Operation Manual

Goodrive800-51 Series
Water-cooled Drive

SHENZHEN INVT ELECTRIC CO., LTD.

No.	Change description	Version	Release date
1	First release	V1.0	July 2020
2	1. Modifed contents in Preface. 2. Modified contents in chapter 6 “Function parameter list”, and deleted the column of “Setting range”. 3. Modified some descriptions relating to altitude. 4. Modified contents in section 8.1.5 “Related function codes”, deleted “Setting range” column, and added “Modify” column.	V1.1	October 2020
3	1. Deleted function code P06.03 and P06.04. 2. Modified the name of P06.01, P06.02, P06.06, P06.07, P06.08, and P06.09.	V1.2	December 2020
4	1. Modifed contents in section 1.4.1. 2. Added some descriptions in section 5.2. 3. Modified function codes P08.14, P09.18–P09.20, and P15.24. 4. Modified contents of fault code SPI in section 7.1. 5. Modified read/write command in section 8.1.3 (03 read command, 06 write command).	V1.3	April 2021
5	1. Modified function codes P01.20, P06.02, P09.00, P09.01 and P17.22. 2. Added fault type codes in section 7.1, and sort these fault type codes according to function codes P07.27-P07.32. 3. Modified contents in section 8.1.3.4, and changed eight high-order bits of device codes to 0X01.	V1.4	May 2022
6	1. Added 160–200kW power range. 2. Added coolant capacity and certification function parameters in section 3.3 Product specifications. 3. Added heat values in section 3.6 Product ratings. 4. Updated section 3.8 Coolant and water	V1.5	April 2023

No.	Change description	Version	Release date
	resistance requirements. 5. Added cable bolt parameters in Table 4-2 Recommended cable models. 6. Added Figure 4-8 Control circuit wiring diagram (for STO models). 7. Updated aviation plug category in Table 4-3 Control terminal function definition. 8. Updated CANopen communication to CAN2.0B communication. 9. Added Appendix A STO function description.		
7	Updated 4.1.2 Installation direction.	V1.6	March 2024

Preface

Thanks for choosing Goodrive800-51 series water-cooled drive (the drive for short; if not otherwise specified in this manual, the drive always indicates Goodrive800-51 series water-cooled drive).

To ensure safety and proper use, read this manual carefully before using the drive.

The drive is a high-performance liquid-cooled drive designed for high-end application markets, occupying small space but providing high power. It is suitable for places where air cooling is difficult or impossible, or the cost of air cooling is too high, such as ships, offshore engineering, mining, tunnel construction, places affected by altitude, or places with extremely limited installation space. As the ingress protection (IP) rating of the drive reaches IP67, the drive can be installed in almost any location in the factory, ship, AGV, flexibly adapting to the hostile industrial environments. Liquid-cooled drives do not require the use of large cooling fans and are among the quietest drives on the market. With the power supply voltage ranging from 400V to 750VDC and the power ranging from 45kW to 200kW, the drive features reliable modular design, meeting the strict application requirements.

The drive implements the driving of both synchronous motors (SMs) and asynchronous motors (AMs), integrates torque control, speed control and position control, and has excellent control performance. It adopts the high-performance closed-loop vector control and can provide more stable, reliable, and precise speed and position control. With the enhanced environmental adaptability, customized and industrialized design, and optimized functions, the drive can be applied more flexibly.

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

If the end user is a military unit or the product is used for weapon manufacturing, please comply with relevant export control regulations in the Foreign Trade Law of the People's Republic of China, and complete necessary formalities.

INVT reserves the right to update the manual information without prior notice and has the final interpretation for the manual content.

Contents

1 Safety precautions

1.1 What this chapter contains

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

We shall not be liable or responsible for any equipment damage or physical injury or death caused by you or your customers due to your ignorance of the safety precautions.

1.2 Safety definition

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

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

Note: Actions taken to ensure proper running.

Qualified electricians: People working on the drive must have received professional electrical and safety training and obtained the certificates, and must be familiar with all steps and requirements of drive installing, commissioning, running and maintaining and capable to prevent any emergencies.

1.3 Warning symbols

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

Symbol	Name	Description	Abbreviation
 Danger	Danger	Severe personal injury or even death can result if related requirements are not followed.	
 Warning	Warning	Physical injury or device damage can result if related requirements are not followed.	
 Do not	Electrostatic sensitive	PCBA board damage can result if related requirements are not followed.	
 Hot sides	Hot sides	The drive base may be hot. Do not touch.	
Note	Note	Actions taken to ensure proper running.	Note

1.4 Safety guidelines

<table>
<tr><td>  </td><td>✧ Only trained and qualified electricians can operate the drive.
✧ Do not perform any wiring, inspection, or component changing when power is applied. Ensure all input power supplies are disconnected before wiring or checking, and always wait at least the time designated on the drive or until the DC bus voltage is less than 36V. The following table lists the waiting time.
<table><tr><th>Drive model</th><th>Minimum waiting time</th></tr><tr><td>45–200kW</td><td>5 minutes</td></tr></table></td></tr>
<tr><td>  </td><td>✧ Do not refit the drive unless authorized; otherwise, fire, electric shock or other injuries may result.</td></tr>
<tr><td>  </td><td>✧ The heat sink base may become hot during running. Do not touch it; otherwise, burns may result.</td></tr>
<tr><td>  </td><td>✧ The electronic components inside the drive are electrostatic sensitive. Take measurements to avoid electrostatic discharge during related operation.</td></tr>
</table>

1.4.1 Delivery and installation

<table>
<tr><td>  </td><td>✧ Install the drive on fire-retardant material and keep the drive away from combustible materials.
✧ Connect the optional braking parts (braking resistors, braking units or feedback units) according to the wiring diagram.
✧ Do not run a damaged or incomplete drive.
✧ Do not touch the drive with wet items or body parts; otherwise, electric shock may result.</td></tr>
</table>

Note:

✧ Select appropriate tools for delivery and installation to ensure proper drive running and prevent accidents. To ensure physical safety, take mechanical protective measures such as wearing safety shoes and working uniforms.

✧ Prevent the drive from physical shock or vibration during delivery and installation.

✧ Do not carry the drive only by its front cover as the cover may fall off.

✧ Install the drive far away from children and other public places.

✧ Use the drive in proper environments. (For details, see section 4.1.1 “Installation environment”.)

✧ Prevent screws, cables and other conductive parts from falling into the drive.

✧ As the leakage current during drive running may exceed 3.5mA, apply reliable grounding and ensure the ground resistance is less than 10mΩ. The PE ground conductor and phase conductor have equal conductivity capability.

✧ (+) and (-) are the power input terminals, while U, V, and W are output terminals for motors. Connect the input power cables and motor cables properly; otherwise, drive damage may result.

1.4.2 Commissioning and running

	✧ Disconnect all power sources applied to the drive before terminal wiring, and wait at least the time designated on the drive after disconnecting the power sources. ✧ The auxiliary control power of the drive is externally provided. Switch on the auxiliary control power before switching on the strong electricity. Cut off the strong electricity before cutting off the auxiliary control power. ✧ Before loaded running, the water cooling system must have been started and the water channel is smooth. ✧ High voltage presents inside the drive during running. Do not carry out any operation on the drive during running except for keypad setup. ✧ The drive may start by itself when P01.21 is set to 1 (restart after power off). Do not get close to the drive and motor. Exercise caution before using this function. ✧ The drive cannot act as an emergency brake for the motor; it is a must to install a mechanical braking device.

Note:

✧ Do not frequently switch on or off the input power source of the drive.

✧ Close the front cover before drive running; otherwise, electric shock may occur.

1.4.3 Maintenance and component replacement

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

Note:

✧ Use proper torque to tighten the screws.

✧ Keep the drive and its parts and components away from combustible materials during maintenance and component replacement.

✧ Do not carry out the insulation voltage-endurance test on the drive, or measure the control circuit of the drive by megameter.

✧ Take proper anti-static measures on the drive and its internal parts during maintenance and

component replacement.

1.4.4 Disposal of a scrap drive

	✧ The drive contains heavy metal. Dispose of a scrap drive as industrial waste.
	✧ Dispose of a scrap drive at an appropriate collection point but not in the normal waste stream.

2 Quick startup

2.1 What this chapter contains

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

2.2 Unpacking inspection

Check the following after receiving the product.

1. Whether the packing box is damaged or dampened.
2. Whether the model identifier on the exterior surface of the packing box is consistent with the purchased model.
3. Whether the interior surface of the packing box is abnormal, for example, in wet condition, or whether the enclosure of the drive is damaged or cracked.
4. Whether the drive nameplate is consistent with the model identifier on the exterior surface of the packing box.
5. Whether the accessories (including the manual) inside the packing box are complete.

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

2.3 Checking before use

Check the following before using the drive.

1. Mechanical type of the load to be driven by the drive. Check whether the drive will be overloaded in actual running and whether the drive power class needs to be increased.
2. The actual running current of the loaded motor is less than the rated current of the drive.
3. The grid voltage is consistent with the rated voltage of the drive.
4. Whether required functions can only be implemented with expansion card configuration.

2.4 Environment checking

Check the following before installing the drive.

1. The actual ambient temperature for all the drive models cannot be lower than -35°C, that for the 132kW drive model cannot exceed 50°C, and that for the 45–110kW and 160–200kW drive models cannot exceed 55°C.
2. Whether the drive installation altitude is higher than 1000 meters. When the altitude exceeds 1000 meters, derate by 1% for every increase of 100 meters. When the altitude exceeds 3000 meters, contact the local INVT dealer or office for details.

3. Whether the ambient humidity is higher than 90% or condensation occurs. If yes, take more protective measures.
4. Whether there is direct sunlight or biological invasion in the environment where the drive is to be used. If yes, take more protective measures.
5. Whether there is dust or inflammable and explosive gas in the environment where the drive is to be used. If yes, take more protective measures.

2.5 Checking after installation

Check the following after the drive installation is complete.

1. Whether the input power cables and motor cables meet the current-carrying capacity requirements of the actual load.
2. Whether all the control cables and power cables are separately routed and whether EMC specification requirements are taken into full account during the routing.
3. Whether all the grounding systems are properly grounded.
4. Whether all drive installation clearances meet the requirements stated in the manual.
5. The installation method of the drive complies with the requirements in the manual. Vertical installation is recommended whenever possible.
6. Whether the external wiring terminals are tightened, and whether the torque meets the requirements.
7. Take protective measures to ensure that no screws, cables, or other conductive objects drop into the drive.
8. Do not use non-deionized water as the coolant. Use the pure water and coolant in an appropriate ratio.

2.6 Basic commissioning

Do as follows to complete basic commissioning before the use:

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

3 Product overview

3.1 What this chapter contains

This chapter describes the basic working principle, specifications, nameplate, and models of the drive.

3.2 Basic working principle

The drive is able to control asynchronous AC induction motors and permanent-magnet synchronous motors. It can be wall mounted or horizontally mounted.

The following is the simplified main circuit diagram of the drive. It uses DC input, and the capacitor bank of the intermediate circuit stablizes the DC voltage, which is outputted after being inverted through the IGBT.

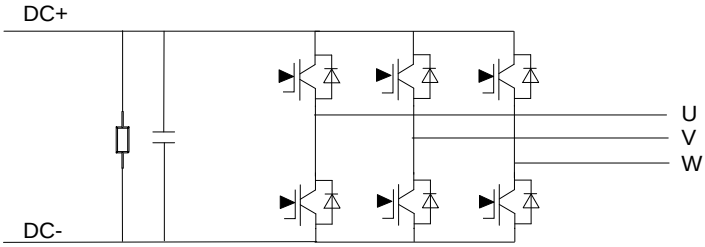


Figure 3–1 Simplified main circuit diagram

3.3 Product specifications

Function		Specification
Power input	Input voltage	DC 400V-750V
	Input current	See section 3.6 Product ratings.
Power output	Rated output voltage (V)	0–0.7Vin
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–400Hz
Control performance	Control mode	For SMs: open-loop vector control and closed-loop vector control For AMs: open-loop vector control, closed-loop vector control, and V/F control
	Max. output frequency	400Hz

Function		Specification
	Speed regulation ratio	For AMs: 1: 200 in open-loop vector control, and 1: 1000 in closed-loop vector control For SMs: 1: 20 in open-loop vector control, and 1: 1000 in closed-loop vector control
	Speed control accuracy	± 0.2% (sensorless vector control, shorted as SVC) ± 0.02% (sensor vector control, shorted as VC)
	Speed fluctuation	± 0.3% (SVC)
	Torque response	<20ms (SVC)
	Torque control	5% (VC) 10% (SVC)
	Starting torque	For AMs: 0.5Hz 150% (SVC) For SMs: 2.5Hz 150% (SVC) For AMs and SMs: 0Hz 200% (VC)
	Overload capacity	150% for 1 minute, 180% for 10 seconds, and 200% for 1 second
Other	Installation method	Wall mounted or horizontally mounted
	IP rating	IP67
	Cooling method	Water cooled
	Coolant capacity	45–132kW: 0.4L, 160–200kW: 0.5L
	Running environment	For the 45–110kW and 160–200kW drive models, the coolant temperature for running must be in the range of 0–+55°C. For the 132kW drive model, the coolant temperature for running must be in the range of 0–+50°C.
	Temperature rise	Meeting test specification requirements in default carrier frequency and rated running conditions
	Certification	RoHs, CE, STO, SIL3

3.4 Product nameplate

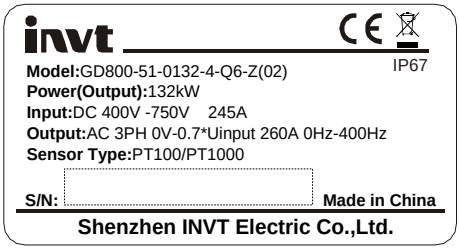


Figure 3–2 Product nameplate

3.5 Product model code

The product model code contains product information. You can find the model code on the nameplate and simple nameplate of the drive.

GD800-51 – 0110 – 4 – Q6 – Z(02)
① ② ③ ④ ⑤

Figure 3–3 Product model code

Field	No.	Description	Example
Product category	①	Abbreviation of the product series	GD800-51: Goodrive800 series power unit
Rated power	②	Rated power	0110: 110kW
Voltage class	③	Voltage class	4: AC 3PH 380V (-15%)–440V (+10%)
Structure type	④	Heat dissipation	Q6: Water cooling
Management number	⑤	Customer management	Default: Empty Z(02): Customer code

3.6 Product ratings

Model	Output power (kW)	Input voltage (V)	Input current (A)	Output current (A)	Carrier frequency	Heat value (kW)
GD800-51-0045-4-Q6-Z(02)	45	DC 400V-750V	84	92	1–8 (8)	1.20
GD800-51-0075-4-Q6-Z(02)	75	DC 400V-750V	139	150	1–8 (8)	1.99
GD800-51-0090-4-Q6-Z(02	90	DC 400V-750V	167	180	1–8 (8)	2.70
GD800-51-0110-4-Q6-Z(02)	110	DC 400V-750V	204	215	1–8 (8)	3.25
GD800-51-0132-4-Q6-Z(02)	132	DC 400V-750V	245	260	1–8 (8)	4.00
GD800-51-0160-4-Q6-Z(02)	160	DC 400V~750V	297	305	1–8 (6)	3.68
GD800-51-0200-4-Q6-Z(02)	200	DC 400V~750V	371	380	1–8 (6)	4.64

Note: () in the Carrier frequency column is the default value.

3.7 Structure diagram

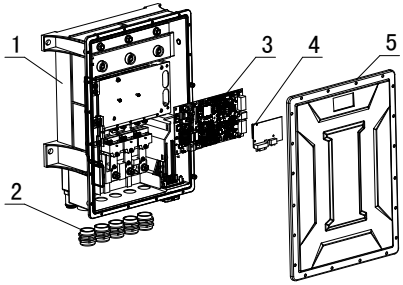


Figure 3–4 Structure diagram

No.	Part	Description
1	Cabinet	Internal component support, to protect internal components.
2	Waterproof connector	Cable inlet.
3	Control board	Control terminals. For details, see Chapter 4 “Installation guidelines”.
4	Communication card	PROFIBUS + Ethernet communication cards.
5	Cover	Used to protect internal components.

3.8 Coolant and water resistance requirements

As the cooling medium of the drive, the coolant must ensure the reliability of heat dissipation and the stability of the water route of the entire machine. Therefore, the coolant must be proportioned according to the following requirements:

Note: Do not use only pure water or tap water as the coolant in any phase such as equipment commissioning, maintenance or onsite use. Please use the mixture of pure water (deionized water) and ethylene glycol that meets the requirements.

1. Coolant temperature

(1) Running temperature:

For the 132kW drive model, the coolant temperature for running is in the range of 0–+50°C.

For the 45–110kW and 160–200kW drive models, the coolant temperature for running is in the range of 0–+55°C.

Note: Do not run the drive when the temperature of the coolant is below 0°C (32°F).

(2) Storage temperature

The storage temperature ranges for different coolants are as follows:

- 60% ethylene glycol + 40% pure water: -45–60°C
- 50% ethylene glycol + 50% pure water: -35–60°C
- 20% ethylene glycol + 80% pure water: -8–60°C
- 10% ethylene glycol + 90% pure water: -3–60°C
- 100% pure water: 0–60°C

Note: The coolant percentage refers to the volume concentration rather than the mass concentration.

2. Coolant flow rate

- Required coolant inlet flow rate for the 45–132kW drive models ≥18L/min
- Required coolant inlet flow rate for the 160–200kW drive models ≥25L/min

3. Max. voltage resistance of water channel

Max. pressure resistance of water channel for the 45–200kW drive models <15bar/1.5MPa

4. Water resistance in the entire machine

- Determine the mixing ratio of coolant.
- Determine the lowest temperature for onsite use.
- Determine the onsite coolant flow rate.
- Query the water resistance curve diagram by the preceding conditions.

The following provides an example:

For the 132kW drive model:

Mixing ratio of coolant: 60% ethylene glycol + 40% pure water

Lowest temperature for onsite use: 0°C

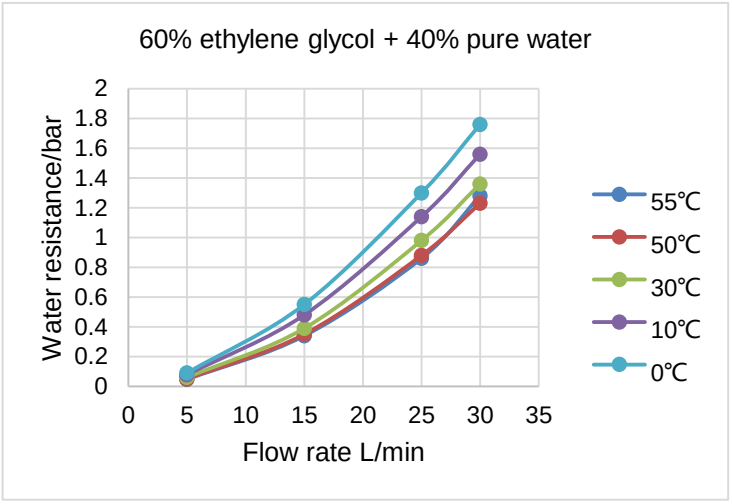
Coolant flow rate at the inlet: 25L/Min

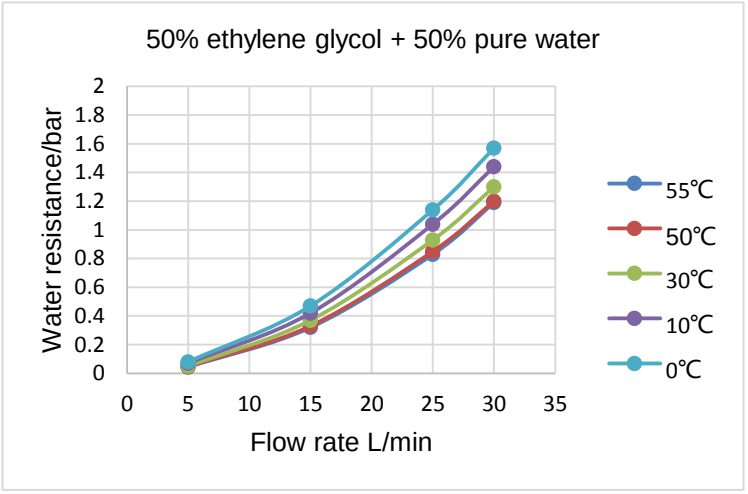
According to the water resistance curve diagram, the water resistance is 1.3bar.

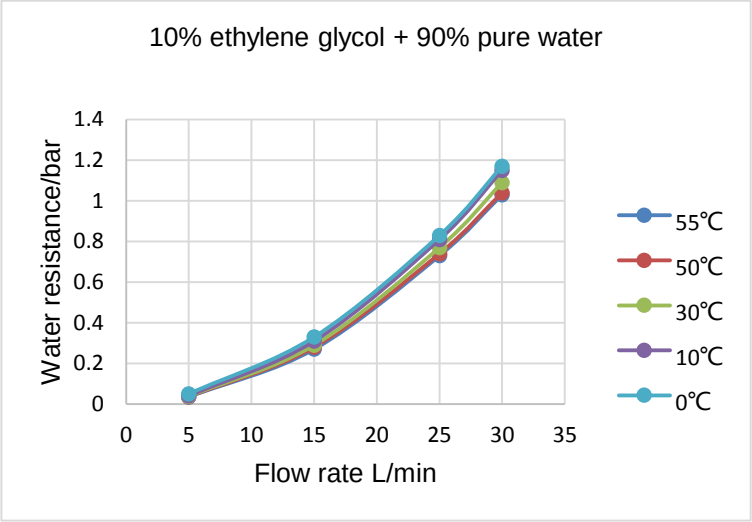
Note: If you use another coolant rather than the coolant as mentioned above, try to use the similar mixing ratio.

5. Water resistance curves for different coolants

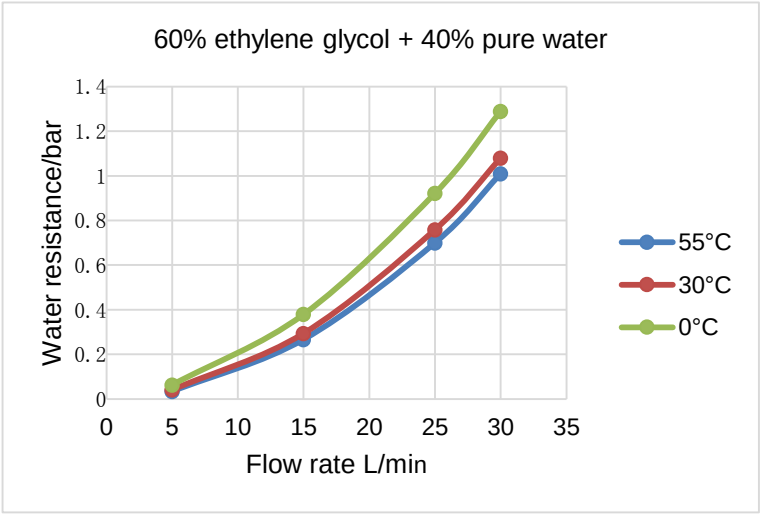
- Water resistance curves of different coolants with different temperatures for the 45–132kW drive models:

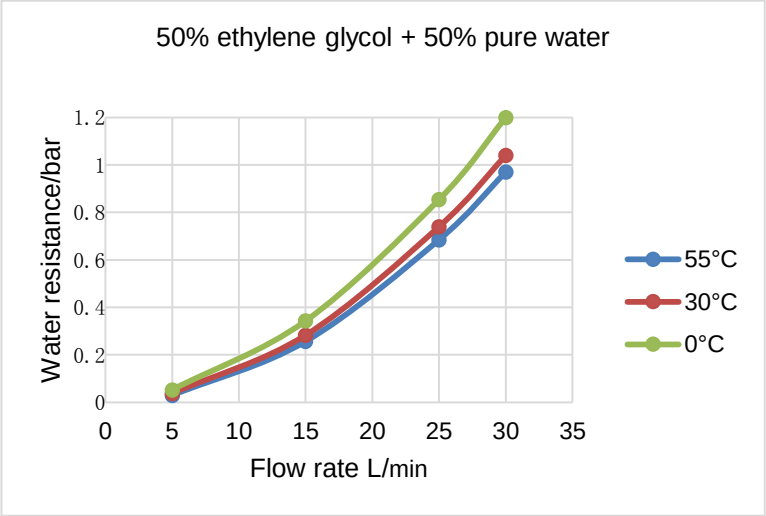

60% ethylene glycol + 40% pure water
Water resistance/bar
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 5 10 15 20 25 30 35
Flow rate L/min
55℃
50℃
30℃
10℃
0℃

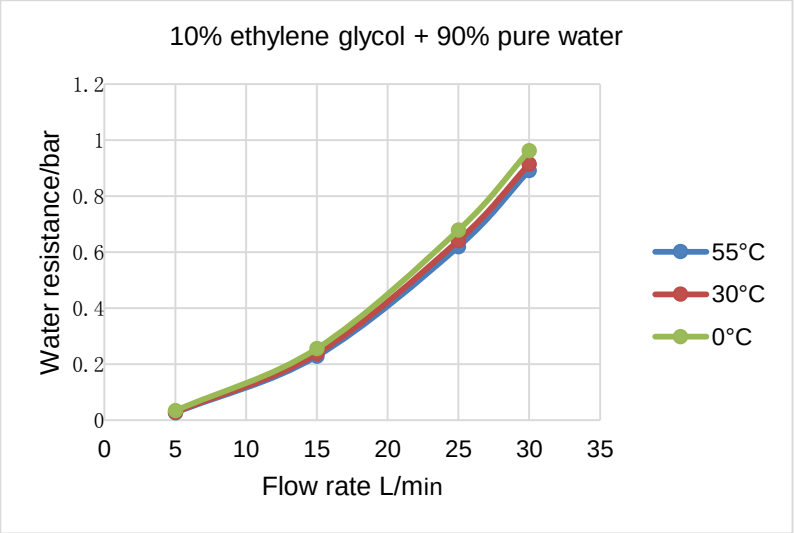

50% ethylene glycol + 50% pure water
Water resistance/bar
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 5 10 15 20 25 30 35
Flow rate L/min
55℃
50℃
30℃
10℃
0℃



- Water resistance curves of different coolants with different temperatures for the 160–200kW drive models:




50% ethylene glycol + 50% pure water
Water resistance/bar
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
35
Flow rate L/min
55°C
30°C
0°C


10% ethylene glycol + 90% pure water
Water resistance/bar
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
35
Flow rate L/min
55°C
30°C
0°C

3.9 Recommended nozzle dimensions

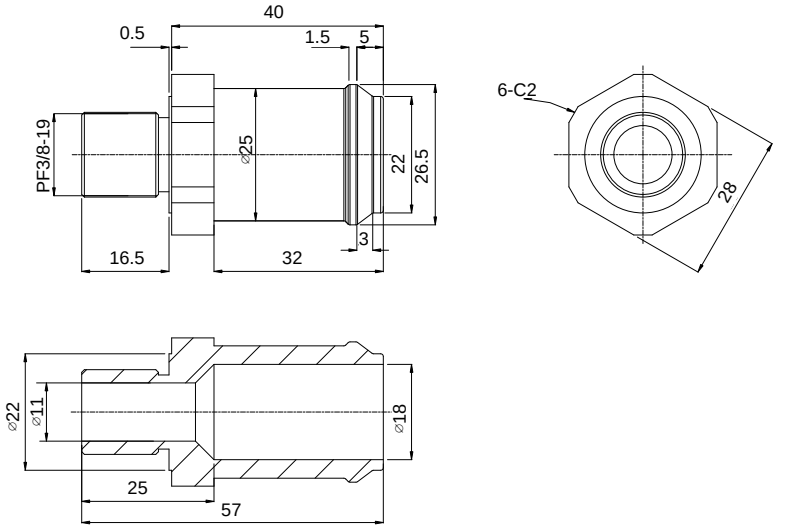


Figure 3–5 Buzzle dimensions of 45–132kW drive models (unit: mm)

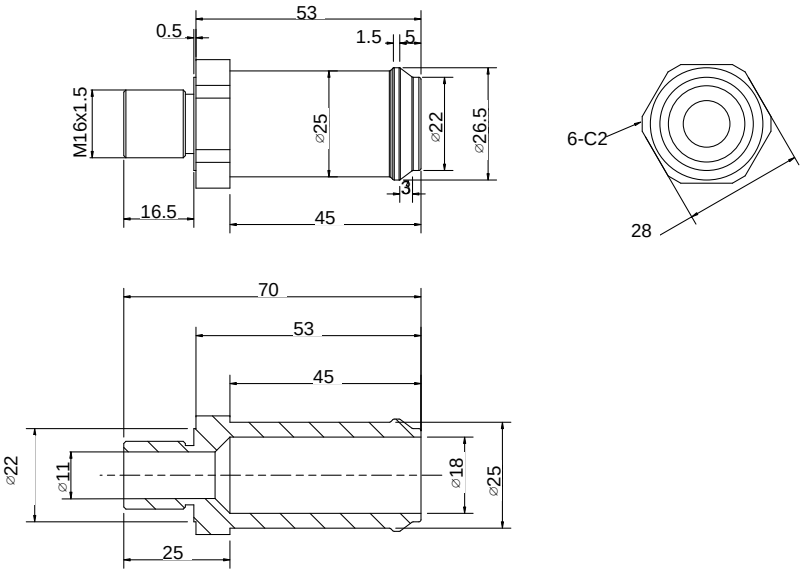


Figure 3–6 Buzzle dimensions of 160–200kW drive models (unit: mm)

4 Installation guidelines

4.1 Mechanical installation

4.1.1 Installation environment

Installation environment is essential for the drive to run with best performance in a long period of time. The drive installation environment must meet the following requirements.

Environment		Requirement
Work environment	Installation site	The drive is vertically installed on an indoor solid base. The power unit is installed in a cabinet, with the base mounting way.
	Ambient temperature	For 45–110kW and 160–200kW drive models, the water temperature range is -35°C–+55°C. For the 132kW drive model, the water temperature range is -35°C–+50°C.
	Relative humidity	5%–95%
	Other weather conditions	No condensation, freezing, rain, snow, hail, and so on. Solar radiation < 700W/m²; air pressure: 70–106kPa
	Salt spray and corrosive gas content	Pollution degree 2
	Dust and solid particle content	Pollution degree 2
	Altitude	Lower than 1000 meters. When the altitude exceeds 1000 meters, derate 1% for every increase of 100 meters.
	Vibration	The max. amplitude of vibration cannot exceed 5.8m/s²(0.6g).
Storage environment	Storage site	Clean and dry indoor place
	Storage temperature	-30°C–60°C, with the air temperature change rate less than 1°C/min
	Relative humidity	5%–95%
	Storage time	The total time of delivery and storage cannot exceed 6 months. If the storage time is long, the storage conditions must be improved (such as lowering the temperature).
Transport environment	Transport means	When standard packing boxes are used, cars, trains, ships and similar means can be used for transport.
	Ambient temperature	-30°C–85°C
	Relative humidity	Less than 95% at 40°C.
	Vibration	15m/s²(1.5g) when the sine vibration range is 9–200Hz

4.1.2 Installation direction

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

The drive must be installed vertically. Check the installation direction according to following requirements.

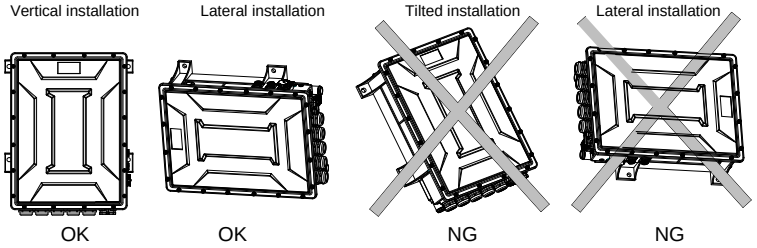


Figure 4–1 Drive installation direction

Note: GD800-51-0132-4-Q6-Z(02) and GD800-51-0200-4-Q6-Z(02) do not support lateral installation.

4.1.3 Installation method

You can install the drive on the wall or horizontally.

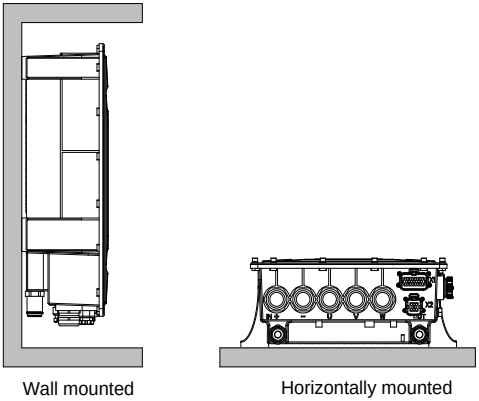


Figure 4–2 Installation method

(1) Mark the position of the installation hole.

(2) Mount the screws or bolts onto the marked positions.

(3) Place the drive against the wall.

(4) Fasten the screws or bolts.

4.1.4 Installing more than one drive

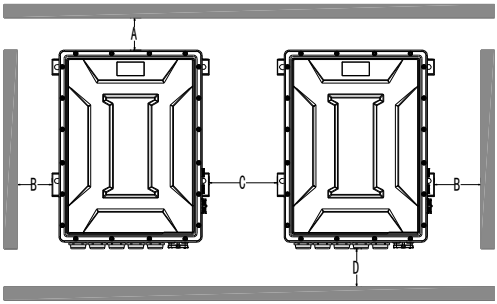


Figure 4–3 Parallel installation

Note:

- ✧ When installing multiple drives in different sizes, align the top of each drive before installation for the convenience of future maintenance.
- ✧ A must be 100mm at least.
- ✧ For B and C, each must be 300mm at least.
- ✧ D must be 500mm at least.

4.1.5 Installation dimensions

The drive must be installed according to the dimensions.

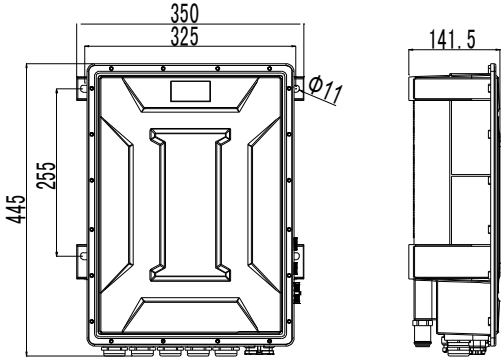


Figure 4–4 Installation dimensions of 45–132kW drive models (unit: mm)

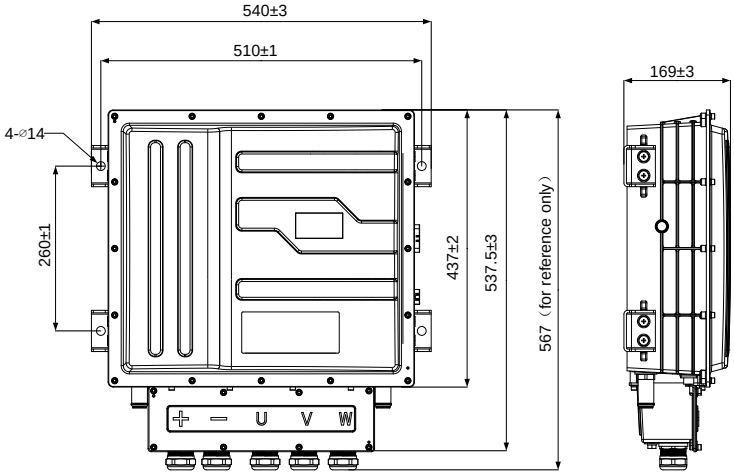
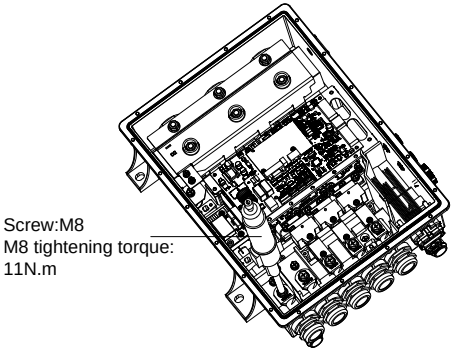


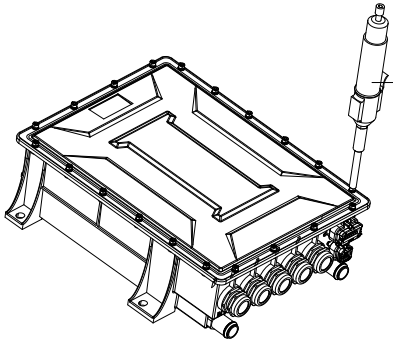
Figure 4–5 Installation dimensions of 160–200kW drive models (unit: mm)

4.1.6 Screw torque requirements

✧ The following figure shows the screw tightening torque between the input copper bar and cable terminals and between the output copper bar and cable terminals.



✧ The following figure shows the cover screw tightening torque.



✧ For details about other screw specifications and torques, see Table 9.1.

4.2 Standard wiring

4.2.1 Standard wiring of main circuit

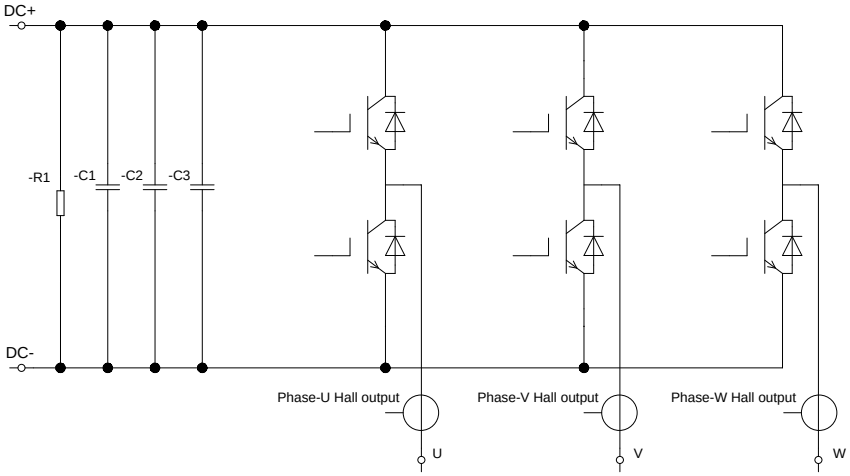


Figure 4–6 Wiring diagram of main circuit

Table 4-1 Main circuit terminals

Terminal	Function
DC+, DC-	DC input terminals, connected to the DC power supply on the input side.
U, V, W	Three-phase AC output terminals, generally connected to the motor.

Table 4-2 Recommended cable models

Drive model	Cable bolt	Cable fastener supported outer diameter (mm)	Cable fastener shielded	Recommended cable model		Supported motor power (kW)
				DC input (mm²)	AC output (mm²)	
GD800-51-0045-4-Q6-Z(02)	M8	13–18	Yes	25	25	45
GD800-51-0075-4-Q6-Z(02)	M8	15–20	Yes	50	50	75
GD800-51-0090-4-Q6-Z(02)	M8	15–20	Yes	50	50	90
GD800-51-0110-4-Q6-Z(02)	M8	15–20	Yes	70	70	110
GD800-51-0132-4-Q6-Z(02)	M8	15–20	Yes	70	70	100
		21–26	Yes	120	120	132
GD800-51-0160-4-Q6-Z(02	M10	24~28	Yes	150	150	160
GD800-51-0200-4-Q6-Z(02	M10	24~28	Yes	150	150	140
		24~28	Yes	185	185	200

Note:

✧ Before product ordering, determine the cable outer diameters. If the preceding table does not include the required outer diameters, contact us. We will configure appropriate cable fastener models.

✧ For GD800-51-0132-4-Q6-Z(02) standard model, the cable fastener supported outer diameter is in the range of 21–26mm. If the cable outer diameter you use is smaller, you can choose the product with the cable outer diameter in the range of 15–20mm.

4.2.2 Standard wiring of control circuit

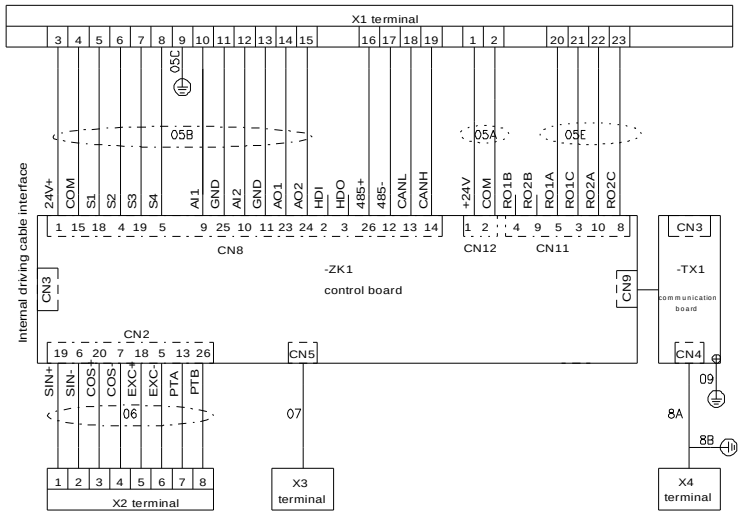


Figure 4–7 Control circuit wiring diagram (for non-STO models)

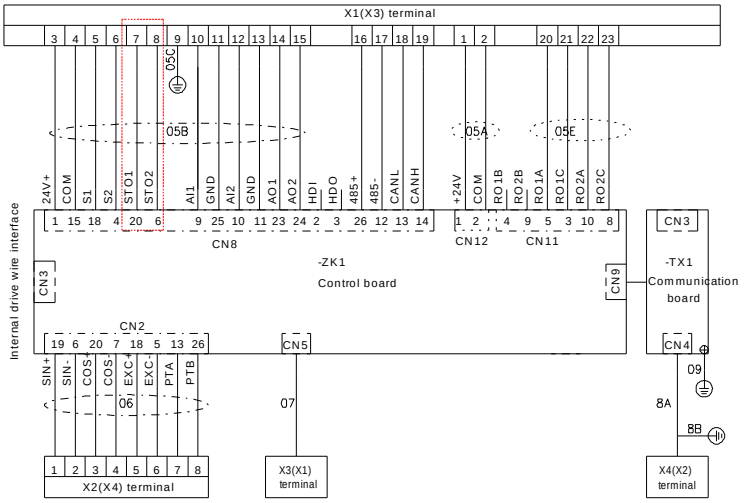


Figure 4–8 Control circuit wiring diagram (for STO models)

4.2.3 External interfaces

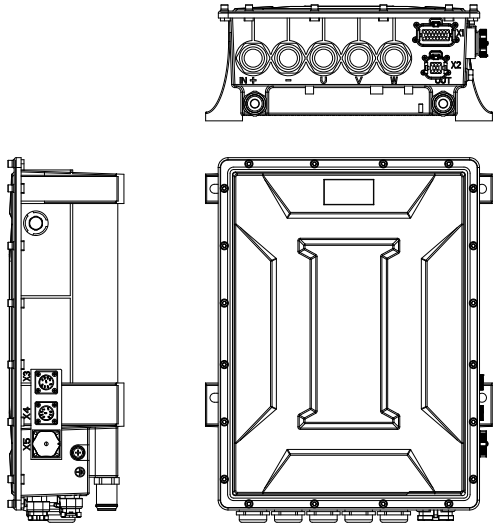


Figure 4–9 External interfaces of 45–132kW drive models

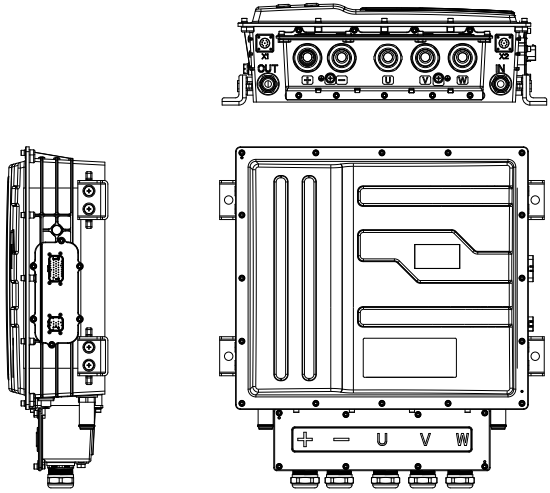


Figure 4–10 External interfaces of 160–200kW drive models

4.2.4 External control terminals

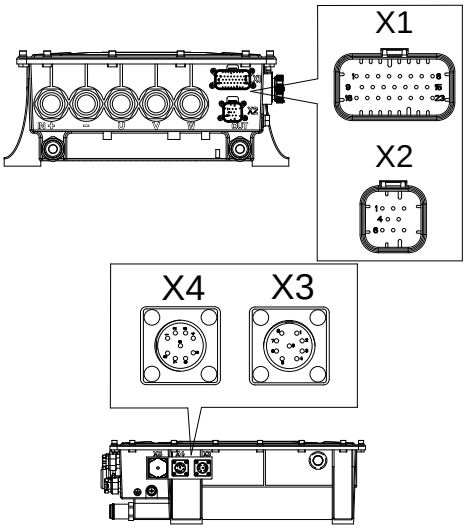


Figure 4–11 Control terminal layout of 45–132kW drive models

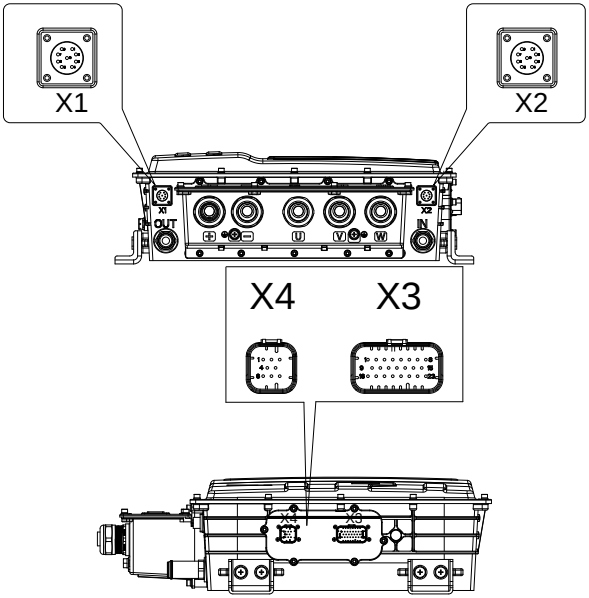


Figure 4–12 Control terminal layout of 160–200kW drive models

Table 4-3 Control terminal function definition

Aviation plug category	Aviation plug number	Internal terminal	Description
X1 (for lower than 132kW) X3 (for higher than 160kW)	1	+24V	Connection terminals of the external 24V power supply
	2	COM	
	3	+24V	When S terminal functions are used, the external 24V power supply is used.
	4	COM	
	5	S1	Programmable common digital input terminals. ● Internal impedance: 3.3kΩ ● Acceptable voltage input: 12–30V ● Bi-directional input terminals, supporting NPN and PNP connection modes ● Max. input frequency: 1kHz STO drive models are STO1 and STO2 Non-STO drive models are S3 and S4
	6	S2	
	7	STO1/S3	
	8	STO2/S4	
	9	⏚	Grounding terminal
	10	AI1	Input range: 0–10V/0–20mA
	11	GND	Reference ground of AI1
	12	AI2	Input range: 0–10V/0–20mA
	13	GND	Reference ground of AI2
	14	AO1	Analog output interfaces; output range: 0–10V voltage or 0–20mA current
	15	AO2	
	16	485+	RS485 communication interfaces, supporting the Modbus RTU communication protocol
	17	485-	
	18	CANL	CAN communication interfaces, supporting the CAN2.0B communication protocol
	19	CANH	
	20	RO1A	RO1 relay output terminals; RO1A is NO, and RO1C is the common terminal. Contact capacity: 3A/AC250V, 1A/DC30V
	21	RO1C	
	22	RO2A	RO2 relay output terminals; RO2A is NO, and RO2C is the common terminal. Contact capacity: 3A/AC250V, 1A/DC30V
	23	RO2C	
X2 (for lower than 132kW) X4 (for higher than 160kW)	1	SIN+	Resolver encoder signal input interfaces
	2	SIN-	
	3	COS+	
	4	COS-	
	5	EXC+	

Aviation plug category	Aviation plug number	Internal terminal	Description
	6	EXC-	
	7	PTA	Temperature detection signal interfaces, supporting PT100/PT1000 temperature input. The sensor type is model depended.
	8	PTB	
X3 (for lower than 132kW) X1 (for higher than 160kW)	1	+15V	Interfaces for an external keypad. A and B are the receiving terminals, while Y and Z are the sending terminals. **Note:** When an external keypad is used, the cable for connecting the aviation plug to the external keypad must be configured.
	2	+15V	
	3	A	
	4	Y	
	5	Z	
	6	B	
	7	GND	
	8	GND	
	9	None	
X4 (for lower than 132kW) X2 (for higher than 160kW)	1	TX+	Ethernet communication interfaces. **Note:** The cable dedicated for communication must be configured when the external communication function is enabled.
	2	TX-	
	3	RX+	
	4	None	
	5	None	
	6	RX-	
	7	None	
	8	None	
	9	None	
X5 (Reserved)	R	R	R/S/T phase detection cable, AC 380V
	S	S	
	T	T	

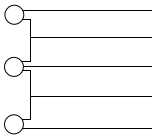
5 Operating the drive by keypad

5.1 Keypad introduction

The drive keypad is an important human-machine interface (HMI) device, used to control the running of the drive, and display and modify parameters of the drive.

Figure 5–1 Keypad

Item	Description	
Status indicator	RUN/TUNE	Drive running status indicator. LED off: The drive is stopped. LED blinking: The drive is autotuning parameters. LED on: The drive is running.
	FWD/REV	Forward or reverse running indicator. LED off: The drive is running forward. LED on: The drive is running reversely.
	LOCAL/REMOT	Indicates whether the drive is controlled through the keypad, terminals, or communication. LED off: The drive is controlled through the keypad. LED blinking: The drive is controlled through terminals. LED on: The drive is controlled through remote communication.
	TRIP	Fault indicator.

<table>
<tr><th>Item</th><th colspan="3">Description</th></tr>
<tr><td></td><td colspan="2"></td><td>LED on: in fault state
LED off: in normal state
LED blinking: in pre-alarm state</td></tr>
<tr><td rowspan="6">Unit indicator</td><td colspan="3">Unit displayed currently</td></tr>
<tr><td colspan="2" rowspan="5">  </td><td>Hz</td><td>Frequency unit</td></tr>
<tr><td>RPM</td><td>Rotational speed unit</td></tr>
<tr><td>A</td><td>Current unit</td></tr>
<tr><td>%</td><td>Percentage</td></tr>
<tr><td>V</td><td>Voltage unit</td></tr>
<tr><td>Digital display</td><td colspan="3">Five-digit LED displays various monitoring data and alarm codes such as the frequency setting and output frequency.
<table>
<tr><th>Display</th><th>Means</th><th>Display</th><th>Means</th><th>Display</th><th>Means</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>3</td><td>3</td><td>4</td><td>4</td><td>5</td><td>5</td></tr>
<tr><td>6</td><td>6</td><td>7</td><td>7</td><td>8</td><td>8</td></tr>
<tr><td>9</td><td>9</td><td>A.</td><td>A</td><td>b</td><td>b</td></tr>
<tr><td>C.</td><td>C</td><td>d</td><td>d</td><td>E.</td><td>E</td></tr>
<tr><td>F.</td><td>F</td><td>H.</td><td>H</td><td>I.</td><td>I</td></tr>
<tr><td>L.</td><td>L</td><td>n.</td><td>N</td><td>n</td><td>n</td></tr>
<tr><td>o</td><td>o</td><td>P.</td><td>P</td><td>r</td><td>r</td></tr>
<tr><td>S.</td><td>S</td><td>t</td><td>t</td><td>U.</td><td>U</td></tr>
<tr><td>v</td><td>v</td><td>.</td><td>.</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td rowspan="6">Keys</td><td>  </td><td>Programming key</td><td>Press it to enter or exit level-1 menus or delete a parameter.</td></tr>
<tr><td>  </td><td>Entry key</td><td>Press it to enter menus in cascading mode or confirm the setting of a parameter.</td></tr>
<tr><td>  </td><td>Up</td><td>Press it to increase data or move upward.</td></tr>
<tr><td>  </td><td>Down</td><td>Press it to decrease data or move downward.</td></tr>
<tr><td>  </td><td>Right shifting</td><td>Press it to select display parameters rightward in the interface for the drive in stopped or running state or to select digits to change during parameter setting.</td></tr>
<tr><td>  </td><td>Run</td><td>Press it to run the drive when using the keypad for control.</td></tr>
</table>

Item	Description		
		Stop/Reset	Press it to stop the device that is running. The function of this key is restricted by P07.04. In fault alarm state, this key can be used for reset in any control modes.
		Multifunctional shortcut key	The function is determined by P07.02.
		Combination	Press them simultaneously for the drive to coast to stop.

5.2 Keypad display

The keypad may display the stopped-state parameters, running-state parameters, function parameter editing status, and fault alarm status.

Goodrive800-51 series keypad display has a priority. The priority is: Communication between the keypad and main control board fails⟶Fault codes⟶C.oFF⟶P.oFF⟶Normal running parameters. See the following figure.

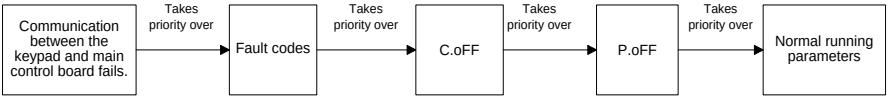


Figure 5–2 Keypad display priority

5.2.1 Displaying stopped-state parameters

When the drive is in stopped state, the keypad displays stopped-state parameters, as shown in Figure 5–3.

You can determine which parameters are displayed by setting the binary bits of P07.07. For definitions of the bits, see the description of P07.07.

P07.07 is used to select parameters to be displayed in stopped state. There are 14 parameters to be selected, including frequency setting, bus voltage, input terminal status, output terminal status, PID reference, PID feedback, torque setting, AI1, AI2, AI3, high-speed pulse HDI frequency, PLC and current step of multi-step speed, pulse counting value and length value.

You can press 》/SHIFT to shift selected parameters from left to right or press QUICK/JOG (P07.02=2) to shift selected parameters from right to left.

5.2.2 Displaying running-state parameters

After receiving a valid running command, the drive enters the running state, and the keypad display running-state parameters, with the RUN/TUNE indicator on. The on/off state of the FWD/REV indicator is determined by the running direction. See Figure 5–2.

P07.05 and P07.06 specify which parameters are displayed in running state. There are 25 parameters that can be displayed in running state, including running frequency, frequency setting, bus voltage, output voltage, output current, rotating speed in running, output power, output torque, PID reference, PID feedback, input terminal status, output terminal status, torque setting, pulse count value, length value, PLC and current step of multi-step speed, AI1, AI2, AI3, high-speed pulse HDI frequency, motor overload percentage, drive overload percentage, ramp frequency reference, linear speed, and AC incoming current.

You can press 》/SHIFT to shift selected parameters from left to right or press QUICK/JOG (P07.02=2) to shift selected parameters from right to left.

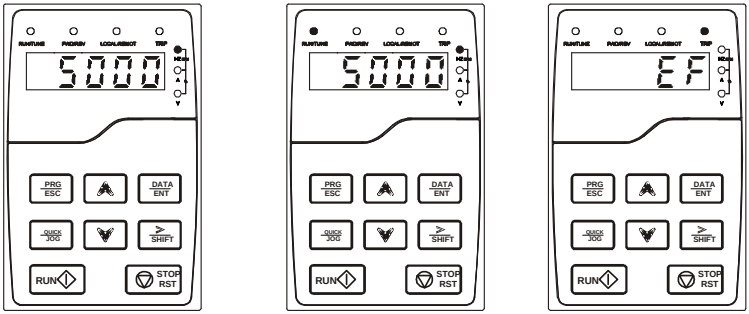
5.2.3 Displaying fault information

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

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

5.2.4 Editing function codes

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



Parameters displayed in stopped state | Parameters displayed in running state | Information displayed in faulty state

Figure 5–3 Keypad display

5.3 How to operate the drive by keypad

You can operate the drive by keypad. For details about the structure of the function codes, see the function code table.

5.3.1 Modifying drive function codes

1. Function code group number (level-1 menu)
2. Function code number (level-2 menu)
3. Function code setting (level-3 menu)

Note: When performing operations on the level-3 menu, you can press the PRG/ESC or DATA/ENT key to return to the level-2 menu. If you press the DATA/ENT key, the set value of the parameter is saved to the control board first, and then the level-2 menu is returned, displaying the next function code. If you press the PRG/ESC key, the level-2 menu is returned directly, without saving the set value of the parameter, and the current function code is displayed.

If you enter the level-3 menu but the parameter does not have a digit blinking, the parameter cannot be modified due to either of the following reasons:

(1) It is read only. Read-only parameters include actual detection parameters and running record parameters.

(2) It cannot be modified in running state and can be modified only in stopped state.

Example: Change the value of P00.01 from 0 to 1.

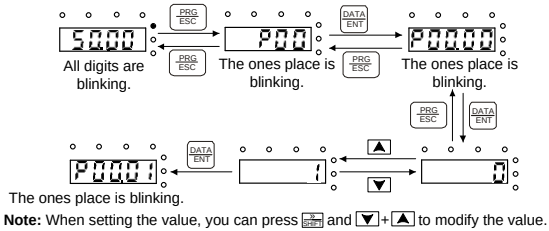


Figure 5–4 Modifying a parameter

5.3.2 Setting a password

The drive provides the user password protection function. When you set P07.00 to a non-zero value, the value is the user password. After you exit the function code editing interface, the password protection function is enabled within 1 minute. If password protection is enabled, "0.0.0.0.0" is displayed when you press the PRG/ESC key again to enter the function code editing interface. You need to enter the correct user password to enter the interface.

To disable the password protection function, you need only to set P07.00 to 0.

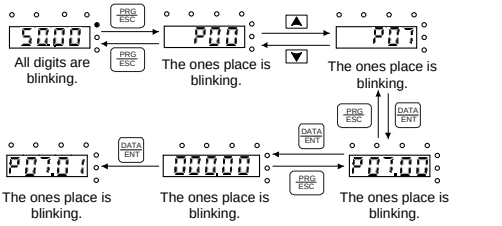


Figure 5–5 Setting a password

5.3.3 Viewing drive status

The drive provides groups P17 and P18 for status viewing. You can access P17 and P18 for viewing.

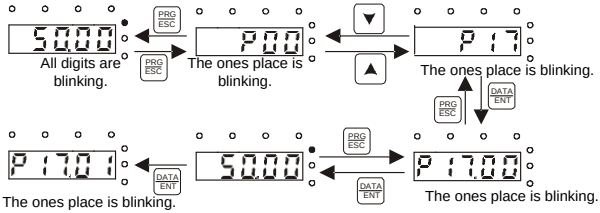


Figure 5–6 Viewing parameter setting

6 Function parameter list

6.1 What this chapter contains

This chapter lists all the function codes and corresponding descriptions of the function codes.

6.2 Function parameters

The function parameters of the drive are divided into 30 groups (P00–P29) by function, and each function group includes several function codes (each function code identifies a function parameter). A three-level menu style is applied to function codes. For example, "P08.08" indicates the 8th function code in the P08 group. The P29 group indicates factory function parameters, which are user inaccessible.

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

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

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

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

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

Column 4 " Default ": Initial value set in factory

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

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

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

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

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

2. The parameters adopt the decimal system (DEC). If the hexadecimal system is adopted, the data in each digit is independent from each other during parameter editing. The values of some of the digits can be hexadecimal (0–F).

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

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

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

5. When you modify function parameters through serial communication, the user password protection function is also applicable and compliant with the same rule.

P00 group Basic functions

Function code	Name	Description	Default	Modify
P00.00	Speed control mode	0: Sensorless vector control 1 (SVC 1) (applicable to AMs and SMs) 1: SVC 2 (applicable to AMs) 2: V/F control 3: Closed-loop vector control **Note:** AM is short for asynchronous motor, and SM is short for synchronous motor. Setting range: 0–3	3	◎
P00.01	Channel of running commands	0: Keypad (LED off) 1: Terminal (LED blinking) 2: Communication (LED on) Setting range: 0–2	0	○
P00.02	Communication channel of running commands	0: Modbus 1: PROFIBUS/CAN2.0B 2: Ethernet 3: CAN2.0 **Note:** The options 1, 2, and 3 are expansion functions that can be implemented only after the corresponding expansion card is inserted. Setting range: 0–3	0	○
P00.03	Max. output frequency	P00.04–600.00 Hz (400.00 Hz) Setting range: 10.00–600.00	50.00Hz	◎
P00.04	Upper limit of running frequency	P00.05–P00.03 (Max. output frequency)	50.00Hz	◎
P00.05	Lower limit of running frequency	0.00Hz–P00.04 (Upper limit of running frequency)	0.00Hz	◎
P00.06	Frequency A command source	0: Keypad 1: Analog input AI1	0	○

Function code	Name	Description	Default	Modify
P00.07	Frequency B command source	2: Analog input AI2 3: Analog input AI3 4: High-speed pulse HDI 5: Simple PLC 6: Multi-step speed running 7: PID control 8: Modbus communication 9: PROFIBUS/CAN2.0B communication 10: Ethernet communication (reserved) 11: CAN2.0 communication 12: (Reserved) Setting range: 0–12	2	○
P00.08	Frequency B command reference object	0: Max. output frequency 1: Frequency A command Setting range: 0–1	0	○
P00.09	Combination mode of setting channels	0: A 1: B 2: A+B 3: A-B 4: Max.(A, B) 5: Min.(A, B) Setting range: 0–5	0	○
P00.10	Frequency set through keypad	0.00 Hz–P00.03 (Max. output frequency)	50.00Hz	○
P00.11	ACC time 1	0.0–3600.0s	Model depended	○
P00.12	DEC time 1	0.0–3600.0s	Model depended	○
P00.13	Running direction	0: Run in the default direction 1: Run in the reverse direction 2: Disable reverse running Setting range: 0–2	0	○
P00.14	Carrier frequency	1.2–8.0kHz	Model depended	○
P00.15	Motor autotuning	0: No operation 1: Rotating autotuning (reserved) 2: Static autotuning (identifying the empty-load	0	◎

Function code	Name	Description	Default	Modify
		current and mutual inductance) 3: Static autotuning (without identifying the empty-load current and mutual inductance) Setting range: 0–3		
P00.16	AVR function setting	0: Invalid 1: Always valid Setting range: 0–1	1	○
P00.17	Drive type	0: G type 1: P type Setting range: 0–1	0	◎
P00.18	Function parameter restoration	0: No operation 1: Restore the default values 2: Delete the fault records Setting range: 0–2	0	◎

P01 group Start and stop control

Function code	Name	Description	Default	Modify
P01.00	Start mode	0: Direct start 1: Start after DC braking 2: Start after rotation speed tracking 1 Setting range: 0–2	0	◎
P01.01	Starting frequency at direct start	0.00–50.00Hz	0.00Hz	◎
P01.02	Starting frequency hold time	0.0–50.0s	0.0s	◎
P01.03	Braking current before start	0.0–100.0%	0.0%	◎
P01.04	Braking time before start	0.0–30.0s	0.0s	◎
P01.05	ACC and DEC type	0: Linear type 1: S-curve type Setting range: 0–1	0	◎
P01.06	ACC time at the S-curve start phase	0.0–50.0s	0.1s	◎

Function code	Name	Description	Default	Modify
P01.07	DEC time at the S-curve end phase	0.0–50.0s	0.1s	◎
P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop Setting range: 0–1	0	○
P01.09	Starting frequency at stop braking	0.00–P00.03 (Max. output frequency)	0.00Hz	○
P01.10	Demagnetizing time	0.00–30.00s	0.00s	○
P01.11	DC braking current at stop	0.0–100.0%	0.0%	○
P01.12	DC braking time at stop	0.0–50.0s	0.0s	○
P01.13	Forward/reverse running deadzone time	0.0–3600.0s	0.0s	○
P01.14	Forward/reverse running switching mode	0: Switched at the zero frequency 1: Switched when the starting frequency is exceeded Setting range: 0–1	0	◎
P01.15	Stop speed	0.00–100.00Hz	0.20 Hz	◎
P01.16	Stop speed detection method	0: By preset speed (this is the only detection mode in V/F mode) 1: By detected speed Setting range: 0–1	0	◎
P01.17	Stop speed delay	0.0–100.0 s	0.5s	◎
P01.18	Terminal-based running command protection at power-on	0: The terminal-based running command is invalid at power-on. 1: The terminal-based running command is valid at power-on. Setting range: 0–1	0	○
P01.19	Action performed when the running frequency is lower than the lower frequency limit (valid when the	0: Run at the frequency lower limit 1: Stop 2: Sleep 3: Run at the zero frequency Setting range: 0–3	0	◎

Function code	Name	Description	Default	Modify
	lower frequency limit is greater than 0)			
P01.20	Delay to recovery from sleep	0.0–3600.0s (valid when P01.19=2)	0.0s	○
P01.21	Restart after power failure	0: Disable restart 1: Enable restart Setting range: 0–1	0	○
P01.22	Wait time for restart after power failure	0.0–3600.0s (valid when P01.17=1)	1.0s	○
P01.23	Start delay	0.00–60.00s	0.00s	○
P01.24	Stop speed delay	0.00–60.00s	0.00s	○
P01.25	DEC time at emergency stop	0.0–60.0s	2.0s	○

P02 group Motor 1 parameters

Function code	Name	Description	Default	Modify
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM) Setting range: 0–1	1	◎
P02.01	Rated power of AM 1	0.1–3000.0kW	Model depended	◎
P02.02	Rated frequency of AM 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.03	Rated rotation speed of AM 1	1–36000rpm	Model depended	◎
P02.04	Rated voltage of AM 1	0–1200V	Model depended	◎
P02.05	Rated current of AM 1	0.8–6000.0A	Model depended	◎
P02.06	Stator resistance of AM 1	0.001–65.535Ω	Model depended	○
P02.07	Rotor resistance of AM 1	0.001–65.535Ω	Model depended	○

Function code	Name	Description	Default	Modify
P02.08	Leakage inductance of AM 1	0.1–6553.5mH	Model depended	○
P02.09	Mutual inductance of AM 1	0.1–6553.5mH	Model depended	○
P02.10	Empty-load current of AM 1	0.1–6553.5A	Model depended	○
P02.11	Magnetic saturation coefficient 1 for the iron core of AM 1	0.0–100.0%	83.0%	◎
P02.12	Magnetic saturation coefficient 2 for the iron core of AM 1	0.0–100.0%	70.0%	◎
P02.13	Magnetic saturation coefficient 3 for the iron core of AM 1	0.0–100.0%	57.0%	◎
P02.14	Magnetic saturation coefficient 4 for the iron core of AM 1	0.0–100.0%	40.0%	◎
P02.15	Rated power of SM 1	0.1–3000.0kW	Model depended	◎
P02.16	Rated frequency of SM 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.17	Number of pole pairs of SM 1	1–128	2	◎
P02.18	Rated voltage of SM 1	0–1200V	Model depended	◎
P02.19	Rated current of SM 1	0.8–6000.0A	Model depended	◎

Function code	Name	Description	Default	Modify
P02.20	Stator resistance of SM 1	0.001–65.535Ω	Model depended	○
P02.21	Direct-axis inductance of SM 1	0.01–655.35mH	Model depended	○
P02.22	Quadrature-axis inductance pole pairs	0.01–655.35mH	Model depended	○
P02.23	Counter electromotive force of SM 1	0–10000	300	○
P02.24	Initial magnetic pole position of SM 1 (reserved)	0x0000–0xFFFF	0x0000	●
P02.25	Identification current of SM 1 (reserved)	0%–50% (rated current of the motor)	10%	●
P02.26	Overload protection setting for motor 1	0: No protection 1: Common motor (with low speed compensation) 2: Variable-frequency motor (without low speed compensation) Setting range: 0–2	2	◎
P02.27	Overload protection coefficient for motor 1	20.0%–120.0%	100.0%	○
P02.28	Rotor resistance compensation coefficient	0.0–200.0%	0.0%	◎
P02.29	Parameter display setting for motor 1	0: Display by motor type 1: Display all the parameters Setting range: 0–1	0	○

P03 group Vector control

Function code	Name	Description	Default	Modify
P03.00	ASR proportional gain 1	0–200.0	16.0	○
P03.01	ASR integral time 1	0.000–10.000s	0.200s	○
P03.02	Low-point frequency for switching	0.00Hz–P03.05	5.00Hz	○
P03.03	ASR proportional gain 2	0–200.0	10.0	○
P03.04	ASR integral time 2	0.000–10.000s	0.200s	○
P03.05	High-point frequency for switching	P03.02–P00.03 (Max. output frequency)	10.00Hz	○
P03.06	ASR output filtering	0–8 (corresponding to 0–2^8/10ms)	0	○
P03.07	Vector control slip compensation coefficient (electromotion)	50%–200%	100%	○
P03.08	Vector control slip compensation coefficient (power generation)	50%–200%	100%	○
P03.09	ACR proportional coefficient P	0–20000	1000	○
P03.10	ACR integral coefficient I	0–20000	1000	○
P03.11	Torque setting method	0: Torque control disabled 1: Keypad (P03.12) 2: Analog input AI1 (100% corresponding to the motor rated current) 3: Analog input AI2 (same as above) 4: Analog input AI3 (same as above) 5: Pulse frequency HDI (same as above)	0	○

Function code	Name	Description	Default	Modify
		6: Multi-step speed running (same as above) 7: Modbus communication (same as above) 8: PROFIBUS/CAN2.0B communication (same as above) 9: Ethernet communication (same as above) 10: Reserved Setting range: 0–10		
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	10.0%	○
P03.13	Torque reference filtering time	0.000–10.000s	0.100s	○
P03.14	Source for setting upper frequency limit of forward rotation in torque control	0: Keypad (P03.16) 1: Analog input AI1 (100% corresponds to the maximum frequency) 2: Analog input AI2 (same as above) 3: Analog input AI3 (same as above) 4: Pulse frequency HDI (same as above) 5: Multi-step running (same as above) 6: Modbus communication (same as above) 7: PROFIBUS/CAN2.0B communication (same as above) 8: Ethernet communication (same as above) Setting range: 0–8	0	○
P03.15	Source for setting upper frequency limit of reverse rotation in torque control	0: Keypad (P03.17) 1: Analog input AI1 (100% corresponds to the maximum frequency) 2: Analog input AI2 (same as above) 3: Analog input AI3 (same as above) 4: Pulse frequency HDI (same as above) 5: Multi-step running (same as above) 6: Modbus communication (same as above) 7: PROFIBUS/CAN2.0B communication (same as above) 8: Ethernet communication (same as above) Setting range: 0–8	0	○
P03.16	Forward rotation upper frequency	0.00Hz–P00.03	50.00 Hz	○

Function code	Name	Description	Default	Modify
	limit set through keypad in torque control			
P03.17	Reverse rotation upper frequency limit set through keypad in torque control	0.00 Hz–P00.03	50.00Hz	○
P03.18	Source for setting upper limit of electromotive torque	0: Keypad (P03.20) 1: Analog input AI1 (100% corresponds to 3 times of the motor rated current) 2: Analog input AI2 (same as above) 3: Analog input AI3 (same as above) 4: Pulse frequency HDI (same as above) 5: Modbus communication (same as above) 6: PROFIBUS/CAN2.0B communication (same as above) 7: Ethernet communication (same as above) Setting range: 0–7	0	○
P03.19	Source for setting upper limit of braking torque	0: Keypad (P03.21) 1: Analog input AI1 (100% corresponds to 3 times of the motor rated current) 2: Analog input AI2 (same as above) 3: Analog input AI3 (same as above) 4: Pulse frequency HDI (same as above) 5: Modbus communication (same as above) 6: PROFIBUS/CAN2.0B communication (same as above) 7: Ethernet communication (same as above) Setting range: 0–7	0	○
P03.20	Electromotive torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	200.0%	○
P03.21	Braking torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	200.0%	○

Function code	Name	Description	Default	Modify
P03.22	Flux-weakening coefficient in the constant power zone	0.01–2.00	1.00	○
P03.23	Lowest flux-weakening point in the constant power zone	5%–50%	20%	○
P03.24	Max. voltage limit	0.0–120.0%	100.0%	○
P03.25	Pre-exciting time	0.000–10.000s	0.000s	○
P03.26	Flux-weakening proportional gain	0–8000	1200	○
P03.27	Flux-weakening integral gain	0–8000	1200	○
P03.28	Flux-weakening control mode	Ones place: Control mode selection 0–2 Tens place: Inductance compensation selection 0: Compensation 1: No compensation Hundreds place: High-speed control mode 0: Mode 0 1: Mode 1 Thousands place: Flux-weakening mode 0: Mode 0 1: Mode 1 2: Mode 2 Setting range: 0–0x112	0	○
P03.29	Control mode	Ones place: Torque command selection 0: Torque setting 1: Torque current setting Tens place: Torque compensation direction at zero-speed friction 0: Forward 1: Reverse Hundreds place: ASR integral separation	0x0001	○

Function code	Name	Description	Default	Modify
		selection 0: Disabled 1: Enabled Thousands place: Torque control word selection Bit0: Torque command filtering mode 0: Inertial filtering 1: Linear ACC and DEC filtering Bit1–2: Upper rotation speed limit ACC/DEC time selection 0: No ACC/DEC time 1: ACC/DEC time 1 2: ACC/DEC time 2 3: ACC/DEC time 3 Setting range: 0–0x7111		
P03.30	Low-speed friction torque	0–50.0% (of the motor rated torque)	0.0%	○
P03.31	High-speed friction torque	0–50.0% (of the motor rated torque)	0.0%	○
P03.32	Frequency corresponding to high-speed friction torque	1.00 Hz–600.00Hz	50.00Hz	○

P04 group V/F control

Function code	Name	Description	Default	Modify
P04.00	V/F curve setting of motor 1	0: Linear V/F curve 1: Multi-point V/F curve 2: Torque-stepdown characteristics V/F curve (1.3 order) 3: Torque-stepdown characteristics V/F curve (1.7 order) 4: Torque-stepdown characteristics V/F curve (2.0 order) 5: User-defined V/F curve (V/F separation)	0	◎

Function code	Name	Description	Default	Modify
		Setting range: 0–5		
P04.01	Torque boost of motor 1	0.0%: (auto) 0.1%–10.0%	0.0%	○
P04.02	Torque boost stop of motor 1	0.0%–50.0% (of the rated frequency of motor 1)	20.0%	○
P04.03	V/F frequency point 1 of motor 1	0.00Hz–P04.05	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1	0.0%–110.0% (of the rated voltage of motor 1)	0.0%	○
P04.05	V/F frequency point 2 of motor 1	P04.03– P04.07	0.00Hz	○
P04.06	V/F voltage point 2 of motor 1	0.0%–110.0% (of the rated voltage of motor 1)	0.0%	○
P04.07	V/F frequency point 3 of motor 1	P04.05–P02.02 (rated frequency of motor 1) or P04.05–P02.16 (rated frequency of motor 1)	0.00Hz	○
P04.08	V/F voltage point 3 of motor 1	0.0%–110.0% (of the rated voltage of motor 1)	0.0%	○
P04.09	V/F slip compensation gain of motor 1	0.0–200.0%	100.0%	○
P04.10	Low-frequency oscillation control factor of motor 1	0–100	10	○
P04.11	High-frequency oscillation control factor of motor 1	0–100	10	○
P04.12	Oscillation control threshold for motor 1	0.00Hz–P00.03 (Max. output frequency)	30.00Hz	○
P04.13	V/F curve setting of motor 2	0: Linear V/F curve 1: Multi-point V/F curve 2: Torque-stepdown characteristics V/F curve (1.3 order) 3: Torque-stepdown characteristics V/F curve (1.7 order) 4: Torque-stepdown characteristics V/F curve	0	◎

Function code	Name	Description	Default	Modify
		(2.0 order) 5: User-defined V/F curve (V/F separation) Setting range: 0–5		
P04.14	Torque boost of motor 2	0.0%: (auto) 0.1%–10.0%	0.0%	○
P04.15	Torque boost stop of motor 2	0.0%–50.0% (of the rated frequency of motor 2)	20.0%	○
P04.16	V/F frequency point 1 of motor 2	0.00Hz– P04.18	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2	0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.18	V/F frequency point 2 of motor 2	P04.16– P04.20	0.00Hz	○
P04.19	V/F voltage point 2 of motor 2	0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.20	V/F frequency point 3 of motor 2	P04.18–P12.02 (rated frequency of motor 2) or P04.18–P12.16 (rated frequency of motor 2)	0.00Hz	○
P04.21	V/F voltage point 3 of motor 2	0.0%–110.0% (of the rated voltage of the motor)	0.0%	○
P04.22	V/F slip compensation gain of motor 2	0.0–200.0%	100.0%	○
P04.23	V/F slip compensation gain of motor 2	0–100	10	○
P04.24	Low-frequency oscillation control factor of motor 2	0–100	10	○
P04.25	High-frequency oscillation control factor of motor 2	0.00Hz–P00.03 (Max. output frequency)	30.00 Hz	○
P04.26	Oscillation control threshold for motor 2	0: No action 1: Auto energy-saving running (reserved) Setting range: 0–1	0	◎
P04.27	Voltage setting channel	0: Keypad (determined by P04.28) 1: AI1	0	○

Function code	Name	Description	Default	Modify
		2: AI2 3: AI3 4: HDI 5: Multi-step speed running (determined by the multi-step speed set in parameters of the P10 group) 6: PID 7: Modbus communication 8: PROFIBUS/CAN2.0B communication 9: Ethernet communication 10: Reserved Setting range: 0–10		
P04.28	Voltage set through keypad	0.0%–100.0%	100.0%	○
P04.29	Voltage increasing time	0.0–3600.0s	5.0s	○
P04.30	Voltage decreasing time	0.0–3600.0s	5.0s	○
P04.31	Max. output voltage	P04.32–100.0% (of the rated voltage of the motor)	100.0%	◎
P04.32	Min. output voltage	0.0%– P04.31 (rated voltage of the motor)	0.0%	◎
P04.33	Flux-weakening coefficient in the constant power zone	1.00–1.30	1.00	○
P04.34–P04.35	Reserved			

P05 group Input terminal parameters

Function code	Name	Description	Default	Modify
P05.00	HDI input type	0: High-speed pulse input 1: Digital input Setting range: 0–1	0	●

Function code	Name	Description	Default	Modify
P05.01	S1 terminal function	0: No function 1: Forward running 2: Reverse running 3: 3-wire running control 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Suspend running 9: External fault input 10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Cancel the setting of frequency increase/decrease 13: Switch between setting A and setting B 14: Switch between combined setting and setting A 15: Switch between combined 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: Suspend multi-step speed 21: ACC/DEC time 1 22: ACC/DEC time 2 23: Stop the simple PLC for reset 24: Suspend the simple PLC 25: Suspend PID control 26: Forward running position limit 27: Reverse running position limit 28: Reserved 29: Disable torque control 30: Disable ACC/DEC 31–32: Reserved 33: Temporarily delete the setting of frequency increase/decrease	1	◎
P05.02	S2 terminal function		4	◎
P05.03	S3 terminal function		7	◎
P05.04	S4 terminal function		0	◎
P05.05	Reserved		0	◎
P05.06	Reserved		0	◎
P05.07	Reserved		0	◎
P05.08	Reserved		0	◎
P05.09	HDI terminal function		0	◎

Function code	Name	Description	Default	Modify
		34: DC braking 35: Switch from motor 1 to motor 2 36: Switch to the command channel of keypad 37: Switch to the command channel of terminal 38: Switch to the command channel of communication 39: Pre-exciting command 40: Delete power consumption records 41: Keep power consumption records 42: Switch the torque upper limit setting source to keypad 43: Position reference point input (valid only for S6, S7, and S8) 44: Disable spindle orientation 45: Spindle returning to zero/local positioning returning to zero 46: Brake feedback 47: Anti-snag protection 48: Spindle indexing 1 49: Spindle indexing 2 50: Spindle indexing 3 51: Terminal for switching between position control and speed control 52: Disable pulse input 53: Eliminate position deviation 54: Switch position proportional gain 55: Enable cyclic digital positioning 56: Emergency stop 57: Motor overtemperature fault input 58: Enable rigid tapping 59: Switch to V/F control 60: Switch to FVC control 61: Switch PID polarity 62: Input of bus undervoltage stop signal 63: Enable the servo Setting range: 0–63		

Function code	Name	Description	Default	Modify
P05.10	Input terminal polarity	0x000–0x1FF	0x000	○
P05.11	Digital filtering time	0.000–1.000s	0.010s	○
P05.12	Virtual terminal setting	0x000–0x1FF (0: Disable; 1: Enable) BIT0: S1 virtual terminal BIT1: S2 virtual terminal BIT2: S3 virtual terminal BIT3: S4 virtual terminal BIT4: S5 virtual terminal BIT5: S6 virtual terminal BIT6: S7 virtual terminal BIT7: S8 virtual terminal BIT8: HDI virtual terminal	0x000	◎
P05.13	Terminal control mode	0: Two-wire control 1 1: Two-wire control 2 2: Three-wire control 1 3: Three-wire control 2 Setting range: 0–3	0	◎
P05.14	Switch-on delay of S1 terminal	0.000–50.000s	0.000s	○
P05.15	Switch-off delay of S1 terminal	0.000–50.000s	0.000s	○
P05.16	Switch-on delay of S2 terminal	0.000–50.000s	0.000s	○
P05.17	Switch-off delay of S2 terminal	0.000–50.000s	0.000s	○
P05.18	Switch-on delay of S3 terminal	0.000–50.000s	0.000s	○
P05.19	Switch-off delay of S3 terminal	0.000–50.000s	0.000s	○
P05.20	Switch-on delay of S4 terminal	0.000–50.000s	0.000s	○
P05.21	Switch-off delay of S4 terminal	0.000–50.000s	0.000s	○

Function code	Name	Description	Default	Modify
P05.22–P05.31	Reserved			
P05.32	Lower limit of AI1	0.00V–P05.34	0.00V	○
P05.33	Setting corresponding to lower limit of AI1	-300.0%–300.0%	0.0%	○
P05.34	Upper limit of AI1	P05.32–10.00V	10.00V	○
P05.35	Setting corresponding to upper limit of AI1	-300.0%–300.0%	100.0%	○
P05.36	AI1 input filtering time	0.000s–10.000s	0.030s	○
P05.37	Lower limit of AI2	0.00V–P05.39	0.00V	○
P05.38	Setting corresponding to lower limit of AI2	-300.0%–300.0%	0.0%	○
P05.39	Upper limit of AI2	P05.37–10.00V	10.00V	○
P05.40	Setting corresponding to upper limit of AI2	-300.0%–300.0%	100.0%	○
P05.41	AI2 input filtering time	0.000s–10.000s	0.030s	○
P05.42–P05.48	Reserved			
P05.49	HDI high-speed pulse input function selection	0: Frequency setting input 1–2: Reserved	0	◎
P05.50	Lower frequency limit of HDI	0.000 KHz–P05.52	0.000KHz	○
P05.51	Setting corresponding to lower frequency limit of HDI	-300.0%–300.0%	0.0%	○
P05.52	Upper frequency limit of HDI	P05.50–50.000KHz	50.000KHz	○
P05.53	Setting corresponding to	-300.0%–300.0%	100.0%	○

Function code	Name	Description	Default	Modify
	upper frequency limit of HDI			
P05.54	HDI frequency input filtering time	0.000s–10.000s	0.030s	○

P06 group Output terminal parameters

Function code	Name	Description	Default	Modify
P06.00	HDO output type	0: Open collector high-speed pulse output	0	●
P06.01	RO1 output	0: Invalid 1: Running 2: Running forward 3: Running reversely 4: Jogging 5: Drive fault 6: Frequency detection threshold 1 (FDT1) 7: Frequency detection threshold 2 (FDT2) 8: Frequency reached 9: Zero-speed running 10: Upper frequency limit reached 11: Lower frequency limit reached 12: Ready for running 13: Pre-exciting 14: Overload alarm 15: Underload alarm 16: Simple PLC stage completed 17: Simple PLC cycle completed 18: Set count value reached 19: Specified count value reached 20: External fault occurring 21: Length reached 22: Running time reached 23: Virtual terminal input in Modbus communication 24: Virtual terminal input in PROFIBUS communication	0	○
P06.02	RO2 output		0	○

Function code	Name	Description	Default	Modify
		26: DC bus voltage established 27: Brake control 28–29: Reserved 30: Positioning completed 31: Spindle returning to zero completed 32: Spindle indexing completed 33: Speed limit reached during torque control 34: Bus voltage too low 35: Bus undervoltage stop state output 36: Speed/position control switching completed 37–40: Reserved Setting range: 0–40		
P06.05	Output terminal polarity	0x00–0x0F	0x00	○
P06.06	RO1 switch-on delay	0.000–50.000s	0.000s	○
P06.07	RO1 switch-off delay	0.000–50.000s	0.000s	○
P06.08	RO2 switch-on delay	0.000–50.000s	0.000s	○
P06.09	RO2 switch-off delay	0.000–50.000s	0.000s	○
P06.10–P06.13	Reserved			
P06.14	AO1 output	0: Running frequency 1: Frequency setting 2: Ramp frequency reference 3: Rotating speed in running 4: Output current (corresponding to the drive) 5: Output current (corresponding to the motor) 6: Output voltage 7: Output power 8: Torque setting 9: Output torque 10: Value input through AI1 11: Value input through AI2	0	○
P06.15	AO2 output		0	○
P06.16	HDO high-speed pulse output		0	○

Function code	Name	Description	Default	Modify
		12: Value input through AI3 13: Value input through high-speed pulse HDI 14: Value 1 set through Modbus communication 15: Value 2 set through Modbus communication 16: Value 1 set through PROFIBUS/CAN2.0B communication 17: Value 2 set through PROFIBUS/CAN2.0B communication 18: Value 1 set through Ethernet communication 19: Value 2 set through Ethernet communication 20–21: Reserved 22: Torque current (bipolar, 100% corresponds to 10 V) 23: Exciting current (100% corresponds to 10 V) 24: Frequency setting (bipolar) 25: Ramp frequency reference (bipolar) 26: Rotating speed in running (bipolar) Setting range: 0–26		
P06.17	Lower limit of AO1 output	-300.0%–P06.19	0.0%	○
P06.18	AO1 output corresponding to the lower limit	0.00V–10.00V	0.00V	○
P06.19	Upper limit of AO1 output	P06.17–300.0%	100.0%	○
P06.20	AO1 output corresponding to the upper limit	0.00V–10.00V	10.00V	○
P06.21	AO1 output filtering time	0.000s–10.000s	0.000s	○
P06.22	Lower limit of AO2 output	-300.0%–P06.24	0.0%	○

Function code	Name	Description	Default	Modify
P06.23	AO2 output corresponding to the lower limit	0.00V–10.00V	0.00V	○
P06.24	Upper limit of AO2 output	P06.22–300.0%	100.0%	○
P06.25	AO2 output corresponding to the upper limit	0.00V–10.00V	10.00V	○
P06.26	AO2 output filtering time	0.000s–10.000s	0.000s	○
P06.27	Lower limit of HDO output	-300.0%–P06.29	0.00%	○
P06.28	HDO output corresponding to the lower limit	0.00–50.00kHz	0.0kHz	○
P06.29	Upper limit of HDO output	P06.27–300.0%	100.0%	○
P06.30	HDO output corresponding to the upper limit	0.00–50.00kHz	50.00kHz	○
P06.31	HDO output filtering time	0.000s–10.000s	0.000s	○

P07 group HMI

Function code	Name	Description	Default	Modify
P07.00	User password	Setting range: 0–65535	0	○
P07.01	Function parameter copying	0: No operation 1: Upload function parameters from the machine to keypad 2: Download function parameters (including the motor parameters) from the keypad to machine 3: Download function parameters (excluding motor parameters of the P02 and P12 groups) from the keypad to machine	0	◎

Function code	Name	Description	Default	Modify
		4: Download function parameters (only motor parameters of the P02 and P12 groups) from the keypad to machine **Note:**After the parameter is set to 1, 2, 3 or 4, and the operation is executed, the parameter is automatically restored to 0. The parameters uploaded or downloaded do not include those of the P29 group (factory function parameters). Setting range: 0–4		
P07.02	QUICK/JOG function selection	0: No function 1: Jogging 2: Switch the display state by using the shifting key 3: Switch between forward running and reverse running 4: Delete the UP/DOWN setting 5: Coast to stop 6: Switch the channel of running commands in sequence 7: Quick commissioning mode (based on the non-factory parameter settings) Setting range: 0–7	1	◎
P07.03	Sequence of switching the channels of running commands by QUICK	0: Keypad control-->terminal control -->communication control 1: Keypad control<-->terminal control 2: Keypad control<-->communication control 3: Terminal control<-->communication control Setting range: 0–3	0	○
P07.04	STOP/RST stop function selection	0: Valid only for keypad control 1: Valid for both keypad and terminal control 2: Valid for both keypad and communication control 3: Valid for all control modes Setting range: 0–3	0	○

Function code	Name	Description	Default	Modify
P07.05	Selection 1 of parameters to be displayed in the running state	0x0000–0xFFFF BIT0: Running frequency (Hz on) BIT1: Frequency setting (Hz blinking) BIT2: Bus voltage (V on) BIT3: Output voltage (V on) BIT4: Output current (A on) BIT5: Rotating speed in running (rpm on) BIT6: Output power (% on) BIT7: Output torque (% on) BIT8: PID reference (% blinking) BIT9: PID feedback value (% on) BIT10: Input terminal state BIT11: Output terminal state BIT12: Torque setting (% on) BIT13: Pulse count value BIT14: Length BIT15: PLC and the current step of the multi-step speed	0x03FF	○
P07.06	Selection 2 of parameters to be displayed in the running state	0x0000–0xFFFF BIT0: Value of AI1 (V on) BIT1: Value of AI2 (V on) BIT2: Value of AI3 (V on) BIT3: High-speed pulse HDI frequency BIT4: Motor overload percentage (% on) BIT5: Drive overload percentage (% on) BIT6: Ramp frequency reference (Hz on) BIT7: Linear speed BIT8: AC incoming current BIT9–15: Reserved	0x0000	
P07.07	Selection of parameters to be displayed in the stop state	0x0000–0xFFFF BIT0: Frequency setting (Hz on, frequency blinking slowly) BIT1: Bus voltage (V on) BIT2: Input terminal state BIT3: Output terminal state BIT4: PID reference (% blinking) BIT5: PID feedback value (% on)	0x00FF	○

Function code	Name	Description	Default	Modify
		BIT6: Torque setting (% on) BIT7: Value of AI1 (V on) BIT8: Value of AI2 (V on) BIT9: Value of AI3 (V on) BIT10: High-speed pulse HDI frequency BIT11: PLC and the current step of the multi-step speed BIT12: Pulse count value BIT13: Length BIT14–BIT15: Reserved		
P07.08	Frequency display coefficient	Displayed frequency = Running frequency * P07.08 Setting range: 0.01–10.00	1.00	○
P07.09	Motor temperature 2 (PT100)	Motor temperature detected by PT100 Setting range: -20–150.0°C		●
P07.10	Motor temperature 1 (PT1000)	Motor temperature detected by PT1000 Setting range: -20–150.0°C		●
P07.11	Ambient temperature	Setting range: -20–120.0°C		●
P07.12	Inverter module temperature	Setting range: -20–120.0°C		●
P07.13	Software version of the control board	1.00–655.35		●
P07.14	Local accumulative running time	0–65535h		●
P07.15	High-order bits of drive power consumption	Drive power consumption=P07.15*1000 + P07.16 Setting range of P07.15: 0–65535 kWh (*1000) Setting range of P07.16: 0.0–999.9 kWh		●
P07.16	Low-order bits of drive power consumption			●
P07.17	Drive type	0: G type 1: P type		●
P07.18	Drive rated power	0.4–3000.0kW		●

Function code	Name	Description	Default	Modify
P07.19	Drive rated voltage	50–1200V		●
P07.20	Drive rated current	0.1–6000.0A		●
P07.21	Factory bar code 1	0x0000–0xFFFF		●
P07.22	Factory bar code 2	0x0000–0xFFFF		●
P07.23	Factory bar code 3	0x0000–0xFFFF		●
P07.24	Factory bar code 4	0x0000–0xFFFF		●
P07.25	Factory bar code 3	0x0000–0xFFFF		●
P07.26	Factory bar code 4	0x0000–0xFFFF		●
P07.27	Type of present fault	0: No fault 1: Inverter unit phase U protection (OUt1)		●
P07.28	Type of last fault	2: Inverter unit phase V protection (OUt2)		●
P07.29	Type of 2nd-last fault	3: Inverter unit phase W protection (OUt3) 4: Overcurrent during ACC (OC1)		●
P07.30	Type of 3rd-last fault	5: Overcurrent during DEC (OC2) 6: Overcurrent at constant speed (OC3)		●
P07.31	Type of 4th-last fault	7: Overvoltage during ACC (OV1) 8: Overvoltage during DEC (OV2)		●
P07.32	Type of 5th-last fault	9: Overvoltage at constant speed (OV3) 10: Bus undervoltage fault (UV) 11: Motor overload (OL1) 12: Drive overload (OL2) 13: Phase loss at the input side (SPI) 14: Phase loss at the output side (SPO) 15: Ambient overtemperature (OSTO1) 16: Inverter module overheat (OSTO2) 17: External fault (EF) 18: 485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (EEP) 22: PID feedback disconnection fault (PIDE) 23: Brake unit fault (bCE) 24: Running time reached (END) 25: Electrical overload (OL3) 26: Panel communication error (PCE) 27: Parameter upload error (UPE)		●

Function code	Name	Description	Default	Modify
		28: Parameter download error (DNE) 29: PROFIBUS communication error (E-DP) 30: Ethernet communication error (E-NET) 31: CAN communication error (E-CAN) 32: Short-to-ground fault 1 (ETSTO1) 33: Short-to-ground fault 2 (ETSTO2) 34: Speed deviation fault (dEu) 35: Misadjustment (STo) 36: Underload fault (LL) 37: Encoder disconnection fault (ENC1O) 38: Encoder reverse running fault (ENC1D) 39: Encoder pulse Z disconnection fault (ENC1Z) 40: Brake fault (FAE-b) 41–42: Reserved 43: Torque verification fault (tCE) 45: Motor overtemperature fault (OT2) 46: Table checking fault (E-tAb) 47: Overload stalling fault (FAE-L) 48: Reserved 49: STL1 fault 50: STL2 fault 51: STL3 fault 52: STO fault		
P07.33	Running frequency at present fault		0.00Hz	●
P07.34	Ramp frequency reference at present fault		0.00Hz	●
P07.35	Output voltage at present fault		0V	●
P07.36	Output current at present fault		0.0A	●
P07.37	Bus voltage at present fault		0.0V	●

Function code	Name	Description	Default	Modify
P07.38	Highest temperature at present fault		0.0°C	●
P07.39	Input terminal state at present fault		0	●
P07.40	Output terminal state at present fault		0	●
P07.41	Running frequency at last fault		0.00Hz	●
P07.42	Ramp frequency reference at last fault		0.00Hz	●
P07.43	Output voltage at last fault		0V	●
P07.44	Output current at last fault		0.0A	●
P07.45	Bus voltage at last fault		0.0V	●
P07.46	Highest temperature at last fault		0.0°C	●
P07.47	Input terminal state at last fault		0	●
P07.48	Output terminal state at last fault		0	●
P07.49	Running frequency at 2nd-last fault		0.00Hz	●
P07.50	Ramp frequency reference at 2nd-last fault		0.00Hz	●
P07.51	Output voltage at 2nd-last fault		0V	●

Function code	Name	Description	Default	Modify
P07.52	Output current at 2nd-last fault		0.0A	●
P07.53	Bus voltage at 2nd-last fault		0.0V	●
P07.54	Highest temperature at 2nd-last fault		0.0°C	●
P07.55	Input terminal state at 2nd-last fault		0	●
P07.56	Output terminal state at 2nd-last fault		0	●

P08 group Enhanced functions

Function code	Name	Description	Default	Modify
P08.00	ACC time 2	0.0–3600.0s	Model depended	○
P08.01	DEC time 2	0.0–3600.0s	Model depended	○
P08.02	ACC time 3	0.0–3600.0s	Model depended	○
P08.03	DEC time 3	0.0–3600.0s	Model depended	○
P08.04	ACC time 4	0.0–3600.0s	Model depended	○
P08.05	DEC time 4	0.0–3600.0s	Model depended	○
P08.06	Jogging frequency	0.00–P00.03 (Max. output frequency)	5.00Hz	○
P08.07	ACC time in jogging	0.0–3600.0s	Model depended	○
P08.08	DEC time in jogging	0.0–3600.0s	Model depended	○
P08.09	Jump frequency 1	0.00–P00.03 (Max. output frequency)	0.00Hz	○
P08.10	Jump frequency	0.00–P00.03 (Max. output frequency)	0.00Hz	○

Function code	Name	Description	Default	Modify
	bandwidth 1			
P08.11	Jump frequency 2	0.00–P00.03 (Max. output frequency)	0.00Hz	○
P08.12	Jump frequency bandwidth 2	0.00–P00.03 (Max. output frequency)	0.00Hz	○
P08.13	Frequency threshold for ACC/DEC switching	0.00–P00.03 (Max. output frequency) 0.00: No switching Switch to ACC/DEC time 2 when the frequency is greater than P08.13.	0.00Hz	○
P08.14	Reserved			
P08.15	Bus voltage regulator gain	0.0–1000.0	12.0	○
P08.16	ASR differential gain	0.00–10.00s	0.00s	○
P08.17	Upper limit of the inertia compensation torque	0.0–150.0% (of the motor rated torque)	20.0%	○
P08.18	Number of inertia compensation filtering times	0–10	7	○
P08.19	High-frequency ACR proportional coefficient	0–20000	1000	○
P08.20	High-frequency ACR integral coefficient	0–20000	1000	○
P08.21	ACR high-frequency switching point	0.0–100.0% (of the Max. frequency)	100.0%	○
P08.22	Torque value for inertia identification	0.0–100.0% (of the motor rated torque)	10.0%	●
P08.23	Inertia identification	0: No operation 1: Enable identification Setting range: 0–1	0	●
P08.24	System inertia	0.000–30.000kgm^2	0.000 kgm^2	○

Function code	Name	Description	Default	Modify
P08.25	Inertia compensation enabling	0: Disable 1: Enable Setting range: 0–1	0	○
P08.26	Stop at power failure	Ones place: Enabling the function of stop at power failure 0: Disable 1: Enable Tens place: Voltage setting for power-failure stop 0: Internal setting 1: Set through P08.27 Setting range: 0–0x11	0x00	○
P08.27	Voltage at power-failure stop	250.0–1000.0V	450.0V	○
P08.28	Number of auto fault resets	0–10	0	○
P08.29	Interval setting for auto fault resets	0.1–3200.0s	1.0s	○
P08.30	Frequency decrease rate in droop control	0.00–30.00Hz	0.00Hz	○
P08.31	Channel for switching between motor 1 and motor 2	0: Terminal 1: Modbus communication 2: PROFIBUS communication Setting range: 0–2	0	◎
P08.32	FDT1 electrical level detection threshold	0.00–P00.03 (Max. output frequency)	50.00Hz	○
P08.33	FDT1 lag detection threshold	0.0–100.0% (of the FDT1 electrical level)	5.0%	○
P08.34	FDT2 electrical level detection threshold	0.00–P00.03 (Max. output frequency)	50.00Hz	○
P08.35	FDT2 lag detection threshold	0.0–100.0% (of the FDT2 electrical level)	5.0%	○

Function code	Name	Description	Default	Modify
P08.36	Frequency arrival detection range	0.0–P00.03 (Max. output frequency)	0.00Hz	○
P08.37	Dynamic braking enabling	0: Disable 1: Enable Setting range: 0–1	1	○
P08.38	Dynamic braking voltage threshold	200.0–2000.0V	700.0V	○
P08.39	Running mode of cooling fan	0: Common running mode 1: The fan keeps running after power-on Range: 0–1	0	○
P08.40	PWM setting	Ones place: PWM mode 0: PWM mode 1, 3PH modulation and 2PH modulation 1: PWM mode 2, 3PH modulation Tens place: Low-frequency carrier frequency setting 0: Reduce the carrier frequency at low frequency 1: Do not reduce the carrier frequency at low frequency Hundreds place: Dead zone compensation mode 0: Mode 1 1: Mode 2 Setting range: 0–0x111	0x001	◎
P08.41	Overmodulation setting	Ones place: Overmodulation setting 0: Disable 1: Enable Tens place: Overmodulation depth coefficient 0–9 Setting range: 0x00–0x91	0x01	○
P08.42	Keypad digital control setting	0x000–0x1223 LED ones place: Frequency control setting 0: Both the ∧ / ∨ keys and the digital potentiometer are enabled for regulation. 1: Only the ∧ / ∨ keys are enabled for regulation.	0x0000	○

Function code	Name	Description	Default	Modify
		2: Only the digital potentiometer is enabled for regulation. 3: Neither the ∧/∨ keys nor the digital potentiometer are enabled for regulation. LED tens place: Frequency control setting 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting modes 2: Invalid for the multi-step speed when the multi-step speed takes priority LED hundreds place: Stop action selection 0: Settings are valid. 1: Valid in operation, deleted after stop 2: Valid in operation, deleted after receiving the stop command LED thousands place: Integral function of the ∧/∨ keys and digital potentiometer 0: The integral function is enabled. 1: The integral function is disabled.		
P08.43	Integral rate of the keypad digital potentiometer	0.01–10.00s	0.10s	○
P08.44	UP/DOWN terminal control setting	0x00–0x221 LED ones place: Frequency control setting 0: Setting through the UP/DOWN terminals is enabled. 1: Setting through the UP/DOWN terminals is disabled. LED tens place: Frequency control setting 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting modes 2: Invalid for the multi-step speed when the multi-step speed takes priority LED hundreds place: Stop action selection 0: Settings are valid. 1: Valid in operation, deleted after stop 2: Valid in operation, deleted after receiving the stop command	0x000	○

Function code	Name	Description	Default	Modify
P08.45	Frequency incremental integral rate of the UP terminal	0.01–50.00Hz/s	0.50Hz/s	○
P08.46	Frequency integral rate of the DOWN terminal	0.01–50.00Hz/s	0.50Hz/s	○
P08.47	Action performed at power failure for frequency setting	0x000–0x111 LED ones place: Action to be performed at power failure for digital-based frequency setting 0: Save the settings at power failure 1: Discard the settings at power failure LED tens place: Action to be performed at power failure for Modbus-based frequency setting 0: Save the settings at power failure 1: Discard the settings at power failure 2: Discard the settings at stop LED hundreds place: Action to be performed at power failure for frequency setting based on other communication modes 0: Save the settings at power failure 1: Discard the settings at power failure Setting range: 0x000–0x121	0x000	○
P08.48	High-order bits of initial power consumption	0–59999kWh(k)	0kWh	○
P08.49	Low-order bits of initial power consumption	0.0–999.9kWh	0.0kWh	○
P08.50	Magnetic flux braking	0: Disable 100–150: A greater coefficient indicates more powerful braking.	0	○
P08.51	Drive input power factor	0.00–1.00	0.56	○

Function code	Name	Description	Default	Modify
P08.52	STO fault lock	0: STO alarm lock 1: STO alarm unlock Range: 0–1	0	○

P09 group PID settings

Function code	Name	Description	Default	Modify
P09.00	PID setting channel	0: P09.01 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Multi-step speed running 6: Modbus communication 7: PROFIBUS/CAN2.0B communication 8: Ethernet communication 9: Reserved Setting range: 0–9	0	○
P09.01	PID value reference	-100.0%–100.0%	0.0%	○
P09.02	PID feedback channel	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDI 4: Modbus communication 5: PROFIBUS communication 6: Ethernet communication 7: Reserved Setting range: 0–7	0	○
P09.03	PID output characteristics setting	0: Positive 1: Negative Setting range: 0–1	0	○
P09.04	Proportional gain (Kp)	0.00–100.00	1.00	○
P09.05	Integral time (Ti)	0.00–50.00s	1.00s	○
P09.06	Differential time	0.00–10.00s	0.00s	○

Function code	Name	Description	Default	Modify
	(Td)			
P09.07	Sampling cycle (T)	0.001–1.000s	0.001s	○
P09.08	PID control deviation limit	0.0–100.0%	0.0%	○
P09.09	Upper limit of PID output	P09.10–100.0% (of the max. frequency or voltage)	100.0%	○
P09.10	Lower limit of PID output	-100.0%–P09.09 (of the max. frequency or voltage)	-50.0%	○
P09.11	Feedback disconnection detection threshold	0.0–100.0%	0.0%	○
P09.12	Feedback disconnection detection time	0.0–3600.0s	1.0s	○
P09.13	PID regulation setting	0x00–0x11 LED ones place: 0: Integral regulation is continued after the frequency reaches the upper or low limit. 1: Integral regulation is stopped after the frequency reaches the upper or low limit. LED tens place: Valid when P00.08=0 0: Same as the main direction reference 1: Can be opposite to the main direction reference LED hundreds place: Valid when P00.08=0 0: Limit the amplitude according to the maximum frequency. 1: Limit the amplitude according to the A frequency.	0x001	○
P09.14	PID deviation limit	0.0–200.0%	200.0%	○
P09.15	PID command ACC/DEC time	0.0–1000.0s	0.0s	○
P09.16	PID output filtering time	0.000–10.000s	0.000s	○
P09.17	Preset PID output	-100.0–100.0% (of the max. frequency or voltage)	0.0%	○

Function code	Name	Description	Default	Modify
P09.18	SIL3 fault detection selection	0: Enable SIL3 fault detection 1: Disable SIL3 fault detection Range: 0–1	0	○
P09.19–P09.20	Reserved			

P10 group Simple PLC

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once 1: Run with the final value after running once 2: Run cyclically Setting range: 0–2	0	○
P10.01	Simple PLC power-failure memory	0: No power-failure memory 1: With power-failure memory Setting range: 0–1	0	○
P10.02	Multi-step speed 0	-100.0–100.0%	0.0%	○
P10.03	Running time of step 0	0.0–6553.5s(min)	0.0s	○
P10.04	Multi-step speed 1	-100.0–100.0%	0.0%	○
P10.05	Running time of step 1	0.0–6553.5s(min)	0.0s	○
P10.06	Multi-step speed 2	-100.0–100.0%	0.0%	○
P10.07	Running time of step 2	0.0–6553.5s(min)	0.0s	○
P10.08	Multi-step speed 3	-100.0–100.0%	0.0%	○
P10.09	Running time of step 3	0.0–6553.5s(min)	0.0s	○
P10.10	Multi-step speed 4	-100.0–100.0%	0.0%	○
P10.11	Running time of step 4	0.0–6553.5s(min)	0.0s	○
P10.12	Multi-step speed 5	-100.0–100.0%	0.0%	○
P10.13	Running time of step 5	0.0–6553.5s(min)	0.0s	○

Function code	Name	Description	Default	Modify
P10.14	Multi-step speed 6	-100.0–100.0%	0.0%	○
P10.15	Running time of step 6	0.0–6553.5s(min)	0.0s	○
P10.16	Multi-step speed 7	-100.0–100.0%	0.0%	○
P10.17	Running time of step 7	0.0–6553.5s(min)	0.0s	○
P10.18	Multi-step speed 8	-100.0–100.0%	0.0%	○
P10.19	Running time of step 8	0.0–6553.5s(min)	0.0s	○
P10.20	Multi-step speed 9	-100.0–100.0%	0.0%	○
P10.21	Running time of step 9	0.0–6553.5s(min)	0.0s	○
P10.22	Multi-step speed 10	-100.0–100.0%	0.0%	○
P10.23	Running time of step 10	0.0–6553.5s(min)	0.0s	○
P10.24	Multi-step speed 11	-100.0–100.0%	0.0%	○
P10.25	Running time of step 11	0.0–6553.5s(min)	0.0s	○
P10.26	Multi-step speed 12	-100.0–100.0%	0.0%	○
P10.27	Running time of step 12	0.0–6553.5s(min)	0.0s	○
P10.28	Multi-step speed 13	-100.0–100.0%	0.0%	○
P10.29	Running time of step 13	0.0–6553.5s(min)	0.0s	○
P10.30	Multi-step speed 14	-100.0–100.0%	0.0%	○
P10.31	Running time of step 14	0.0–6553.5s(min)	0.0s	○
P10.32	Multi-step speed 15	-100.0–100.0%	0.0%	○
P10.33	Running time of step 15	0.0–6553.5s(min)	0.0s	○

Function code	Name	Description	Default	Modify
P10.34	ACC/DEC time of steps 0–7 in simple PLC control	0x0000–0xFFFF	0x0000	○
P10.35	ACC/DEC time of steps 8–15 in simple PLC control	0x0000–0xFFFF	0x0000	○
P10.36	PLC restart mode	0: Restart from the first step 1: Restart with the frequency of the interrupted step Setting range: 0–1	0	◎
P10.37	Unit of the multi-step speed running time	0: Second 1: Minute Setting range: 0–1	0	◎

P11 group Protection parameters

Function code	Name	Description	Default	Modify
P11.00	Phase loss protection	0x00–0x11 LED ones place: 0: Phase loss protection is disabled for software input. 1: Phase loss protection is enabled for software input. LED tens place: 0: Output phase loss protection is disabled. 1: Output phase loss protection is enabled. LED hundreds place: 0: Phase loss protection is disabled for hardware input. 1: Phase loss protection is enabled for hardware input.	0x111	○
P11.01	Frequency decrease at instantaneous power failure	0: Disable 1: Enable Setting range: 0–1	0	○
P11.02	Frequency	0.00Hz–P00.03/s (Max. output frequency)	10.00Hz/s	○

Function code	Name	Description	Default	Modify
	decrease rate at instantaneous power failure			
P11.03	Overvoltage stall protection	0: Disable 1: Enable Setting range: 0–1	0	○
P11.04	Overvoltage stall protection voltage	120–150% (of the standard bus voltage) (380V)	136%	○
		120–150% (of the standard bus voltage) (220V)	120%	
P11.05	Current-limiting action selection	0: Invalid 1: Always valid Setting range: 0–1	1	◎
P11.06	Auto current-limiting threshold	50.0–200.0%	G type: 160.0% P type: 120.0%	◎
P11.07	Frequency decrease rate during current limiting	0.00–50.00Hz/s	10.00Hz/s	◎
P11.08	Drive or motor overload/ underload alarm setting	0x000–0x131 LED ones place: 0: A pre-alarm is reported for motor overload/underload based on the motor rated current. 1: A pre-alarm is reported for drive overload/underload based on the rated current of the drive. LED tens place: 0: The drive continues to run after an overload/underload alarm is generated. 1: The drive continues to run after an underload alarm is generated, but it stops running after an overload fault occurs. 2: The drive continues to run after an overload alarm is generated, but it stops running after	0x000	○

Function code	Name	Description	Default	Modify
		an underload fault occurs. 3: The drive stops running after an overload/underload fault is reported. LED hundreds place: 0: Detect all the time. 1: Detect in constant-speed running.		
P11.09	Overload alarm detection threshold	P11.11–200%	For G type: 150% For P type: 120%	○
P11.10	Overload alarm detection time	0.1–3600.0s	1.0s	○
P11.11	Underload alarm detection threshold	0%–P11.09	50%	○
P11.12	Underload alarm detection time	0.1–3600.0s	1.0s	○
P11.13	Action of the faulty output terminal	0x00–0x11 LED ones place: 0: Act when an undervoltage fault occurs. 1: Do not act when an undervoltage fault occurs. LED tens place: 0: Act during auto reset. 1: Do not act during auto reset.	0x00	○
P11.14	Speed deviation detection threshold	It is relative to the percentage of max. output frequency (P00.03). If the speed deviation is greater than the value of P11.14, the machine enters the speed deviation state. 0.0–50.0%	10.0%	○
P11.15	Speed deviation detection time	0.0–10.0s (0.0: no speed deviation protection)	1.0s	○
P11.16	Open-loop vector and VF zero-frequency output setting	0: No voltage output 1: With voltage output	0	○

P12 group Motor 2 parameters

Function code	Name	Description	Default	Modify
P12.00	Type of motor 2	0: Asynchronous motor (AM) 1: Synchronous motor (SM) Setting range: 0–1	0	◎
P12.01	Rated power of AM 2	0.1–3000.0kW	Model depended	◎
P12.02	Rated frequency of AM 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	Rated rotation speed of AM 2	1–36000rpm	Model depended	◎
P12.04	Rated voltage of AM 2	0–1200V	Model depended	◎
P12.05	Rated current of AM 2	0.8–6000.0A	Model depended	◎
P12.06	Stator resistance of AM 2	0.001–65.535Ω	Model depended	○
P12.07	Rotor resistance of AM 2	0.001–65.535Ω	Model depended	○
P12.08	Leakage inductance of AM 2	0.1–6553.5mH	Model depended	○
P12.09	Mutual inductance of AM 2	0.1–6553.5mH	Model depended	○
P12.10	Empty-load current of AM 2	0.1–6553.5A	Model depended	○
P12.11	Magnetic saturation coefficient 1 for the iron core of AM 2	0.0–100.0%	83%	◎
P12.12	Magnetic saturation coefficient 2 for the iron core of AM 2	0.0–100.0%	70%	◎

Function code	Name	Description	Default	Modify
P12.13	Magnetic saturation coefficient 3 for the iron core of AM 2	0.0–100.0%	57%	◎
P12.14	Magnetic saturation coefficient 4 for the iron core of AM 2	0.0–100.0%	40%	◎
P12.15	Rated power of SM 2	0.1–3000.0kW	Model depended	◎
P12.16	Rated frequency of SM 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.17	Number of pole pairs of SM 2	1–128	2	◎
P12.18	Rated voltage of SM 2	0–1200V	Model depended	◎
P12.19	Rated current of SM 2	0.8–6000.0A	Model depended	◎
P12.20	Stator resistance of SM 2	0.001–65.535Ω	Model depended	○
P12.21	Direct-axis inductance of SM 2	0.01–655.35mH	Model depended	○
P12.22	Quadrature-axis inductance of SM 2	0.01–655.35mH	Model depended	○
P12.23	Counter electromotive force constant of SM 2	0–10000V	300	○
P12.24	Initial magnetic pole position of SM 2 (reserved)	0x0000–0xFFFF	0x0000	●
P12.25	Identification current of SM 2 (reserved)	0%–50% (of the motor rated current)	10%	●

Function code	Name	Description	Default	Modify
P12.26	Overload protection setting for motor 2	0: No protection 1: Common motor (with low speed compensation) 2: Variable-frequency motor (without low speed compensation) Setting range: 0–2	2	◎
P12.27	Overload protection coefficient for motor 2	20.0%–120.0%	100.0%	○
P12.28	Reserved			●
P12.29	Parameter display setting for motor 2	0: Display by motor type 1: Display all the parameters Setting range: 0–1	0	○

P13 group Synchronous motor control parameters

Function code	Name	Description	Default	Modify
P13.00	Decrease rate of the injected current of the SM	0.0%–100.0% (of the motor rated current)	80.0%	◎
P13.01	Initial magnetic pole detection mode	0: Preset current 1: High frequency superposition (reserved) 2: pulse superposition (reserved) Setting range: 0–2	0	◎
P13.02	Injected current 1	0.0%–100.0% (of the motor rated current)	20.0%	○
P13.03	Injected current 2	0.0%–100.0% (of the motor rated current)	10.0%	○
P13.04	Frequency threshold for switching the injected current	0.0%–80.0% (of the maximum frequency)	20.0%	○
P13.05	Frequency threshold for high frequency superposition (reserved)	200Hz–1000Hz	500Hz	◎

Function code	Name	Description	Default	Modify
P13.06	Voltage threshold for high frequency superposition	0.0–50.0% (of the motor rated voltage)	50.0%	◎
P13.07	Reserved	0–65535	0	○
P13.08	Control parameter 1	0–0xFFFF	0	○
P13.09	Control parameter 2	0–655.35	2.00	○
P13.10	Reserved	0–65535	0	○
P13.11	Misadjustment detection time	0.0–10.0s	0.5s	○
P13.12	High-frequency compensation coefficient for the SM	0.0–100.0%	0.0	○
P13.13	Short-circuit braking current	0.0–150.0% (Drive)	0.0%	○
P13.14	Short-circuit braking hold time at start	0.0–50.0s	0.0s	○
P13.15	Short-circuit braking hold time at stop	0.0–50.0s	0.0s	○

P14 group Communication configuration 1

Function code	Name	Description	Default	Modify
P14.00	Local communication address	1–247; 0 indicates a broadcast address	1	○
P14.01	Baud rate	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps	4	○

Function code	Name	Description	Default	Modify
		6: 57600bps 7: 115200bps Setting range: 0–7		
P14.02	Data bit check	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 Setting range: 0–5	1	○
P14.03	Communication response delay	0–200ms	5ms	○
P14.04	Communication timeout time	0.0 (invalid); 0.1–60.0s	0.0s	○
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: No alarm and continue to run 2: No alarm and stop according to the stop mode (only in the communication-based control mode) 3: No alarm and stop according to the stop mode (in all control modes) Setting range: 0–3	0	○
P14.06	Communication processing action	0x00–0x11 LED units place: 0: Responding to write operations 1: No response to write operations LED tens place: 0: Communication password protection is disabled. 1: Communication password protection is enabled. Setting range: 0–11	0x00	○
P14.07–P14.08	Reserved			

P15 group Communication configuration 2

Function code	Name	Description	Default	Modify
P15.00	Module type	0: PROFIBUS/CAN2.0B 1: Reserved Setting range: 0–1	0	◎
P15.01	Module address	0–127	2	◎
P15.02	Received PZD2	0: Invalid 1: Frequency setting (0–F_{max}, unit: 0.01 Hz) 2: PID reference (0–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (0–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–3000, in which 1000 corresponds to 100.0% of the motor rated current) 5: Set upper limit of the forward running frequency (0–F_{max}, unit: 0.01 Hz) 6: Set upper limit of the reverse running frequency (0–F_{max}, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current) 8: Upper limit of the braking torque (0–2000, in which 1000 corresponds to 100.0% of the motor rated current) 9: Virtual input terminal command, range: 0x000–0x1FF 10: Virtual output terminal command, range: 0x00–0x0F 11: Set voltage (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: Set AO value 1 (-1000–1000, in which 1000 corresponds to 100.0%) 13: Set AO value 2 (-1000–1000, in which 1000 corresponds to 100.0%) 14: External ACC time (0–3600.0s) 15: External DEC time (0–3600.0s)	0	○
P15.03	Received PZD3		0	○
P15.04	Received PZD4		0	○
P15.05	Received PZD5		0	○
P15.06	Received PZD6		0	○
P15.07	Received PZD7		0	○
P15.08	Received PZD8		0	○
P15.09	Received PZD9 (reserved)		0	○
P15.10	Received PZD10 (reserved)		0	○
P15.11	Received PZD11 (reserved)		0	○
P15.12	Received PZD12 (reserved)		0	○

Function code	Name	Description	Default	Modify
		16: Reserved 17: Droop rate setting (0.00–30.00 Hz) 18–20: Reserved Setting range: 0–20		
P15.13	Sent PZD2	0: Disabled 1: Running frequency (×100, Hz) 2: Frequency setting (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotation speed in running (×1, rpm) 9: Linear speed in running (×1, m/s) 10: Ramp frequency reference 11: Fault code 12: AI1 value (x100, V) 13: AI2 value (x100, V) 14: AI3 value (x100, V) 15: Internal ambient temperature (x10, °C) 16: Inverter module temperature (x10, °C) 17: Motor temperature 1 (Pt1000) (×10, °C) 18: PG card speed (signed) 19: Terminal input state 20: Terminal output state 21: PID reference (×100, %) 22: PID feedback (×100, %) 23: CAN communication heartbeat 24: Actual output power (×10, kW) 25: Accumulated running time (h) 26: Motor temperature 1 (Pt100) (×10, °C) Setting range: 0–26	0	○
P15.14	Sent PZD3		0	○
P15.15	Sent PZD4		0	○
P15.16	Sent PZD5		0	○
P15.17	Sent PZD6		0	○
P15.18	Sent PZD7		0	○
P15.19	Sent PZD8		0	○
P15.20	Sent PZD9		0	○
P15.21	Sent PZD10		0	○
P15.22	Sent PZD11		0	○
P15.23	Sent PZD12		0	○
P15.24	Communication control	Ones place: indicates whether CAN communication is automatically reset 0: Disable 1–0xf: Auto reset count Tens place: Reserved	0	○

Function code	Name	Description	Default	Modify
		Hundreds place: Reserved Thousands place: Reserved Setting range: 0–0xFFFF		
P15.25	DP communication timeout time	0.0 (invalid); 0.1–60.0s	0.0s	○
P15.26	CAN2.0B communication timeout time	0.0 (invalid); 0.1–60.0s	0.0s	○
P15.27	CAN2.0B communication baud rate	0: 1000k 1: 800k 2: 500k 3: 250k 4: 125k 5: 100k 6: 50k 7: 20k Setting range: 0–7	0	○
P15.28	External ACC/DEC enabling	0: Disable 1: Enable Setting range: 0–1	0	◎
P15.29	External droop control enabling	0: Disable 1: Enable Setting range: 0–1	0	◎

P16 group Communication configuration 3

Function code	Name	Description	Default	Modify
P16.00	Ethernet communication rate	0: Self-adaption 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex Setting range: 0–4	3	◎
P16.01	IP address 1	0–255	192	◎
P16.02	IP address 2	0–255	168	◎

Function code	Name	Description	Default	Modify
P16.03	IP address 3	0–255	0	◎
P16.04	IP address 4	0–255	1	◎
P16.05	Subnet mask 1	0–255	255	◎
P16.06	Subnet mask 2	0–255	255	◎
P16.07	Subnet mask 3	0–255	255	◎
P16.08	Subnet mask 4	0–255	0	◎
P16.09	Gateway 1	0–255	192	◎
P16.10	Gateway 2	0–255	168	◎
P16.11	Gateway 3	0–255	1	◎
P16.12	Gateway 4	0–255	1	◎
P16.13–P16.14	Reserved			

P17 group Drive status

Function code	Name	Description	Default	Modify
P17.00	Frequency setting	0.00Hz–P00.03	0.00Hz	●
P17.01	Output frequency	0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp frequency reference	0.00Hz–P00.03	0.00Hz	●
P17.03	Output voltage	0–1200V	0V	●
P17.04	Output current	0.0–5000.0A	0.0A	●
P17.05	Motor rotation speed	0–65535RPM	0 RPM	●
P17.06	Torque current	-3000.0–3000.0A	0.0A	●
P17.07	Exciting current	-3000.0–3000.0A	0.0A	●
P17.08	Motor power	-300.0–300.0% (of the motor rated power)	0.0%	●
P17.09	Output torque	-250.0–250.0%	0.0%	●
P17.10	Estimated motor frequency	0.00– P00.03	0.00Hz	●
P17.11	DC bus voltage	0.0–2000.0V	0V	●
P17.12	Digital input terminal state	0x0000–0x01FF	0	●
P17.13	Digital output terminal state	0000–000F	0	●

Function code	Name	Description	Default	Modify
P17.14	Digital regulation	0.00Hz–P00.03	0.00V	●
P17.15	Torque reference	-300.0%–300.0% (of the motor rated current)	0.0%	●
P17.16	Torque reference	0.00–10.00V	0.00V	●
P17.17	Voltage regulated through AI1	0.00–10.00V	0.00V	●
P17.18	Pt100 detection voltage	0.000–3.000V	0.000V	●
P17.19	AI1 input voltage	0.00–10.00V	0.00V	●
P17.20	AI2 input voltage	0.00–10.00V	0.00V	●
P17.21	Pt1000 detection voltage	0.000–3.000V	0.000V	●
P17.22	HDI input frequency	0.000–50.000kHz	0.000 kHz	●
P17.23	PID reference value	-100.0–100.0%	0.0%	●
P17.24	PID feedback value	-100.0–100.0%	0.0%	●
P17.25	Motor power factor	-1.00–1.00	0.0	●
P17.26	Elapsed time of this run	0–65535min	0min	●
P17.27	Simple PLC and the current step of the multi-step speed	0–15	0	●
P17.28	ASR output	-300.0%–300.0% (of the motor rated current)	0.0%	●
P17.29	SM pole angle	0.0–360.0	0.0	●
P17.30	SM phase compensation	-180.0–180.0	0.0	●
P17.31	SM high frequency superposition current	0.0%–200.0% (of the motor rated current)	0.0	●
P17.32	Flux linkage	0.0%–200.0%	0.0%	●
P17.33	Exciting current reference	-3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	-3000.0–3000.0A	0.0A	●

Function code	Name	Description	Default	Modify
P17.35	AC incoming current	0.0–5000.0A	0.0A	●
P17.36	Output torque	-3000.0Nm–3000.0Nm	0.0Nm	●
P17.37	Process PID deviation	-100.0%–100.0%	0.0%	●
P17.38	Status word	See section 8.2 CAN communication.		●
P17.39	Function code in a parameter download error	0.00–29.00	0.00	●

P18 group Encoder status

Function code	Name	Description	Default	Modify
P18.00	Measured encoder frequency	-327.68–327.67Hz	0.00Hz	●
P18.01	Encoder position count value	0–65535	0	●
P18.02	Encoder Z pulse count value	0–65535	0	●
P18.03	High-order bits of the position reference value	0–30000	0	●
P18.04	Low-order bits of the position reference value	0–65535	0	●
P18.05	High-order bits of the position feedback value	0–30000	0	●
P18.06	Low-order bits of the position feedback value	0–65535	0	●
P18.07	Position deviation	-32768–32767	0	●
P18.08	Position reference point	0–65535	0.00	●
P18.09	Spindle current position setting	0.00–359.99	0.00	●

Function code	Name	Description	Default	Modify
P18.10	Spindle current position	0.00–359.99	0	●
P18.11	Z pulse direction	0–1	0	●
P18.12	Z pulse angle	0.00–359.99	0.00	●
P18.13	Number of Z pulse errors	0–65535	0	●
P18.14	High-order bits of PG1 pulse count value	0–65535	0	●
P18.15	Low-order bits of PG1 pulse count value	0–65535	0	●
P18.16	Reserved	0–65535	0	●
P18.17	Pulse command frequency	0–65535	0	●
P18.18	Pulse command feedforward	0–65535	0	●
P18.19	Position regulator output	0–65535	0	●
P18.20	Resolver count value	0–65535	0	●
P18.21	Resolver angle	0.00–359.99	0.00	●
P18.22	Pole angle	0.00–359.99	0.00	●
P18.23	Status control word 3	0–65535	0	●
P18.24	High-order bits of PG2 pulse count value	0–65535	0	●
P18.25	Low-order bits of PG2 pulse count value	0–65535	0	●
P18.26	Inertia compensation torque	-100.0%–100.0%	0.0%	●
P18.27	Friction compensation torque	-100.0%–100.0%	0.0%	●

Function code	Name	Description	Default	Modify
P18.28	Spindle speed reduction ratio	0.000–65.535	0.000	●
P18.29	UVW fan zone	0–7	0	●
P18.30	Number of pole pairs	0–65535	0	●
P18.31	Rotor identification value	0.000–65.535Ω	0.000Ω	●
P18.32	Reserved	0–65535	0	●
P18.33	Reserved	0–65535	0	●
P18.34	Reserved	0–65535	0	●

P20 group Encoder settings

Function code	Name	Description	Default	Modify
P20.00	Encoder type	0: Incremental encoder 1: Reserved 2: Resolver encoder 3–4: Reserved Setting range: 0–4	2	◎
P20.01	Number of encoder pulses	0–60000	4096	◎
P20.02	Encoder direction	Ones place: AB direction 0: Forward; 1: Reverse Tens place: Z pulse direction 0: Forward; 1: Reverse Hundreds place: CD/UVW pole signal direction 0: Forward; 1: Reverse Setting range: 0–0x111	0x000	◎
P20.03	Encoder disconnection fault detection time	0.0–10.0s	1.0s	○
P20.04	Encoder reverse running fault detection time	0.0–100.0s	0.8s	○

Function code	Name	Description	Default	Modify
P20.05	Number of encoder detection filtering times	Ones place: Number of low-speed filtering times Tens place: Number of high-speed filtering times Setting range: 0–0x99	0x33	○
P20.06	Rotation speed ratio of the motor to the encoder mounting shaft	0.000–65.535	1.000	○
P20.07	SM control parameter	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Select resolver speed measurement mode Bit4: Z pulse capture mode Bit5: Do not detect encoder initial angle in V/F control Bit6: Enable CD signal calibration Bit7: Disable sin/cos sub-division speed measurement Bit8: Do not detect encoder fault during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable Z pulse calibration optimization Bit12: Delete Z pulse arrival signals after stop Setting range: 0–0xffff	3	○
P20.08	Z pulse disconnection detection	0–1	0	○
P20.09	Initial angle of Z pulse	0.00–359.99	0.00	○
P20.10	Initial pole angle	0.00–359.99	0.00	○
P20.11	Initial pole angle autotuning	0: No operation 1: Rotating autotuning (DC braking) 2: Static autotuning (applicable to resolvers, and sin/cos encoders with CD signal feedback) 3: Rotation autotuning (initial angle	0	◎

Function code	Name	Description	Default	Modify
		identification) Setting range: 0–3		
P20.12	Reserved	0–65535	0	○
P20.13	Speed detection optimization	0: Disable 1: Enable	0	◎
P20.14	Disconnection detection selection	0: Disable the resolver disconnection detection 1: Enable the resolver disconnection detection Range: 0–1	0	○

P21 group Additional parameters 1

Function code	Name	Description	Default	Modify
P21.24	Low-speed carrier frequency limit value	1.2–8.0kHz	5.0kHz	○
P21.25	Overload protection equivalent coefficient	When the tens place of P24.04 is 1 and P24.00 is a non-zero value, the junction temperature protection model takes effect. The parameter shall not exceed the recommended value, improper adjustment may cause damage to the drive. 132kW recommended value: 1.00 200kW recommended value: 1.50 Range: 0.00–5.00	1.00	○
P21.26	Low-frequency stalling detection time	0.000–20.000s	1.000s	○
P21.27	Serious fault lock time	When P21.27 is a non-zero value, if overcurrent OC/speed deviation dEu/stalling FAE-b/FAE-L/VFD overload OL2 fault occurs, you need to wait for the time set in P21.27 before you can reset. When P21.27 is 0, the function is invalid. **Note:** Reset at power-off, and you have no need to wait for the time set in P21.27. Range: 0.00–60.00min	5.00min	○

Function code	Name	Description	Default	Modify
P21.28	High-frequency stalling judgment frequency point	When the tens place of P24.04 is 1, if the encoder frequency feedback is greater than the value set in P21.28, the reference frequency is greater than or equal to the brake release frequency (P24.00), the torque upper limit is reached, and the duration is P24.08, FAE-L is reported, indicating the stall occurs due to the too heavy load. Range: P21.29–100.00Hz	5.00Hz	◎
P21.29	Low-frequency stalling judgment frequency point	When the tens place of P24.04 is 1, if the encoder frequency feedback is less than the value set in P21.29, the reference frequency is greater than or equal to the brake release frequency (P24.00), and duration is P21.26, FAE-b is reported, indicating the barke fault. Range: 0.00–P21.28	0.50Hz	○
P21.33	CAN backup address	In standby mode, modify the value of P21.33 to a value rather than 20. After re-power on, the CAN communication address no longer uses P24.19 and switches to the written value of P21.33. Range: 0–255	20	◎
P21.34	AGV application macro definition	0–1 0: General application mode 1: AGV application macro 1	0	◎

P22 group Additional parameters 2

Function code	Name	Description	Default	Modify
P22.16	Environment overtemperature point	When this value is exceeded, the environment overtemperature fault is reported. (P07.11 displays the environment temperature.) When this function code is set to 0, overtemperature protection is disabled. Setting range: 0.0–145.0°C	85.0°C	○

P23 group Additional parameters 3

Function code	Name	Description	Default	Modify
P23.00	Enabling table query	Indicates whether to enable the table query function. 0: Disable 1: Enable Setting range: 0–1	0	◎
P23.01	Enabling calibration (Reserved)	Indicates whether to enable motor calibration functions. Setting range: 0–1	0	◎
P23.02	Control parameter	Ones place: indicates whether to enable power limit. 0: Disable 1: Enable Setting range: 0–0x0001	0	◎
P23.03	Pole angle storage value	The value must be the same as that of P20.10. Otherwise, the error "ENC1Z" is reported. You can change the value of P20.10 to reset the fault. Setting range: 0–35999	0	●
P23.10	Pt1000 calibration voltage low value	Uses the voltage (P17.21) that resistor detects at -20°C. Setting range: 0.000–3.000V	0.286V	○
P23.11	Pt1000 calibration voltage high value	Uses the voltage (P17.21) that resistor detects at 150°C. Setting range: 0.000–3.000V	2.909V	○
P23.12	Pt1000 calibration voltage middle value 1	Uses the voltage (P17.21) that resistor detects at 40°C. Setting range: 0.000–3.000V	1.277V	○
P23.13	Pt1000 calibration voltage middle value 2	Uses the voltage (P17.21) that resistor detects at 90°C. Setting range: 0.000–3.000V	2.043V	○
P23.14	Pt100 calibration voltage low value	Uses the voltage (P17.18) that resistor detects at -20°C. Setting range: 0.000–3.000V	0.0V	○
P23.15	Pt100 calibration voltage high value	Uses the voltage (P17.18) that resistor detects at 150°C.	0.0V	○

Function code	Name	Description	Default	Modify
		Setting range: 0.000–3.000V		
P23.16	Pt100 calibration voltage middle value 1	Uses the voltage (P17.18) that resistor detects at 40°C. Setting range: 0.000–3.000V	0.0V	○
P23.17	Pt100 calibration voltage middle value 2	Uses the voltage that resistor detects at 90°C (P17.18). Setting range: 0.000–3.000V	0.0V	○
P23.18	Motor overtemperature point 1 (Pt1000)	The motor overtemperature fault is reported when the value is exceeded. (P07.10 displays motor temperature 1.) When the value is 0, overtemperature protection is disabled. Setting range: 0.0–145.0°C	105.0°C	○
P23.19	Motor overtemperature point 2 (Pt100)	The motor overtemperature fault is reported when the value is exceeded. (P07.09 displays motor temperature 2.) When the value is 0, overtemperature protection is disabled. Setting range: 0.0–145.0°C	0.0°C	○

P24 group Lifting functions

Function code	Name	Description	Default	Modify
P24.00	External brake release detection frequency	When it is external brake (the tens place of P24.04 is 1), the external brake torque limit can be set to switch to a lower value.	1.00Hz	○
P24.01	Electromotive torque upper limit of external brake	When the set frequency is detected to be less than P24.00, it is judged to be not in brake release state. The torque upper limit adopts the torque limit values of P24.01 (electromotive) and P24.02 (brake). When the set frequency is detected to be greater than P24.00, it is judged to be in brake release state. The torque upper limit adopts the torque limit values of P03.20 (electromotive) and P03.21 (brake).	70.0%	○
P24.02	Braking torque upper limit of external brake		70.0%	○
P24.03	Torque limit switching delay of external brake		1.000s	○

Function code	Name	Description	Default	Modify
		Setting range of P24.00: 0–20.00Hz Setting range of P24.01: 0–120.0% Setting range of P24.02: 0–120.0% Setting range of P24.03: 0.000–10.000s		
P24.04	Pre-torque direction and brake control selection	LED ones place: (reserved) 0: Forward direction 1: Reverse direction LED tens place: 0: Disable brake control 1: Enable brake control Setting range: 0x00–0x11	0x00	◎
P24.05	Brake release delay	0.000–5.000s	0.000s	◎
P24.06	Brake closing frequency	0.00–50.00Hz	0.00Hz	◎
P24.07	Brake closing delay	0.00–5.000s	0.000s	◎
P24.08	High-frequency stall detection time	0.00–20.000s	5.000s	◎
P24.09	Torque verification	0: Invalid 1: By current percentage 2: By the torque percentage Setting range: 0–2	0	◎
P24.10	Torque verification value set through keypad	0.0–100.0% (of the motor rated current or torque) The value 0.0% indicates that torque verification is invalid.	0.0%	◎
P24.11	Torque verification fault detection time	0.00–10.000s	0.500s	◎
P24.12	Braking torque of anti-snag protection	0.0–300.0% (of the motor rated current)	0	◎
P24.13	Braking torque ACC time	0.000–10.000s	0.200s	◎
P24.14	Braking torque end frequency	0.00–30.00Hz	0.10Hz	◎

Function code	Name	Description	Default	Modify
P24.15	CAN communication baud rate	0: 1000k 1: 500k 2: 250k 3: 125k 4: 100k 5: 50k Setting range: 0–5	2	○
P24.16	CAN communication period	0–1000ms	100ms	○
P24.17	CAN communication timeout time	0.0–60.0s (0.0: The fault diagnosis function is disabled.)	0.0s	○
P24.18	PS domain value of CAN communication	P24.18: Destination address of a communication packet. P24.19: Source address (SA) of a communication packet. SA of upper computer *m*: SA_Um SA of lower computer *n*: SA_Ln The SA of upper computer *m* should be the destination address of packets sent from the drive (namely, the lower computer that the upper computer controls). The SA of lower computer *n* should be the destination address of packets sent from the upper computer. In a packet sent from the upper computer: PS:SA= SA_Ln:SA_Um In a packet sent from the lower computer: PS:SA= SA_Um:SA_Ln Setting range: 0–255	0	◎
P24.19	SA domain value of CAN communication		0	◎

7 Fault tracking

7.1 Faults and solutions

Note: The numbers enclosed in square brackets such as [1], [2] and [3] in the Fault type column in the following table indicate the VFD fault type codes read through communication.

Fault code	Fault type	Possible cause	Solution
OUt1	[1] Inverter unit phase U protection	● The ACC is too fast. ● The IGBT of the phase is internally damaged. ● Interference causes maloperation. ● The drive wire is not properly connected. ● The device is short to ground.	● Increase the ACC time. ● Replace the power unit. ● Check the drive line. ● Check whether there are strong interference sources among the peripheral devices.
OUt2	[2] Inverter unit phase V protection		
OUt3	[3] Inverter unit phase W protection		
OC1	[4] Overcurrent during ACC	● The ACC or DEC is too fast. ● The grid voltage is too low. ● The power of the drive is too low. ● The load suddenly changes or encounters an exception. ● The device is short to ground or output phase loss occurs. ● There are strong external interference sources. ● The overvoltage stall protection function is not enabled.	● Increase the ACC or DEC time. ● Check the input power. ● Use a drive with higher power. ● Check whether the load is short-circuited (short to ground or between conductors) or the rotation is blocked. ● Check the output wiring. ● Check whether there is strong interference. ● Check the settings of the related function codes.
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent at constant speed		
OV1	[7] Overvoltage during ACC	● Exceptions occur on the input voltage. ● There is a large amount of energy feedback. ● A brake component is lost.	● Check the input power. ● Check whether the DEC time of the load is too short, or the device is started when the motor is rotating.
OV2	[8] Overvoltage during DEC		
OV3	[9] Overvoltage at constant speed		

Fault code	Fault type	Possible cause	Solution
		● The dynamic braking function is not enabled.	● Add a dynamic brake component. ● Check the settings of the related function codes.
UV	[10] Bus undervoltage fault	● The grid voltage is too low. ● The overvoltage stall protection function is not enabled.	● Check the input grid power. ● Check the settings of the related function codes.
OL1	[11] Motor overload	● The grid voltage is too low. ● The rated current of the motor is set incorrectly. ● The rotation of the motor is blocked or the load suddenly changes.	● Check the grid voltage. ● Reset the rated current of the motor. ● Check the load, and adjust the torque boost.
OL2	[12] Drive overload	● The ACC is too fast. ● The rotating motor is restarted. ● The grid voltage is too low. ● The load is too heavy. ● The motor power is too high, and the drive power is too low.	● Increase the ACC time. ● Avoid restarting the device immediately after stopping it. ● Check the grid voltage. ● Use a drive with higher power. ● Use a suitable motor.
SPI	[13] Phase loss on the input side	● Phase loss or great fluctuation occurs between input terminals (+) and (-).	● Check the input power. ● Check the installation wiring.
SPO	[14] Phase loss on the output side	● Phase loss occurs among the output phases U, V, and W (or the three phases of the load are seriously unbalanced.)	● Check the output wiring. ● Check the motor and cables.
OSTO1	[15] Ambient overtemperature	● The water cooling system does not work properly. ● The ambient temperature is too high.	● Check and maintain the water cooling system. ● Check whether overload occurs.
OSTO2	[16] Inverter module overheat		

Fault code	Fault type	Possible cause	Solution
		● Long-time overload run.	
EF	[17] External fault	● External fault caused by actions of input terminals.	● Check the input of external devices.
CE	[18] 485 communication fault	● The baud rate is set improperly. ● The communication line is faulty. ● The communication address is incorrect. ● There is strong interference on the communication.	● Set the baud rate properly. ● Check the communication interface wiring. ● Set the communication address correctly. ● Change or modify the wiring to improve the anti-interference capability.
ItE	[19] Current detection fault	● The control panel connector is in poor contact. ● The Hall component is damaged. ● The magnifying circuit encounters an exception.	● Check the connector and rewire. ● Replace the Hall component. ● Replace the main control board.
tE	[20] Motor autotuning fault	● The motor capacity and the drive capacity do not match. ● The parameters of the motor are not properly set. ● The parameter values obtained through autotuning are significantly different from those standard ones. ● The autotuning times out.	● Replace the drive with one of another model. ● Set the model and nameplate parameters of the motor correctly. ● Empty the motor load for re-identification. ● Check the cable connection and parameter settings of the motor. ● Check whether the upper frequency limit is higher than 2/3 of the rated frequency.
EEP	[21] EEPROM operation fault	● Error occurs in writing or reading control parameters.	● Press STOP\RST to reset. ● Replace the main

Fault code	Fault type	Possible cause	Solution
		● EEPROM is damaged.	control board.
PIDE	[22] PID feedback disconnection fault	● The PID feedback is disconnected. ● The PID feedback source cannot be found.	● Check the PID feedback signal line. ● Check the PID feedback source.
bCE	[23] Brake unit fault	● The brake line is faulty or the brake pipe is damaged. ● The resistance of the external brake resistor is too low.	● Check the brake unit and replace the brake pipe. ● Increase the brake resistance.
END	[24] Running time reached	● The actual running time of the drive is longer than the preset running time.	● Ask the supplier to adjust the preset running time.
OL3	[25] Electrical overload fault	● The drive generates overload alarms based on the preset value.	● Check the load and overload alarm generating threshold.
PCE	[26] Panel communication error	● The keypad cable is in poor contact or disconnected. ● The keypad cable is too long, encountering strong interference. ● Some of the keypad or mainboard communication circuits are faulty.	● Check the keypad cable to determine whether a fault occurs. ● Check the environment and remove interference sources. ● Replace the hardware and seek maintenance services.
UPE	[27] Parameter upload error	● The keypad cable is in poor contact or disconnected. ● The keypad cable is too long, encountering strong interference. ● Some of the keypad or mainboard communication circuits are faulty.	● Check the keypad cable to determine whether a fault occurs. ● Check the environment and remove interference sources. ● Replace the hardware and seek maintenance services.
DNE	[28] Parameter	● The keypad cable is in	● Check the environment

Fault code	Fault type	Possible cause	Solution
	download error	poor contact or disconnected. ● The keypad cable is too long, encountering strong interference. ● Data storage errors occur on the keypad.	and remove interference sources. ● Replace the hardware and seek maintenance services. ● Re-back up the data on the keypad.
E-DP	[29] PROFIBUS communication error	● The communication address is incorrect or the build-out resistor is not removed. ● The GSD file of the main station is properly configured. ● The surrounding interference is too strong.	● Check related settings. ● Check the surrounding environment and eliminate interference.
E-NET	[30] Ethernet communication error	● The Ethernet address is incorrectly set. ● The Ethernet communication mode is not properly selected. ● The surrounding interference is too strong.	● Check related settings. ● Check the selection of the communication mode. ● Check the surrounding environment and eliminate interference.
E-CAN	[31] CAN2.0B communication error	● The lines are in poor contact. ● The build-out resistor is not removed. ● The communication baud rates are different. ● The surrounding interference is too strong.	● Check the lines and remove the build-out resistor. ● Set the same baud rates. ● Check the surrounding environment and eliminate interference.
ETSTO1	[32] To-ground short-circuit fault 1	● The drive output is shorted to ground. ● The current detection circuit is faulty.	● Check the wiring of the motor. ● Replace the Hall component. ● Replace the main control board.
ETSTO2	[33] To-ground short-circuit fault 2	● The drive output is shorted to ground.	● Check the wiring of the motor.

Fault code	Fault type	Possible cause	Solution
		● The current detection circuit is faulty.	● Replace the Hall component. ● Replace the main control board.
dEu	[34] Speed deviation fault	● The load is too heavy or the rotation is blocked. ● The encoder is disconnected.	● Check the load. Ensure that the load is normal. Increase the detection time. ● Check whether the control parameters are properly set. ● Check whether the encoder is disconnected.
STo	[35] Misadjustment fault	● The control parameters of the synchronous motor are incorrectly set. ● The autotuning parameters are incorrectly set. ● The drive is not connected to a motor.	● Check the load, and ensure that the load is normal. ● Check whether the control parameters are set correctly. ● Increase the misadjustment detection time.
LL	[36] Electrical underload fault	● The drive generates overload alarms based on the preset value.	● Check the load and overload alarm generating threshold.
ENC1O	[37] Encoder disconnection fault	● The encoder line sequence is incorrect or the signal line is not properly connected.	● Check the wiring of the encoder.
ENC1D	[38] Encoder reverse running fault	● The direction information in the encoder speed signal is opposite to the running direction of the motor.	● Reset the direction of the encoder.
ENC1Z	[39] Encoder pulse Z disconnection fault	● The Z signal line is disconnected.	● Check the wiring of the Z signal.
FAE-b	[40] Brake action	● Brake release fails or the	● When there is brake

Fault code	Fault type	Possible cause	Solution
	fault	brake release signal feedback line is disconnected. ● An external brake fault occurs.	feedback, check and maintain the feedback line. ● When there is no brake feedback, set the software brake (stall) fault detection function. ● Check and maintain the external brake unit.
OT1	[43] Motor overtemperature fault (terminal or PT1000)	● The motor overtemperature input terminal is enabled. ● PT1000 temperature detection resistor is abnormal. ● The motor runs with overload for a long time or it encounters an exception.	● Check the wiring of the motor overtemperature input terminal (terminal function 57). ● Check whether PT1000 temperature sensor works properly. If PT1000 is not used for temperature detection, set P23.18=0 to ignore this fault. ● Check and maintain the motor.
tCE	[44] Torque verification failure	● If torque verification is enabled (P24.09 > 0), during running, the output torque is less than the minimum setting P24.10, which lasts a time longer than P24.11.	● Set or disable this function depending on the actual situation. ● If the output torque is insufficient, check the drive.
OT2	[45] Motor overtemperature fault (PT100)	● PT100 temperature detection resistor is abnormal.	● Check whether PT100 temperature sensor works properly. If PT100 is not used for temperature detection, set P23.19=0 to ignore this fault. ● Check and maintain the motor.
FAE-L	[47] Overload stalling	● There is a mismatch	● The brake release

Fault code	Fault type	Possible cause	Solution
	fault	between the ramp reference frequency and the brake release frequency. ● Overload running, the slope is too large or ACC setting is improper.	frequency is set to be less than the slope reference frequency, and a fault is reported during the start-up. ● Check whether there is overload or ACC around the corner, whether road conditions or tire pressure is normal, or whether ACC/DEC time is set properly.
STO	[48] Safety torque off	● External trigger safety torque off.	● /
STL1	[49] Safety circuit 1 exception	● The wiring of the STO function circuit is improper. ● Channel 1 external switch exception/the signal is not synchronous. ● Channel 1 circuit hardware exception.	● Check whether the wiring of the STO circuit is proper and solid. ● Check whether the safety relay of STO circuit is normal. ● Replace the control board.
STL2	[50] Safety circuit 2 exception	● The wiring of the STO function circuit is improper. ● Channel 2 external switch exception/the signal is not synchronous. ● Channel 2 circuit hardware exception.	● Check whether the wiring of the STO circuit is proper and solid. ● Check whether the safety relay of STO circuit is normal. ● Replace the control board.
STL3	[51] Safety circuit 1 and 2 exceptions	● STO function circuit hardware exception.	● Replace the control board.

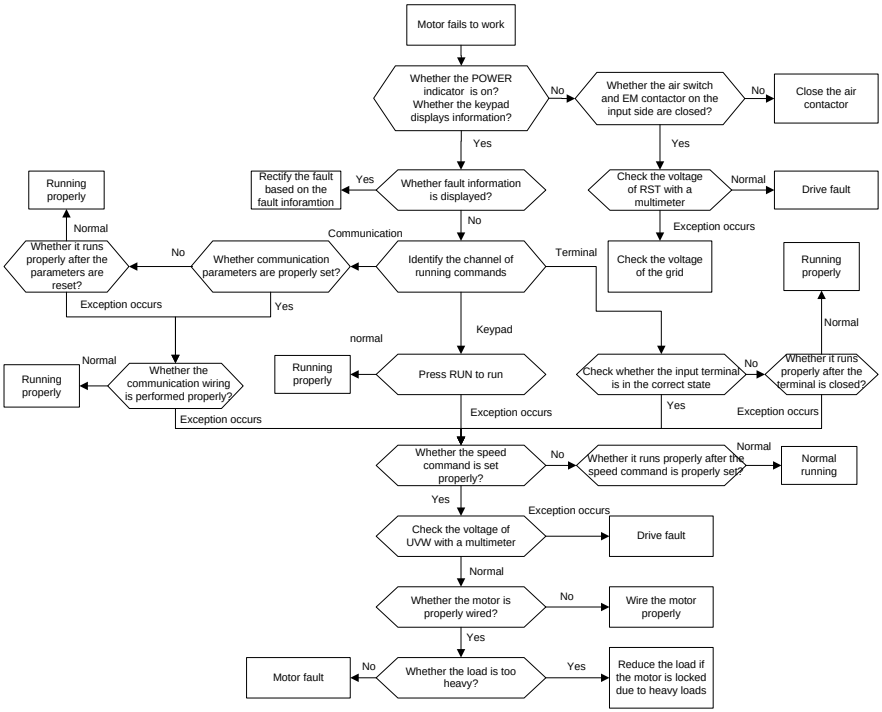
7.2 Other states

Displayed code	State type	Possible cause	Solution
PoFF	System power failure	● The system is powered off or the bus voltage is too	● Check the grid conditions.

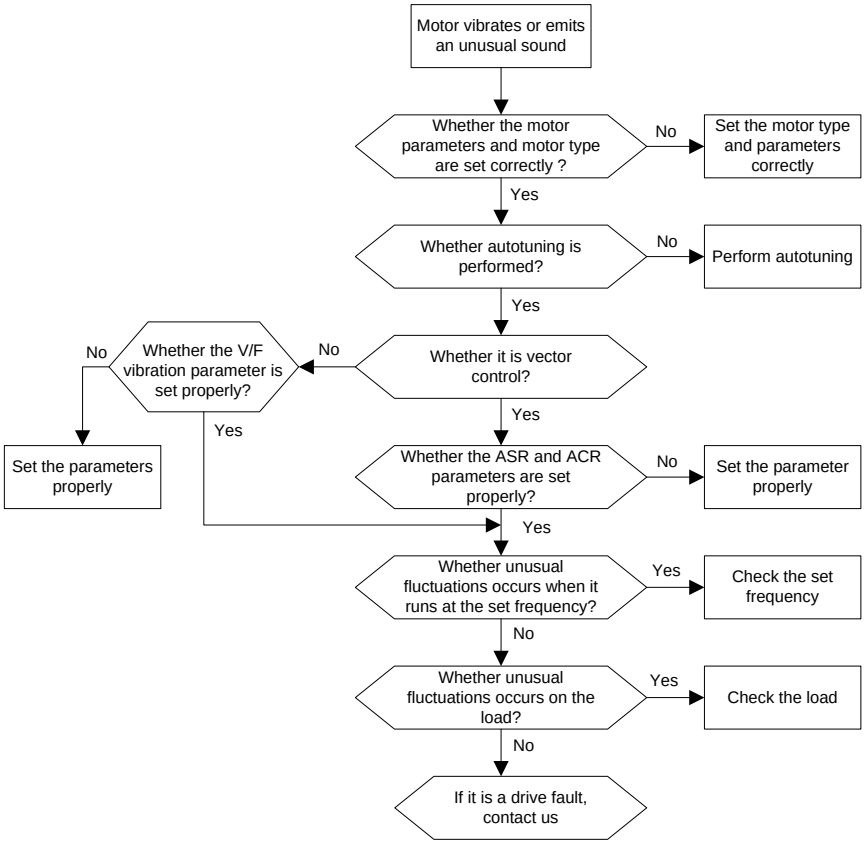
Displayed code	State type	Possible cause	Solution
		low.	
PCE	Failure of communication between the keypad and main control board	● The keypad is not properly connected.	● Check the installation environment of the keypad.

7.3 Analysis on common faults

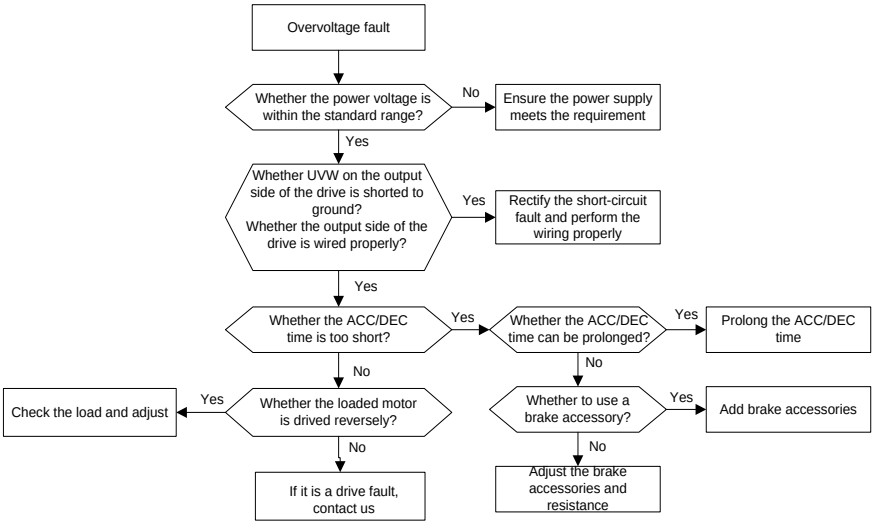
7.3.1 Motor fails to rotate



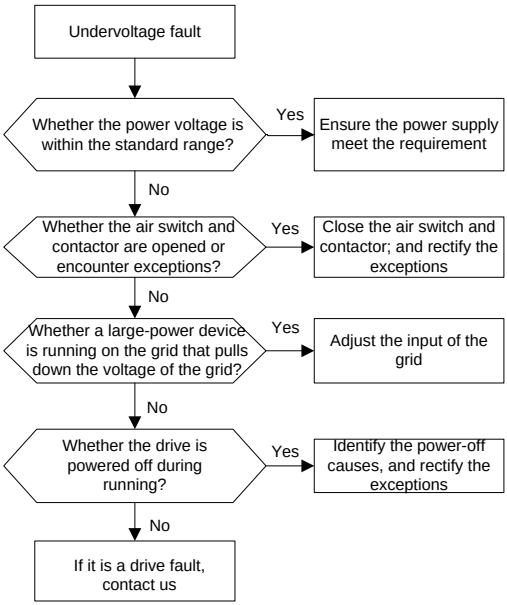
7.3.2 Motor vibrates



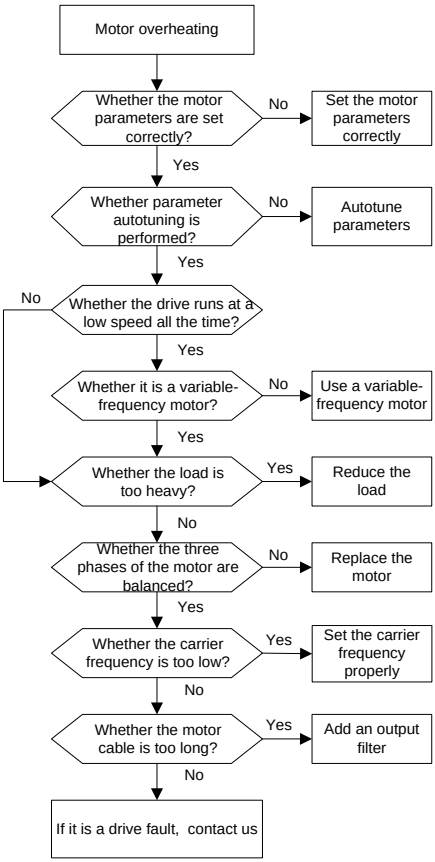
7.3.3 Overvoltage



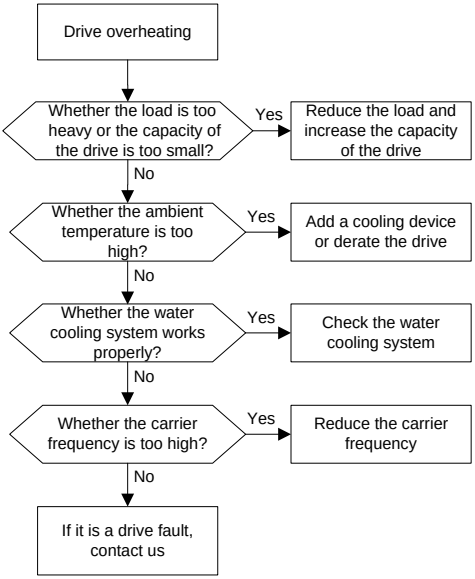
7.3.4 Undervoltage



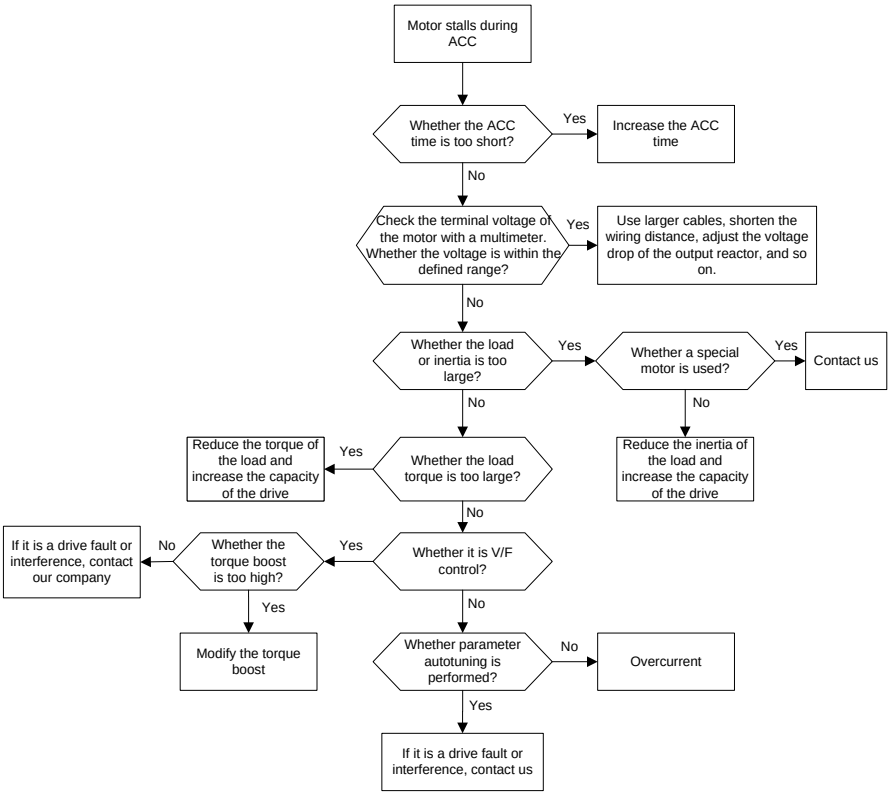
7.3.5 Motor overheating



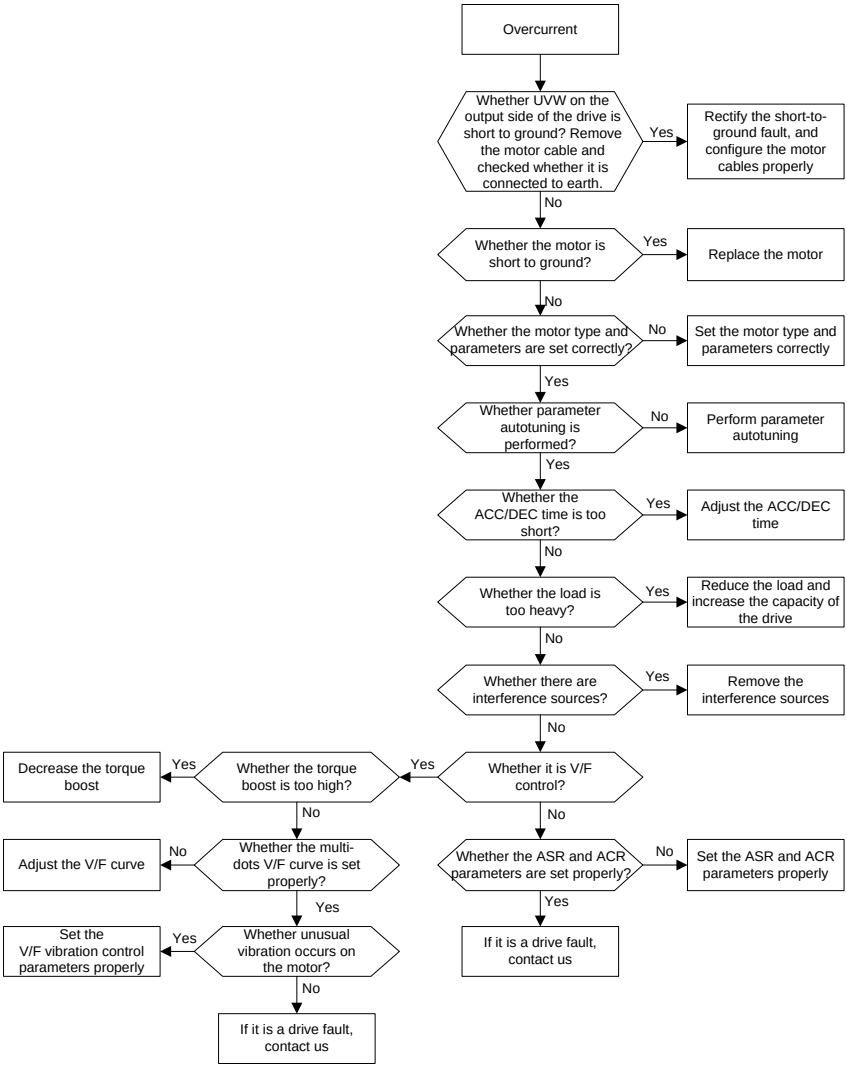
7.3.6 Drive overheating



7.3.7 Motor stalls during ACC



7.3.8 Overcurrent



8 Communication

8.1 Modbus protocol

This chapter describes the communication protocols supported by the drive.

The drive provides RS485 communication interfaces and adopts the master/slave communication based on the international standard Modbus communication protocol. You can implement centralized control (setting commands for controlling the drive, modifying the running frequency and related function parameters, and monitoring the running status and fault information of the drive) through PC/PLC, upper control computer, or other devices to meet specific application requirements.

8.1.1 Modbus protocol introduction

Modbus is a software protocol, a common language used in electronic controllers. By using this protocol, a controller can communicate with other devices through transmission lines. It is a general industrial standard. With this standard, control devices produced by different manufacturers can be connected to form an industrial network and be monitored in a centralized way.

The Modbus protocol provides two transmission modes, namely American Standard Code for Information Interchange (ASCII) and remote terminal units (RTU). On one Modbus network, all the devices must be consistent in transmission modes, baud rates, data bits, check bits, stop bits, and other basic parameters.

A Modbus network is a control network with one master and multiple slaves, that is, on one Modbus network, there is only one device serving as the master, and other devices are the slaves. The master can communicate only with one slave or with all the slaves by sending broadcast messages. For separate access commands, a slave needs to return a response. For broadcast messages, slaves do not need to return responses.

8.1.2 Application of Modbus

The drive uses the Modbus RTU mode and communicates through RS485 interfaces.

8.1.2.1 RS485

RS485 interfaces work in half-duplex mode and send data signals in the differential transmission way, which is also referred to as balanced transmission. An RS485 interface uses a twisted pair, in which one wire is defined as A (+), and the other B (-). Generally, if the positive electrical level between the transmission drivers A and B ranges from +2 V to +6 V, the logic is "1"; and if it ranges from -2 V to -6 V, the logic is "0".

On the drive terminal block, the 485+ terminal corresponds to A, and 485- corresponds to B.

The communication baud rate (P20.01) indicates the number of bits sent in a second, and the unit is

bit/s (bps). A higher baud rate indicates faster transmission and poorer anti-interference capability. When a twisted pair of 0.56 mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

Baud rate (bps)	Max. transmission distance (meter)	Baud rate (bps)	Max. transmission distance (meter)
2400	1800	9600	800
4800	1200	19200	600

When RS485 interfaces are used for long-distance communication, it is recommended that you use shielded cables, and use the shielding layer as the ground wires.

When there are fewer devices and the transmission distance is short, the whole network works well without terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120 Ω terminal resistor when the transmission distance is long.

8.1.2.2 RTU mode

(1) RTU communication frame structure

When a controller is set to use the RTU communication mode on a Modbus network, every byte (8 bits) in the message includes 2 hexadecimal characters (each includes 4 bits). Compared with the ASCII mode, the RTU mode can help to send more data at the same baud rate.

Code system

- 1 start bit
- 7 or 8 data bits; the minimum valid bit is sent first. Each frame domain of 8 bits includes 2 hexadecimal characters (0–9, A–F).
- 1 odd/even check bit; this bit is not provided if no check is needed.
- 1 stop bit (with check performed), or 2 bits (without check)

Error detection domain

- Cyclic redundancy check (CRC)

The following table describes the data format.

11-bit character frame (Bits 1 to 8 are data bits)

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Check bit	Stop bit

10-bit character frame (Bits 1 to 7 are data bits)

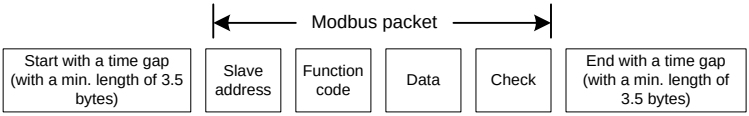
Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Check bit	Stop bit

In a character frame, only the data bits carry information. The start bit, check bit, and stop bit are used

to facilitate the transmission of the data bits to the destination device. In practical applications, you must set the data bits, parity check bits, and stop bits consistently.

In RTU mode, a new frame always must be preceded by a time gap with a minimum length of 3.5 bytes. On a network where the transmission rate is calculated based on the baud rate, the transmission time of 3.5 bytes can be easily obtained. After the idle time ends, the data domains are sent in the following sequence: slave address, operation command code, data, and CRC check character. Each byte sent in each domain includes 2 hexadecimal characters (0–9, A–F). The network devices always monitor the communication bus. After receiving the first domain (address information), each network device identifies the byte. After the last byte is sent, a similar transmission interval (with a minimum length of 3.5 bytes) is used to indicate that the frame transmission ends. Then, the transmission of a new frame starts.

RTU data frame format



The information of a frame must be sent in a continuous data flow. If there is an interval greater than the transmission time of 1.5 bytes before the transmission of the entire frame is complete, the receiving device deletes the incomplete information, and mistakes the subsequent byte for the address domain of a new frame. Similarly, if the transmission interval between two frames is shorter than the transmission time of 3.5 bytes, the receiving device mistakes it for the data of the last frame. The CRC check value is incorrect due to the disorder of the frames, and thus a communication fault occurs.

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

START (frame header)	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR (slave address domain)	Communication address: 0–247 (decimal system) (0 is the broadcast address)
CMD (function domain)	03H: read slave parameters 06H: write slave parameters
DATA (N-1) ... DATA (0) (data domain)	Data of 2×N bytes, main content of the communication as well as the core of data exchanging
CRC CHK (low-order bits)	Detection value: CRC (16 bits)
CRC CHK (high-order bits)	
END (frame tail)	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

(2) RTU communication frame error check modes

During data transmission, errors may occur due to various reasons. Without check, the data receiving device cannot identify data errors and may make an incorrect response. The incorrect response may cause severe problems. Therefore, the data must be checked.

The check is implemented as follows: The sender calculates the to-be-sent data based on a specific algorithm to obtain a result, adds the result to the rear of the message, and sends them together. After receiving the message, the receiver calculates the data based on the same algorithm to obtain a result, and compares the result with that sent by the sender. If the results are the same, the message is correct. Otherwise, the message is considered incorrect.

The error check of a frame includes two parts, namely bit check on individual bytes (that is, odd/even check bit using the check bit in the character frame), and whole data check (CRC check).

Bit check on individual bytes (odd/even check)

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

Definition of even check: Before the data is sent, an even check bit is added to indicate whether the number of "1" in the to-be-sent data is odd or even. If it is even, the check bit is set to "0"; and if it is odd, the check bit is set to "1".

Definition of odd check: Before the data is sent, an odd check bit is added to indicate whether the number of "1" in the to-be-sent data is odd or even. If it is odd, the check bit is set to "0"; and if it is even, the check bit is set to "1".

For example, the data bits to be sent are "11001110", including five "1". If the even check is applied, the even check bit is set to "1"; and if the odd check is applied, the odd check bit is set to "0". During the transmission of the data, the odd/even check bit is calculated and placed in the check bit of the frame. The receiving device performs the odd/even check after receiving the data. If it finds that the odd/even parity of the data is inconsistent with the preset information, it determines that a communication error occurs.

CRC check mode

A frame in the RTU format includes an error detection domain based on the CRC calculation. The CRC domain checks all the content of the frame. The CRC domain consists of two bytes, including 16 binary bits. It is calculated by the sender and added to the frame. The receiver calculates the CRC of the received frame, and compares the result with the value in the received CRC domain. If the two CRC values are not equal to each other, errors occur in the transmission.

During CRC, 0xFFFF is stored first, and then a process is invoked to process a minimum of 6 contiguous bytes in the frame based on the content in the current register. CRC is valid only for the 8-bit data in each character. It is invalid for the start, stop, and check bits.

During the generation of the CRC values, the "exclusive or" (XOR) operation is performed on the each 8-bit character and the content in the register. The result is placed in the bits from the low-order

bits to the high-order bits, and 0 is placed in the high-order bits. Then, low-order bits are detected. If the low-order bit is 1, the XOR operation is performed on the current value in the register and the preset value. If the low-order bit is 0, no operation is performed. This process is repeated 8 times. After the last bit (8th bit) is detected and processed, the XOR operation is performed on the next 8-bit byte and the current content in the register. The final values in the register are the CRC values obtained after operations are performed on all the bytes in the frame.

The calculation adopts the international standard CRC check rule. You can refer to the related standard CRC algorithm to compile the CRC calculation program as required.

The following is a simple CRC calculation function for your reference (using the C programming language):

```
unsigned int crc_cal_value(unsigned char*data_value,unsigned char data_length)
{
    int i;
    unsigned int crc_value=0xffff;
    while(data_length--)
    {
        crc_value^=*data_value++;
        for(i=0;i<8;i++)
        {
            if(crc_value&0x0001)
                crc_value=(crc_value>>1)^0xa001;
            else
                crc_value=crc_value>>1;
        }
    }
    return(crc_value);
}
```

In the ladder logic, CKSM uses the table look-up method to calculate the CRC value according to the content in the frame. The program using this method is simple, and the calculation is fast, but the ROM space occupied is large. Use this method with caution in scenarios where there are space occupation requirements on programs.

8.1.3 RTU command code and communication data

8.1.3.1 Command code 03H, reading *N* words (continuously reading a maximum of 16 words)

The command code 03H is used by the master to read data from the drive. The count of data to be read depends on the "data count" in the command. A maximum of 16 pieces of data can be read. The

addresses of the read parameters must be contiguous. Each piece of data occupies 2 bytes, that is, one word. The command format is presented using the hexadecimal system (a number followed by "H" indicates a hexadecimal value). One hexadecimal value occupies one byte.

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

For example, if the slave (drive) address is 01H, to read two contiguous pieces of data (that is, to read content from the data addresses 0004H and 0005H) starting from the data address of 0004H, the frame structures are described in the following.

RTU master command (sent from the master to the drive):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR (address)	01H
CMD (command code)	03H
Start address high-order bits	00H
Start address low-order bits	04H
Data count high-order bits	00H
Data count low-order bits	02H
CRC low-order bits	85H
CRC high-order bits	CAH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

"START" and "END" are "T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)", indicating that a time gap with a minimum length of 3.5 bytes must be kept before RS485 communication is executed. The time gap is used to distinguish one message from another so that the two messages are not regarded as one message.

"ADDR" is "01H", indicating that the command is sent to the drive whose address is 01H. The ADDR information occupies one byte.

"CMD" is "03H", indicating that the command is used to read data from the drive. The CMD information occupies one byte.

"Start address" indicates that data reading is started from this address. It occupies two bytes, with the high-order bits on the left and low-order bits on the right.

"Data count" indicates the count of data to be read (unit: word).

"Start address" is "0004H" and "Data count" is 0002H, indicating that data is to be read from the data addresses of 0004H and 0005H.

CRC check occupies two bytes, with the low-order bits on the left and high-order bits on the right.

RTU slave response (sent from the drive to the master):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	01H
CMD	03H
Byte count	04H
High-order bits of data in 0004H	13H
Low-order bits of data in 0004H	88H
High-order bits of data in 0005H	00H
Low-order bits of data in 0005H	00H
CRC low-order bits	7EH
CRC high-order bits	9DH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

The definition of the response information is described as follows:

"ADDR" is "01H", indicating that the message is sent from the drive whose address is 01H. The ADDR information occupies one byte.

"CMD" is "03H", indicating that the message is a response of the drive to the 03H command of the master for reading data. The CMD information occupies one byte.

"Byte count" indicates the number of bytes between it (not included) and the CRC byte (not included). The value "04" indicates that there are four bytes of data between "Byte count" and "CRC low-order bits", that is, "High-order bits of data in 0004H", "Low-order bits of data in 0004H", "High-order bits of data in 0005H", and "Low-order bits of data in 0005H".

A piece of data is two bytes, with the high-order bits on the left and low-order bits on the right. From the response, the data in 0004H is 1388H, and that in 0005H is 0000H.

CRC check occupies two bytes, with the low-order bits on the left and high-order bits on the right.

8.1.3.2 Command word 06H, writing a word

This command is used by the master to write data to the drive. One command can be used to write only one piece of data. It is used to modify the parameters and running mode of the drive.

For example, to write 5000 (1388H) to 0004H of the drive whose address is 02H, the frame structures are described in the following.

RTU master command (sent from the master to the drive):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	02H
CMD	06H
High-order bits of data writing address	00H
Low-order bits of data writing address	04H
Data content high-order bits	13H

Data content low-order bits	88H
CRC low-order bits	C5H
CRC high-order bits	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

RTU slave response (sent from the drive to the master):

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	02H
CMD	06H
High-order bits of data writing address	00H
Low-order bits of data writing address	04H
Data content high-order bits	13H
Data content low-order bits	88H
CRC low-order bits	C5H
CRC high-order bits	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

Note: Sections 8.1.3.1 and 8.1.3.2 mainly describe the command formats. For the detailed application, see section 8.1.3.7.

8.1.3.3 Command code 08H, diagnosis

Sub-function code description:

Sub-function code	Description
0000	Return data based on requests

For example, to query about the circuit detection information about the drive whose address is 01H, the request and response strings are the same, and the format is described in the following tables.

RTU master command:

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code high-order bits	00H
Sub-function code low-order bits	00H
Data content high-order bits	12H
Data content low-order bits	ABH
CRC CHK low-order bits	ADH
CRC CHK high-order bits	14H
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

RTU slave response:

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code high-order bits	00H
Sub-function code low-order bits	00H
Data content high-order bits	12H
Data content low-order bits	ABH
CRC CHK low-order bits	ADH
CRC CHK high-order bits	14H
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

8.1.3.4 Data address definition

This section describes the address definition of communication data. The addresses are used for controlling the running, obtaining the status information, and setting function parameters of the drive.

(1) Function code address format rules

The address of a function code consists of two bytes, with the high-order bits on the left and low-order bits on the right. The high-order bits range from 00 to ffH, and the low-order bits also range from 00 to ffH. The high-order bit is the hexadecimal form of the group number before the dot mark, and low-order bit is that of the number behind the dot mark. Take P05.06 as an example: The group number is 05, that is, the high-order bits of the parameter address are the hexadecimal form of 05; and the number behind the dot mark is 06, that is, the low-order bits are the hexadecimal form of 06. Therefore, the function code address is 0506H in the hexadecimal form. For P10.01, the parameter address is 0A01H.

Note: The parameters in the P29 group are factory set. They cannot be read or modified. Some parameters cannot be modified when the drive is running; some cannot be modified regardless of the drive status. Pay attention to the setting range, unit, and description of a parameter when modifying it.

The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. For users, some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the high-order bits of the corresponding function code address from 0 to 1. For example, if P00.07 is not to be stored in the EEPROM, you need only to modify the value in the RAM, that is, set the address to 8007H. The address can be used only for writing data to the on-chip RAM, and it is invalid when used for reading data.

(2) Description of other function code addresses

In addition to modifying the parameters of the drive, the master can also control the drive, such as starting and stopping the drive, and monitoring the running status of the drive.

Table 8-1 Other function code addresses

Function	Address	Description	R/W
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coasting to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax; unit: 0.01Hz)	R/W
	2002H	PID reference; range (0–1000, 1000 corresponding to 100.0%)	
	2003H	PID feedback; range (0–1000, 1000 corresponding to 100.0%)	R/W
	2004H	Torque setting (-3000–+3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2005H	Setting of the upper limit of the forward running frequency (0–Fmax, unit: 0.01Hz)	R/W
	2006H	Setting of the upper limit of the reverse running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2007H	Upper limit of the electromotive torque (0–3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2008H	Upper limit of the braking torque (0–3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2009H	Special control command word: Bit0–1: =00: Motor 1 =01: Motor 2 =10: Motor 3 =11: Motor 4 Bit2: =1 Torque control =0: Speed control	R/W
	200AH	Virtual input terminal command; range: 0x0000–0x00FF	R/W
	200BH	Virtual output terminal command; range: 0x00–0x3F	R/W
	200CH	Voltage setting (used when V/F separation is implemented)	R/W

Function	Address	Description	R/W
		(0–1000, 1000 corresponding to 100.0% of the motor rated voltage)	
	200DH	AO output setting 1(-1000–1000, 1000 corresponding to 100.0%)	R/W
	200EH	AO output setting 2(-1000–1000, 1000 corresponding to 100.0%)	R/W
Drive status word 1	2100H	0001H: Forward running	R
		0002H: Reverse running	
		0003H: Stopped	
		0004H: Faulty	
		0005H: POFF	
Drive status word 2	2101H	Bit0: =0: Bus voltage not established =1: Bus voltage established Bi1–2: =00: Motor 1 =01: Motor 2 =10: Motor 3 =11: Motor 4 Bit3: =0: AM =1: SM Bit4: =0: No overload alarm =1: Overload alarm Bit5: =0: Hold the brake =1: Release the brake	R
Drive fault code	2102H	See the description of fault types.	R
Drive identification code	2103H	GD800-51-----0x0109	R
Running frequency	3000H	Compatible with CHF100A and CHV100 communication addresses	R
Frequency setting	3001H		R
Bus voltage	3002H		R
Output voltage	3003H		R
Output current	3004H		R
Rotation speed	3005H		R
Output power	3006H		R
Output torque	3007H		R
Closed-loop setting	3008H		R
Closed-loop feedback	3009H		R
Input I/O state	300AH		R
Output I/O state	300BH		R
Analog input 1	300CH		R
Analog input 2	300DH		R
Analog input 3	300EH		R

Function	Address	Description	R/W
Analog input 4	300FH		R
Read input of high-speed pulse 1	3010H		R
Read input of high-speed pulse 2	3011H		R
Read current step of multi-step speed	3012H		R
External length value	3013H		R
External counting value	3014H		R
Torque setting	3015H		R
Drive identification code	3016H		R
Fault code	5000H		R

The Read/Write (R/W) characteristics indicate whether a function can be read and written. For example, if "Communication-based control command" can be written, the command code 06H is used to control the drive. "R" indicates that a function is read only, and "W" indicates that a function is written only.

Note: Some parameters in the preceding table are valid only after they are enabled. Take the running and stop operations as examples. You need to set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to "Modbus". For example, when performing the PID setting operation, set P09.00 PID setting channel to Modbus.

The following table describes the encoding rules of device codes (corresponding to the identification code 2103H of the drive).

Eight high-order bits	Meaning	Eight low-order bits	Meaning
0x01	Goodrive	0x09	Goodrive800-51 series water-cooled drive

Note: A device code consists of 16 bits, with 8 high-order bits and 8 low-order bits. The 8 high-order bits indicate the model series, and the 8 low-order bits indicate the derivative model.

8.1.3.5 Fieldbus scale

In actual applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. For example, 50.12 Hz cannot be represented in the hexadecimal form. In such cases, multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H (5012 in the decimal form) in the hexadecimal form.

In the process of multiplying a non-integer by a multiple to obtain an integer, the multiple is referred to as a fieldbus scale.

The fieldbus scale depends on the number of decimals in the value specified in "Setting range" or "Default value". If there are n decimals in the value, the fieldbus scale m is the nth-power of 10. Take the following as an example, where m is 10.

Function code	Name	Description	Setting range	Default value	Modify
P01.20	Delay to recovery from sleep	0.0–3600.0s (Valid when P01.19=2)	0.0–3600.0	0.0s	○
P01.21	Restart after power failure	0: Disable restart 1: Enable restart	0–1	0	○

If "Setting range" or "Default value" contains one decimal, the fieldbus scale is 10. If the value received by the upper computer is 50, "Delay to recovery from sleep" of the drive is 5.0 (5.0=50/10).

To set "Delay to recovery from sleep" to 5.0s through Modbus communication, you need first to multiply 5.0 by 10 according to the scale to obtain an integer 50, that is, 32H in the hexadecimal form, and then send the following write command:

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

After receiving the command, the drive converts 50 into 5.0 based on the fieldbus scale, and then sets "Delay to recovery from sleep" to 5.0s.

For another example, after the upper computer sends the "Delay to recovery from sleep" parameter read command, the master receives the following response from the drive:

01	03	02	00 32	39 91
Drive address	Read command	2-byte data	Parameter data	CRC

The parameter data is 0032H, that is, 50, and 5.0 is obtained based on the fieldbus scale (50/10=5.0). In this case, the master identifies that the "Delay to recovery from sleep" is 5.0s.

8.1.3.6 Error messages

Operation errors may occur during communication-based control. For example, some parameters are read only, but a write command is sent. In this case, the drive returns an error message.

Error messages are sent from the drive to the master. The following table lists the error messages.

Error code	Name	Description
01H	Invalid command	The command code received by the upper computer is not allowed to be executed. The possible causes are as follows: • The function code is applicable only on new devices and is not implemented on this device. • The slave is in faulty state when processing this request.
02H	Invalid data address	For the drive, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and to-be-sent bytes is invalid.
03H	Invalid data value	The received data domain contains a value that is not allowed. The value indicates the error of the remaining structure in the combined request. **Note:** It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
04H	Operation failure	The parameter is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Password error	The password entered in the password verification address is different from that set in P07.00.
06H	Data frame error	The length of the data frame sent from the upper computer is incorrect, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the upper computer is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the upper computer cannot be modified during the running of the drive.
09H	Password protection	A user password is set, and the upper computer does not provide the password to unlock the system when performing a read or write operation. The error of "system locked" is reported.

When returning a response, the slave uses a function code domain and fault address to indicate whether it is a normal response (no error) or exception response (some errors occur). In a normal response, the slave returns the corresponding function code and data address or sub-function code.

In an exception response, the slave returns a code that is equal to a normal code, but the high-order bit is logic 1.

For example, if the master sends a request message to the slave for reading a group of function code address data, the following code is generated

0 0 0 0 0 0 1 1 (03H in the hexadecimal form)

For a normal response, the same code is returned.

For an exception response, the following code is returned:

1 0 0 0 0 0 1 1 (83H in the hexadecimal form)

In addition to the modification of the code, the slave returns a byte of exception code that describes the cause of the exception. After receiving the exception response, the typical processing of the master is to send the request message again or modify the command based on the fault information.

For example, to set the "Channel of running commands" (P00.01, the parameter address is 0001H) of the drive whose address is 01H to 03, the command is as follows:

01	06	00 01	00 03	98 0B
Drive address	Write command	Parameter address	Parameter data	CRC

The setting range of the "Channel of running commands" is 0 to 2. The value 3 exceeds the setting range. In this case, the drive returns an error message as shown in the following:

01	86	04	43 A3
Drive address	Exception response code	Error code	CRC

The exception response code 86H (generated based on the high-order bit "1" of the write command 06H) indicates that it is an exception response to the write command (06H). The error code is 04H that indicates the error "Operation failure", which means "The parameter is set to an invalid value in the write operation".

8.1.3.7 Read/Write operation examples

For formats of the read and write commands, see sections 8.1.3.1 and 8.1.3.2.

(1) Read command 03H

Example 1: Read status word 1 of the drive whose address is 01H. According to the table of other function code addresses, the parameter address of status word 1 of the drive is 2100H.

The read command sent to the drive is as follows:

01	03	21 00	00 01	8E 36
Drive address	Read command	Parameter address	Data quantity	CRC

Assume that the following response is returned:

01	03	02	00 03	F8 45
Drive address	Read command	Number of bytes	Data content	CRC

The data content returned by the drive is 0003H, which indicates that the drive is in stopped state.

Example 2: View information about the drive whose address is 03H, including "Type of present fault" (P07.27) to "Type of 5th-last fault" (P07.32) of which the parameter addresses are 071BH–071FH (contiguous 6 parameter addresses starting from 071BH).

The command sent to the drive is as follows:

03	03	07 1B	00 06	B5 59
Drive address	Read command	Start address	6 parameters in total	CRC

Assume that the following response is returned:

03	03	0C	00 23	00 23	00 23	00 23	00 23	00 23	5F D2
Drive address	Read command	Number of bytes	Present fault type	Last fault type	2nd-last fault type	3rd-last fault type	4th-last fault type	5th-last fault type	CRC

From the returned data, all the fault types are 0023H, which is 35 in the decimal form and means the STO fault (STo).

(2) Write command 06H

Example 1: Enable the drive whose address is 03H to run forward. According to the table of other function code addresses, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Run forward	R/W
		0002H: Run reversely	
		0003H: Jog forward	
		0004H: Jog reversely	
		0005H: Stop	
		0006H: Coast to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Stop jogging	

The command sent from the master is as follows:

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

If the operation is successful, the following response is returned (same as the command sent from the master):

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

Example 2: Set "Max. output frequency" of the drive whose address is 03H to 100.00kHz.

Function code	Name	Description	Setting range	Default value	Modify
P00.03	Max. output frequency	P00.04–600.00Hz(400.00Hz)	10.00–600.00	50.00Hz	◎

According to the decimal point, the fieldbus scale of the "Max. output frequency" (P00.03) is 100. Multiply 100kHz by 100. The value 10000 is obtained, which is 2710H in the hexadecimal form.

The command sent from the master is as follows:

03	06	00 03	27 10	62 14
Drive address	Write command	Parameter address	Parameter data	CRC

If the operation is successful, the following response is returned (same as the command sent from the master):

03	06	00 03	27 10	62 14
Drive address	Write command	Parameter address	Parameter data	CRC

Note: In the preceding command description, spaces are added to a command just for explanatory purposes. In practical applications, no space is required in the commands.

(3) Modbus communication commissioning 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 upper computer commissioning software is the serial port commissioning assistant Commix, which can be downloaded from the Internet. Download a version that can automatically execute the CRC check function. The following figure shows the interface of Commix.

First, set the serial port to COM1. Then, set the baud rate, data bits, check bits, and stop bits. The baud rate must be consistent with that set in P14.01, and the data bits, check bits, and stop bits must be consistent with that set in P14.02. If the RTU mode is selected, you need to select the hexadecimal form Input HEX. To set the software to automatically execute the CRC function, you need to select ModbusRTU, and select CRC16 (MODBU SRTU), and set the start byte to 1. After the auto CRC check function is enabled, do not enter CRC information in commands. Otherwise, command errors may occur due to repeated CRC check.

The commissioning command to set the drive whose address is 03H to run forward is as follows:

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

Note:

- ✧ You need to set the drive address (P14.00) to 03.
- ✧ You need to set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to "Modbus".
- ✧ Click **Send**. If the line configuration and settings are correct, a response sent from the drive is received.

8.1.4 Common communication faults

Common communication faults include the following:

- ✧ No response is returned.
- ✧ The drive returns an exception response.

Possible causes of no response include the following:

- ✧ The serial port is set incorrectly. For example, the converter uses the serial port COM1, but

COM2 is selected for the communication.

✧ The settings of the baud rate, data bits, stop bits, and check bits are inconsistent with those set on the drive.

✧ The positive pole (+) and negative pole (-) of the RS485 bus are connected reversely.

8.1.5 Related function codes

Function code	Name	Description	Default	Modify
P14.00	Local communication address	1–247; 0 indicates a broadcast address	1	○
P14.01	Baud rate	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps Setting range: 0–7	4	○
P14.02	Data bit check	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 Setting range: 0–5	1	○
P14.03	Communication response delay	0–200ms	5ms	○
P14.04	Communication timeout time	0.0 (invalid); 0.1–60.0s	0.0s	○
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: No alarm and continue to run 2: No alarm and stop according to the stop mode (only in the communication-based control mode) 3: No alarm and stop according to the stop mode (in all control modes) Setting range: 0–3	0	○
P14.06	Communication	0x00–0x11	0x00	○

Function code	Name	Description	Default	Modify
	processing action	LED units place: 0: Responding to write operations 1: No response to write operations LED tens place: 0: Communication password protection is disabled. 1: Communication password protection is enabled.		
P14.07–P14.08	Reserved			

8.2 CAN communication

8.2.1 Referred standard

SAE J1939-21.

8.2.2 Communication frame formats

A complete CAN data frame is divided into 7 bit fields: including start of frame (SOF), arbitration field, control field, data field, check field, reply field, and end of frame (EOF). An extended CAN frame message has a 29-bit identifier in the arbitration field. See the following figure.

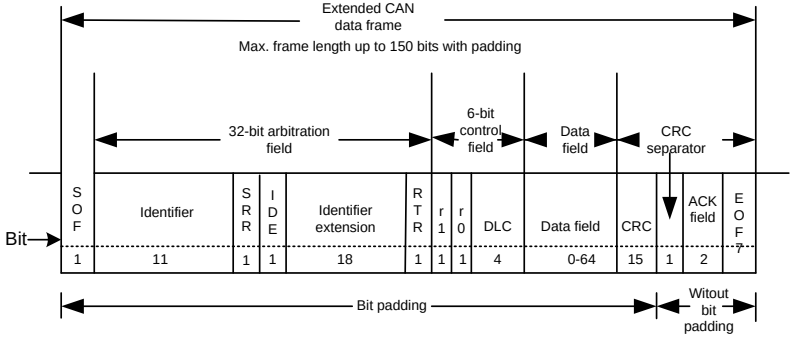


Figure 8–1 CAN data frame

According to the figure, the arbitration field includes 32 bits, including the 29-bit identifier, SRR bit, IDE bit, and RTR bit.

The 29-bit identifier must not be all recessive. The identifier is divided into two parts in the arbitration field, that is, 11 bits for the base identifier and 18 bits for the identifier extension. The substitute remote request (SRR) bit must be a recessive bit, and it replaces the RTR bit in the standard

message location in the extended format. The identifier extension (IDE) bit belongs to the arbitration field in the extended format and the IDE bit in the extended format is recessive. The remote transmission request (RTR) bit must be dominant in the data frame, but it must be recessive in the remote frame.

The protocol data unit (PDU) format complies with PDU1 in SAE J1939-21. See the following.

Reference	J1939 PDU						
Domain	P	R	DP	PF	PS	SA	Data field
Length (bit)	3	1	1	8	8	8	0-64

Priority (P): 3 bits, only used to optimize the wait time of bus transmission for a message. The receiver can ignore these bits when receiving data. The priority ranges from 0 to 8 in descending order.

Reserved (R): This bit is reserved by SAE. The SAE reserved bit is set to 0 during the transmission of any message.

Data page (DP): 1 bit, as the auxiliary page for description of parameter group selection. All parameter group numbers must be filled in page zero before the assignment of page 1.

PDU format (PF): 8 bits, defining the protocol data format, also one of the fields that determine the data group number assignment to the data field.

PDU characteristics (PS): 8 bits. According to the PDU format definition, this field may be the destination address or group extension. If the value of the PDU format field is lower than 240, then the PS field is the destination address. If the value of the PDU format field is between 240 and 255, then the PS field includes a group extension value.

Source address (SA): 8 bits. Each device in a network should have a given SA. Therefore, each SA must be unique, and each SA cannot be repeatedly used.

8.2.3 CAN communication node address

Function code	Description
P24.18	PS domain value of CAN communication
P24.19	SA domain value of CAN communication

8.2.4 Function code read/write request format

OUT	IN	ID						Period (ms)
Controller	Drive	In decimal						
		P	R	DP	PF	PS	SA	
		3	0	0	18			
Data								
Location	Data name					Remarks		
Byte 1	Read/write command.					1: Read		

	Bit0–Bit2: Operation request. 1: Read function codes 2: Write function codes to the RAM 3: Write function codes to the ROM Bit3–Bit7: Reserved	2: Write to the RAM 3: Write to the RAM and EEROM (Note 1)
Byte 2	Reserved	
Byte 3	Function code group number	
Byte 4	Sequence number in the group	
Byte 5	Low-order byte of written data	
Byte 6	High-order byte of written data	
Byte 7	Reserved	
Byte 8	Reserved	

8.2.5 Function code read/write response format

OUT	IN	ID						Period (ms)
Drive	Controller	In decimal						
		P	R	DP	PF	PS	SA	
		3	0	0	19			
Data								
Location	Data name						Remarks	
Byte 1	Read/write command response. Bit0–Bit7: Operation response. 1: Read function codes 2: Write function codes to the RAM 3: Write function codes to the ROM When an error is returned as the response, bit 7 is set to 1. That is, when an error occurs during function code reading, the response 0x81 is returned. The detailed error code (note 2) is assigned to byte 7.						1: Feedback of reading 2: Feedback of writing data to the RAM 3: Feedback of writing data to the RAM and EEROM	
Byte 2	Reserved							
Byte 3	Response to the function code group number request							
Byte 4	Response to the request for the sequence number in the group							
Byte 5	Response to the request for the low-order bits of written data							
Byte 6	Response to the request for the high-order bits of written data							
Byte 7	Error code							
Byte 8	Reserved							

8.2.6 Control command data format

(1) Data frame 1 received by the drive

OUT	IN	ID						Period (ms)
Controller	Drive	In decimal						P24.16
		P	R	DP	PF	PS	SA	
		3	0	0	10			
Data								
Location	Data name				Remarks			
Byte 1	Low-order 8 bits of control word				See note 3			
Byte 2	High-order 8 bits of control word							
Byte 3	Low-order 8 bits of received PZD2				Note 5			
Byte 4	High-order 8 bits of received PZD2							
Byte 5	Low-order 8 bits of received PZD3				Note 5			
Byte 6	High-order 8 bits of received PZD3							
Byte 7	Low-order 8 bits of received PZD4				Note 5			
Byte 8	High-order 8 bits of received PZD4							

(2) Data frame 2 received by the drive

OUT	IN	ID						Period (ms)
Controller	Drive	In decimal						P24.16
		P	R	DP	PF	PS	SA	
		3	0	0	11			
Data								
Location	Data name				Remarks			
Byte 1	Low-order 8 bits of received PZD5				Note 5			
Byte 2	High-order 8 bits of received PZD5							
Byte 3	Low-order 8 bits of received PZD6				Note 5			
Byte 4	High-order 8 bits of received PZD6							
Byte 5	Low-order 8 bits of received PZD7				Note 5			
Byte 6	High-order 8 bits of received PZD7							
Byte 7	Low-order 8 bits of received PZD8				Note 5			
Byte 8	High-order 8 bits of received PZD8							

(3) Data frame 1 sent by the drive

OUT	IN	ID						Period (ms)
Drive	Controller	In decimal						P24.16
		P	R	DP	PF	PS	SA	
		3	0	0	20			

Data		
Location	Data name	Remarks
Byte 1	Low-order 8 bits of status word	Note 4
Byte 2	High-order 8 bits of status word	
Byte 3	Low-order 8 bits of sent PZD2	Note 6
Byte 4	High-order 8 bits of sent PZD2	
Byte 5	Low-order 8 bits of sent PZD3	Note 6
Byte 6	High-order 8 bits of sent PZD3	
Byte 7	Low-order 8 bits of sent PZD4	Note 6
Byte 8	High-order 8 bits of sent PZD4	

(4) Data frame 2 sent by the drive

OUT	IN	ID						Period (ms)
Drive	Controller	In decimal						P24.16
		P	R	DP	PF	PS	SA	
		3	0	0	21			
Data								
Location	Data name	Remarks						
Byte 1	Low-order 8 bits of sent PZD5	Note 6						
Byte 2	High-order 8 bits of sent PZD5							
Byte 3	Low-order 8 bits of sent PZD6	Note 6						
Byte 4	High-order 8 bits of sent PZD6							
Byte 5	Low-order 8 bits of sent PZD7	Note 6						
Byte 6	High-order 8 bits of sent PZD7							
Byte 7	Low-order 8 bits of sent PZD8	Note 6						
Byte 8	High-order 8 bits of sent PZD8							

(5) Data frame 3 sent by the drive

OUT	IN	ID						Period (ms)
Drive	Controller	In decimal						P24.16
		P	R	DP	PF	PS	SA	
		3	0	0	22			
Data								
Location	Data name	Remarks						
Byte 1	Low-order 8 bits of sent PZD9	Note 6						
Byte 2	High-order 8 bits of sent PZD9							
Byte 3	Low-order 8 bits of sent PZD10	Note 6						
Byte 4	High-order 8 bits of sent PZD10							
Byte 5	Low-order 8 bits of sent PZD11	Note 6						

Byte 6	High-order 8 bits of sent PZD11	
Byte 7	Low-order 8 bits of sent PZD12	Note 6
Byte 8	High-order 8 bits of sent PZD12	

Note 1: Function code read/write command and response definition

Command	Function	Response
0	No task.	0
1	Read parameter values.	1
2	Modify parameter values [only in the RAM].	2
3	Modify parameter values [both in the RAM and EEPROM].	3

Note 2: Responses to function code operation requests

- If the read/write operation is successful, the current function code value is returned.
- If the read/write operation fails, the failure cause is returned.

Error code	Name	Description
01H	Invalid command	The command code received by the upper computer is not allowed to be executed. The possible causes are as follows: • The function code is applicable only on new devices and is not implemented on this device. • The slave is in faulty state when processing this request.
02H	Invalid data address	For the drive, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and to-be-sent bytes is invalid.
03H	Invalid data value	The received data domain contains a value that is not allowed. The value indicates the error of the remaining structure in the combined request. **Note:** It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
04H	Operation failure	The parameter is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that set in P07.00.
06H	Incorrect data frame	The length of the data frame sent by the upper computer is incorrect, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the upper computer is a read-only parameter.
08H	Parameter	The parameter to be modified in the write operation of the upper

Error code	Name	Description
	cannot be modified in running state	computer cannot be modified when the drive is running.
09H	Password protection	When the upper computer performs a read/write operation, but the upper computer does not provide the password to unlock since the user password protection has been enabled, the error of system being locked is reported.

Note 3: Control word definition

Bit	Name	Value	Status
0–7	Communication based control command	1	Running forward
		2	Running reversely
		3	Jogging forward
		4	Jogging reversely
		5	Stopped
		6	Coasting to stop
		7	Fault reset
		8	Jogging stopped
		9	Pre-exciting
8	Reserved	1	/
9–10	Reserved	0	/
		1	/
		2	/
		3	/
11	Torque control selection	1	Disable torque control
		0	Enable torque control
13	Pre-excitation	1	Enable pre-excitation
		0	Disable pre-excitation
14	Enabling droop control	1	Enable droop control
		0	Disable droop control
15	Reserved	1	Reserved
		0	Reserved

Note 4: Status word definition

Bit	Name	Value	Status
0–3	Run status byte	1	Running forward
		2	Running reversely
		3	Stopped

Bit	Name	Value	Status
		4	Faulty
		5	POFF
4–5	Reserved	/	/
6	Reserved	1	/
		0	/
7	Establishing DC bus voltage	1	DC bus voltage established
		0	DC bus voltage not established
8	Ready for operation (bus voltage established successfully)	1	Ready to run
		0	Not ready to run
9–10	Reserved	0	/
		1	/
		2	/
		3	/
11	Motor type feedback	1	Synchronous motor
		0	Asynchronous motor
12	Overload alarm	1	Overload alarm
		0	No alarm
13	Brake control	1	Brake release control
		0	Brake closing control
14	Reserved		/
			/
15	Reserved	1	/
		0	/

Note 5: Setting/reference (REF)

Word	Description	Function selection
Received PZD2	0: Invalid 1: Frequency setting; range: 0–Fmax, unit: 0.01Hz	0
Received PZD3	2: PID reference; range: 0–1000, 1000 corresponding to 100.0% 3: PID feedback; range: 0–1000, 1000 corresponding to 100.0%	0
Received PZD4	4: Torque setting; range: -3000–3000, 1000 corresponding to 100.0% of the motor rated current	0
Received PZD5	5: Setting of frequency upper limit in forward running; range: 0–Fmax, unit: 0.01Hz	0
Received PZD6	6: Setting of frequency upper limit in reverse running; range: 0–Fmax, unit: 0.01Hz	0

Word	Description	Function selection
Received PZD7	7: Upper limit of electromotive torque; range: 0–3000, 1000 corresponding to 100.0% of the motor rated current	0
Received PZD8	8: Upper limit of braking torque; range: 0–2000, 1000 corresponding to 100.0% of the motor rated current	0
Reserved	9: Virtual input terminal command; range: 0x000–0x0FF	0
Reserved	10: Virtual output terminal command; range: 0x00–0x3F	0
Reserved	11: Voltage setting (special for V/F separation); range: 0–1000, 1000 corresponding to 100.0% of the motor rated current	0
Reserved	12: AO output setting 1; range: -1000–1000, 1000 corresponding to 100.0% 13: AO output setting 2; range: -1000–1000, 1000 corresponding to 100.0% 14: External ACC time; range: 0–3600.0s 15: External DEC time; range: 0–3600.0s 16: Pre-torque setting; range: -100.0%–100.0% 17: Droop rate setting; range: 0.00–30.00Hz 18–20: Reserved	0

Note 6: Actual value (ACT)

Word	Description	Function selection
Sent PZD2	0: Invalid	0
Sent PZD3	1: Running frequency (*100, Hz)	0
Sent PZD4	2: Frequency setting (*100, Hz)	0
Sent PZD5	3: Bus voltage (*10, V)	0
Sent PZD6	4: Output voltage (*1, V)	0
Sent PZD7	5: Output current (*10, A)	0
Sent PZD8	6: Actual value of output torque (*10, %)	0
Sent PZD9	7: Actual value of output power (*10, %)	0
Sent PZD10	8: Running rotation speed (*1, RPM)	0
Sent PZD11	9: Running linear speed (*1, m/s)	0
Sent PZD12	10: Ramp reference frequency 11: Fault code 12: AI1 value (*100, V) 13: AI2 value (*100, V) 14: AI3 value (*100, V) 15: Rectifier bridge module temperature (*10,°C) 16: Inverter module temperature (*10,°C)	0

Word	Description	Function selection
	17: S8 frequency value (*100, kHz) 18: PG card speed (signed) 19: Terminal input status 20: Terminal output status 21: PID reference (*100, %) 22: PID feedback (*100, %) 23: Reserved 24: Actual output power (*10, kW) 25: Accumulative running time (h)	

For details about PDZ parameters, see P15.02–P15.23 in group P15.

8.3 Ethernet communication

You can easily set, upload, and download all drive parameters by using the upper computer. You can also monitor more than 100 internal information waveforms of the drive in real time.

The drive provides the "black box" function. The drive can save the waveform information generated within 0.2s before the most recent fault that causes its stop. You can obtain the waveform information from the upper computer and analyze fault causes.

Function code	Name	Description	Setting range	Default
P22.00	Ethernet communication rate	0: Self adaptive 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0–4	0
P22.01	IP address 1	0–255	0–255	192
P22.02	IP address 2	0–255	0–255	168
P22.03	IP address 3	0–255	0–255	0
P22.04	IP address 4	0–255	0–255	1
P22.05	Subnet mask 1	0–255	0–255	255
P22.06	Subnet mask 2	0–255	0–255	255
P22.07	Subnet mask 3	0–255	0–255	255
P22.08	Subnet mask 4	0–255	0–255	0
P22.09	Gateway 1	0–255	0–255	192
P22.10	Gateway 2	0–255	0–255	168
P22.11	Gateway 3	0–255	0–255	1
P22.12	Gateway 4	0–255	0–255	1

9 Maintenance and repair

9.1 Overview

Only trained and qualified professionals are allowed to maintain the device.

Before you perform any maintenance on the device, you need to:

- ✧ Disconnect all the power sources of the device (note that no switch or breaker inside the cabinet can cut off the power sources of the device).
- ✧ Wait 5 minutes for the capacitor of the intermediate DC circuit to discharge.
- ✧ Ensure that the DC bus voltage is lower than 36V.

9.2 Required tools

The following tools are required for removing and installing components and screws during maintenance and repair:

- ✧ One set of torque wrenches or sleeves
- ✧ One set of open-end wrenches or sleeves
- ✧ One set of hex keys
- ✧ Medium- and small-sized cross screwdrivers
- ✧ Medium-sized cross screwdriver
- ✧ Small cart

Table 9-1 Screw tightening torque (fastener rating: 4.8; unit: N.m)

Screw	Connected through copper bar	Connected through sheet metal	Remarks
M5	3	2	
M6	5	3	
M8	11	8.5	
M10	22	16.4	
M12	39	28.5	
M16	98	71	

9.3 Routine maintenance

When installed in a proper environment, the drive requires little maintenance. The following table describes the routine maintenance periods recommended by INVT.

Table 9-2 Maintenance period

Maintain	To
Once every 6 to 12 months (depending on the actual installation environment)	Check the items in the following table.
Once every 6 to 12 months (depending on the actual installation environment)	Check and clean the water tube
Once every year (if the drive is stored without being used)	Check capacitor aging status
Once every 10 years	Replace capacitors

Table 9-3 Checklist

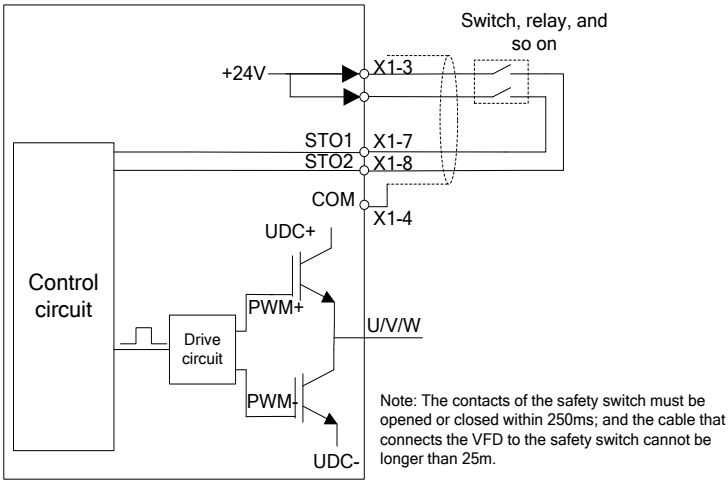
Check category		Check item	Check method	Expected result
Ambient environment		Check the temperature and humidity, and whether there is vibration, dust, gas, oil spray, and water droplets in the environment.	Visual inspection, and instrument measurement	The requirements stated in this manual are met.
		Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.	Visual inspection	There are no tools or dangerous substances placed nearby.
Main circuit	Common	Check whether bolts are loose or fall off.	Screw them up.	No exception.
		Check whether the machine or insulators are deformed, cracked, or damaged, or discolored due to overheating and aging.	Visual inspection	No exception.
		Check whether there are stains and dust attached.	Visual inspection	No exception. **Note:** Discoloration of copper bars does not mean that they cannot work properly.
	Conductor and wire	Check whether conductors are deformed or discolored due to overheating.	Visual inspection	No exception.
		Check whether wire sheaths are cracked or discolored.	Visual inspection	No exception.
	Terminal block	Check whether the terminal block is damaged.	Visual inspection	No exception.

Check category		Check item	Check method	Expected result
	Filter capacitor	Check whether there is electrolyte leakage, discoloration, cracks, and casing expansion.	Visual inspection	No exception.
		Check whether the safety valves are released.	Determine the service life based on the maintenance information, or measure them through the electrostatic capacity.	No exception.
		Check whether the electrostatic capacity is measured as required.	Use instruments to measure the capacity.	Electrostatic capacity ≥ (Initial value * 0.8)
	Resistor	Check whether there is displacement or insulator cracks caused due to overheating.	Olfactory and visual inspection	No exception.
	Transformer, reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception.
	Electromagnetic contactor, relay	Check whether there are vibration sounds during operation.	Auditory inspection	No exception.
		Check whether the contacts are in good contact.	Use multimeters for measurement.	No exception.
Control circuit	Connector	Check whether the screws and connectors are loose.	Screw them up.	No exception.
		Check whether there is unusual smell or discoloration.	Olfactory and visual inspection	No exception.
		Check whether there are cracks, damage, deformation, or rust.	Visual inspection	No exception.
Cooling system	Cooling water tube	Check whether the water inlet or outlet is blocked or there are foreign matters attached.	Visual inspection	No exception.
		Check whether the water tube is loose.	Fasten it.	No exception.

Appendix A STO function description

Reference standards: IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, IEC 62061, ISO 13849-1, and IEC 61800-5-2

You can enable the safe torque off (STO) function to prevent unexpected startups when the main power supply of the drive is not switched off. The STO function switches off the drive output by turning off the drive signals to prevent unexpected startups of the motor (see the following figure). After the STO function is enabled, you can perform some-time operations or maintain the non-electrical components of the device without switching off the drive.



Note: The STO circuit power supply (X1-4 COM) and the control power common terminal (X1-2 COM) need to be equipotentialed externally.

A.1 STO function logic table

The following table describes the input states and corresponding faults of the STO function.

STO input state	Corresponding fault
STO1 and STO2 opened simultaneously	The STO function is triggered, and the drive stops running. Fault code: 52: Safe torque off (STO)
STO1 and STO2 closed simultaneously	The STOP function is not triggered, and the drive runs properly.

STO input state	Corresponding fault
Either of STO1 and STO2 opened, and the other closed	The STL1, STL2, or STL3 fault occurs. Fault code: 49: Channel 1 exception (STL1) 50: Channel 2 exception (STL2) 51: Both channels STO1 and STO2 are abnormal (STL3)

A.2 STO channel delay description

The following table describes the trigger and indication delay of the STO channels.

STO mode	STO trigger delay[1] and STO indication delay[2]
STO fault: STL1	Trigger delay < 10 ms Indication delay < 280 ms
STO fault: STL2	Trigger delay < 10 ms Indication delay < 280 ms
STO fault: STL3	Trigger delay < 10 ms Indication delay < 280 ms
STO fault: STO	Trigger delay < 10 ms Indication delay < 100 ms

1. STO trigger delay: Time interval between triggering the STO function and switching off the drive output
2. STO instruction delay: Time interval between triggering the STO function and indicating STO output status

A.3 STO function installation checklist

Before installing the STO, check the items described in the following table to ensure that the STO function can be properly used.

	Item
☐	Ensure that the drive can be run or stopped randomly during commissioning.
☐	Stop the drive (if it is running), disconnect the input power supply, and isolate the drive from the power cable through the switch.
☐	Check the STO circuit connection according to the circuit diagram.
☐	Check whether the shielding layer of the STO input cable is connected to the +24 V reference ground COM.
☐	Connect the power supply.
☐	Test the STO function as follows after the motor stops running: ✧ If the drive is running, send a stop command to it and wait until the shaft of the motor stops rotating. ✧ Activate the STO circuit and send a start command to the drive. Ensure that the

	Item
	motor does not start. ✧ Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.
☐	Test the STO function as follows when the motor is running: ✧ Start the drive. Ensure that the motor is running properly. ✧ Activate the STO circuit. ✧ The drive reports an STO fault (for details, see section 7.1 Faults and solutions). Ensure that the motor coasts to stop rotating. ✧ Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.

Service line: 86-755-23535967 E-mail: overseas@invt.com.cn Website: www.invt.com

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