0	2.4	5	IE2
ST300-1R5G1	1.2	1.1	1.8	0.9	1.1	2.1	0.7	2.0	5	IE2
ST300-2R2G1	0.9	1.2	1.6	0.9	1.2	2.1	1.2	2.2	5	IE2
ST300-0R7G3	1.5	0.9	0.3	2.5	1.2	0.8	2.0	1.6	7	IE2
ST300-1R5G3	2.4	1.6	5.4	1.1	1.3	2.0	1.4	2.2	7	IE2
ST300-2R2G3	0.6	0.8	1.5	0.5	0.8	1.6	0.8	1.9	8	IE2
ST300-003G3	0.7	0.6	0.3	0.8	1.0	1.1	1.8	1.8	8	IE2
ST300-004G3	1.3	1.6	2.6	1.2	1.8	2.7	1.5	2.9	8	IE2
ST300-5R5G3	0.7	0.9	1.6	0.6	1.0	1.8	0.9	1.9	9	IE2
ST300-7R7G3	0.4	0.7	0.4	0.3	0.5	1.4	0.6	2.7	9	IE2

Product Model	Apparent Power (kVA)	Output Power (kW)	Input Current (A)	Output Current (A)	Max. Working Temperature	Rated Power Frequency
AC 1PH 200–240V						
ST300-0R4G1	0.9	0.4	6.5	2.5	50°C	50Hz or 60Hz Allowed Range: 47–63Hz
ST300-0R7G1	1.6	0.75	11	4.2		
ST300-1R5G1	2.8	1.5	18	7.5		
ST300-2R2G1	3.8	2.2	24.3	10		
AC 3PH 380–480V						
ST300-0R7G3	1.6	0.75	4.5	2.5	50°C	50Hz or 60Hz Allowed Range: 47–63Hz
ST300-1R5G3	2.5	1.5	6.5	3.7		
ST300-2R2G3	3.9	2.2	8.8	5.5		
ST300-003G3	5.1	3	12.2	7.5		
ST300-004G3	6.4	4	15.6	9.5		
ST300-5R5G3	9.2	5.5	22.3	14		
ST300-7R5G3	12.1	7.5	28.7	18.5		

Appendix G Function Parameter List

The function parameters of the VFD are divided into groups based on their purpose. Among the function parameter groups, group P28 is the group for calibrating the analog inputs and outputs, while group P29 contains the factory function parameters which are not accessible to the user.

Each group contains several function codes, each of which identifies a function parameter. The function codes use a three-level menu. For example, "P08.08" indicates the 8th function code in group P08.

The VFD offers password protection. For details see P07.00. The parameters are displayed in the decimal system (0–9) and in the hexadecimal system (0–F). If the hexadecimal system is used, all bits are independent of each other when editing the parameters. The symbols in the table refer to the following:

"○" indicates that the value of this parameter can be modified both while the VFD is running and while it is not.

"◎" indicates that the value of this parameter cannot be modified while the VFD is running, but can be modified while it is stopped.

"●" indicates that the value of this parameter is recorded and can be viewed but not modified by the user.

When the device is reset to factory settings, the recorded parameter values will not be restored

P00—Basic Functions

Function Code	Name	Description	Default	Modifiable?
P00.00	Speed Control Mode	Specifies a speed control mode. **Setting Range:** 0–2 0: SVC 0 1: SVC 1 2: Space voltage vector control mode **Note:** Before using a vector control mode (0 or 1), enable the VFD to perform motor parameter autotuning first.	2	◎
P00.01	Channel of Operating Commands	Specifies the channel through which the VFD receives operating commands. **Setting Range:** 0–2 0: Keypad 1: Terminals 2: Communication	0	○
P00.02	Reserved	–	–	–
P00.03	Max. Output Frequency	Specifies the maximum output frequency of the VFD, which is the basis of setting desired	50.00 Hz	◎

		frequencies and the acceleration (ACC) and deceleration (DEC) speed. **Setting Range:** P00.04–599.00 Hz		
P00.04	Upper Limit of Operating Frequency	Specifies the upper limit of the VFD operating frequency, which must be smaller than or equal to the max. output frequency. If the set frequency is above the upper limit of the operating frequency, the upper limit will instead be used for operation. **Setting Range:** P00.05–P00.03	50.00 Hz	◎
P00.05	Lower Limit of Operating Frequency	Specifies the lower limit of the VFD operating frequency. If the set frequency is below the lower limit of the operating frequency, the lower limit will instead be used for operation. **Setting Range:** 0.00 Hz–P00.04 **Note:** P00.03 ≥ P00.04 ≥ P00.05	0.00 Hz	◎
P00.06	Channel for Frequency Reference A	Specifies the channel through which the VFD receives frequency reference values. **Setting Range:** 0–8 0: Keypad (P00.10) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Simple PLC program 6: Multi-step speed operation 7: PID control 8: Modbus communication	0	○
P00.07	Channel for Frequency Reference B		1	○
P00.08	Reference Object of Frequency Reference B	Specifies the reference object used for the frequency reference value B. Setting Range: 0–1 0: Max. output frequency 1: Frequency reference A	0	○

P00.09	Combination Mode of Frequency Reference Values	Specifies how the two (A and B) are combined for the frequency reference value. **Setting Range:** 0–5 0: A 1: B 2: (A+B) 3: (A–B) 4: Max (A, B) 5: Min (A, B)	0	○
P00.10	Setting Frequency Through the Keypad	Specifies the initial VFD frequency value when reference values A and B are set to be defined via the keypad. **Setting Range:** 0.00 Hz–P00.03	50.00 Hz	○
P00.11	ACC Time 1	Specifies the ACC time of the ramp frequency. **Setting Range:** 0.0–3600.0 s	Model-dependent	○
P00.12	DEC Time 1	Specifies the DEC time of the ramp frequency. **Setting Range:** 0.0–3600.0 s	Model-dependent	○
P00.13	Running Direction	Specifies the running direction. **Setting Range:** 0–2 0: Run in default direction (forward) 1: Run in reverse direction (backward) 2: Disable reverse running	0	○
P00.14	Carrier Frequency	Specifies the carrier frequency. A high carrier frequency will have an ideal current waveform, few current harmonics, and little motor noise, but it will increase the switch loss, increase VFD temperature, and impact the output capacity. At the same time, the VFD current leakage and electrical magnetic interference will increase. On the other hand, an extremely low carrier frequency may cause unstable operation at	Model-dependent	○

		low frequency, decrease the torque, or even lead to oscillation. The carrier frequency has been properly set in the factory before shipping. Most of the time you will not need to modify it. The mapping between VFD models and default carrier frequency values is as follows: **Models 0R7G3 and higher:** 4 kHz **All other models:** 8 kHz **Setting Range:** 1.0–15.0 kHz **Note:** When the frequency used exceeds the default carrier frequency, the VFD must derate by 10% for each increase of 1 kHz.		
P00.15	Motor Parameter Autotuning	Enables and specifies the motor autotuning function. **Setting Range:** 0–3 0: Disable 1: Rotary autotuning 1 2: Static autotuning 1 (comprehensive) 3: Static autotuning 2 (partial autotuning)	0	◎
P00.16	AVR Function	Enables or disables the VFD automatic voltage regulation (AVR) function, which can eliminate the impact of the bus voltage fluctuation on the VFD output voltage. **Setting Range:** 0–1 0: Disable 1: Enable (active during the whole process)	1	○
P00.17	Reserved	–	–	–
P00.18	Function Parameter Reset	Resets function parameters. **Setting Range:** 0–3 0: Disable 1: Reset to default values (excluding motor parameters) 2: Clear error records	0	◎

		3: Lock all function codes **Note:** Resetting to default values will delete the user password. After the selected operation is performed, this function code is automatically reset to 0. While it is set to 3 (lock all function codes), you cannot modify the value of any function code.		

P01—Start and Stop Control

Function Code	Name	Description	Default	Modifiable?
P01.00	Start Mode	Specifies the start mode. **Setting Range:** 0–1 0: Direct start 1: Start after DC braking	0	◎
P01.01	Starting Frequency at Direct Start	Specifies the initial frequency to be used upon VFD direct start. **Setting Range:** 0.00–50.00Hz	0.50Hz	◎
P01.02	Hold Time of Starting Frequency	Specifies the hold time of the starting frequency. **Setting Range:** 0.0–50.0s	0.0s	◎
P01.03	Braking Current Before Start-Up	Specifies the DC braking current before start-up. **Setting Range:** 0.0%–100.0%	0.0%	◎
P01.04	Braking Time Before Start-Up	Specifies the DC braking time before startup. **Setting Range:** 0.00–50.00s	0.00s	◎
P01.05	ACC/DEC Mode	Specifies the mode of increasing/decreasing the frequency at start-up and while running. **Setting Range:** 0–1 0: Linear: The output frequency increases or decreases linearly. 1: S-curve: The output frequency increases or decreases according to an S-curve.	0	◎

		Note: • The S-curve is often used with elevators, conveyors, and other scenarios where a smooth start/stop is required. • When S curve mode is selected, P01.06, P01.07, P01.27, and P01.28 need to be set accordingly.		
P01.06	Starting Segment of ACC S-Curve	Specifies the time of the starting segment of the ACC S-curve. This parameter works in conjunction with P01.07 to determine the curvature of the S-curve. **Setting Range:** 0.0–50.0s	0.1s	◎
P01.07	Ending Segment of ACC S-Curve	Specifies the time of the ending segment of the ACC S-curve. This parameter works in conjunction with P01.06 to determine the curvature of the S-curve. **Setting Range:** 0.0–50.0s	0.1s	◎
P01.08	Stop Mode	Specifies the stop mode. **Setting Range:** 0–1 0: Decelerate to stop. When a stop command registers, the VFD lowers output frequency gradually based on the selected DEC mode and DEC time; after the frequency drops to the selected stop speed (P01.15), the VFD stops. 1: Coast to stop. When a stop command registers, the VFD ceases its output immediately, and the load coasts to a gradual stop according to mechanical inertia.	0	○
P01.09	Starting Frequency of DC Braking	Specifies the starting frequency when using DC braking to stop the device. **Setting Range:** 0.00Hz–P00.03	0.00Hz	○

P01.10	Demagnetization Time	Specifies the demagnetization time (that is, the required wait time before using DC braking to stop the device). **Setting Range:** 0.00–30.00s	0.00s	○
P01.11	DC Braking Current	Specifies the DC braking current (that is, the DC braking energy). **Setting Range:** 0.0%–100.0% (of the VFD's rated output current)	0.0%	○
P01.12	DC Braking Time	Specifies the duration of DC braking to stop the device. **Setting Range:** 0.00–50.00s **Note:** If the value is 0, DC braking is invalid, and the VFD decelerates to stop within the specified time.	0.00s	○
P01.13	FWD/REV Running Deadzone Time	Specifies the transition time of switching between FWD/REV running mode (works in conjunction with the switching mode specified by P01.14). **Setting Range:** 0.0–3600.0s	0.0s	○
P01.14	FWD/REV Switching Mode	Specifies switching between forward and reverse running mode. **Setting Range:** 0–2 0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed (with a delay)	1	◎
P01.15	Stop Speed	Specifies the stop speed (frequency). **Setting Range:** 0.00–100.00Hz	0.50Hz	◎
P01.16	Stop Speed Detection Mode	Specifies how the VFD detects whether the stop speed has been reached. The VFD stops when the value in the selected mode drops below that specified by P01.15. **Setting Range:** 0–1	1	◎

		0: Detect by the set speed (only in space voltage vector control mode) 1: Detect by the feedback speed		
P01.17	Stop Speed Detection Time	Specifies the stop speed detection time. **Setting Range:** 0.00–100.00s	0.00s	◎
P01.18	Terminal-Based Operating Command Protection at Power-On	Specifies whether terminal-based operating commands will be registered at power-on. **Setting Range:** 0–1 0: Terminal-based operating commands are invalid at power-on. 1: Terminal-based operating commands are valid at power-on.	0	○
P01.19	Action Selected when Operating Frequency is Less Than Frequency Lower Limit	Specifies the status of the VFD when the operating frequency drops below the lower limit (valid only when a frequency lower limit greater than 0 has been set). **Setting Range:** 0x00–0x12 *Ones digit: Action selection* 0: Continue to run at the lower limit 1: Stop 2: Sleep *Tens digit: Stop mode* 0: Coast to stop 1: Decelerate to stop	0x00	◎
P01.20	Wake-Up-From-Sleep Delay	Specifies the wake-up-from-sleep delay time (usable only when the ones digit of P01.19 is set to 2). **Setting Range:** 0.0–3600.0s	0.0s	○
P01.21	Restart After Power-Off	Specifies whether the VFD automatically resumes operation after power is restored. **Setting Range:** 0–1 0: Disable	0	○

		1: Enable. If the restart condition is met, the VFD will run automatically (after waiting for the duration of the time defined by P01.22).		
P01.22	Wait Time for Restart After Power-Off	Specifies the wait time before the VFD automatically resumes operation after power is restored (valid only when P01.21=1). **Setting Range:** 0.0–3600.0s	1.0s	○
P01.23	Start Delay	Upon receiving a start command, the VFD remains in standby mode and restarts with a delay to allow the brake to be released. **Setting Range:** 0.0–600.0s	0.0s	○
P01.24	Stop Speed Delay	**Setting Range:** 0.0–600.0s	0.0s	○
P01.25	Open-Loop 0Hz Output Selection	**Setting Range:** 0–2 0: Output without voltage 1: Output with voltage 2: Output with the DC braking current	0	○
P01.26	DEC Time for Emergency Stop	**Setting Range:** 0.0–60.0s	2.0s	○
P01.27	Starting Segment of DEC S-Curve	DEC equivalent to P01.06. **Setting Range:** 0.0–50.0s	0.1s	◎
P01.28	Ending Segment of DEC S-Curve	DEC equivalent to P01.07. **Setting Range:** 0.0–50.0s	0.1s	◎
P01.29	Short-Circuit Braking Current	**Setting Range:** 0.0%–150.0% (of the rated VFD output current)	0.0%	○
P01.30	Hold Time of Short-Circuit Braking at Start-Up	If the VFD starts in direct start mode (P01.00=0), set P01.30 to a value other than zero to activate short-circuit braking. **Setting Range:** 0.00–50.00s	0.00s	○
P01.31	Hold Time of Short-Circuit Braking	While stopped, if the operating frequency of VFD is lower than the starting frequency of brake for stop (P01.09), set P01.31 to a non-zero value to enter short-circuit braking, and	0.00s	○

		then carry out DC braking in the time specified by P01.12. (See also: descriptions for P01.09–P01.12.) **Setting Range:** 0.00–50.00s		
P01.32	Pre-Excitation Time for Jogging	**Setting Range:** 0.000–10.000s	0.300s	○
P01.33	Starting Frequency of Braking for Stop in Jogging	**Setting Range:** 0.00Hz–P00.03	0.00Hz	○
P01.34	Sleep Delay	**Setting Range:** 0–3600.0s	0.0s	○

P02—Parameters of Motor 1

Function Code	Name	Description	Default	Modifiable?
P02.00	Type of Motor 1	**Setting Range:** 0–1 0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P02.01	Rated Power of AM 1	**Setting Range:** 0.1–3000.0kW	Model-dependent	◎
P02.02	Rated Frequency of AM 1	**Setting Range:** 0.01Hz–P00.03	50.00Hz	◎
P02.03	Rated Speed of AM 1	**Setting Range:** 1–60000RPM	Model-dependent	◎
P02.04	Rated Voltage of AM 1	**Setting Range:** 0–1200V	Model-dependent	◎
P02.05	Rated Current of AM 1	**Setting Range:** 0.08–600.00A	Model-dependent	◎
P02.06	Stator Resistance of AM 1	**Setting Range:** 0.001–65.535Ω	Model-dependent	○
P02.07	Rotor Resistance of AM 1	**Setting Range:** 0.001–65.535Ω	Model-dependent	○

P02.08	Leakage Inductance of AM 1	**Setting Range:** 0.1–6553.5mH	Model-dependent	○
P02.09	Mutual Inductance of AM 1	**Setting Range:** 0.1–6553.5mH	Model-dependent	○
P02.10	No-Load Current of AM 1	**Setting Range:** 0.01–655.35A	Model-dependent	○
P02.11	Magnetic Saturation Coefficient 1 of AM 1 Iron Core	**Setting Range:** 0.0%–100.0%	80.0%	○
P02.12	Magnetic Saturation Coefficient 2 of AM 1 Iron Core	**Setting Range:** 0.0%–100.0%	68.0%	○
P02.13	Magnetic Saturation Coefficient 3 of AM 1 Iron Core	**Setting Range:** 0.0%–100.0%	57.0%	○
P02.14	Magnetic Saturation Coefficient 4 of AM 1 Iron Core	**Setting Range:** 0.0%–100.0%	40.0%	○
P02.15	Rated Power of SM 1	**Setting Range:** 0.1–3000.0kW	Model-dependent	◎
P02.16	Rated Frequency of SM 1	**Setting Range:** 0.01Hz–P00.03	50.00Hz	◎
P02.17	Number of Pole Pairs of SM 1	**Setting Range:** 1–128	2	◎
P02.18	Rated Voltage of SM 1	**Setting Range:** 0–1200V	Model-dependent	◎
P02.19	Rated Current of SM 1	**Setting Range:** 0.08–600.00A	Model-dependent	◎
P02.20	Stator Resistance of SM 1	**Setting Range:** 0.001–65.535Ω	Model-dependent	○

P02.21	Direct-Axis Inductance of SM 1	**Setting Range:** 0.01–655.35mH	Model-dependent	○
P02.22	Quadrature-Axis Inductance of SM 1	**Setting Range:** 0.01–655.35mH	Model-dependent	○
P02.23	Counter-EMF Constant of SM 1	**Setting Range:** 0–10000	300	○
P02.24	Initial Pole Position of SM 1	**Setting Range:** 0x0000–0xFFFF	0x0000	●
P02.25	Identification Current of SM 1	**Setting Range:** 0%–50%	10%	●
P02.26	Overload Protection of Motor 1	**Setting Range:** 0–2 0: Disable (no protection) 1: Common motor (with low-speed compensation) As the cooling effect of a common motor decreases at low speed operation, the corresponding electronic thermal protection value needs to be adjusted accordingly. The low compensation indicates lowering the overload protection threshold of a motor that is operating at a frequency below 30Hz. 2: Frequency-variable motor (without low-speed compensation) The heat dissipation function for a variable-frequency motor is not impacted by the rotation speed; therefore it is not necessary to adjust the protection value at low speed operation.	2	◎
P02.27	Overload Protection Coefficient of Motor 1	Specifies the motor overload protection coefficient. A small motor overload protection coefficient indicates a great overload multiplication (M). • When M=116%, overload protection occurs if motor overload lasts for 1h	100.0%	○

		• When M=150%, overload protection occurs if motor overload lasts for 12 min • When M=200%, overload protection occurs if motor overload lasts for 60 s • When M≥400%, overload protection occurs immediately. **Setting Range:** 20.0%–150.0%		
P02.28	Power Display Calibration Coefficient of Motor 1	Used to adjust the power display value of motor 1. This does not affect the control performance of the VFD. **Setting Range:** 0.00–3.00	1.00	○
P02.29	Parameter Display of Motor 1	**Setting Range:** 0–1 0: Display by motor type. In this mode, only parameters related to the currently used motor type are displayed. 1: Display all. In this mode, all motor parameters are displayed.	0	○
P02.30	System Inertia of Motor 1	**Setting Range:** 0.000–30.000 kgm^2	0.000 kgm^2	○
P02.31–P02.32	Reserved	–	–	–

P03—Vector Control of Motor 1

Function Code	Name	Description	Default	Modifiable?
P03.00	Speed-Loop Proportional Gain 1	**Setting Range:** 0.0–200.0 **Note:** Applicable only to vector control mode.	20.0	○
P03.01	Speed-Loop Integral Time 1	**Setting Range:** 0.000–10.000s **Note:** Applicable only to vector control mode.	0.200s	○
P03.02	Low-Point Frequency for Switching	**Setting Range:** 0.00Hz–P03.05 **Note:** Applicable only to vector control mode.	5.00Hz	○
P03.03	Speed-Loop Proportional Gain 2	**Setting Range:** 0.0–200.0 **Note:** Applicable only to vector control mode.	20.0	○
P03.04	Speed-Loop Integral Time 2	**Setting Range:** 0.000–10.000s **Note:** Applicable only to vector control mode.	0.200s	○
P03.05	High-Point Frequency for Switching	**Setting Range:** P03.02–P00.03 **Note:** Applicable only to vector control mode.	10.00Hz	○
P03.06	Speed-Loop Output Filter	**Setting Range:** 0–8 (corresponding to 0–2^8/10ms)	0	○
P03.07	Electromotive Slip Compensation Coefficient of Vector Control	The slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the system's speed control accuracy. Adjusting the parameter properly can manage the speed steady-state error. **Setting Range:** 50%–200%	100%	○
P03.08	Power-Generation Slip Compensation Coefficient of Vector Control	The slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the system's speed control accuracy. Adjusting the parameter properly can manage the speed steady-state error. **Setting Range:** 50–200%	100%	○
P03.09	Reserved	–	–	–

P03.10	Current-Loop Band Width	**Setting Range:** 0–2000 **Note:** • P03.10 is a current loop PI regulation parameter that impacts the system's dynamic response speed and control accuracy. Most of the time you will not need to modify it. • Applicable to SVC 0 (P00.00=0) and SVC 1 (P00.00=1).	400	○
P03.11	Torque Setting Channel	Specifies the channel through which the VFD receives torque reference values. **Setting Range:** 0–7 0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: HDIA 6: Multi-step torque 7: Modbus communication **Note:** • For AMs, 100% corresponds to the motor rated torque current when the value 0 or 1 is selected (i.e. when the keypad is selected). Otherwise, 100% instead corresponds to triple the motor rated torque current. • For SMs, 100% corresponds to the motor rated current when the value 0 or 1 is selected (i.e. when the keypad is selected). Otherwise 100% instead corresponds to triple the motor rated current.	0	○
P03.12	Setting Torque Through the Keypad	Specifies the torque value when it's set to be defined via the keypad. **Setting Range:** -300.0%–300.0% (of the motor rated current)	20.0%	○

		Note: For AMs, 100% corresponds to the motor rated torque current; for SMs, 100% corresponds to the motor rated current.		
P03.13	Torque Reference Filter Time	**Setting Range:** 0.000–10.000s	0.010s	○
P03.14	Channel for Forward Rotation Frequency Upper Limit in Torque Control	Specifies the channel through which the VFD receives the forward rotation upper frequency limit. **Setting Range:** 0–6 0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step setting 6: Modbus communication **Note:** 100% corresponds to the max. frequency.	0	○
P03.15	Channel for Reverse Rotation Frequency Upper Limit in Torque Control	Specifies the channel through which the VFD receives the reverse rotation upper frequency limit. **Setting Range:** 0–6 0: Keypad (P03.17) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step setting 6: Modbus communication **Note:** 100% corresponds to the max. frequency.	0	○
P03.16	Setting Forward Rotation Frequency Upper Limit	Specifies the forward rotation frequency limit when it's set to be defined via the keypad. **Setting Range:** 0.00Hz–P00.03	50.00Hz	○

	Through the Keypad in Torque Control	**Note:** 100% corresponds to the max. frequency.		
P03.17	Setting Reverse Rotation Frequency Upper Limit Through the Keypad in Torque Control	Specifies the reverse rotation frequency limit when it's set to be defined via the keypad. **Setting Range:** 0.00 Hz–P00.03 **Note:** 100% corresponds to the max. frequency.	50.00 Hz	○
P03.18	Channel for Electromotive Torque Upper Limit	Specifies the channel through which the VFD receives the electromotive torque upper limit. **Setting Range:** 0–5 0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Modbus communication **Note:** • For AMs, 100% corresponds to the motor rated torque current when the value 0 is selected, and corresponds to triple the motor rated torque current when a value from 1 to 5 is selected. • For SMs, 100% corresponds to the motor rated current when the value 0 or 1 is selected, and corresponds to triple the motor rated current when a value from 2 to 5 is selected.	0	○
P03.19	Channel for Braking Torque Upper Limit	Specifies the channel through which the VFD receives the braking torque upper limit. **Setting Range:** 0–5 0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: HDIA	0	○

		5: Modbus communication **Note:** • For AMs, 100% corresponds to the motor rated torque current when the value 0 is selected, and corresponds to triple the motor rated torque current when a value from 1 to 5 is selected. • For SMs, 100% corresponds to the motor rated current when the value 0 or 1 is selected, and corresponds to triple the motor rated current when a value from 2 to 5 is selected.		
P03.20	Setting Electromotive Torque Upper Limit Through the Keypad	Specifies the electromotive torque limit when it's set to be defined via the keypad. **Setting Range:** 0.0%–300.0% **Note:** For AMs, 100% corresponds to the motor rated torque current; for SMs, 100% corresponds to the motor rated current.	180.0%	○
P03.21	Setting Braking Torque Upper Limit Through the Keypad	Specifies the braking torque limit when it's set to be defined via the keypad. **Setting Range:** 0.0%–300.0% **Note:** For AMs, 100% corresponds to the motor rated torque current; for SMs, 100% corresponds to the motor rated current.	180.0%	○
P03.22	Weakening Coefficient in Constant Power Zone	Used when the AM is in flux weakening control. **Setting Range:** 0.0%–200.0%	100.0%	○
P03.23	Lowest Weakening Point in Constant Power Zone	**Setting Range:** 5%–100%	5%	○
P03.24	Max. Voltage Limit	Specifies the maximum VFD output voltage, which is defined as a percentage of the motor rated voltage. Set the value according to on-site conditions. **Setting Range:** 0.0%–120.0%	100.0%	○

P03.25	Pre-Excitation Time	Specifies the motor's pre-excitation time. Pre-excitation is performed on the motor when the VFD starts up. A magnetic field is built up inside the motor to improve the torque performance during the start-up process. **Setting Range:** 0.000–10.000 s	0.300 s	○
P03.26	Flux Weakening Proportional Gain	**Setting Range:** 0–8000	1000	○
P03.27	Speed Display in Vector Control	**Setting Range:** 0–1 0: Display the actual value 1: Display the set value	0	○
P03.28	Static Friction Compensation Coefficient	**Setting Range:** 0.0%–100.0%	0.0%	○
P03.29	Corresponding Frequency Point of Static Friction	**Setting Range:** 0.50 Hz–P03.31	1.00 Hz	○
P03.30	High-Speed Friction Compensation Coefficient	**Setting Range:** 0.0%–100.0%	0.0%	○
P03.31	Corresponding Frequency of High-Speed Friction Torque	**Setting Range:** P03.29–P00.03	50.00 Hz	○
P03.32	Torque Control	**Setting Range:** 0–1 0: Disable 1: Enable	0	○
P03.33	Flux Weakening Integral Gain	**Setting Range:** 0.0%–300.0%	30.0%	○
P03.34	Reserved	–	–	–
P03.35	Control Mode Optimization	**Setting Range:** 0x0000–0x1111 *Ones digit: Torque reference selection*	0x0000	○

		0: Torque reference 1: Torque current reference *Tens digit: Reserved* 0: Reserved 1: Reserved *Hundreds digit: indicates whether to enable speed-loop integral separation* 0: Disable 1: Enable *Thousands digit: Reserved* 0: Reserved 1: Reserved		
P03.36	Speed-Loop Differential Time	**Setting Range:** 0.00–10.00s	0.00s	○
P03.37–P03.44	Reserved	–	–	–
P03.45	SM Max. Flux Weakening Current	**Setting Range:** 0.0%–200.0%	100.0%	◎
P03.46	Reserved	–	–	–
P03.47	Bus Voltage Delay Compensation	**Setting Range:** 0–60000	0	○
P03.48–P03.61	Reserved	–	–	–

P04—V/F Control

Function Code	Name	Description	Default	Modifiable?
P04.00	V/F Curve of Motor 1	Specifies the V/F curve type of motor 1 to meet the needs of different loads. **Setting Range:** 0–5 0: Straight-line V/F curve, applicable to constant torque loads 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) Curves 2–4 are applicable to torque loads such as fans and water pumps. You can adjust according to the characteristics of your required loads to achieve best performance. 5: Custom V/F (V/F separation) In this mode, V is separated from F. This way, F can be adjusted through the frequency setting channel specified by P00.06 or the voltage setting channel specified by P04.27 to change the characteristics of the curve.	0	◎
P04.01	Torque Boost of Motor 1	**Setting Range:** 0.0%–10.0% (of the rated voltage of motor 1) **Note:** When the value is set to 0.0%, the VFD uses automatic torque boost.	0.0%	○
P04.02	Torque Boost Cut-Off of Motor 1	**Setting Range:** 0.0%–50.0% (of motor 1's rated frequency)	20.0%	○
P04.03	V/F Frequency Point 1 of motor 1	When P04.00=1 (multi-dot V/F curve), you can adjust the V/F curve by setting P04.03–P04.08 according to your requirements. **Setting Range:** 0.00Hz–P04.05	0.00Hz	○

		Note: • $V_1 < V_2 < V_3$ • $f_1 < f_2 < f_3$ • Too high voltage for too low frequency will cause motor to overheat or take damage and will cause a VFD overcurrent stalling or overcurrent protection.		
P04.04	V/F Voltage Point 1 of Motor 1	**Setting Range:** 0.0%–110.0% (of motor 1's rated voltage) **Note:** Refer to the description for P04.03.	0.0%	○
P04.05	V/F Frequency Point 2 of motor 1	**Setting Range:** P04.03–P04.07 **Note:** Refer to the description for P04.03.	0.00Hz	○
P04.06	V/F Voltage Point 2 of Motor 1	**Setting Range:** 0.0%–110.0% (of motor 1's rated voltage) **Note:** Refer to the description for P04.03.	0.0%	○
P04.07	V/F Frequency Point 3 of motor 1	**Setting Range:** P04.05–P02.02 (AM 1 rated frequency) or P04.05–P02.16 (SM 1 rated frequency) **Note:** Refer to the description for P04.03.	0.00Hz	○
P04.08	V/F Voltage Point 3 of Motor 1	**Setting Range:** 0.0%–110.0% (of motor 1's rated voltage) **Note:** Refer to the description for P04.03.	0.0%	○
P04.09	V/F Slip Compensation Gain of Motor 1	Used to compensate for the change in motor rotation speed caused by a load change in space voltage vector mode, which will improve the rigidity of the motor's mechanical characteristics. **Setting Range:** 0.0%–200.0%	100.0%	○
P04.10	Low-Frequency Oscillation Control Factor of Motor 1	In space voltage vector control mode, the motor, especially a high-powered motor, may ex-	10	○

P04.11	High-Frequency Oscillation Control Factor of Motor 1	perience current oscillation at certain frequencies, which may cause unstable motor operation, or even a VFD overcurrent. You can adjust these two function parameters properly to avoid this. **Setting Range:** 0–100	10	○
P04.12	Oscillation Control Threshold of Motor 1	**Setting Range:** 0.00 Hz–P00.03	30.00 Hz	○
P04.13–P04.26	Reserved	–	–	–
P04.27	Voltage Setting Channel	Specifies the channel through which the VFD receives voltage values. **Setting Range:** 0–7 0: Keypad (P04.28) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step speed operation 6: PID 7: Modbus communication	0	○
P04.28	Setting Voltage Through the Keypad	Specifies the voltage when it's set to be defined via the keypad. **Setting Range:** 0.0%–100.0%	100.0%	○
P04.29	Voltage Increase Time	Refers to the time needed for the VFD to accelerate from min. output voltage to max. output frequency. **Setting Range:** 0.0–3600.0 s	5.0 s	○
P04.30	Voltage Decrease Time	Refers to the time needed for the VFD to decelerate from max. output frequency to min. output voltage. **Setting Range:** 0.0–3600.0 s	5.0s	○

P04.31	Max. Output Voltage	Specifies the upper limit of output voltage. **Setting Range:** P04.32–100.0% (of the motor's rated voltage)	100.0%	◎
P04.32	Min. Output Voltage	Specifies the lower limit of output voltage. **Setting Range:** 0.0%–P04.31 (of the motor's rated voltage)	0.0%	◎
P04.33	Weakening Coefficient in Constant Power Zone	1.00–1.30	1.00	○
P04.34	Pull-In Current 1 in SM V/F Control	While SM V/F control mode is enabled, this function code specifies the reactive current of the motor when the output frequency drops below that specified by P04.36. **Setting Range:** -100.0%–100.0% (of the motor's rated current)	20.0%	○
P04.35	Pull-in Current 2 in SM V/F Control	While SM V/F control mode is enabled, this function code specifies the reactive current of the motor when the output frequency drops below that specified by P04.36. **Setting Range:** -100.0%–100.0% (of the motor's rated current)	10.0%	○
P04.36	Frequency Threshold to Switch Pull-In Currents in SM V/F Control	While SM VF control mode is enabled, this function code specifies the frequency threshold for switching between pull-in current 1 and pull-in current 2. Setting Range: 0.0%–200.0% (of the motor rated frequency).	20.0%	○
P04.37	Reactive Current Closed-Loop Proportional Coefficient in SM V/F Control	While SM VF control mode is enabled, this function code specifies the proportional coefficient of the reactive current closed-loop control. **Setting Range:** 0–3000	50	○

P04.38	Reactive Current Closed-Loop Integral Coefficient in SM V/F control	While SM VF control mode is enabled, the function code specifies the integral coefficient of the reactive current closed-loop control. **Setting Range:** 0–3000	30	○
P04.39–P04.51	Reserved	–	–	–

P05—Input Terminals

Function Code	Name	Description	Default	Modifiable?
P05.00	HDI Input Type	**Setting Range:** 0–1 0: Defines HDIA as a high-speed pulse input 1: Defines HDIA as a digital input	0	◎
P05.01	S1 Function	**Setting Range:** 0–95 0: No function selected 1: Forward-running operation 2: Reverse-running operation 3: Three-wire control mode 4: Jog forward 5: Jog reversely 6: Coast to stop 7: Reset errors 8: Pause running 9: External error input 10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between frequency reference A and reference B 14: Switch between frequency combination setting and setting A	1	◎
P05.02	S2 Function		4	◎
P05.03	S3 Function		7	◎

<table>
<tr><td>P05.04</td><td>S4 Function</td><td rowspan="5">15: Switch between frequency combination setting and setting 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: Pause multi-step speed operation
21: ACC/DEC time selection 1
22: ACC/DEC time selection 2
23: Simple PLC stop/reset
24: Pause simple PLC
25: Pause PID control
26: Pause wobbling frequency
27: Reset wobbling frequency
28: Reset counter
29: Switch between speed control and torque control
30: Disable ACC/DEC
31: Trigger the counter
32: Reserved
33: Temporarily clear the frequency increase/ decrease setting
34: DC braking
35: Reserved
36: Switch the operating command channel to keypad
37: Switch the operating command channel to terminal
38: Switch the operating command channel to modbus communication
39: Start pre-excitation of motor
40: Clear electricity consumption
41: Keep electricity consumption
42: Switch the channel for the braking torque upper limit to keypad</td><td>0</td><td>◎</td></tr>
<tr><td>P05.05</td><td>S5 Function</td><td>0</td><td>◎</td></tr>
<tr><td>P05.06</td><td>S6 Function</td><td>0</td><td>◎</td></tr>
<tr><td>P05.07</td><td>S7 Function</td><td>0</td><td>◎</td></tr>
<tr><td>P05.08</td><td>S8 Function</td><td>0</td><td>◎</td></tr>
</table>

P05.09	HDIA Function	43–55: Reserved 56: Emergency stop 57–60: Reserved 61: Switch PID polarities 62–95: Reserved **Note:** Terminals S5–S8 are virtual terminals, which are enabled via P05.12. After a virtual terminal is enabled, the terminal status can then only be changed in modbus communication mode. The communication address is 0x200A.	0	◎
P05.10	Input Terminal Polarity	Specifies input terminal polarity. When a bit is 0, the input terminal is positive; when a bit is 1, the input terminal is negative. **Setting Range:** 0x000–0x1FF	0x000	○
P05.11	Digital Filter Time	Specifies the sampling filter time of the S1–S8 and HDIA terminals. In cases of strong interference, increase the value to avoid malfunction. **Setting Range:** 0.000–1.000s	0.010s	○
P05.12	Enable Virtual Terminals	**Setting Range:** 0x00–0x3F 0: Disable 1: Enable Bit 0: S1 virtual terminal Bit 1: S2 virtual terminal Bit 2: S3 virtual terminal Bit 3: S4 virtual terminal Bit 4: S5 virtual terminal Bit 5: S6 virtual terminal Bit 6: S7 virtual terminal Bit 7: S8 virtual terminal Bit 8: HDIA virtual terminal **Note:** After a virtual terminal is enabled, the terminal status can then only be changed in modbus communication mode. The communication address is 0x200A.	0x00	◎

P05.13	Terminal Control Mode	Specifies the terminal control mode. **Setting Range:** 0–3 0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0	◎
P05.14	S1 Switch-On Delay	Specifies the delay time corresponding to the change in electrical level when a programmable input terminal switches on or switches off. **Setting Range:** 0.000–50.000s **Note:** Terminals S5–S8 are virtual terminals, which are enabled via P05.12. After a virtual terminal is enabled, the terminal status can then only be changed in modbus communication mode. The communication address is 0x200A.	0.000s	○
P05.15	S1 Switch-Off Delay		0.000s	○
P05.16	S2 Switch-On Delay		0.000s	○
P05.17	S2 Switch-Off Delay		0.000s	○
P05.18	S3 Switch-On Delay		0.000s	○
P05.19	S3 Switch-Off Delay		0.000s	○
P05.20	S4 Switch-On Delay		0.000s	○
P05.21	S4 Switch-Off Delay		0.000s	○
P05.22	S5 Switch-On Delay		0.000s	○
P05.23	S5 Switch-Off Delay		0.000s	○
P05.24	S6 Switch-On Delay		0.000s	○
P05.25	S6 Switch-Off Delay		0.000s	○
P05.26	S7 Switch-On Delay		0.000s	○
P05.27	S7 Switch-Off Delay		0.000s	○
P05.28	S8 Switch-On Delay		0.000s	○
P05.29	S8 Switch-Off Delay		0.000s	○
P05.30	HDIA Switch-On Delay		0.000s	○
P05.31	HDIA Switch-Off Delay		0.000s	○

P05.32	AI1 Input Lower Limit	**Setting Range:** 0.00V–P05.34	0.00V	○
P05.33	Corresponding Setting of AI1 Lower Limit	**Setting Range:** -300.0%–300.0%	0.0%	○
P05.34	AI1 Input Upper Limit	**Setting Range:** P05.32–10.00V	10.00V	○
P05.35	Corresponding Setting of AI1 Upper Limit	**Setting Range:** -300.0%–300.0%	100.0%	○
P05.36	AI1 Input Filter Time	**Setting Range:** 0.000–10.000s	0.030s	○
P05.37	AI2 Input Lower Limit	**Setting Range:** 0.00V–P05.39	0.00V	○
P05.38	Corresponding Setting of AI2 Lower Limit	**Setting Range:** -300.0%–300.0%	0.0%	○
P05.39	AI2 Input Upper Limit	**Setting Range:** P05.37–10.00V	10.00V	○
P05.40	Corresponding Setting of AI2 Upper Limit	**Setting Range:** -300.0%–300.0%	100.0%	○
P05.41	AI2 Input Filter Time	**Setting Range:** 0.000–10.000s	0.030s	○
P05.42	AI3 Input Lower Limit	**Setting Range:** 0.00V–P05.44	0.00V	○
P05.43	Corresponding Setting of AI3 Lower Limit	**Setting Range:** -300.0%–300.0%	0.0%	○
P05.44	AI3 Input Upper Limit	**Setting Range:** P05.42–10.00V	10.00V	○

P05.45	Corresponding Setting of AI3 Upper Limit	**Setting Range:** -300.0%–300.0%	100.0%	○
P05.46	AI3 Input Filter Time	**Setting Range:** 0.000–10.000s	0.030s	○
P05.47	HDIA Frequency Lower Limit	**Setting Range:** 0.000kHz–P05.49	0.000kHz	○
P05.48	Corresponding Setting of HDIA Frequency Lower Limit	**Setting Range:** -300.0%–300.0%	0.0%	○
P05.49	HDIA Frequency Upper Limit	**Setting Range:** P05.47–50.000kHz	50.000kHz	○
P05.50	Corresponding Setting of HDIA Frequency Upper Limit	**Setting Range:** -300.0%–300.0%	100.0%	○
P05.51	HDIA Frequency Input Filter Time	**Setting Range:** 0.000–10.000s	0.030s	○
P05.52	AI1 Input Signal Type	**Setting Range:** 0–1 0: Voltage 1: Current **Note:** When the switch of AI1 is turned to "V", set the value to 0; otherwise, set the value to 1.	0	◎
P05.53	Channel for AI3 Input Signal	Specifies the channel through which the VFD receives AI3 input signals. **Setting Range:** 0–1 0: Local potentiometer 1: External keypad potentiometer **Note:** For details, see the analog potentiometer description in Section 5 Keypad Operation Guidelines.	0	◎

P06—Output Terminals

<table>
<tr><th>Function Code</th><th>Name</th><th>Description</th><th>Default</th><th>Modifiable?</th></tr>
<tr><td>P06.00</td><td>Reserved</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>P06.01</td><td>Y1 Output</td><td rowspan="3">Setting Range: 0–63
0: Disable
1: Operating (Running)
2: Forward running operation
3: Reverse running operation
4: Jogging
5: VFD in error state
6: Frequency level detection FDT1
7: Frequency level detection FDT2
8: Frequency reached
9: Running in zero speed
10: Frequency upper limit reached
11: Frequency lower limit reached
12: Ready for operation
13: Pre-excitation
14: Overload pre-alarm
15: Underload pre-alarm
16: Simple PLC stage completed
17: Simple PLC cycle completed
18: Set counting value reached
19: Designated counting value reached
20: External error
21: Reserved
22: Running time reached
23: modbus communication virtual terminal output
24: Reserved
25: Reserved
26: DC bus voltage established</td><td>0</td><td>○</td></tr>
<tr><td>P06.02</td><td>Reserved</td><td>–</td><td>–</td></tr>
<tr><td>P06.03</td><td>RO1 Output</td><td>1</td><td>○</td></tr>
</table>

		27–28: Reserved 29: STO action 30–36: Reserved 37: Any frequency reached 38–63: Reserved		
P06.04	Reserved	–	–	–
P06.05	Output Terminal Polarity	Specifies output terminal polarity. **Setting Range:** 0x00–0x0F BIT0: Y1 Bit1: Reserved Bit 2: RO1 Bit 3: Reserved	0x00	○
P06.06	Y1 Switch-On Delay	Specifies the delay time corresponding to the change in electrical level when a programmable output terminal switches on or switches off. **Setting Range:** 0.000–50.000s	0.000s	○
P06.07	Y1 Switch-Off Delay	Specifies the delay time corresponding to the change in electrical level when a programmable output terminal switches on or switches off. **Setting Range:** 0.000–50.000s	0.000s	○
P06.08–P06.09	Reserved	–	–	–
P06.10	RO1 Switch-On Delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. **Setting Range:** 0.000–50.000s	0.000s	○
P06.11	RO1 Switch-Off Delay	Specifies the delay time corresponding to the electrical level change when a programmable output terminal switches on or switches off. **Setting Range:** 0.000–50.000s	0.000s	○
P06.12–P06.13	Reserved	–	–	–

P06.14	AO1 Output	**Setting Range:** 0–63 0: Operating frequency (100% corresponds to max. output frequency) 1: Set frequency (100% corresponds to max. output frequency) 2: Ramp reference frequency (100% corresponds to max. output frequency) 3: Rotational speed (100% corresponds to the speed corresponding to the max. output frequency) 4: Output current (100% corresponds to twice the VFD rated current) 5: Output current (100% corresponds to twice the motor rated current) 6: Output voltage (100% corresponds to 1.5 times the VFD rated voltage) 7: Output power (100% corresponds to twice the motor rated power) 8: Set torque (100% corresponds to twice the motor rated torque) 9: Output torque (Absolute value, 100% corresponds to twice the motor rated torque) 10: AI1 input (0–10V or 0–20mA) 11: AI2 input (0–10V) 12: AI3 input (0–10V) 13: HDIA input (0.00–50.00kHz) 14: Value 1 set through Modbus communication (0–1000) 15: Value 2 set through Modbus communication (0–1000) 16–21: Reserved 22: Torque current (100% corresponds to triple the motor rated current) 23: Exciting current (100% corresponds to triple the motor rated current) 24: Set frequency (bipolar)	0	○

		25: Ramp reference frequency (bipolar) 26: Rotational speed (bipolar) 27–29: Reserved 30: Rotational speed (100% corresponds to twice the motor rated synchronous speed) 31: Output torque (100% corresponds to twice the motor rated torque) 32–63: Reserved		
P06.15–P06.16	Reserved	–	–	
P06.17	AO1 Output Lower Limit	**Setting Range:** -300.0%–P06.19	0.0%	○
P06.18	AO1 Output Corresponding to Lower Limit	**Setting Range:** 0.00–10.00V	0.00V	○
P06.19	AO1 Output Upper Limit	**Setting Range:** P06.17–300.0%	100.0%	○
P06.20	AO1 Output Corresponding to Upper Limit	**Setting Range:** 0.00–10.00V	10.00V	○
P06.21	AO1 Output Filter Time	**Setting Range:** 0.000–10.000s	0.000s	○
P06.22–P06.32	Reserved	–	–	–
P06.33	Detection Value for Frequency Being Reached	Specifies the threshold value for the VFD to output the "frequency reached" signal (provided this lasts for at least the duration of the the time specified by P06.34). **Setting Range:** 0.00Hz–P00.03	1.00Hz	○
P06.34	Detection Time for Frequency Being Reached	**Setting Range:** 0–3600.0s	0.5s	○

P07—Human-Machine Interface

Function Code	Name	Description	Default	Modifiable?
P07.00	User password	The user password protection function is disabledby default. If P07.00 is set to any non-zero value, the password protection function is enabled. After you exit the function code editing interface, the password takes effect within 1 min. When you press the PRG/JOG key, "0.0.0.0.0" is displayed. You then need to enter the correct user password to access the function code editing interface. When you set the value to 00000, the user password you have set is cleared, and the password protection function is disabled. **Setting Range:** 0–65535	0	○
P07.01	Parameter Copying	**Setting Range:** 0–4 0: Disable 1: Upload parameters to the keypad 2: Download all parameters 3: Download only non-motor parameters 4: Download only motor parameters **Note:** The parameter copying function is available only for the external parameter copying keypad, not for the local LED keypad or an external common keyboard.	0	◎
P07.02	Key Function	**Setting Range:** 0x00–0x26 *Ones digit: Function selection of PRO/JOG (pressed long)* 0: No function 1: Jog 2: Reserved 3: Switch between forward/reverse rotation 4: Clear the UP/DOWN setting	0x01	◎

		5: Coast to stop 6: Switch command channels in sequence (P07.03) *Tens digit: Reserved*		
P07.03	Sequence of Switching Operating Command Channels Through PRO/JOG (Long Press)	Specifies the sequence of switching operating command channels by pressing the key when P07.02=6. **Setting Range:** 0–3 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication	0	○
P07.04	Stop Function Validity of STOP/RST	Specifies the circumstances under which the STOP/RST key can be used. For error reset, the key is always available. **Setting Range:** 0–3 0: Usable in keypad control mode only 1: Usable both in keypad and terminal control mode 2: Usable both in keypad and modbus communication control mode 3: Usable in all control modes	0	○
P07.05	Selection 1 of Parameters Displayed in Running State	**Setting Range:** 0x0000–0xFFFF Bit 0: Operating frequency (“Hz” ON) Bit 1: Set frequency (“Hz” blinking) Bit 2: Bus voltage (“V” ON) Bit 3: Output voltage (“V” ON) Bit 4: Output current (“A” ON) Bit 5: Running speed (“RPM” ON) Bit 6: Output power (“%” ON) Bit 7: Output torque (“%” ON) Bit 8: PID reference value (“%” blinking) Bit 9: PID feedback value (“%” ON)	0x03FF	○

		Bit 10: Input terminal status Bit 11: Output terminal status Bit 12: Set torque (“%” ON) Bit 13: Pulse count value Bit 14: Motor overload percentage (“%” ON) Bit 15: PLC and current step number of multi-step speed		
P07.06	Selection 2 of Parameters Displayed in Running State	**Setting Range:** 0x0000–0Xffff Bit 0: AI1 (“V” ON) Bit 1: AI2 (“V” ON) Bit 2: AI3 (“V” ON) Bit 3: High-speed pulse HDIA frequency Bit 4: Reserved Bit 5: VFD overload percentage (“%” ON) Bit 6: Ramp frequency reference (“Hz” ON) Bit 7: Linear speed Bit 8: Reserved Bit 9: Frequency upper limit Bit 10–Bit 15: Reserved	0x0000	○
P07.07	Selection of Parameters Displayed in Stopped State	**Setting Range:** 0x0000–0xFFFF Bit 0: Set frequency (Hz “ON”, blinking slowly) Bit 1: Bus voltage (“V” ON) Bit 2: Input terminal status Bit 3: Output terminal status Bit 4: PID reference value (“%” blinking) Bit 5: PID feedback value (“%” ON) Bit 6: Set torque (“%” ON) Bit 7: AI1 value (“V” ON) Bit 8: AI2 value (“V” ON) Bit 9: AI3 value (“V” ON) Bit 10: High-speed pulse HDIA frequency Bit 11: Reserved	0x00FF	○

		Bit 12: Count value Bit 13: PLC and current step number of multi-step speed operation Bit 14: Frequency upper limit Bit 15: Reserved		
P07.08	Frequency Display Coefficient	**Setting Range:** 0.01–10.00 Displayed frequency=Operating frequency · P07.08	1.00	○
P07.09	Rotational Speed Display Coefficient	**Setting Range:** 0.1%–999.9% Mechanical rotation speed=120·(Displayed operating frequency)·P07.09/(Number of motor pole pairs)	100.0%	○
P07.10	Linear Speed Display Coefficient	**Setting Range:** 0.1%–999.9% Linear speed = (Mechanical rotation speed) · P07.10	1.0%	○
P07.11	Control Board Software Version	**Setting Range:** 1.00–655.35	Version-dependent	●
P07.12	Inverter Temperature	**Setting Range:** -20.0°C–120.0°C	0.0°C	●
P07.13	Drive Board Software Version	**Setting Range:** 1.00–655.35	Version-dependent	●
P07.14	Local Accumulative Running Time	**Setting Range:** 0–65535h	0h	●
P07.15	VFD Electricity Consumption High Bit	Displays the VFD's electricity consumption. VFD electricity consumption=P07.15 · 1000 + P07.16 **Setting Range:** 0–65535kWh (·1000)	0kWh	●
P07.16	VFD Electricity Consumption Low Bit	Displays the VFD's electricity consumption. VFD electricity consumption=P07.15 · 1000 + P07.16 **Setting Range:** 0.0–999.9kWh	0.0kWh	●

P07.17	VFD Model	**Setting Range:** 0–1	0	●
P07.18	VFD Rated Power	**Setting Range:** 0.4–3000.0kW	0.4kW	●
P07.19	VFD Rated Voltage	**Setting Range:** 50–520V	380V	●
P07.20	VFD Rated Current	**Setting Range:** 0.01–600.00A	0.01A	●
P07.21	Factory Bar Code 1	**Setting Range:** 0x0000–0xFFFF	0xFFFF	●
P07.22	Factory Bar Code 2	**Setting Range:** 0x0000–0xFFFF	0xFFFF	●
P07.23	Factory Bar Code 3	**Setting Range:** 0x0000–0xFFFF	0xFFFF	●
P07.24	Factory Bar Code 4	**Setting Range:** 0x0000–0xFFFF	0xFFFF	●
P07.25	Factory Bar Code 5	**Setting Range:** 0x0000–0xFFFF	0xFFFF	●
P07.26	Factory Bar Code 6	**Setting Range:** 0x0000–0xFFFF	0xFFFF	●
P07.27	Present Error Type	**Setting Range:** 0–94 0: No error 1–3: Reserved 4: Overcurrent during ACC (E4) 5: Overcurrent during DEC (E5) 6: Overcurrent during constant speed running (E6) 7: Overvoltage during ACC (E7) 8: Overvoltage during DEC (E8) 9: Overvoltage during constant speed running (E9) 10: Bus undervoltage error (E10) 11: Motor overload (E11) 12: VFD overload (E12) 13: Phase loss on input side (E13) 14: Phase loss on output side (E14) 15: Reserved	0	●
P07.28	Last Error Type		0	●

<table>
<tr><td>P07.29</td><td>2nd-Last Error Type</td><td rowspan="4">16: Inverter module overheat (E16)
17: External error (E17)
18: Modbus communication error (E18)
19: Current detection error (E19)
20: Motor autotuning error (E20)
21: EEPROM operation error (E21)
22: PID feedback offline error (E22)
23: Braking unit error (E23)
24: Running time reached (E24)
25: Electronic overload (E25)
26: Reserved
27: Parameter upload error (E27)
28: Parameter download error (E28)
29–31: Reserved
32: To-ground short-circuit error 1 (E32)
33: To-ground short-circuit error 2 (E33)
34: Speed deviation error (E34)
35: Mal-adjustment error (E35)
36: Underload error (E36)
37–39: Reserved
40: Safe torque off (E40)
41: Exception to safety circuit of channel 1 (E41)
42: Exception to safety circuit of channel 2 (E42)
43: Exception to both channels 1 and 2 (E43)
44: AI1 disconnection error (E44)
45: AI2 disconnection error (E45)
46: AI3 disconnection error (E46)
44–91: Reserved
92: AI1 disconnection error (E92)
93: AI2 disconnection error (E93)
94: AI3 disconnection error (E94)</td><td>0</td><td>●</td></tr>
<tr><td>P07.30</td><td>3rd-Last Error Type</td><td>0</td><td>●</td></tr>
<tr><td>P07.31</td><td>4th-Last Error Type</td><td>0</td><td>●</td></tr>
<tr><td>P07.32</td><td>5th-Last Error Type</td><td>0</td><td>●</td></tr>
</table>

P07.33	Operating Frequency at Present Error	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P07.34	Ramp Reference Frequency at Present Error	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P07.35	Output Voltage at Present Error	**Setting Range:** 0–1200 V	0 V	●
P07.36	Output Current at Present Error	**Setting Range:** 0.00–630.00 A	0.00 A	●
P07.37	Bus Voltage at Present Error	**Setting Range:** 0.0–2000.0 V	0.0 V	●
P07.38	Temperature at Present Error	**Setting Range:** -20.0°C–120.0°C	0.0°C	●
P07.39	Input Terminal Status at Present Error	**Setting Range:** 0x0000–0xFFFF	0x0000	●
P07.40	Output Terminal Status at Present Error	**Setting Range:** 0x0000–0xFFFF	0x0000	●
P07.41	Operating Frequency at Last error	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P07.42	Ramp Reference Frequency at Last Error	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P07.43	Output Voltage at Last Error	**Setting Range:** 0–1200 V	0 V	●
P07.44	Output Current at Last Error	**Setting Range:** 0.00–630.00 A	0.00 A	●
P07.45	Bus Voltage at Last Error	**Setting Range:** 0.0–2000.0 V	0.0 V	●

P07.46	Temperature at Last Error	**Setting Range:** -20.0°C–120.0°C	0.0°C	●
P07.47	Input Terminal Status at Last Error	**Setting Range:** 0x0000–0xFFFF	0x0000	●
P07.48	Output Terminal Status at Last Error	**Setting Range:** 0x0000–0xFFFF	0x0000	●
P07.49	Operating Frequency at 2nd-Last Error	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P07.50	Ramp Reference Frequency at 2nd-Last Error	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P07.51	Output Voltage at 2nd-Last Error	**Setting Range:** 0–1200 V	0 V	●
P07.52	Output Current at 2nd-Last Error	**Setting Range:** 0.00–630.00 A	0.00 A	●
P07.53	Bus Voltage at 2nd-Last Error	**Setting Range:** 0.0–2000.0 V	0.0 V	●
P07.54	Temperature at 2nd-Last Error	**Setting Range:** -20.0°C–120.0°C	0.0°C	●
P07.55	Input Terminal Status at 2nd-Last Error	**Setting Range:** 0x0000–0xFFFF	0x0000	●
P07.56	Output Terminal Status at 2nd-Last Error	**Setting Range:** 0x0000–0xFFFF	0x0000	●

P08—Enhanced Functions

Function Code	Name	Description	Default	Modifiable?
P08.00	ACC Time 2	**Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.01	DEC Time 2	**Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.02	ACC Time 3	**Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.03	DEC Time 3	**Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.04	ACC Time 4	**Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.05	DEC Time 4	**Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.06	Operating Frequency of Jogging Function	Specifies the reference frequency used for the jogging function. **Setting Range:** 0.00Hz–P00.03	5.00Hz	○
P08.07	ACC Time for Jogging Function	Specifies the time needed for the VFD to accelerate from 0Hz to the max. output frequency (P00.03). **Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.08	DEC Time for Jogging Function	Specifies the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. **Setting Range:** 0.0–3600.0s	Model-dependent	○
P08.09	Jump Frequency 1	The VFD can avoid mechanical resonance points by setting jump frequencies. When the set frequency is within the jump frequency range, the VFD will run at the jump frequency boundary.	0.00Hz	○

		The VFD supports the setting of three jump frequencies. When the jump frequency points are set to 0, this function is inactive. **Setting Range:** 0.00 Hz–P00.03		
P08.10	Jump Frequency Amplitude 1	See the description of P08.09. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	○
P08.11	Jump Frequency 2	See the description of P08.09. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	○
P08.12	Jump Frequency Amplitude 2	See the description of P08.09. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	○
P08.13	Jump Frequency 3	See the description of P08.09. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	○
P08.14	Jump Frequency Amplitude 3	See the description of P08.09. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	○
P08.15	Amplitude of Wobbling Frequency	**Setting Range:** 0.0%–100.0% (of the set frequency)	0.0%	○
P08.16	Amplitude of Sudden Jump Frequency	**Setting Range:** 0.0%–50.0% (of the wobbling frequency amplitude)	0.0%	○
P08.17	Rise Time of Wobbling Frequency	**Setting Range:** 0.1–3600.0 s	5.0 s	○
P08.18	Fall Time of Wobbling Frequency	**Setting Range:** 0.1–3600.0 s	5.0 s	○
P08.19	Switching Frequency of ACC/DEC Time	**Setting Range:** 0.00 Hz–P00.03 0.00 Hz: No switchover If the operating frequency surpasses P08.19, the device switches to ACC/DEC time 2.	0.00 Hz	○
P08.20	Frequency Threshold of the Start of Droop Control	**Setting Range:** 0.00–50.00 Hz	2.00 Hz	○

P08.21	Reference Frequency of ACC/DEC Time	**Setting Range:** 0–2 0: Max. output frequency 1: Set frequency 2: 100 Hz **Note:** Valid for straight ACC/DEC only.	0	◎
P08.22	Output Torque Calculation Method	**Setting Range:** 0–1 0: Based on torque current 1: Based on output power	0	○
P08.23	Number of Decimal Points in Frequency Value	**Setting Range:** 0–1 0: Two 1: One	0	○
P08.24	Number of Decimal Points in Linear Speed Value	**Setting Range:** 0–3 0: No decimal point 1: One 2: Two 3: Three	0	○
P08.25	Set Counting Value	**Setting Range:** P08.26–65535	0	○
P08.26	Designated Counting Value	**Setting Range:** 0–P08.25	0	○
P08.27	Set Running Time	**Setting Range:** 0–65535 min	0 min	○
P08.28	Auto Error Reset Count	Specifies the number of consecutive times the VFD uses its automatic error reset function. When the number of consecutive resets exceeds this value, the VFD reports an error and stops. After the VFD starts, if no error occurred within 600 s, P08.28 is reset to zero. **Setting Range:** 0–10	0	○
P08.29	Auto Error Reset Interval	Specifies the time interval from when an error occurred to when automatic error reset takes effect.	1.0 s	○

		Setting Range: 0.1–3600.0 s		
P08.30	Frequency Decrease Ratio in Droop Control	Specifies the variation rate of the VFD output frequency based on the load. It is mainly used in balancing the power when multiple motors drive the same load. **Setting Range:** 0.00–50.00 Hz	0.00 Hz	○
P08.31	Reserved	–	–	–
P08.32	FDT1 Electrical Level Detection Value	Used to view the FDT1 electrical level detection value. When the output frequency exceeds the corresponding frequency of the FDT electrical level, the multifunction digital output terminal continuously outputs the signal of “Frequency level detection FDT”. The signal deactivates only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level) – (FDT lagging detection value). **Setting Range:** 0.00 Hz–P00.03	50.00 Hz	○
P08.33	FDT1 Lagging Detection Value	Used to view the FDT1 lagging detection value. When the output frequency exceeds the corresponding frequency of the FDT electrical level, the multifunction digital output terminal continuously outputs the signal of “Frequency level detection FDT”. The signal deactivates only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level) – (FDT lagging detection value). **Setting Range:** 0.0%–100.0% (relative to FDT1 electrical level)	5.0%	○
P08.34	FDT2 Electrical Level Detection Value	Used to view the FDT2 electrical level detection value. When the output frequency exceeds the corresponding frequency of the FDT electrical level, the multifunction digital output terminal continuously outputs the signal of “Frequency level detection FDT”. The signal deactivates only when the output frequency decreases to a value lower than the	50.00Hz	○

		frequency corresponding to (FDT electrical level) – (FDT lagging detection value). **Setting Range:** 0.00 Hz–P00.03		
P08.35	FDT2 Lagging Detection Value	Used to view the FDT2 lagging detection value. When the output frequency exceeds the corresponding frequency of the FDT electrical level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal deactivates only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level) – (FDT lagging detection value). **Setting Range:** 0.0%–100.0% (relative to FDT2 electrical level)	5.0%	○
P08.36	Detection Value for Frequency Being Reached	When the output frequency is within the detection range, the multifunction digital output terminal outputs the signal of "Frequency reached". **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	○
P08.37	Dynamic Braking	**Setting Range:** 0–1 0: Disable 1: Enable	1	○
P08.38	Dynamic Braking Threshold Voltage	Specifies the starting bus voltage for dynamic braking. Adjust this value according to your device's load to achieve optimized braking. The default value varies depending on the voltage class. **Setting Range:** 200.0–2000.0 V	**For 220 V models:** 380.0 V **For 380 V models:** 700.0 V	○
P08.39	Cooling Fan Operation Mode	**Setting Range:** 0–2 0: Normal mode 1: Permanent operation after power-on 2: Operation mode 2	0	○
P08.40	PWM Settings	**Setting Range:** 0x0000–0x221	0x100	◎

		Ones digit: PWM mode selection 0: PWM mode 1, 3PH modulation 1: PWM mode 2, 3PH modulation and 2PH modulation *Tens digit: PWM low-speed carrier frequency limit* 0: Low-speed carrier frequency limit mode 1 1: Low-speed carrier frequency limit mode 2 2: No limit on low-speed carrier frequency *Hundreds digit: Deadzone compensation method* 0: Compensation method 1 1: Compensation method 2		
P08.41	Overmodulation Settings	Setting Range: 0x0000–0x1111 *Ones digit: Overmodulation on/off* 0: Disable 1: Enable *Tens digit: Reserved* *Hundreds digit: Carrier frequency limit* 0: Yes 1: No *Thousands digit: Reserved*	0x1001	◎
P08.42–P08.43	Reserved	–	–	–
P08.44	UP/DOWN Terminal Control Settings	**Setting Range:** 0x000–0x221 *Ones digit: Frequency setting selection* 0: Enable use of the setting made via UP/DOWN terminal. 1: Disable use of the setting made via UP/DOWN terminal. *Tens digit: Frequency control selection* 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods	0x000	○

		2: Invalid for multi-step speed operation when multi-step speed operation has priority *Hundreds digit: Stop action* 0: Setting remains valid. 1: Valid during operation, cleared after stop 2: Valid during operation, cleared after a stop command is received		
P08.45	Frequency Integral Rate of the UP terminal	**Setting Range:** 0.01–50.00 Hz/s	0.50 Hz/s	○
P08.46	Frequency Integral Rate of the DOWN Terminal	**Setting Range:** 0.01–50.00 Hz/s	0.50 Hz/s	○
P08.47	Action at Power-Off During Frequency Setting	**Setting Range:** 0x000–0x111 *Ones digit: Reserved* *Tens digit: Action selection at power-off during frequency adjusting (through Modbus communication)* 0: Save the setting at power-off. 1: Clear the setting at power-off. *Hundreds digit: Reserved*	0x000	○
P08.48	Initial Electricity Consumption High Bit	Specifies the initial electricity consumption. Initial electricity consumption = P08.48 × 1000 + P08.49 **Setting Range:** 0–59999 kWh (k)	0 kWh	○
P08.49	Initial Electricity Consumption Low Bit	Specifies the initial electricity consumption. Initial electricity consumption = P08.48 × 1000 + P08.49 **Setting Range:** 0.0–999.9 kWh	0.0 kWh	○
P08.50	Magnetic Flux Braking	Used to enable the magnetic flux braking. Magnetic flux braking can be used to stop the motor, as well as to change the motor's rotation speed. The current of the stator (but not	0	○

		the rotor) increases during magnetic flux braking; therefore the cooling is better. 0: Disable 100–150: A larger value indicates stronger braking. **Setting Range:** 0; 100–150		
P08.51	VFD Input Power Factor	Used to adjust the current display value on the AC input side. **Setting Range:** 0.00–1.00	0.56	○
P08.52	STO Lock	**Setting Range:** 0–1 0: Lock upon STO (E40) alarm This indicates that upon an STO alarm occurring, manual resetting is required after the VFD recovers from the error. 1: Don't lock upon STO (E40) alarm This indicates that upon an STO alarm occurring, the alarm disappears automatically after the VFD recovers from the error.	0	○
P08.53	Upper Limit Frequency Bias Value in Torque Control	**Setting Range:** 0.00 Hz–P00.03 **Note:** Applicable to torque control mode only.	0.00 Hz	○
P08.54	Upper Limit of ACC/DEC Times in Torque Control	**Setting Range:** 0–4 0: No limit on acceleration or deceleration 1: ACC/DEC time 1 2: ACC/DEC time 2 3: ACC/DEC time 3 4: ACC/DEC time 4	0	○
P08.55	Auto Carrier Frequency Reduction	**Setting Range:** 0–1 0: Disable 1: Enable **Note:** Automatic carrier frequency reduction indicates that the VFD automatically reduces	0	○

		the carrier frequency when detecting that the heat sink temperature exceeds the rated temperature. When the temperature decreases to a specified value, the carrier frequency is restored to its previous setting. This function can reduce the chances of a VFD overheating alarm occurring.		
P08.56	Min. Carrier Frequency	**Setting Range:** 0.0–15.0kHz	4.0kHz	○
P08.57	Temperature Point of Auto Carrier Frequency Reduction	**Setting Range:** 40.0°C–85.0°C	70.0°C	○
P08.58	Interval of Carrier Frequency Reduction	**Setting Range:** 0–30ss	10s	○
P08.59	AI1 Disconnection Detection Threshold	**Setting Range:** 0%–100% (relative to 10V)	0%	○
P08.60	AI2 Disconnection Detection Threshold	**Setting Range:** 0%–100% (relative to 10V)	0%	○
P08.61	AI3 Disconnection Detection Threshold	**Setting Range:** 0%–100% (relative to 10V)	0%	○
P08.62	Output Current Filter Time	**Setting Range:** 0.000–10.000s	0.000s	○
P08.63	Output Torque Filter Times	**Setting Range:** 0–8	8	○
P08.64	STO Function	**Setting Range:** 0–1 0: Disable 1: Enable	0	○
P08.65	STO Power Supply Detection	**Setting Range:** 0–1 0: Normal 1: Abnormal	0	●
P08.66–P08.68	Reserved	–	–	–

P09—PID Control

Function Code	Name	Description	Default	Modifiable?
P09.00	Channel for PID Reference Value	Specifies the channel through which the VFD will receive target values during the PID process. **Setting Range:** 0–6 0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step speed operation 6: Modbus communication **Note:** The set target of PID control is a relative value, for which 100% refers to 100% of the feedback signal of the controlled system. The system always calculates a related value (0.0%–100.0%).	0	○
P09.01	Setting PID Reference Through the Keypad	Specifies the PID reference value when it's set to be defined via the keypad. **Setting Range:** -100.0%–100.0%	0.0%	○
P09.02	Channel for PID Feedback	Specifies the PID feedback source. **Setting Range:** 0–4 0: AI1 1: AI2 2: AI3 3: HDIA 4: Modbus communication **Note:** The reference channel and feedback channel cannot be assigned twice, otherwise PID control cannot work properly.	0	○
P09.03	PID Output Characteristics	**Setting Range:** 0–1 0: PID output is positive.	0	○

		When the feedback signal is greater than the PID reference value, the output frequency of the VFD will decrease to balance the PID. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will increase to balance the PID.		
P09.04	Proportional Gain (Kp)	Specifies the proportional gain of PID input. **Setting Range:** 0.00–100.00	1.80	○
P09.05	Integral Time (Ti)	Determines the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. **Setting Range:** 0.00–10.00s	0.90s	○
P09.06	Differential Time (Td)	Determines the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. **Setting Range:** 0.00–10.00s	0.00s	○
P09.07	Sampling Cycle (T)	Specifies the feedback sampling cycle. The regulator calculates in each sampling cycle. A longer sampling cycle indicates a slower response. **Setting Range:** 0.001–1.000s	0.001s	○
P09.08	PID Control Deviation Limit	Specifies the max. deviation allowed by the output of PID system relative to the closed loop reference, which can adjust the accuracy and stability of the PID system. Setting Range: 0.0–100.0%	0.0%	○
P09.09	PID Output Upper Limit	Specifies the upper limit of the PID output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). **Setting Range:** P09.10–100.0%	100.0%	○

P09.10	PID Output Lower Limit	Specifies the lower limit of the PID output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). **Setting Range:** -100.0%–P09.09	0.0%	○
P09.11	Feedback Offline Detection Value	Specifies the PID feedback offline detection value. **Setting Range:** 0.0%–100.0%	0.0%	○
P09.12	Feedback Offline Detection Time	**Setting Range:** 0.0–3600.0s	1.0s	○
P09.13	PID Control Settings	**Setting Range:** 0x0000–0x1111 *Ones digit:* 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit *Tens digit:* 0: Same as the main reference direction 1: Contrary to the main reference direction *Hundreds digit:* 0: Limit as per the max. frequency 1: Limit as per frequency reference value A *Thousands digit:* 0: Frequency A+B. ACC/DEC of main reference A frequency source buffering is invalid. 1: Frequency A+B. ACC/DEC of main reference A frequency source buffering is valid. The ACC/DEC is determined by P08.04 (ACC time 4).	0x0001	○
P09.14	Low Frequency Proportional Gain (Kp)	**Setting Range:** 0.00–100.00 Low-frequency switching point: 5.00Hz High-frequency switching point: 10.00Hz P09.04 corresponds to the high-frequency parameter, and the middle is the linear interpolation between these two points.	1.00	○

P09.15	ACC/DEC Time of PID Command	**Setting Range:** 0.0–1000.0s	0.0s	○
P09.16	PID Output Filter Time	**Setting Range:** 0.000–10.000s	0.000s	○
P09.17	Reserved	–	–	–
P09.18	Low Frequency Integral time (Ti)	**Setting Range:** 0.00–10.00s	0.90s	○
P09.19	Low Frequency Differential Time (Td)	**Setting Range:** 0.00–10.00s	0.00s	○
P09.20	Low Frequency Point for PID Parameter Switching	**Setting Range:** 0.00–P09.21	5.00Hz	○
P09.21	High Frequency Point for PID Parameter Switching	**Setting Range:** P09.20–P00.03	10.00Hz	○
P09.22–P09.26	Reserved	–	–	–

P10—Simple PLC and Multi-Step Speed Control

Function Code	Name	Description	Default	Modifiable?
P10.00	Simple PLC Mode	**Setting Range:** 0–2 0: Stop after running once. The VFD stops automatically after running for one cycle, and you have to issue a new operating command to restart it. 1: Keep running on the final value after running for one cycle. The VFD sticks to the operating 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 it receives a stop command.	0	○

P10.01	Simple PLC Memory Selection	**Setting Range:** 0–1 0: Do not memorize at power outage 1: Memorize at power outage. The PLC memories its running stage and operating frequency before power-off.	0	○
P10.02	Multi-Step Speed 0	**Setting Range:** -300.0%–300.0% 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.03	Running Time Step 0	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.04	Multi-Step Speed 1	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.05	Running Time Step 1	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.06	Multi-Step Speed 2	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.07	Running Time Step 2	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.08	Multi-Step Speed 3	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.09	Running Time Step 3	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.10	Multi-Step Speed 4	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.11	Running Time Step 4	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○

P10.12	Multi-Step Speed 5	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.13	Running Time Step 5	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.14	Multi-Step Speed 6	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.15	Running Time Step 6	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.16	Multi-Step Speed 7	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.17	Running Time Step 7	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.18	Multi-Step Speed 8	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.19	Running Time Step 8	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.20	Multi-Step Speed 9	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.21	Running Time Step 9	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.22	Multi-Step Speed 10	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.23	Running Time Step 10	**Setting Range:** 0.0–6553.5s (min)	0.0s (min)	○

		The time unit is specified by P10.37.		
P10.24	Multi-Step Speed 11	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.25	Running Time Step 11	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.26	Multi-Step Speed 12	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.27	Running Time Step 12	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.28	Multi-Step Speed 13	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.29	Running Time Step 13	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.30	Multi-Step Speed 14	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.31	Running Time Step 14	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.32	Multi-Step Speed 15	**Setting Range:** -300.0–300.0% The setting 100.0% corresponds to the max. output frequency (P00.03).	0.0%	○
P10.33	Running Time Step 15	**Setting Range:** 0.0–6553.5s (min) The time unit is specified by P10.37.	0.0s (min)	○
P10.34	ACC/DEC Time for Steps 0–7 of Simple PLC	**Setting Range:** 0x0000–0xFFFF	0x0000	○

P10.35	ACC/DEC Time for Steps 8–15 of Simple PLC	**Setting Range:** 0x0000–0xFFFF	0x0000	○
P10.36	PLC Restart Mode	**Setting Range:** 0–1 0: Restart from the first step; namely if the VFD stops mid-run (caused by stop command, error or power down), it will run from the first step upon restart. 1: Continue running from the frequency step that was active when interruption occurred; namely if the VFD stops mid-run (caused by stop command or error), it will record the current step's running time and enter this step automatically after restart, then continue running at the frequency defined by this step for duration of the remaining time.	0	◎
P10.37	Multi-Step Time Unit	**Setting Range:** 0–1 0: Second; the running time of each step is counted in seconds 1: Minute; the running time of each step is counted in minutes	0	◎

P11—Protective Parameters

Function Code	Name	Description	Default	Modifiable?
P11.00	Phase Loss Protection	**Setting Range:** 0x000–0x011 *Ones digit:* 0: Disable software input phase loss protection. 1: Enable software input phase loss protection. *Tens digit:* 0: Disable output phase loss protection. 1: Enable output phase loss protection. *Hundreds digit: Reserved*	**For G1 models:** 0x010 **For G3 models:** 0x011	○
P11.01	Frequency Drop at Transient Power-Off	**Setting Range:** 0–1 0: Disable 1: Enable	0	○

P11.02	Energy-Consumption Braking	**Setting Range:** 0–1 0: Disable 1: Enable	0	◎
P11.03	Overvoltage Stalling Protection	**Setting Range:** 0–1 0: Disable 1: Enable	1	○
P11.04	Overvoltage Stalling Protection Voltage	**Setting Range:** 120%–150% (of the standard bus voltage)	**For 220V models:** 120% **For 380V models:** 136%	○
P11.05	Current Limit Mode	During accelerated operation, as the load is too heavy, the motor's actual acceleration rate is lower than that of the output frequency. To prevent the VFD from tripping due to overcurrent during the acceleration, be sure to take current limit measures. **Setting Range:** 0x00–0x11 *Ones digit: Current limit action* 0: Inactive 1: Always active *Tens digit: Hardware current limit overload alarm* 0: Active 1: Inactive	0x01	◎
P11.06	Automatic Current Limit Threshold	**Setting Range:** 50.0%–200.0% (of the rated VFD output current)	160.0%	◎
P11.07	Frequency Drop Rate During Current Limit	**Setting Range:** 0.00–50.00Hz/s	10.00Hz/s	◎
P11.08	VFD/Motor OL/UL Pre-Alarm	**Setting Range:** 0x0000–0x1132 *Ones digit:*	0x0000	○

		0: Motor OL/UL pre-alarm, relative to the motor rated current. 1: VFD OL/UL pre-alarm, relative to the VFD rated output current. 2: Motor output torque OL/UL pre-alarm, relative to the motor rated torque. *Tens digit:* 0: The VFD continues to work when an OL/UL alarm occurs 1: The VFD continues to work when a UL alarm occurs but stops running at an OL error 2: The VFD continues to work when an OL alarm occurs but stops running for a UL error 3. The VFD stops running for an OL/UL alarm *Hundreds digit:* 0: Detect all the time. 1: Detect during constant speed running *Thousands digit: VFD overload current reference* 0: Referencing current calibration coefficient 1: Not referencing current calibration coefficient		
P11.09	Overload Pre-Alarm Detection Threshold	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload pre-alarm detection time (P11.10), the device will output a pre-alarm signal. **Setting Range:** P11.11–200% (relative value determined by P11.08—ones digit)	150%	○
P11.10	Overload Pre-Alarm Detection Time	**Setting Range:** 0.1–3600.0 s	1.0 s	○
P11.11	Underload Pre-Alarm Detection Threshold	If the VFD or motor output current is lower than the underload pre-alarm detection level (P11.11), and the duration exceeds the underload pre-alarm detection time (P11.12), the device will output a pre-alarm signal. **Setting Range:** 0%–P11.09 (relative value determined by P11.08—ones digit)	50%	○

P11.12	Underload Pre-Alarm Detection Time	**Setting Range:** 0.1–3600.0s	1.0s	○
P11.13	Error Output Terminal Action Upon Error Occurring	Specifies how error output terminals react at undervoltage and error reset. **Setting Range:** 0x00–0x11 *Ones digit:* 0: Act upon an undervoltage error 1: Do not act upon an undervoltage error *Tens digit:* 0: Act during the automatic reset period 1: Do not act during the automatic reset period	0x00	○
P11.14	Speed Deviation Detection Value	Specifies the speed deviation detection value. **Setting Range:** 0.0%–50.0%	10.0%	○
P11.15	Speed Deviation Detection Time	Specifies the speed deviation detection time. If the speed deviation detection time is smaller than the set value, the VFD continues running. **Setting Range:** 0.0–10.0s **Note:** Speed deviation protection is inactive when P11.15 is set to 0.0s.	2.0s	○
P11.16	Automatic Frequency Reduction During Voltage Drop	**Setting Range:** 0–1 0: Disable 1: Valid	0	○
P11.17	Proportional Coefficient of Voltage Regulator During Undervoltage Stalling	Specifies the proportional coefficient of the bus voltage regulator in the event of undervoltage stalling. **Setting Range:** 0–127	20	○
P11.18	Integral Coefficient of Voltage Regulator During Undervoltage Stalling	Specifies the integral coefficient of the bus voltage regulator in the event of undervoltage stalling. **Setting Range:** 0–1000	5	○
P11.19	Proportional Coefficient of Current Regulator During Undervoltage Stalling	Specifies the proportional coefficient of the active current regulator in the event of undervoltage stalling. **Setting Range:** 0–1000	20	○

P11.20	Integral Coefficient of Current Regulator During Undervoltage Stalling	Specifies the integral coefficient of the active current regulator in the event of undervoltage stalling. **Setting Range:** 0–2000	20	○
P11.21	Proportional Coefficient of Voltage Regulator During Overvoltage Stalling	Specifies the proportional coefficient of the bus voltage regulator in the event of overvoltage stalling. **Setting Range:** 0–127	60	○
P11.22	Integral Coefficient of Voltage Regulator During Overvoltage Stalling	Specifies the integral coefficient of the bus voltage regulator in the event of overvoltage stalling. **Setting Range:** 0–1000	5	○
P11.23	Proportional Coefficient of Current Regulator During Overvoltage Stalling	Specifies the proportional coefficient of the active current regulator in the event of overvoltage stalling. **Setting Range:** 0–1000	60	○
P11.24	Integral Coefficient of Current Regulator During Overvoltage Stalling	Specifies the integral coefficient of the active current regulator during overvoltage stalling. **Setting Range:** 0–2000	250	○
P11.25	Keep Overload Timing Value	**Setting Range:** 0–1 0: Disable. The overload timing value is reset to zero after the VFD is stopped. In this case, the determination of VFD overload takes more time, and therefore the effective protection of the device may be weakened. 1: Enable. The overload timing value is not reset, and the overload timing value is accumulative. In this case, the determination of VFD overload takes less time, and protective measures can be taken more quickly.	0	◎
P11.26–P11.27	Reserved	–	–	–

P11.28	SPO Detection Switch-On Delay Time	**Setting Range:** 0.0–60.0s **Note:** The SPO detection is started only after the VFD runs for the delay time P11.28 to avoid false alarms caused by the unstable frequency.	5.0s	○
P11.29	SPO Unbalance Factor	**Setting Range:** 0–10	6	○
P11.30–P11.32	Reserved	–	–	–

P13—SM Control

Function Code	Name	Description	Default	Modifiable?
P13.00	SM Injected-Current Decrease Ratio	Specifies the reduction rate of the input reactive current. When the active current of the synchronous motor increases, the input reactive current can be reduced to improve the power factor of the motor. **Setting Range:** 0.0%–100.0% (of the motor's rated current)	80.0%	○
P13.01	Detection Mode of Initial Pole	**Setting Range:** 0–2 0: No detection 1: Reserved 2: Pulse superposition	2	◎
P13.02	Pull-In Current 1	Specifies the pole position orientation current which can be set within the lower limit of the pull-in current switch-over frequency threshold. If you need to increase the start torque, increase the value of this function parameter accordingly. **Setting Range:** -100.0%–100.0% (of the motor's rated current)	30.0%	○
P13.03	Pull-In Current 2	Specifies the pole position orientation current which can be set within the upper limit of the pull-in current switch-over frequency threshold. Generally speaking, you will not need to change this value.	0.0%	○

		Setting Range: -100.0%–100.0% (of the motor's rated current)		
P13.04	Switch-Over Frequency of Pull-In Current	**Setting Range:** 0.0%–200.0% (of the motor's rated frequency)	20.0%	○
P13.05	SVC Observer Speed Feedback Bandwidth	**Setting Range:** 10.0–200.0	62.5	◎
P13.06	High-Frequency Superposition Voltage	Specifies the pulse current threshold when the initial magnetic pole position is detected in the pulse mode. **Setting Range:** 0.0%–300% (of the motor rated voltage)	80.0%	◎
P13.07	Control Parameter 0	**Setting Range:** 0.0–400.0	0.0	○
P13.08	Control Parameter 1	**Setting Range:** 0x0000–0xFFFF	0x0000	○
P13.09	Reserved	–	–	–
P13.10	Initial Compensation Angle of SM	**Setting Range:** 0.0–359.9	0.0	○
P13.11	Maladjustment Detection Time	Used to adjust the anti-maladjustment function's responsiveness. If the load inertia is large, increase the value of this parameter, however, the responsiveness may slow down accordingly. **Setting Range:** 0.0–10.0s	0.5s	○
P13.12–P13.13	Reserved	–	–	–
P13.14	Deadzone Compensation Switching Current Permillage	0–1000	0	○
P13.15–P13.19	Reserved	–	–	–

P14—Serial Communication

Function Code	Name	Description	Default	Modifiable?
P14.00	Local Communication Address	**Setting Range:** 1–247 When the master writes the slave communication address to 0 indicating a broadcast address in a frame, all the slaves on the Modbus bus receive the frame but do not respond to it. The communication addresses on the communication network are unique, which is the basis of the point-to-point communication. **Note:** The slave address cannot be set to 0.	1	○
P14.01	Communication Baud Rate Setting	Specifies the data transmission speed between the host controller and the VFD. **Setting Range:** 0–7 0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps **Note:** The baud rate set on the VFD must be consistent with that on the host controller, else the communication fails. A greater baud rate indicates faster communication.	4	○
P14.02	Data Bit Check Setting	**Setting Range:** 0–5 0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU	1	○

		Note: The data format set on the VFD must be consistent with that on the host controller. Otherwise, the communication fails.		
P14.03	Communication Response Delay	**Setting Range:** 0–200 ms	5 ms	○
P14.04	RS485 Communication Timeout Period	**Setting Range:** 0.0–60.0 s **Note:** When this parameter is set to 0.0, the timeout is inactive.	0.0 s	○
P14.05	Transmission Error Processing	**Setting Range:** 0–3 0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applies only to modbus communication mode) 3: Stop in enabled stop mode without reporting an alarm (applies to any mode)	0	○
P14.06	Modbus Communication Processing Action	**Setting Range:** 0x000–0x111 *Ones digit:* 0: Responds to write operations 1: Does not respond to write operations *Tens digit:* 0: Modbus communication password protection is inactive. 1: Modbus communication password protection is active. *Hundreds digit: (applies to communication mode only)* 0: User-defined addresses specified by P14.07 and P14.08 are invalid. 1: User-defined addresses specified by P14.07 and P14.08 are valid.	0x000	○
P14.07	User-Defined Operating Command Address	**Setting Range:** 0x0000–0xFFFF	0x2000	○

P14.08	User-Defined Frequency Setting Address	**Setting Range:** 0x0000–0xFFFF	0x2001	○
P14.09	Monitoring Variable Address 1	**Setting Range:** 0x0000–0xFFFF	0x0000	○
P14.10	Monitoring Variable Address 2	**Setting Range:** 0x0000–0xFFFF	0x0000	○
P14.11	Monitoring Variable Address 3	**Setting Range:** 0x0000–0xFFFF	0x0000	○
P14.12	Monitoring Variable Address 4	**Setting Range:** 0x0000–0xFFFF	0x0000	○

P17—Status Viewing

Function Code	Name	Description	Default	Modifiable?
P17.00	Set Frequency	Displays the present set frequency of the VFD. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P17.01	Output Frequency	Displays the present output frequency of the VFD. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P17.02	Ramp Reference Frequency	Displays the present ramp reference frequency of the VFD. **Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P17.03	Output Voltage	Displays the present output voltage of the VFD. **Setting Range:** 0–1200 V	0 V	●
P17.04	Output Current	Displays the present output current of the VFD. **Setting Range:** 0.00–500.00 A	0.00 A	●
P17.05	Motor Rotation Speed	Displays the present motor rotation speed. **Setting Range:** 0–65535 RPM	0 RPM	●

P17.06	Torque Current	Displays the present torque current of the VFD. **Setting Range:** -300.00–300.00A	0.00A	●
P17.07	Excitation Current	Displays the present excitation current of the VFD. **Setting Range:** -300.00–300.00A	0.00A	●
P17.08	Motor Power	Displays the present motor power. **Setting Range:** -300.0%–300.0% (of the motor's rated power)	0.0%	●
P17.09	Motor Output Torque	Displays the present output torque of the VFD. **Setting Range:** -250.0%–250.0% (of the motor's rated torque)	0.0%	●
P17.10	Estimated Motor Frequency	Used to indicate the estimated motor rotor frequency under the open-loop vector condition. **Setting Range:** 0.00Hz–P00.03	0.00Hz	●
P17.11	DC Bus Voltage	Displays the present DC bus voltage of the VFD. **Setting Range:** 0.0–2000.0V	0.0V	●
P17.12	Digital Input Terminal State	Displays the present state of the digital input terminals. **Setting Range:** 0x00–0x1FF The bits from high to low correspond to HDIA, S8, S7, S6, S5, S4, S3, S2, and S1 respectively.	0x000	●
P17.13	Digital Output Terminal State	Displays the present state of the digital output terminals. **Setting Range:** 0x00–0x0F The bits from high to low correspond to Reserved, RO1, Reserved, and Y1 respectively.	0x00	●
P17.14	Digital Adjustment Value	Displays the adjustment on the VFD through the UP/DOWN terminal. **Setting Range:** 0.00Hz–P00.03	0.00Hz	●

P17.15	Torque Reference Value	Indicates the current motor's percentage of the rated torque, displaying the torque reference. **Setting Range:** -300.0%–300.0% (of the motor's rated current)	0.0%	●
P17.16	Linear Speed	0–65535	0	●
P17.17	Reserved	–	–	–
P17.18	Accumulative Counting Value	0–65535	0	●
P17.19	AI1 Input Voltage	Displays the AI1 input signal. **Setting Range:** 0.00–10.00V	0.00V	●
P17.20	AI2 Input Voltage	Displays the AI2 input signal. **Setting Range:** 0.00–10.00V	0.00V	●
P17.21	AI3 Input Voltage	Displays the AI3 input signal. **Setting Range:** 0.00–10.00V	0.00V	●
P17.22	HDIA Input Frequency	Displays the HDIA input frequency. **Setting Range:** 0.000–50.000kHz	0.000kHz	●
P17.23	PID Reference Value	Displays the PID reference value. **Setting Range:** -100.0%–100.0%	0.0%	●
P17.24	PID Feedback Value	Displays the PID feedback value. **Setting Range:** -100.0%–100.0%	0.0%	●
P17.25	Motor Power Factor	Displays the power factor of the present motor. **Setting Range:** -1.00–1.00	0.00	●
P17.26	Duration of Present Run	Displays the duration of this run of the VFD. **Setting Range:** 0–65535min	0min	●
P17.27	Present Step of Simple PLC	Displays the present step of the simple PLC function. **Setting Range:** 0–15	0	●

P17.28	Motor ASR Controller Output	Displays the ASR controller output value as a percentage relative to the rated motor torque under the vector control mode. **Setting Range:** -300.0%–300.0% (of the motor's rated current)	0.0%	●
P17.29	Pole Angle of Open-Loop SM	Displays the initial identification angle of SM. **Setting Range:** 0.0–360.0	0.0	●
P17.30	Phase Compensation of SM	Displays the phase compensation of SM. **Setting Range:** -180.0–180.0	0.0	●
P17.31	Reserved	–	–	–
P17.32	Motor Flux Linkage	0.0%–200.0%	0.0%	●
P17.33	Excitation Current Reference	Displays the excitation current reference value in vector control mode. **Setting Range:** -300.00–300.00A	0.00A	●
P17.34	Torque Current Reference	Displays the torque current reference value under the vector control mode. Setting Range: -300.00–300.00A	0.00A	●
P17.35	Reserved	-	-	-
P17.36	Output Torque	Displays the output torque value. During forward running, a positive value is the motoring state while a negative value is generating state. During reverse running, a positive value is the generating state while a negative value is the motoring state. **Setting Range:** -3000.0–3000.0Nm	0.0Nm	●
P17.37	Motor Overload Count Value	**Setting Range:** 0–65535	0	●
P17.38	PID Output	**Setting Range:** -100.0%–100.0%	0.0%	●

P17.39	Function Code in Parameter Download Error	**Setting Range:** 0.00–99.00	0.00	●
P17.40	Motor Control Mode	**Setting Range:** 0x000–0x122 *Ones digit: Control mode* 0: Open-loop vector control 1: Reserved 2: VF control *Tens digit: Open-loop vector control mode* 0: SVC0 1: SVC1 2: Reserved *Hundreds digit: Motor type* 0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0x000	●
P17.41	Electromotive Torque Upper Limit	Displays the value set via P03.20. **Setting Range:** 0.0%–300.0% (of the motor rated current)	180.0%	●
P17.42	Braking Torque Upper Limit	Displays the value set via P03.21. **Setting Range:** 0.0%–300.0% (of the motor rated current)	180.0%	●
P17.43	Forward Rotation Frequency Upper Limit in Torque Control	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P17.44	Reverse Rotation Frequency Upper Limit in Torque Control	**Setting Range:** 0.00 Hz–P00.03	0.00 Hz	●
P17.45	Inertia Compensation Torque	**Setting Range:** -100.0%–100.0%	0.0%	●

P17.46	Friction Compensation Torque	**Setting Range:** -100.0%–100.0%	0.0%	●
P17.47	Motor Pole Pairs	**Setting Range:** 0–65535	0	●
P17.48	VFD Overload Count Value	**Setting Range:** 0–65535	0	●
P17.49	Frequency Set by Source A	**Setting Range:** 0.00–P00.03	0.00Hz	●
P17.50	Frequency Set by Source B	**Setting Range:** 0.00–P00.03	0.00Hz	●
P17.51	PID Proportional Output	**Setting Range:** -100.0%–100.0%	0.0%	●
P17.52	PID Integral Output	**Setting Range:** -100.0%–100.0%	0.0%	●
P17.53	PID Differential Output	**Setting Range:** -100.0%–100.0%	0.0%	●
P17.54	PID Present Proportional Gain	**Setting Range:** 0.00–100.00	0.00	●
P17.55	PID Present Integral Gain	**Setting Range:** 0.00–10.00s	0.00s	●
P17.56	PID Present Differential Time	**Setting Range:** 0.00–10.00s	0.00s	●
P17.57–P17.58	Reserved	–	–	–
P17.59	Monitoring Variable 1	**Setting Range:** 0–65535	0	●
P17.60	Monitoring Variable 2			
P17.61	Monitoring Variable 3			
P17.62	Monitoring Variable 4			
P17.63	Reserved	–	–	–

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