Operation Manual

Goodrive20-UL Series VFD

SHENZHEN INVT ELECTRIC CO., LTD.

Contents

Chapter 1 Safety precautions

Please read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the variable-frequency drive (VFD). If ignored, physical injury or death may occur, or damage may occur to the devices.

If any physical injury or death or damage to the devices occurs for ignoring to the safety precautions in the manual, our company will not be responsible for any damages and we are not legally bound in any manner.

1.1 Safety definition

Danger:	Serious physical injury or even death may occur if not follow relevant requirements.
Warning:	Physical injury or damage to the devices may occur if not follow relevant requirements.
Note:	Physical hurt may occur if not follow relevant requirements.
Qualified electricians:	People working on the device should take part in professional electrical and safety training, receive the certification and be familiar with all steps and requirements of installing, commissioning, operating and maintaining the device to avoid any emergency.

1.2 Warning symbols

Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advice on how to avoid the danger. The following warning symbols are used in this manual:

Symbol	Name	Instruction	Abbreviation
 Danger	Danger	Serious physical injury or even death may occur if related requirements are not followed.	
 Warning	Warning	Physical injury or damage to the devices may occur if related requirements are not followed.	
 Forbid	Electrostatic discharge	The PCBA may be damaged if related requirements are not followed.	
 Hot	Hot sides	The VFD base may become hot. Do not touch.	

Symbol	Name	Instruction	Abbreviation
	Electric shock	As high voltage still presents in the bus capacitor after power off, wait for at least five minutes (or 15min/25min, depending on the warning symbols on the machine) after power off to prevent electric shock.	
	Read manual	Read the operation manual before operating on the equipment.	
Note	Note	Actions taken to ensure proper operation.	**Note**

1.3 Safety guide

✧ Only qualified electricians are allowed to operate on the VFD.

✧ Do not carry out any wiring and inspection or changing components when the power supply is applied. Ensure all input power supply is disconnected before wiring and checking and always wait for at least the time designated on the VFD or until the DC bus voltage is less than 36V. Below is the table of the waiting time:

VFD model		Minimum waiting time
1PH 110V	0.4–1.1kW	5 minutes
1PH 220V	0.4–2.2kW	5 minutes
3PH 220V	0.4–0.75kW	5 minutes
3PH 460V	0.75–2.2kW	5 minutes

✧ Do not refit the VFD unauthorized; otherwise fire, electric shock or other injury may occur.

✧ The base of the radiator may become hot during running. Do not touch to avoid hurt.

✧ The electrical parts and components inside the VFD are electrostatic. Take measurements to avoid electrostatic discharge during relevant operation.

1.3.1 Delivery and installation

- ✧ Please install the VFD on fire-retardant material and keep the VFD away from combustible materials.
- ✧ Connect the braking optional parts (braking resistors, braking units or feedback units) according to the wiring diagram.
- ✧ Do not operate on the VFD if there is any damage or components loss to the VFD.
- ✧ Do not touch the VFD with wet items or body, otherwise electric shock may occur.
- ✧ Solid-state motor overload protection is performed when the VFD runs at 150% of FLA.
- ✧ The VFD does not provide motor over-temperature protection.

Note:

- ✧ Select appropriate moving and installing tools to ensure a safe and normal running of the VFD and avoid physical injury or death. For physical safety, the erector should take some mechanical protective measurements, such as wearing exposure shoes and working uniforms.
- ✧ Ensure to avoid physical shock or vibration during delivery and installation.
- ✧ Do not carry the VFD by its cover. The cover may fall off.
- ✧ Install away from children and other public places.
- ✧ The leakage current of the VFD may be above 3.5mA during operation. Ground with proper techniques and ensure the grounding resistor is less than 10Ω. The conductivity of PE grounding conductor is the same as that of the phase conductor.
- ✧ R, S and T are the input terminals of the power supply, while U, V and W are the motor terminals. Please connect the input power cables and motor cables with proper techniques; otherwise the damage to the VFD may occur.

1.3.2 Commissioning and running

- ✧ Disconnect all power supplies applied to the VFD before the terminal wiring and wait for at least the designated time after disconnecting the power supply.
- ✧ High voltage is present inside the VFD during running. Do not carry out any operation except for the keypad setting.
- ✧ The VFD may start up by itself when P01.21=1. Do not get close to the VFD and motor.
- ✧ The VFD can not be used as "Emergency-stop device".
- ✧ The VFD can not be used to break the motor suddenly. A mechanical braking device should be provided.

Note:

✧ Do not switch on or off the input power supply of the VFD frequently.

✧ For VFDs that have been stored for a long time, check and fix the capacitance and try to run it again before utilization (see Maintenance and Hardware Fault Diagnose).

✧ Cover the front board before running, otherwise electric shock may occur.

1.3.3 Maintenance and component replacement

	✧ Only qualified electricians are allowed to perform the maintenance, inspection, and components replacement of the VFD. ✧ Disconnect all power supplies to the VFD before the terminal wiring. Wait for at least the time designated on the VFD after disconnection. ✧ Take measures to avoid screws, cables and other conductive matters to fall into the VFD during maintenance and component replacement.

Note:

✧ Please select proper torque to tighten screws.

✧ Keep the VFD, parts and components away from combustible materials during maintenance and component replacement.

✧ Do not carry out any isolation and pressure test on the VFD and do not measure the control circuit of the VFD by megameter.

1.3.4 What to do after scrapping

	✧ There are heavy metals in the VFD. Deal with it as industrial effluent.
	✧ When the life cycle ends, the product should enter the recycling system. Dispose of it separately at an appropriate collection point instead of placing it in the normal waste stream.

Chapter 2 Product overview

2.1 Quick startup

2.1.1 Unpacking inspection

Check as follows after receiving products:

1. Check whether the packing box is damaged or dampened. If yes, contact local dealers or INVT offices.
2. Check the model identifier on the exterior surface of the packing box is consistent with the purchased model. If no, contact local dealers or INVT offices.
3. Check whether the interior surface of packing box is abnormal, for example, in wet condition, or whether the enclosure of the VFD is damaged or cracked. If yes, contact local dealers or INVT offices.
4. Check whether the name plate of the VFD is consistent with the model identifier on the exterior surface of the packing box. If no, contact local dealers or INVT offices.
5. Check whether the accessories (including user's manual and control keypad) inside the packing box are complete. If not, please contact with local dealers or INVT offices.

2.1.2 Checking before applying

Check the machine before beginning to use the VFD:

1. Check the load type to verify that there is no overload of the VFD during work and check whether the power degree of the VFD needs to be modified.
2. Check that the actual current of the motor is less than the rated current of the VFD.
3. Check that the control accuracy of the load is the same of the VFD.
4. Check that the incoming supply voltage is correspondent to the rated voltage of the VFD.

2.1.3 Environment confirmation

Check as follows before the actual installation and usage:

1. Check that the ambient temperature of the VFD is below 40°C. If exceeds, derate 1% for every additional 1°C. Additionally, the VFD can not be used if the ambient temperature is above 50°C. **Note:** For the cabinet VFD, the ambient temperature means the air temperature inside the cabinet.
2. Check that the ambient temperature of the VFD in actual usage is above -10°C. If not, add heating facilities. **Note:** For the cabinet VFD, the ambient temperature means the air temperature inside the cabinet.

3. When the altitude exceeds 1000m, derate by 1% for every increase of 100m. When the altitude exceeds 3000m, consult the local INVT dealer or office for details.
4. Check that the humidity of the actual usage site is below 90% and condensation is not allowed. If not, add additional protection VFDs.
5. Check that the actual usage site is away from direct sunlight and foreign objects can not enter the VFD. If not, add additional protective measures.
6. Check that there is no conductive dust or flammable gas in the actual usage site. If not, add additional protection to VFDs.

2.1.4 Installation confirmation

Check as follows after the installation:

1. Check that the load range of the input and output cables meet the need of actual load.
2. Check that the accessories of the VFD are correctly and properly installed. The installation cables should meet the needs of every component (including reactors, input filters, output reactors, output filters, DC reactors, brake units and braking resistors).
3. Check that the VFD is installed on non-flammable materials and the calorific accessories (reactors and braking resistors) are away from flammable materials.
4. Check that all control cables and power cables are run separately and the routation complies with EMC requirement.
5. Check that all grounding systems are properly grounded according to the requirements of the VFD.
6. Check that the free space during installation is sufficient according to the instructions in user's manual.
7. Check that the installation conforms to the instructions in user's manual. The VFD must be installed in an upright position.
8. Check that the external connection terminals are tightly fastened and the torque is appropriate.
9. Check that there are no screws, cables and other conductive items left in the VFD. If not, get them out.

2.1.5 Basic commissioning

Complete the basic commissioning as follows before actual utilization:

1. Autotune. If possible, de-coupled from the motor load to start dynamic autotune. Or if not, static autotune is available.
2. Adjust the ACC/DEC time according to the actual running of the load.
3. Commission the device via jogging and check that the rotation direction is as required. If not, change the rotation direction by changing the wiring of motor.
4. Set all control parameters and then operate.

2.2 Product specification

Function		Specification
Power input	Input voltage (V)	AC 1PH 110V–120V; AC 1PH 200V–240V; AC 3PH 200V–240V; AC 3PH 380V–480V
	Allowable Voltage Fluctuation	-15%–+10%
	Input current (A)	Refer to section 2.5 "Rated specifications"
	Input frequency (Hz)	50Hz or 60Hz; allowed range: 47–63Hz
Power output	Output voltage (V)	0–input voltage (S12 model: 0–240)
	Output current (A)	Refer to section 2.5 "Rated specifications"
	Output power (kW)	Refer to section 2.5 "Rated specifications"
	Output frequency (Hz)	0–400Hz
Technical control feature	Control mode	SVPWM, SVC
	Adjustable-speed ratio	Asynchronous motor 1: 100 (SVC)
	Speed control accuracy	±0.2% (SVC)
	Speed fluctuation	±0.3% (SVC)
	Torque response	<20ms (SVC)
	Torque control accuracy	10%
	Starting torque	0. 5Hz/150% (SVC)
Running control feature	Frequency setting method	Digital setting, analog setting, pulse frequency setting, multi-step speed running setting, simple PLC setting, PID setting, Modbus communication setting Shift between the set combination and set channel.
	Auto-adjustment of the voltage	Keep a stable voltage automatically when the grid voltage transients
	Fault protection	Provide comprehensive fault protection functions: overcurrent, overvoltage, undervoltage, overheating, phase loss and overload, etc.
Peripheral interface	Analog input	1 input (AI2): 0–10V/0–20mA; 1 input (AI3): -10–10V
	Analog output	2 inputs (AO1, AO2): 0–10V/0–20mA

Function		Specification
	Digital input	4 common inputs, max. frequency: 1kHz; 1 high speed input, max. frequency: 50kHz
	Digital output	1 Y1 terminal output; 2 programmable relay outputs
	Relay output	2 programmable relay outputs RO1A NO, RO1B NC, RO1C common terminal RO2A NO, RO2B NC, RO2C common terminal Contact capacity: 3A/AC250V, 1A/DC30V
Others	Mountable method	Wall and rail mountable
	Temperature of the running environment	-10–50°C, derate above 40°C
	Protective degree	**Note:** 1. The VFD with plastic casing should be installed in metal distribution cabinet, which conforms to IP20 and of which the top conforms to IP3X. 2. Install device in pollution degree 2 environment
	Cooling mode	Forced air cooling
	Braking unit	Embedded
	EMI filter	Optional filter: meet the degree requirement of IEC 61800-3 C2, IEC 61800-3 C3
	Safety	Meet the requirements of CE, UL and CUL
	Overvoltage category	1PH&3PH 240V: Used in Canada only: "Transient surge suppression shall be installed on the line side of this equipment and shall be rated 240V (phase to ground), 240V (phase to phase), suitable for overvoltage category III, and shall provide protection for a rated impulse withstand voltage peak of 4kV" or equivalent. 3PH: Used in Canada only: "Transient surge suppression shall be installed on the line side of this equipment and shall be rated 480V (phase to ground), 480V (phase to phase), suitable for overvoltage category III, and shall provide protection for a rated impulse withstand voltage peak of 6kV" or equivalent.

2.3 Product nameplate

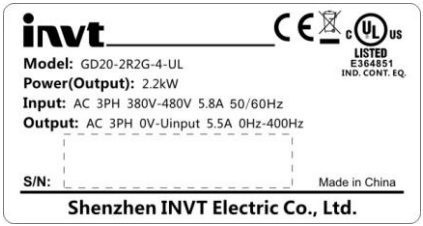


Figure 2-1 Product nameplate

2.4 Model code

The model code contains product information. You can find the model code on the VFD nameplate or simplified nameplate.

GD20 – 2R2G – 4 – UL

① ② ③ ④

Figure 2-2 Product model

Key	No.	Detailed description	Detailed content
Abbreviation of product series	①	Abbreviation of product series	GD20: Goodrive20 series VFD
Rated power	②	Power range + Load type	2R2: 2.2kW G: Constant torque load
Voltage class	③	Voltage class	S12: AC 1PH 110V–120V S2: AC 1PH 200V–240V 2: AC 3PH 200V–240V 4: AC 3PH 380V–480V
Certification mark	④	Used in America	S12 model by default Certified by UL and CUL

2.5 Rated specifications

Model	Rated output power (kW)	Rated input current (A)	Rated output current (A)
GD20-0R4G-S12	0.4	8.1	2.5
GD20-0R7G-S12	0.75	15.1	4.2
GD20-1R1G-S12	1.1	20	5.8

Model	Rated output power (kW)	Rated input current (A)	Rated output current (A)
GD20-0R4G-S2-UL	0.4	6.5	2.5
GD20-0R7G-S2-UL	0.75	9.3	4.2
GD20-1R5G-S2-UL	1.5	15.7	7.5
GD20-2R2G-S2-UL	2.2	20	10
GD20-0R4G-2-UL	0.4	3.7	2.5
GD20-0R7G-2-UL	0.75	5.0	4.2
GD20-0R7G-4-UL	0.75	3.4	2.5
GD20-1R5G-4-UL	1.5	5.0	4.2
GD20-2R2G-4-UL	2.2	5.8	5.5

2.6 Structure diagram

The following figure shows the structure of the VFD (using the 0.75kW VFD model as the example).

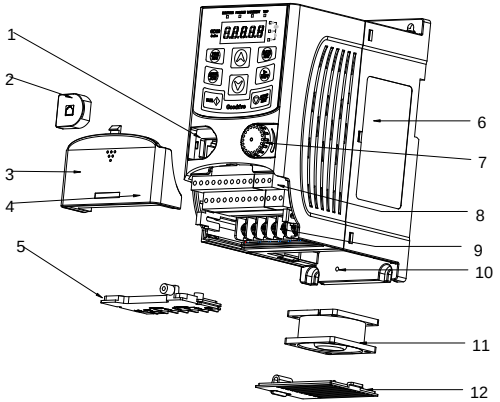


Figure 2-3 Product structure

Serial No.	Name	Description
1	External keypad port	Connect the external keypad
2	Port cover	Protect the external keypad port
3	Cover	Protect the internal parts and components
4	Hole for the sliding cover	Fix the sliding cover

Serial No.	Name	Description
5	Trunking board	Protect the inner components and fix the cables of the main circuit
6	Name plate	See Chapter 2 "Product overview" for detailed information
7	Potentiometer knob	Refer to the Chapter 4 "Keypad operation"
8	Control terminals	See Chapter 3 "Installation guidelines" for detailed information
9	Main circuit terminals	See Chapter 3 "Installation guidelines" for detailed information
10	Screw hole	Fix the fan cover and fan
11	Cooling fan	See Chapter 6 "Fault tracking" for detailed information
12	Fan cover	Protect the fan
Note: In above figure, the screws at 4 and 10 are provided with packaging and specific installation depends on the requirements of customers.		

Chapter 3 Installation guidelines

The chapter describes the mechanical installation and electric installation of the VFD.

- ✧ Only qualified electricians are allowed to carry out what described in this chapter. Please operate as the instructions in Chapter 1 "Safety precautions". Ignoring these may cause physical injury or death or damage to the devices.
- ✧ Ensure the power supply of the VFD is disconnected during the operation. Wait for at least the time designated after the disconnection if the power supply is applied.
- ✧ The installation and design of the VFD should be complied with the requirement of the local laws and regulations in the installation site. If the installation infringes the requirement, our company will exempt from any responsibility. Additionally, if users do not comply with the suggestion, some damage beyond the assured maintenance range may occur.

3.1 Mechanical installation

3.1.1 Installation environment

The installation environment is the safeguard for a full performance and long-term stable functions of the VFD. Check the installation environment as follows:

Environment	Conditions
Installation site	Indoor
Environment temperature	✧ -10°C–+50°C, and the temperature changing rate is less than 0.5°C/minute. ✧ If the ambient temperature of the VFD is above 40°C, derate 1% for every additional 1°C. ✧ It is not recommended to use the VFD if the ambient temperature is above 50°C. ✧ In order to improve the reliability of the device, do not use the VFD if the ambient temperature changes frequently. ✧ Please provide cooling fan or air conditioner to control the internal ambient temperature below the required one if the VFD is used in a close space such as in the control cabinet. ✧ When the temperature is too low, if the VFD needs to restart to run after a long stop, it is necessary to provide an external heating device to increase the internal temperature, otherwise damage to the devices may occur.
Humidity	✧ RH ≤ 90%. ✧ No condensation is allowed.

Environment	Conditions
Storage temperature	-40°C–+70°C, and the temperature changing rate is less than 1°C/minute.
Running environment condition	The installation site should meet the following requirements. ✧ Away from electromagnetic radiation sources. ✧ Away from oil mist, corrosive gases and combustible gases. ✧ Ensure foreign object like metal powder, dust, oil and water will not fall into the VFD (do not install the VFD onto combustible object like wood). ✧ Away from radioactive substance and combustible objects. ✧ Away from harmful gases and liquids. ✧ Low salt content. ✧ No direct sunlight.
Altitude	✧ Below 1000m. ✧ When the altitude exceeds 1000m, derate by 1% for every increase of 100m. ✧ When the altitude exceeds 3000m, consult the local INVT dealer or office for details.
Vibration	Max. vibration acceleration: 5.8m/s^2 (0.6g)
Installation direction	The VFD should be installed on an upright position to ensure sufficient cooling effect.

Note:

✧ Goodrive20-UL series VFDs should be installed in a clean and ventilated environment according to enclosure classification.

✧ Cooling air must be clean, free from corrosive materials and electrically conductive dust.

3.1.2 Installation direction

The VFD may be installed in a cabinet.

The VFD needs be installed in the vertical position. Check the installation site according to the requirements below. Refer to Appendix B "Dimension drawings" in the appendix for frame details.

3.1.3 Installation mode

The VFD can be installed in two different ways, depending on the frame size:

a) Wall mounting (for all frame sizes)

b) Rail mounting (for all frame sizes, but need optional installation bracket)

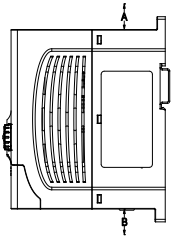


Figure 3-1 Wall mounting

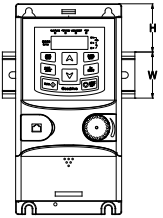


Figure 3-2 Rail mounting

Note: The minimum space of A and B is 100mm. H is 36.6mm and W is 35.0mm.

3.2 Standard wiring

3.2.1 Wiring of main circuit

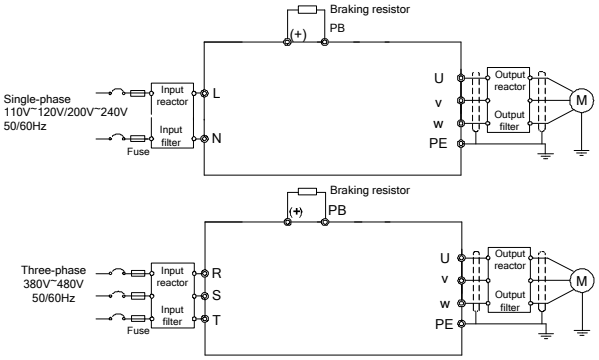


Figure 3-3 Connection diagram of main circuit

Note:

✧ The fuse, braking resistor, input reactor, input filter, output reactor, output filter are optional parts. Please refer to Appendix C "Optional peripheral accessories" for detailed information.

✧ Remove the yellow warning labels of PB, (+) and (-) on the terminals before connecting the braking resistor; otherwise, poor connection may occur.

3.2.2 Main circuit terminals

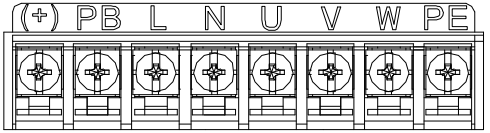


Figure 3-4 1PH terminals of main circuit

Terminal	Terminal name	Function
L	Power input of the main circuit	1-phase AC input terminals which are generally connected with the power supply.
N		
U	VFD output	3-phase AC output terminals which are generally connected with the motor.
V		
W		
PB, (+)	Braking resistor terminal	PB and (+) are connected to the external resistor.
PE	Grounding terminal	Each machine should be grounded.

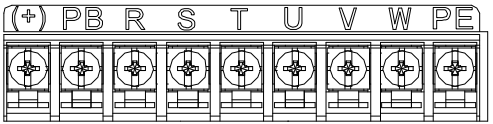


Figure 3-5 3PH terminals of main circuit

Terminal	Terminal name	Function
R, S, T	Power input of the main circuit	3-phase AC input terminals which are generally connected with the power supply.
U, V, W	VFD output	3-phase AC output terminals which are generally connected with the motor.
PB, (+)	Braking resistor terminal	PB and (+) are connected to the external resistor.
PE	Grounding terminal	Each machine should be grounded.

Note:

✧ It is not recommended to use asymmetrically motor cables. If there is a symmetrically grounding conductor in the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the VFD and motor ends.

✧ Route the motor cable, input power cable and control cables separately.

✧ When selecting C3 input filters, connect the filters in parallel at the input side of the VFD.

3.2.3 Wiring of main circuit terminals

1. Connect the ground line of input power cable to the ground terminal of VFD (PE) directly, and connect 3PH input cable to R, S and T and fasten up.
2. Connect the ground line of motor cable to the ground terminal of the VFD, and connect the 3PH motor cable to U, V, W and fasten up.
3. Connect the braking resistor which carries cables to the designated position.
4. Fasten up all the cables on the outside of the VFD if allowed.

3.2.4 Wiring of control circuit

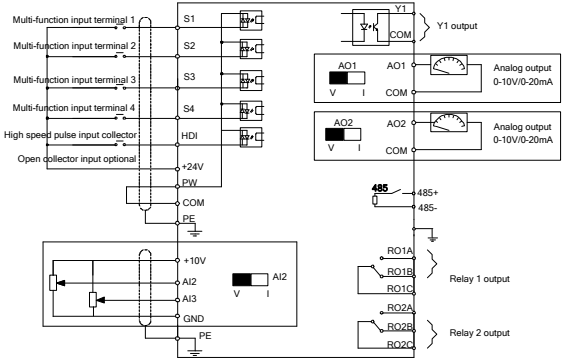


Figure 3-6 Wiring of control circuit

3.2.5 Control circuit terminals

Figure 3-7 Terminals of control circuit

Type	Terminal name	Function description	Technical specifications
Communication	485+	485 communication	485 communication interface
	485-		
Digital input/output	S1	Digital input	1. Internal impedance: 3.3kΩ 2. 12–30V voltage input is available 3. The terminal is the dual-direction input terminal 4. Max. input frequency: 1kHz
	S2		
	S3		
	S4		
	HDI	High frequency input channel	Except for S1–S4, this terminal can be used as high frequency input channel. Max. inputfrequency: 50kHz Duty cycle: 30%–70%
	PW	Digital power supply	External power input terminal for digital input circuits Voltage range: 12–30V
	Y1	Digital output	Contact capacity: 50mA/30V
	COM		Common terminal of the open collector output
Analog input/output	+10V	External 10V reference power supply	10V reference power supply Max. output current: 50mA As the adjusting power supply of the external potentiometer Potentiometer resistance: 5kΩ above
	AI2	Analog input	1. Input range: AI2 voltage and current can be chosen: 0–10V/0–20mA; AI3: -10V–+10V. 2. Input impedance:voltage input: 20kΩ; current input: 500Ω. 3. Voltage or current input can be set by dip switch. 4. Resolution: the minimum AI2/AI3 is 10mV/20mV when 10V corresponds to 60Hz.
	AI3		
	GND	Analog reference ground	Analog reference ground
	AO1	Analog output	1. Output range: 0–10V or 0–20mA 2. The voltage or the current output

Type	Terminal name	Function description	Technical specifications
	AO2		is depended on the dip switch. 3. Deviation±1%, 25°C when full range.
Relay output	RO1A	Relay 1 NO contact	RO1 relay output, RO1A NO, RO1B NC, RO1C common terminal RO2 relay output, RO2A NO, RO2B NC, RO2C common terminal Contact capacity: 3A/AC250V, 1A/DC30V
	RO1B	Relay 1 NC contact	
	RO1C	Relay 1 common contact	
	RO2A	Relay 2 NO contact	
	RO2B	Relay 2 NC contact	
	RO2C	Relay 2 common contact	

3.2.6 Input/output signal connection figure

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

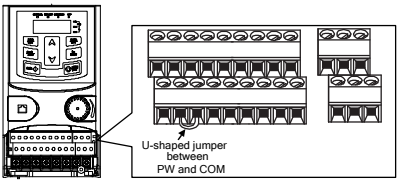


Figure 3-8 U-shaped jumper

If input signal comes from NPN transistors, set the U-shaped jumper based on the power used according to the following figure.

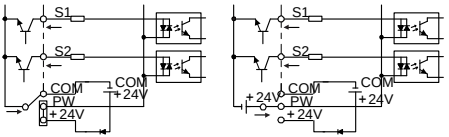


Figure 3-9 NPN mode

If input signal comes from PNP transistors, set the U-shaped jumper based on the power used according to the following figure.

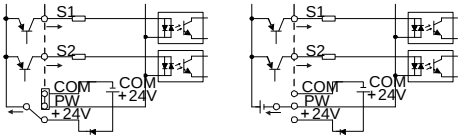


Figure 3-10 PNP mode

3.3 Wiring protection

3.3.1 Protect the VFD and input power cable when a short circuit occurs

Protect the VFD and input power cable in short circuit situations and against thermal overload.

Arrange the protection according to the following guide.

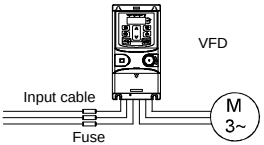


Figure 3-11 Fuse configuration

Note: Select the fuse as the manual indicated. The fuse will protect the input power cable from damage in short-circuit situations. It will protect the surrounding devices when the internal of the VFD is short circuited.

3.3.2 Protect the motor and motor cables

The VFD protects the motor and motor cable in a short-circuit situation when the motor cable is dimensioned according to the rated current of the VFD. No additional protection devices are needed.

	✧ If the VFD is connected to multiple motors, a separate thermal overload switch or a circuit breaker must be used for protecting each cable and motor. These devices may require a separate fuse to cut off the short-circuit current.

3.3.3 Establish a bypass connection

It is necessary to set power frequency and variable frequency conversion circuits for the assurance of continuous normal work of the VFD if faults occur in some significant situations.

In some special situations, for example, if it is only used in soft start, the VFD can be conversed into power frequency running after starting and some corresponding bypass should be added.

	✧ Never connect the supply power to the VFD output terminals U, V and W. Power line voltage applied to the output can result in permanent damage to the VFD.

If frequent shifting is required, employ mechanically connected switches or contactors to ensure that the motor terminals are not connected to the AC power line and VFD output terminals simultaneously.

Chapter 4 Keypad operation

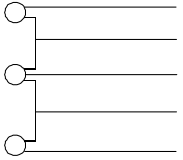
4.1 Keypad introduction

You can use the keypad to control the start and stop, read status data, and set parameters of the VFD. The keypad can be externally connected to the VFD, which requires a network cable with a standard RJ45 crystal head as the connection cable.

Figure 4-1 Keypad

Note: The external keypads are optional (including the external keypads with and without the function of parameter copying).

Serial No.	Name	Description	
1	State LED	RUN/TUNE	LED off means that the VFD is in the stopping state; LED blinking means the VFD is in the parameter autotune state; LED on means the VFD is in the running state.
		FWD/REV	FED/REV LED LED off means the VFD is in the forward rotation state; LED on means the VFD is in the reverse rotation state
		LOCAL/REMOT	LED for keypad operation, terminals operation and remote communication control

<table>
<tr><th>Serial No.</th><th>Name</th><th colspan="3">Description</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="2"></td><td>LED off means that the VFD is in the keypad operation state; LED blinking means the VFD is in the terminals operation state; LED on means the VFD is in the remote communication control state.</td></tr>
<tr><td colspan="2">TRIP</td><td>LED for faults
LED on when the VFD is in the fault state; LED off in normal state; LED blinking means the VFD is in the pre-alarm state.</td></tr>
<tr><td>2</td><td>Unit LED</td><td colspan="3">Mean the unit displayed currently
 
Hz — Frequency unit
RPM — Rotating speed unit
A — Current unit
% — Percentage
V — Voltage unit</td></tr>
<tr><td>3</td><td>Digital display zone</td><td colspan="3">5-figure LED display displays various monitoring data and alarm code such as set frequency 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="3">4</td><td rowspan="3">Buttons</td><td>PRG ESC</td><td>Programming key</td><td>Enter or escape from the first level menu and remove the parameter quickly</td></tr>
<tr><td>DATA ENT</td><td>Entry key</td><td>Enter the menu step-by-step
Confirm parameters</td></tr>
<tr><td>∧</td><td>UP key</td><td>Increase data or function code progressively</td></tr>
</table>

Serial No.	Name	Description		
			DOWN key	Decrease data or function code progressively
			Right-shift key	Move right to select the displaying parameter circularly in stopping and running mode. Select the parameter modifying digit during the parameter modification
			Run key	This key is used to operate on the VFD in key operation mode
			Stop/ Reset key	This key is used to stop in running state and it is limited by function code P07.04 This key is used to reset all control modes in the fault alarm state
			Quick key	The function of this key is confirmed by function code P07.02.
5	Keypad port	External keypad port. When the external keypad with the function of parameter copying is valid, the local keypad LED is off; When the external keypad without the function of parameter copying is valid, the local and external keypad LEDs are on. **Note:** Only the external keypad which has the function of parameters copy owns the function of parameters copy, other keypads do not have.		
6	Analog potentiometer	AI1, When the external common keypad (without the function of parameter copy) is valid, the difference between the local keypad AI1 and the external keypad AI1 is: When the external keypad AI1 is set to the Min. value, the local keypad AI1 will be valid and P17.19 will be the voltage of the local keypad AI1; otherwise, the external keypad AI1 will be valid and P17.19 will be the voltage of the external keypad AI1. **Note**: If the external keypad AI1 is frequency reference source, adjust the local potentiometer AI1 to 0V/0mA before starting the VFD.		

4.2 Keypad display

The keypad of Goodrive20-UL series VFD displays the stopped-state parameters, running-state parameters, function parameter editing status, and fault alarm status.

4.2.1 Displaying stopped-state parameters

When the VFD is in stopped state, the keypad displays stopped-state parameters.

In the stopped state, parameters in various states can be displayed. 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.

In stopping state, there are 14 parameters that can be selected for display, including set frequency, bus voltage, input terminal status, output terminal status, PID reference value, PID feedback value, torque setting, AI1, AI2, AI3, high-speed pulse HDI frequency, PLC and the current step of multi-step speed, pulse counting value, length value. P07.07 can select the parameter to be displayed or not by bit, and you can press 》/SHIFT to shift selected parameters from left to right or press QUICK/JOG to shift selected parameters from right to left.

4.2.2 Displaying running-state parameters

After receiving a valid running command, the VFD enters the running state, and the keypad displays running-state parameters, with the RUN/TUNE indicator on. The on/off state of the FWD/REV indicator is determined by the current running direction.

In running state, there are 24 parameters that can be selected for display, including running frequency, set frequency, bus voltage, output voltage, output current, running speed, output power, output torque, PID reference value, PID feedback value, input terminal status, output terminal status, torque setting, length value, PLC and the current step of multi-step speed, AI1, AI2, AI3, high-speed pulse HDI frequency, motor overload percentage, VFD overload percentage, ramp reference value, linear speed, and AC input current. P07.05 and P07.06 can select the parameter to be displayed or not by bit, and you can press 》/SHIFT to shift selected parameters from left to right or press QUICK/JOG to shift selected parameters from right to left.

4.2.3 Displaying fault information

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

4.2.4 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 code setting. You can press the DATA/ENT key to enter the function parameter display interface. On the function parameter display interface, you can press the DATA/ENT key to save parameter settings or press the PRG/ESC key to exit the parameter display interface.

Figure 4-2 Status display

4.3 Operations on the keypad

You can operate the VFD by using the keypad. For details about function code descriptions, see the function code list.

4.3.1 Modifying VFD function codes

The VFD provides three levels of menus, including:

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.

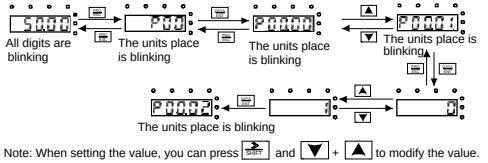


Figure 4-3 Modifying a parameter

4.3.2 Setting a password for the VFD

Goodrive20-UL series VFDs provide password protection function to users. Set P07.00 to gain the password and the password protection becomes effective 1 minute later after retreating from the function code editing state. Press PRG/ESC again to the function code editing state, "0.0.0.0.0" will be displayed. Unless using the correct password, you cannot enter it.

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

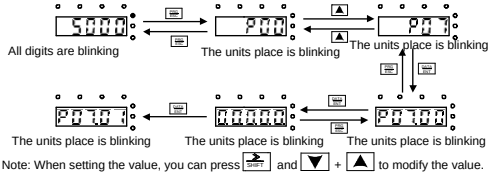


Figure 4-4 Setting a password

4.3.3 Viewing VFD status

The VFD provides group P17 for status viewing. You can enter group P17 for viewing.

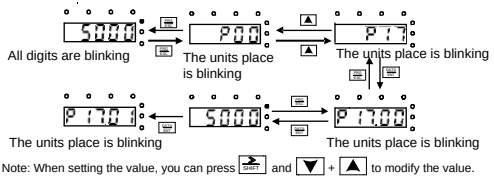


Figure 4-5 Viewing a parameter

Chapter 5 Function parameters

The function parameters of Goodrive20-UL series VFDs have been divided into 30 groups (P00–P29) according to the function, of which P18–P28 are reserved. Each function group contains certain function codes. A three-level menu style is applied to function codes. For example, "P08.08" indicates the 8th function code in the P8 group. The P29 group consist of factory function parameters, which are user inaccessible.

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

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

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

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

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

Column 4 "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 VFD is in the stop or running state.

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

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

P00 group Basic functions

Function code	Name	Description	Default	Modify
P00.00	Speed control mode	0: SVC 0 No need to install encoders. Suitable in applications which need low frequency, big torque for high accuracy of rotating speed and torque control. Relative to mode 1, it is more suitable for the applications which need small power. 1: SVC 1	2	◎

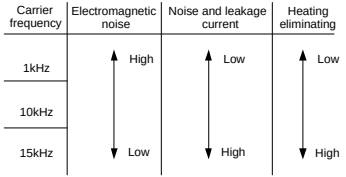
Function code	Name	Description	Default	Modify
		1 is suitable in high performance cases with the advantage of high accuracy of rotating speed and torque. It does not need to install pulse encoder. 2: SVPWM control 2 is suitable in applications which do not need high control accuracy, such as the load of fan and pump. One VFD can drive multiple motors.		
P00.01	Run command channel	Select the run command channel of the VFD. The control command of the VFD includes: start, stop, forward/reverse rotating, jogging and fault reset. 0: Keypad running command channel ("LOCAL/REMOT" light off) Carry out the command control by RUN, STOP/RST on the keypad. Set the multi-function key QUICK/JOG to FWD/REVC shifting function (P07.02=3) to change the running direction; press RUN and STOP/RST simultaneously in running state to make the VFD coast to stop. 1: Terminal running command channel ("LOCAL/REMOT" flickering) Carry out the running command control by the forward rotation, reverse rotation and forward jogging and reverse jogging of the multi-function terminals 2: Communication running command channel ("LOCAL/REMOT" on); The running command is controlled by the upper monitor via communication	0	○
P00.03	Max. output frequency	The parameter is used to set the max. output frequency of the VFD. It is the basis of frequency setup and the acceleration/deceleration. Setting range: P00.04–630.00Hz	60.00Hz	◎

Function code	Name	Description	Default	Modify
P00.04	Upper limit of the running frequency	The upper limit of the running frequency is the upper limit of the output frequency of the VFD which is lower than or equal to the maximum frequency. Setting range: P00.05–P00.03 (Max. output frequency)	60.00Hz	◎
P00.05	Lower limit of the running frequency	The lower limit of the running frequency is that of the output frequency of the VFD. The VFD runs at the lower limit frequency if the set frequency is lower than the lower limit. **Note:** Max. output frequency ≥ Upper limit frequency ≥ Lower limit frequency Setting range: 0.00Hz–P00.04 (Upper limit of the running frequency)	0.00Hz	◎
P00.06	A frequency command selection	0: Keypad data setting Modify the value of function code P00.10 (set the frequency by keypad) to modify the frequency by the keypad.	0	○
P00.07	B frequency command selection	1: Analog AI1 setting (corresponding keypad potentiometer) 2: Analog AI2 setting (corresponding terminal AI2) 3: Analog AI3 setting (corresponding terminal AI3) Set the frequency by analog input terminals. Goodrive20-UL series VFDs provide 3 channels analog input terminals as the standard configuration, of which AI1 is adjusting through analog potentiometer, while AI2 is the voltage/current option (0–10V/0–20mA) which can be shifted by jumpers; while AI3 is voltage input (-10V–+10V). **Note:** When analog AI2 select 0–20mA input, the corresponding voltage of 20mA is 10V. 100.0% of the analog input setting corresponds to the maximum frequency (function code P00.03) in forward direction and -100.0%	2	○

Function code	Name	Description	Default	Modify
		corresponds to the maximum frequency in reverse direction (function code P00.03) 4: High-speed pulse HDI setting The frequency is set by high-speed pulse terminals. Goodrive20-UL series VFDs provide 1 high speed pulse input as the standard configuration. The pulse frequency range is 0.000–50.000kHz. 100.0% of the high speed pulse input setting corresponds to the maximum frequency in forward direction (function code P00.03) and -100.0% corresponds to the maximum frequency in reverse direction (function code P00.03). **Note:** The pulse setting can only be input by multi-function terminals HDI. Set P05.00 (HDI input selection) to high speed pulse input, and set P05.49 (HDI high speed pulse input function selection) to frequency setting input. 5: Simple PLC program setting The VFD runs at simple PLC program mode when P00.06=5 or P00.07=5. Set P10 (simple PLC and multi-step speed control) to select the running frequency running direction, ACC/DEC time and the keeping time of corresponding stage. See the function description of P10 for detailed information. 6: Multi-step speed running setting The VFD runs at multi-step speed mode when P00.06=6 or P00.07=6. Set P05 to select the current running step, and set P10 to select the current running frequency. The multi-step speed has the priority when P00.06 or P00.07 does not equal to 6, but the setting stage can only be the 1–15 stage. The setting stage is 1–15 if P00.06 or P00.07 equals to 6. 7: PID control setting		

Function code	Name	Description	Default	Modify
		The running mode of the VFD is process PID control when P00.06=7 or P00.07=7. It is necessary to set P09. The running frequency of the VFD is the value after PID effect. See P09 for the detailed information of the preset source, preset value and feedback source of PID. 8: Modbus communication setting The frequency is set by Modbus communication. See P14 for detailed information. 9–11: Reserved **Note:** A frequency and B frequency can not set as the same frequency reference method.		
P00.08	B frequency command reference selection	0: Maximum output frequency, 100% of B frequency setting corresponds to the maximum output frequency 1: A frequency command, 100% of B frequency setting corresponds to the maximum output frequency. Select this setting if it needs to adjust on the base of A frequency command.	0	○
P00.09	Combination of the setting source	0: A, the current frequency setting is A frequency command 1: B, the current frequency setting is B frequency command 2: A+B, the current frequency setting is A frequency command + B frequency command 3: A-B, the current frequency setting is A frequency command - B frequency command 4: Max (A, B): The bigger one between A frequency command and B frequency is the set frequency. 5: Min (A, B): The lower one between A frequency command and B frequency is the set frequency. **Note:** The combination manner can be shifted by P05 (terminal function)	0	○

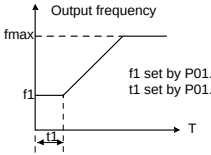
Function code	Name	Description	Default	Modify
P00.10	Keypad set frequency	When A and B frequency commands are selected as "keypad setting", this parameter will be the initial value of VFD reference frequency. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	60.00Hz	○
P00.11	ACC time 1	ACC time means the time needed if the VFD speeds up from 0Hz to the Max. One (P00.03).	Depend on model	○
P00.12	DEC time 1	DEC time means the time needed if the VFD speeds down from the Max. Output frequency to 0Hz (P00.03). Goodrive20-UL series VFDs have four groups of ACC/DEC time which can be selected by P05. The factory default ACC/DEC time of the VFD is the first group. Setting range of P00.11 and P00.12: 0.0–3600.0s	Depend on model	○
P00.13	Running direction selection	0: Runs at the default direction, the VFD runs in the forward direction. FWD/REV indicator is off. 1: Runs at the opposite direction, the VFD runs in the reverse direction. FWD/REV indicator is on. Modify the function code to shift the rotation direction of the motor. This effect equals to the shifting the rotation direction by adjusting either two of the motor lines (U, V and W). The motor rotation direction can be changed by QUICK/JOG on the keypad. Refer to parameter P07.02. **Note:** When the function parameter comes back to the default value, the motor's running direction will come back to the factory default state, too. In some cases it should be used with caution after commissioning if the change of rotation direction is disabled. 2: Forbid to run in reverse direction: It can be used in some special cases if the reverse running is disabled.	0	○

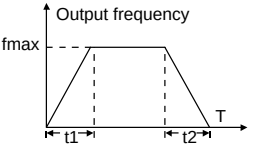
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P00.14</td><td>Carrier frequency setting</td><td>


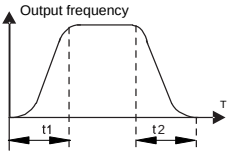
The relationship table of the motor type and carrier frequency:
<table>
<tr><th>Motor type</th><th>Factory setting of carrier frequency</th></tr>
<tr><td>0.4–2.2kW</td><td>8kHz</td></tr>
</table>
The advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor noise.
The disadvantage of high carrier frequency: increasing the switch loss, increasing VFD temperature and the impact to the output capacity. The VFD needs to derate on high carrier frequency. At the same time, the leakage and electrical magnetic interference will increase.
Applying low carrier frequency is contrary to the above, too low carrier frequency will cause unstable running, torque decreasing and surge.
The manufacturer has set a reasonable carrier frequency when the VFD is in factory. In general, users do not need to change the parameter.
When the frequency used exceeds the default carrier frequency, the VFD needs to derate 20% for each additional 1k carrier frequency.
Setting range: 1.0–15.0kHz</td><td>Depend on model</td><td>○</td></tr>
<tr><td>P00.15</td><td>Motor parameter autotuning</td><td>0: No operation
1: Rotation autotuning
Comprehensive motor parameter autotune
It is recommended to use rotation autotuning when high control accuracy is needed.</td><td>0</td><td>◎</td></tr>
</table>

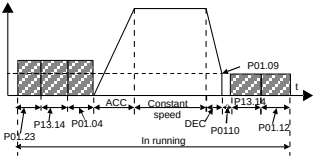
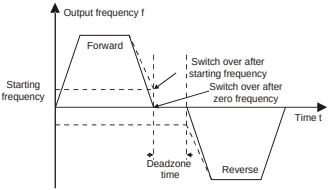
Function code	Name	Description	Default	Modify
		2: Static autotuning 1 (autotune totally); It is suitable in the cases when the motor can not de-couple from the load. The antotuning for the motor parameter will impact the control accuracy. 3: Static autotuning 2 (autotune part parameters); when the current motor is motor 1, autotune P02.06, P02.07, P02.08		
P00.16	AVR function selection	0: Invalid 1: Valid during the whole procedure The auto-adjusting function of the VFD can cancel the impact on the output voltage of the VFD because of the bus voltage fluctuation.	1	○
P00.18	Function restore parameter	0–6 0: No operation 1: Restore the default value (excluding the motor parameters) 2: Clear fault records 3: Function code locking (lock all function codes) 4: Reserved 5: Restore the default value (factory test mode) 6: Restore the default value (including the motor parameters) **Note:** ✧ After the selected operation is performed, the function code is automatically restored to 0. Restoring default values may delete the user password. Exercise caution when using this function. ✧ Restoring default values (factory test mode) will restore the parameters to the corresponding standard version. Non-professionals shall exercise caution when using this function.	0	◎

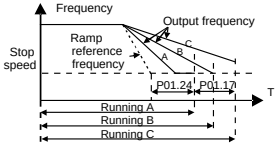
P01 group Start and stop control

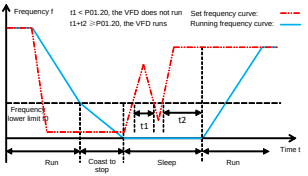
Function code	Name	Description	Default	Modify
P01.00	Start mode	0: Start-up directly: start from the starting frequency P01.01 1: Start-up after DC braking: start the motor from the starting frequency after DC braking (set the parameter P01.03 and P01.04). It is suitable in the cases where reverse rotation may occur to the low inertia load during starting. 2: Start after speed tracking 1 3: Start after speed tracking 2 The direction and speed will be tracked automatically for the smoothing starting of rotating motors. It suits the application with reverse rotation when big load starting. Note: This function is only available for the VFDs≥4kW.	0	◎
P01.01	Starting frequency of direct start-up	Starting frequency of direct start-up means the original frequency during the VFD starting. See P01.02 for detailed information. Setting range: 0.00–50.00Hz	0.50Hz	◎
P01.02	Retention time of the starting frequency	Set a proper starting frequency to increase the torque of the VFD during starting. During the retention time of the starting frequency, the output frequency of the VFD is the starting frequency. And then, the VFD will run from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the VFD will stop running and keep in the stand-by state. The starting frequency is not limited in the lower limit frequency. 	0.0s	◎

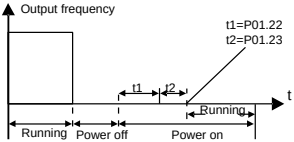
Function code	Name	Description	Default	Modify
		Setting range: 0.0–50.0s		
P01.03	Braking current before starting	The VFD will carry out DC braking at the braking current set before starting and it will speed up after the DC braking time. If the DC braking time is set to 0, the DC braking is invalid.	0.0%	◎
P01.04	Braking time before starting	The stronger the braking current, the bigger the braking power. The DC braking current before starting is the percentage of rated current of the VFD. Setting range of P01.03: 0.0–100.0% (rated current peak of the VFD) Setting range of P01.04: 0.00–50.00s	0.00s	◎
P01.05	ACC/DEC selection	The changing mode of the frequency during start-up and running. (t1=P01.06, t2=P01.07) 0: Linear type The output frequency increases or decreases linearly.  1: S curve, the output frequency will increase or decrease according to the S curve.	0	◎

Function code	Name	Description	Default	Modify
		 S curve is generally used in cases where smooth start/stop is required, eg, elevator, conveyer belt, etc.		
P01.06	ACC time of the starting step of S curve	Setting range: 0.0–50.0s **Note:** Valid when P01.05 is 1.	0.1s	◎
P01.07	DEC time of the ending step of S curve		0.1s	◎
P01.08	Stop selection	0: Decelerate to stop: after the stop command becomes valid, the VFD decelerates to reduce the output frequency during the set time. When the frequency decreases to 0Hz, the VFD stops. 1: Coast to stop: after the stop command becomes valid, the VFD ceases the output immediately. And the load coasts to stop at the mechanical inertia.	0	○
P01.09	Starting frequency of DC braking	Starting frequency of DC braking: start the DC braking when running frequency reaches starting frequency determined by P1.09. Waiting time before DC braking: VFDs blocks the output before starting the DC braking. After this waiting time, the DC braking will be started so as to prevent over-current fault caused by DC braking at high speed.	0.00Hz	○
P01.10	Waiting time before DC braking		0.00s	○

Function code	Name	Description	Default	Modify
P01.11	DC braking current	DC braking current: the value of P01.11 is the percentage of rated current of VFD. The bigger the DC braking current is, the greater the braking torque is.	0.0%	○
P01.12	DC braking time	DC braking time: the retention time of DC braking. If the time is 0, the DC braking is invalid. The VFD will stop at the mode of coasting to stop.  Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency) Setting range of P01.10: 0.00–50.00s Setting range of P01.11: 0.0–100.0% (rated current peak of the VFD) Setting range of P01.12: 0.00–50.00s	0.00s	○
P01.13	FWD/REV running deadzone time	This function code indicates the transition time specified in P01.14 during FWD/REV rotation switching. See the following figure.  Setting range: 0.0–3600.0s	0.0s	○
P01.14	Switching between FWD/REV rotation	Set the threshold point of the VFD: 0: Switch after zero frequency 1: Switch after the starting frequency 2: Switch after the speed reach P01.15 and delay for P01.24	1	◎

Function code	Name	Description	Default	Modify
P01.15	Stopping speed	0.00–100.00Hz	0.50Hz	◎
P01.16	Detection of stopping speed	0: Set value of speed (the only detection mode valid in V/F mode) 1: Detection value of speed	1	◎
P01.17	Detection time of the feedback speed	When P01.16=1, the actual output frequency of the VFD is less than or equal to P01.15 and is detected during the time set by P01.17, the VFD will stop; otherwise, the VFD stops in the time set by P01.24.  Setting range: 0.00–100.00s (valid only when P01.16=1)	0.50s	◎
P01.18	Terminal running protection selection when powering on	When the running command channel is the terminal control, the system will detect the state of the running terminal during powering on. 0: The terminal running command is invalid when powering on. Even the running command is detected to be valid during powering on, the VFD won't run and the system keeps in the protection state until the running command is canceled and enabled again. 1: The terminal running command is valid when powering on. If the running command is detected to be valid during powering on, the system will start the VFD automatically after the initialization. **Note:** This function should be selected with cautions, or serious result may follow.	0	○
P01.19	Action selected	0x00–0x12 Ones place: Action selection	0x00	◎

Function code	Name	Description	Default	Modify
	when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop		
P01.20	Wake–up–from-sleep delay	This function code determines the wake-up-from-sleep delay time. When the running frequency of the VFD is lower than the lower limit, the VFD becomes standby. When the set frequency exceeds the lower limit one again and it lasts for the time set by P01.20, the VFD runs automatically.  Setting range: 0.0–3600.0s (valid when the ones place of P01.19=2)	0.0s	○
P01.21	Restart after power off	This function can enable the VFD start or not after the power off and then power on. 0: Disabled 1: Enabled, if the starting need is met, the VFD will run automatically after waiting for the time defined by P01.22.	0	○
P01.22	The waiting time of	The function determines the waiting time before the automatic running of the VFD when powering off and then powering on.	1.0s	○

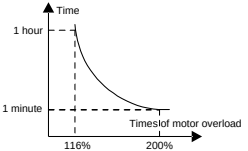
Function code	Name	Description	Default	Modify
	restart after power off	 Setting range: 0.0–3600.0s (valid when P01.21=1)		
P01.23	Start delay time	The function determines the brake release after the running command is given, and the VFD is in a stand-by state and wait for the delay time set by P01.23 Setting range: 0.0–60.0s	0.0s	○
P01.24	Delay of the stopping speed	Setting range: 0.0–100.0s	0.0s	○
P01.25	0Hz output	Select the 0Hz output of the VFD. 0: Output without voltage 1: Output with voltage 2: Output at the DC braking current	0	○

P02 group Motor 1 parameters

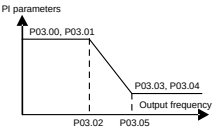
Function code	Name	Description	Default	Modify
P02.01	Rated power of asynchronous motor	0.1–3000.0kW	Depend on model	◎
P02.02	Rated frequency of asynchronous motor	0.01Hz–P00.03	60.00Hz	◎
P02.03	Rated speed of asynchronous motor	1–60000rpm	Depend on model	◎

Function code	Name	Description	Default	Modify
P02.04	Rated voltage of asynchronous motor	0–1200V	Depend on model	◎
P02.05	Rated current of asynchronous motor	0.8–6000.0A	Depend on model	◎
P02.06	Stator resistor of asynchronous motor	0.001–65.535Ω	Depend on model	○
P02.07	Rotor resistor of asynchronous motor	0.001–65.535Ω	Depend on model	○
P02.08	Leakage inductance of asynchronous motor	0.1–6553.5mH	Depend on model	○
P02.09	Mutual inductance of asynchronous motor	0.1–6553.5mH	Depend on model	○
P02.10	Non-load current of asynchronous motor	0.1–6553.5A	Depend on model	○
P02.11	Magnetic saturation coefficient 1 for the iron core of AM1	0.0–100.0%	80.0%	◎
P02.12	Magnetic saturation	0.0–100.0%	68.0%	◎

Function code	Name	Description	Default	Modify
	coefficient 2 for the iron core of AM1			
P02.13	Magnetic saturation coefficient 3 for the iron core of AM1	0.0–100.0%	57.0%	◎
P02.14	Magnetic saturation coefficient 4 for the iron core of AM1	0.0–100.0%	40.0%	◎
P02.26	Motor overload protection selection	0: No protection 1: Common motor (with low speed compensation). Because the heat-releasing effect of the common motors will be weakened, the corresponding electric heat protection will be adjusted properly. The low speed compensation characteristic mentioned here means reducing the threshold of the overload protection of the motor whose running frequency is below 30Hz. 2: Frequency conversion motor (without low speed compensation). Because the heat-releasing of the specific motors won't be impacted by the rotation speed, it is not necessary to adjust the protection value during low-speed running.	2	◎
P02.27	Motor overload protection coefficient	Times of motor overload M = Iout/(In x K) In is the rated current of the motor, Iout is the output current of the VFD and K is the motor protection coefficient. So, the bigger the value of K is, the smaller the value of M is. When M=116%, protection is	100.0%	○

Function code	Name	Description	Default	Modify
		performed after motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; when M=180%, protection is performed after motor overload lasts for 5 minutes; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥ 400%, protection is performed immediately.  Setting range: 20.0%–120.0%		
P02.28	Correction coefficient of motor 1 power	Correct the power displaying of motor 1. Only impact the displaying value other than the control performance of the VFD. Setting range: 0.00–3.00	1.00	○

P03 group Vector control

Function code	Name	Description	Default	Modify
P03.00	Speed loop proportional gain1	The parameters P03.00–P03.05 only apply to vector control mode. Below the switching frequency 1 (P03.02), the speed loop PI parameters are: P03.00 and P03.01. Above the switching frequency 2 (P03.05), the speed loop PI parameters are: P03.03 and P03.04. PI parameters are gained according to the linear change of two groups of parameters. It is shown as below:  	20.0	○
P03.01	Speed loop integral time1		0.200s	○
P03.02	Low switching frequency		5.00Hz	○
P03.03	Speed loop proportional gain 2		20.0	○
P03.04	Speed loop integral time 2		0.200s	○

Function code	Name	Description	Default	Modify
P03.05	High switching frequency	PI has a close relationship with the inertia of the system. Adjust on the base of PI according to different loads to meet various demands. Setting range of P03.00 and P03.03: 0–200.0 Setting range of P03.01 and P03.04: 0.000–10.000s Setting range of P03.02: 0.00Hz–P00.05 Setting range of P03.05: P03.02–P00.03	10.00Hz	○
P03.06	Speed loop output filter	0–8 (corresponds to 0–2^8/10ms)	0	○
P03.07	Compensation coefficient of vector control electromotion slip	Slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the system. Adjusting the parameter properly can control the speed steady-state error. Setting range: 50%–200%	100%	○
P03.08	Compensation coefficient of vector control brake slip		100%	○
P03.09	Current loop percentage coefficient P	**Note**: ✧ The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ✧ The parameters P03.09 and P03.10 are applicable only to SVC 0 (P00.00=0). Setting range: 0–65535	1000	○
P03.10	Current loop integral coefficient I		1000	○
P03.11	Torque setting method	This parameter is used to enable the torque control mode, and set the torque setting means. 0: Torque control is invalid 1: Keypad setting torque (P03.12) 2: Analog AI1 setting torque 3: Analog AI2 setting torque	0	○

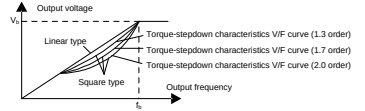
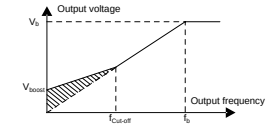
Function code	Name	Description	Default	Modify
		4: Analog AI3 setting torque 5: Pulse frequency HDI setting torque 6: Multi-step torque setting 7: Modbus communication setting torque 8–10: Reserved **Note**: Setting mode 2–7, 100% corresponds to 3 times of the motor rated current		
P03.12	Keypad setting torque	Setting range: -300.0%–300.0% (motor rated current)	50.0%	○
P03.13	Torque reference filter time	0.000–10.000s	0.100s	○
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0: Keypad setting upper-limit frequency (P03.16 sets P03.14, P03.17 sets P03.15) 1: Analog AI1 setting upper-limit frequency 2: Analog AI2 setting upper-limit frequency 3: Analog AI3 setting upper-limit frequency 4: Pulse frequency HDI setting upper-limit frequency 5: Multi-step setting upper-limit frequency 6: Modbus communication setting upper-limit frequency 7–9: Reserved **Note:** Setting method 1–9, 100% corresponds to the maximum frequency	0	○
P03.15	Setting source of reverse rotation upper-limit frequency in torque control		0	○
P03.16	Torque control forward rotation upper-limit frequency keypad defined value	This function is used to set the upper limit of the frequency. P03.16 sets the value of P03.14; P03.17 sets the value of P03.15. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	60.00 Hz	○

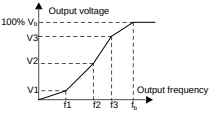
Function code	Name	Description	Default	Modify
P03.17	Torque control reverse rotation upper-limit frequency keypad defined value		60.00 Hz	○
P03.18	Upper-limit setting of electromotion torque	This function code is used to select the electromotion and braking torque upper-limit setting source selection. 0: Keypad setting upper-limit frequency (P03.20 sets P03.18 and P03.21 sets P03.19) 1: Analog AI1 setting upper-limit torque 2: Analog AI2 setting upper-limit torque 3: Analog AI3 setting upper-limit torque 4: Pulse frequency HDI setting upper-limit torque 5: Modbus communication setting upper-limit torque 6–8: Reserved **Note:** Setting mode 1–8, 100% corresponds to three times of the motor current.	0	○
P03.19	Upper-limit setting of braking torque		0	○
P03.20	Electromotion torque upper-limit keypad setting	The function code is used to set the limit of the torque. Setting range: 0.0–300.0% (motor rated current)	180.0%	○
P03.21	Braking torque upper-limit keypad setting		180.0%	○
P03.22	Weakening coefficient in constant power zone	The usage of motor in weakening control. Function code P03.22 and P03.23 are effective at constant power. The motor will enter into the weakening state when the motor runs at rated	0.3	○

Function code	Name	Description	Default	Modify
P03.23	The lowest weakening point in constant power zone	speed. Change the weakening curve by modifying the weakening control coefficient. The bigger the weakening control coefficient is, the steeper the weak curve is. Setting range of P03.22: 0.1–2.0 Setting range of P03.23: 10%–100%	20%	○
P03.24	Max. voltage limit	P03.24 set the Max. Voltage of the VFD, which is dependent on the site situation. Setting range: 0.0–120.0%	100.0%	◎
P03.25	Pre-exciting time	Pre-activate the motor when the VFD starts up. Build up a magnetic field inside the VFD to improve the torque performance during the starting process. Setting time: 0.000–10.000s	0.300s	○
P03.26	Weakening proportional gain	0–8000	1200	○
P03.27	Speed display selection of vector control	0: Display at the actual value 1: Display at the setting value	0	○

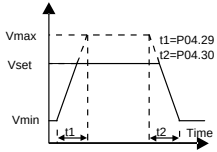
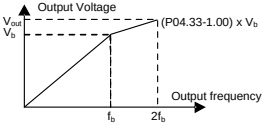
P04 group SVPWM control

Function code	Name	Description	Default	Modify
P04.00	V/F curve setting of motor 1	These function codes define the V/F curve of Goodrive20-UL motor 1 to meet the need of different loads. 0: Straight line V/F curve; applying to the constant torque load 1: Multi-dots V/F curve 2: 1.3th power low torque V/F curve 3: 1.7th power low torque V/F curve 4: 2.0th power low torque V/F curve Curves 2–4 apply to the torque loads such as fans and water pumps. Users can adjust according to the features of the loads to get the	0	◎

Function code	Name	Description	Default	Modify
		best performance. 5: Customized V/F (V/F separation); in this mode, V can be separated from f and f can be adjusted through the frequency reference channel set by P00.06 or the voltage reference channel set by P04.27 to change the feature of the curve. **Note:** V_b in the below picture is the motor rated voltage and f_b is the motor rated frequency. 		
P04.01	Torque boost of motor 1	Torque boost to the output voltage for the features of low frequency torque. P04.01 is for the Max. output voltage V_b. P04.02 defines the percentage of closing frequency of manual torque to f_b. Torque boost should be selected according to the load. The bigger the load is, the bigger the torque is. Too big torque boost is inappropriate because the motor will run with over magnetic, and the current of the VFD will increase to add the temperature of the VFD and decrease the efficiency. When the torque boost is set to 0.0%, the VFD is automatic torque boost. Torque boost threshold: below this frequency point, the torque boost is valid, but over this frequency point, the torque boost is invalid.  Setting range of P04.01: 0.0%: (automatic) 0.1%–10.0% Setting range of P04.02: 0.0%–50.0%	0.0%	○
P04.02	Torque boost cut-off of motor 1		20.0%	○

Function code	Name	Description	Default	Modify
P04.03	V/F frequency point 1 of motor 1	 When P04.00 =1, the user can set V//F curve through P04.03–P04.08. V/F is generally set according to the load of the motor. **Note:**V1＜V2＜V3, f1＜f2＜f3. Too high low frequency voltage will heat the motor excessively or damage. Overcurrent stall or overcurrent protection may occur. Setting range of P04.03: 0.00Hz–P04.05 Setting range of P04.04, P04.06 and P04.08: 0.0%–110.0% (rated voltage of motor 1) Setting range of P04.05: P04.03– P04.07 Setting range of P04.07: P04.05–P02.02 (rated frequency of motor 1)	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1		0.0%	○
P04.05	V/F frequency point 2 of motor 1		0.00Hz	○
P04.06	V/F voltage point 2 of motor 1		0.0%	○
P04.07	V/F frequency point 3 of motor 1		0.00Hz	○
P04.08	V/F voltage point 3 of motor 1		0.0%	○
P04.09	V/F slip compensation gain of motor 1	This function code is used to compensate the change of the rotation speed caused by load during compensation SVPWM control to improve the rigidity of the motor. It can be set to the rated slip frequency of the motor which is counted as below: $\triangle f=f_b-n \times p/60$ Of which, f_b is the rated frequency of the motor, its function code is P02.02; n is the rated rotating speed of the motor and its function code is P02.03; p is the pole pair of the motor. 100.0% corresponds to the rated slip frequency$\triangle f$. Setting range: 0.0–200.0%	100.0%	○
P04.10	Low	In the SVPWM control mode, current fluctuation	10	○

Function code	Name	Description	Default	Modify
	frequency vibration control factor of motor 1	may occur to the motor on some frequency, especially the motor with big power. The motor can not run stably or overcurrent may occur. These phenomena can be canceled by adjusting this parameter.		
P04.11	High frequency vibration control factor of motor 1	Setting range of P04.10: 0–100 Setting range of P04.11: 0–100 Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)	10	○
P04.12	Vibration control threshold of motor 1		30.00 Hz	○
P04.26	Energy-saving operation selection	0: No operation 1: Automatic energy-saving operation Motor on the light load conditions, automatically adjusts the output voltage to save energy	0	◎
P04.27	Voltage Setting channel	Select the output setting channel at V/F curve separation. 0: Keypad setting voltage: the output voltage is determined by P04.28. 1: AI1 setting voltage 2: AI2 setting voltage 3: AI3 setting voltage 4: HDI setting voltage 5: Multi-step speed setting voltage; 6: PID setting voltage; 7: Modbus communication setting voltage; 8–10: Reversed **Note:** 100% corresponds to the rated voltage of the motor.	0	○
P04.28	Keypad setting voltage	The function code is the voltage digital set value when the voltage setting channel is selected as "keypad selection". Setting range: 0.0%–100.0%	100.0%	○
P04.29	Voltage increasing	Voltage increasing time is the time when the VFD accelerates from the output minimum	5.0s	○

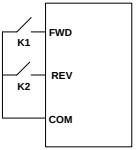
Function code	Name	Description	Default	Modify
	time	voltage to the output maximum voltage.		
P04.30	Voltage decreasing time	Voltage decreasing time is the time when the VFD decelerates from the output maximum voltage to the output minimum voltage. Setting range: 0.0–3600.0s	5.0s	○
P04.31	Output maximum voltage	Set the upper and low limit of the output voltage. Setting range of P04.31: P04.32–100.0% (the rated voltage of the motor)	100.0%	◎
P04.32	Output minimum voltage	Setting range of P04.32: 0.0%– P04.31 (the rated voltage of the motor) 	0.0%	◎
P04.33	Weakening coefficient in constant power zone	Adjust the output voltage of the VFD in SVPWM mode when weakening. **Note:** Invalid in the constant torque mode.  Setting range of P04.33: 1.00–1.30	1.00	○

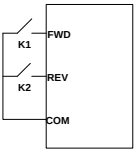
P05 group Input terminals

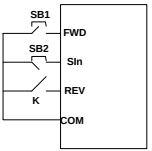
Function code	Name	Description	Default	Modify
P05.00	HDI input selection	0: HDI is high pulse input. See P05.50–P05.54 1: HDI is switch input	0	◎
P05.01	S1 terminals function selection	**Note**: S1–S4, HDI are the upper terminals on the control board and P05.12 can be used to set the function of S5–S8 0: No function	1	◎

Function code	Name	Description	Default	Modify
P05.02	S2 terminals function selection	1: Forward rotation operation 2: Reverse rotation operation 3: 3-wire control operation 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Operation pause 9: External fault input 10: Increasing frequency setting (UP) 11: Decreasing frequency setting (DOWN) 12: Cancel the frequency change setting 13: Shift between A setting and B setting 14: Shift between combination setting and A setting 15: Shift between combination setting and B setting 16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi- stage speed terminal 4 20: Multi- stage speed pause 21: ACC/DEC time 1 22: ACC/DEC time 2 23: Simple PLC stop reset 24: Simple PLC pause 25: PID control pause 26: Traverse Pause (stop at the current frequency) 27: Traverse reset (return to the center frequency) 28: Counter reset 29: Torque control prohibition 30: ACC/DEC prohibition 31: Counter trigger 32: Reserve 33: Cancel the frequency change setting temporarily 34: DC brake	4	◎
P05.03	S3 terminals function selection		7	◎
P05.04	S4 terminals function selection		0	◎
P05.05	S5 terminals function selection		0	◎
P05.06	S6 terminals function selection		0	◎
P05.07	S7 terminals function selection		0	◎
P05.08	S8 terminals function selection		0	◎
P05.09	HDI terminals function selection		0	◎

Function code	Name	Description	Default	Modify
		35: Reserve 36: Shift the command to the keypad 37: Shift the command to the terminals 38: Shift the command to the communication 39: Pre-magnetized command 40: Clear the power 41: Keep the power 42: Emergency stop 43–60: Reserved 61: PID pole switching 62–63: Reserved		
P05.10	Polarity selection of the input terminals	The function code is used to set the polarity of the input terminals. Set the bit to 0, the input terminal is anode. Set the bit to 1, the input terminal is cathode. BIT8 BIT7 BIT6 BIT5 BIT4 HDI S8 S7 S6 S5 BIT3 BIT2 BIT1 BIT0 S4 S3 S2 S1 Setting range: 0x000–0x1FF	0x000	○
P05.11	Switch filter time	Set the sample filter time of S1–S4 and HDI terminals. If the interference is strong, increase the parameter to avoid wrong operation. 0.000–1.000s	0.010s	○
P05.12	Virtual terminals setting	0x000–0x1FF (0: Disabled, 1:Enabled) 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 **Note:** After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.	0x000	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P05.13</td><td>Terminals control running mode</td><td>
Set the operation mode of the terminals control
0: 2-wire control 1, comply the enable with the direction. This mode is widely used. It determines the rotation direction by the defined FWD and REV terminals command.


<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stopping</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Reverse running</td></tr>
<tr><td>ON</td><td>ON</td><td>Hold on</td></tr>
</table>
1: 2-wire control 2; Separate the enable from the direction. FWD defined by this mode is the enabling ones. The direction depends on the state of the defined REV.


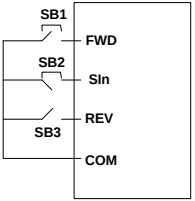
<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stopping</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Stopping</td></tr>
<tr><td>ON</td><td>ON</td><td>Reverse running</td></tr>
</table>
2: 3-wire control 1; Sin is the enabling terminal on this mode, and the running command is caused by FWD and the direction is controlled by REV. Sin is natural closed.


The direction control is as below during operation:
<table>
<tr><th>SIn</th><th>REV</th><th>Previous direction</th><th>Current direction</th></tr>
<tr><td>ON</td><td>OFF→ON</td><td>Forward</td><td>Reverse</td></tr>
</table>
</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify

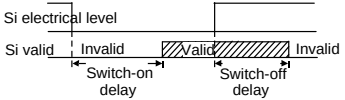
		Reverse	Forward
ON	ON→OFF	Reverse	Forward
		Forward	Reverse
ON→OFF	ON	Decelerate to stop	
	OFF		

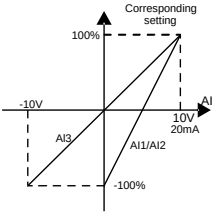
3: 3-wire control 2; Sin is the enabling terminal on this mode, and the running command is caused by SB1 or SB3 and both of them control the running direction.NC SB2 generates the stop command.



SIn	FWD	REV	Direction
ON	OFF→ON	ON	Forward
		OFF	Reverse
ON	ON	OFF→ON	Forward
	OFF		Reverse
ON→OFF			Decelerate to stop

Note: For the 2-wire running mode, when FWD/REV terminal is valid, the VFD stop because of the stopping command from other sources, even the control terminal FWD/REV keeps valid; the VFD won't work when the stopping command is canceled. Only when FWD/REV is relaunched, the VFD can start again. For example, the valid STOP/RST stop when PLC signal cycles stop, fixed-length stop and terminal control (see P07.04).

Function code	Name	Description	Default	Modify
P05.14	S1 terminal switching on delay time	The function code defines the corresponding delay time of electrical level of the programmable terminals from switching on to switching off.  Setting range: 0.000–50.000s	0.000s	○
P05.15	S1 terminal switching off delay time		0.000s	○
P05.16	S2 terminal switching on delay time		0.000s	○
P05.17	S2 terminal switching off delay time		0.000s	○
P05.18	S3 terminal switching on delay time		0.000s	○
P05.19	S3 terminal switching off delay time		0.000s	○
P05.20	S4 terminal switching on delay time		0.000s	○
P05.21	S4 terminal switching off delay		0.000s	○

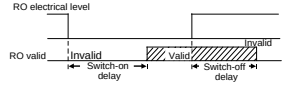
Function code	Name	Description	Default	Modify
	time			
P05.30	HDI terminal switching on delay time		0.000s	○
P05.31	HDI terminal switching off delay time		0.000s	○
P05.32	Lower limit of AI1	AI1 is set by the analog potentiometer, AI2 is set by control terminal AI2 and AI3 is set by control terminal AI3. The function code defines the relationship between the analog input voltage and its corresponding set value. If the analog input voltage beyond the set minimum or maximum input value, the VFD will count at the minimum or maximum one. When the analog input is the current input, the corresponding voltage of 0–20mA is 0–10V. In different cases, the corresponding rated value of 100.0% is different. See the application for detailed information. The figure below illustrates different applications:  Input filter time: this parameter is used to adjust the sensitivity of the analog input. Increasing the	0.00V	○
P05.33	Corresponding setting of the lower limit of AI1		0.0%	○
P05.34	Upper limit of AI1		10.00V	○
P05.35	Corresponding setting of the upper limit of AI1		100.0%	○
P05.36	AI1 input filter time		0.100s	○
P05.37	Lower limit of AI2		0.00V	○
P05.38	Corresponding setting of the lower limit of AI2		0.0%	○
P05.39	Upper limit of AI2		10.00V	○

Function code	Name	Description	Default	Modify
P05.40	Corresponding setting of the upper limit of AI2	value properly can enhance the anti-interference of the analog, but weaken the sensitivity of the analog input **Note:** AI1 supports 0–10V input and AI2 supports 0–10V or 0–20mA input, when AI2 selects 0–20mA input, the corresponding voltage of 20mA is 10V. AI3 can support the output of -10V–+10V. Setting range of P05.32: 0.00V–P05.34 Setting range of P05.33: -100.0%–100.0% Setting range of P05.34: P05.32–10.00V Setting range of P05.35: -100.0%–100.0% Setting range of P05.36: 0.000s–10.000s Setting range of P05.37: 0.00V–P05.39 Setting range of P05.38: -100.0%–100.0% Setting range of P05.39: P05.37–10.00V Setting range of P05.40: -100.0%–100.0% Setting range of P05.41: 0.000s–10.000s Setting range of P05.42: -10.00V–P05.44 Setting range of P05.43: -100.0%–100.0% Setting range of P05.44: P05.42–P05.46 Setting range of P05.45: -100.0%–100.0% Setting range of P05.46: P05.44–10.00V Setting range of P05.48: 0.000s–10.000s	100.0%	○
P05.41	AI2 input filter time		0.100s	○
P05.42	Lower limit of AI3		-10.00V	○
P05.43	Corresponding setting of the lower limit of AI3		-100.0%	○
P05.44	Middle value of AI3		0.00V	○
P05.45	Corresponding middle setting of AI3		0.0%	○
P05.46	Upper limit of AI3		10.00V	○
P05.47	Corresponding setting of the upper limit of AI3		100.0%	○
P05.48	AI3 input filter time		0.100s	○
P05.50	Lower limit frequency of HDI	0.000kHz–P05.52	0.000 kHz	○
P05.51	Corresponding setting of HDI low	-100.0%–100.0%	0.0%	○

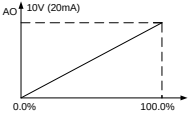
Function code	Name	Description	Default	Modify
	frequency setting			
P05.52	Upper limit frequency of HDI	P05.50–50.000kHz	50.000 kHz	○
P05.53	Corresponding setting of upper limit frequency of HDI	-100.0%–100.0%	100.0%	○
P05.54	HDI frequency input filter time	0.000s–10.000s	0.100s	○

P06 group Output terminals

Function code	Name	Description	Default	Modify
P06.01	Y1 output selection	0: Invalid 1: In operation 2: Forward rotation operation 3: Reverse rotation operation 4: Jogging operation 5: The VFD fault 6: Frequency degree test FDT1 7: Frequency degree test FDT2 8: Frequency arrival 9: In zero-speed operation (output in running state) 10: Upper limit frequency arrival 11: Lower limit frequency arrival 12: Ready for operation 13: Pre-magnetizing 14: Overload pre-alarm 15: Underload pre-alarm 16: Completion of simple PLC stage 17: Completion of simple PLC cycle 18: Setting count value arrival	0	○
P06.03	Relay RO1 output selection		1	○
P06.04	Relay RO2 output selection		5	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>19: Defined count value arrival
20: External fault valid
21: Zero-speed output (output in both running and stopping states)
22: Running time arrival
23: Modbus communication virtual terminals output
24–25: Reserved
26: Establishment of DC bus voltage
27–30: Reserved</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Polarity selection of output terminals</td><td>The function code is used to set the pole of the output terminal.
When the current bit is set to 0, input terminal is positive.
When the current bit is set to 1, input terminal is negative.
<table><tr><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr><tr><td>RO2</td><td>RO1</td><td>Reserved</td><td>Y1</td></tr></table>Setting range: 0x00–0x0F</td><td>0x00</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y1 switch-on delay</td><td>Setting range: 0.000–50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.07</td><td>Y1 switch-off delay</td><td>Setting range: 0.000–50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.10</td><td>RO1 switch-on delay</td><td rowspan="4">The function code defines the corresponding delay time of the electrical level change during the programmable terminal switching on and off.
 
Setting range: 0.000–50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.11</td><td>RO1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.12</td><td>RO2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.13</td><td>RO2 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.14</td><td>AO1 output</td><td>0: Running frequency
1: Setting frequency</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
P06.15	AO2 output	2: Ramp reference frequency 3: Running rotation speed (relative to twice the rotation speed of the motor) 4: Output current (relative to twice the rated current of the VFD) 5: Output current (relative to twice the rated current of the motor) 6: Output voltage (relative to 1.5 times the rated voltage of the VFD) 7: Output power (relative to twice the rated power of the motor) 8: Set torque value (relative to twice the rated torque of the motor) 9: Output torque (relative to twice the rated torque of the motor) 10: Analog AI1 input value 11: Analog AI2 input value 12: Analog AI3 input value 13: High speed pulse HDI input value 14: Modbus communication set value 1 15: Modbus communication set value 2 16–21: Reserved 22: Torque current (corresponds to 3 times rated current of the motor) 23: Ramp reference frequency (with sign) 24–30: Reserved	0	○
P06.17	Lower limit of AO1 output	The above function codes define the relative relationship between the output value and analog output. When the output value exceeds the range of set maximum or minimum output, it will count according to the low-limit or upper-limit output. When the analog output is current output, 1mA equals to 0.5V. In different cases, the corresponding analog output of 100% of the output value is different. For detailed information, please refer to analog output instructions in *Chapter 7*.	0.0%	○
P06.18	Corresponding AO1 output to the lower limit		0.00V	○
P06.19	Upper limit of		100.0%	○

Function code	Name	Description	Default	Modify
	AO1 output			
P06.20	Corresponding AO1 output to the upper limit	Setting range of P06.17: -100.0%– P06.19 Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–100.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s Setting range of P06.22: -100.0%– P06.24 Setting range of P06.23: 0.00V–10.00V Setting range of P06.24: P06.22–100.0% Setting range of P06.25: 0.00V–10.00V Setting range of P06.26: 0.000s–10.000s	10.00V	○
P06.21	AO1 output filter time		0.000s	○
P06.22	Lower limit of AO2 output		0.0%	○
P06.23	Corresponding AO2 output to the lower limit		0.00V	○
P06.24	Upper limit of AO2 output		100.0%	○
P06.25	Corresponding AO2 output to the upper limit		10.00V	○
P06.26	AO2 output filter time		0.000s	○

P07 group HMI

Function code	Name	Description	Default	Modify

Function code	Name	Description	Default	Modify
P07.00	User's password	0–65535 The password protection will be valid when setting any non-zero number. 00000: Clear the previous user's password, and make the password protection invalid. After the user's password becomes valid, if the password is incorrect, users cannot enter the parameter menu. Only correct password can make the user check or modify the parameters. Please remember all users' passwords. Retreat editing state of the function codes and the password protection will become valid in 1 minute. If the password is available, press PRG/ESC to enter into the editing state of the function codes, and then "0.0.0.0.0" will be displayed. Unless input right password, the operator can not enter into it. **Note:** Restoring to the default value can clear the password, please use it with caution.	0	○
P07.01	Parameter copy	0: No operation 1: Upload the local function parameter to the keypad 2: Download the keypad function parameter to local address (including the motor parameters) 3: Download the keypad function parameter to local address (excluding the motor parameter of P02 and P12 group) 4: Download the keypad function parameters to local address (only for the motor parameter of P02 and P12 group) **Note**: After finish 1–4, the parameter will restore to 0 and the uploading and downloading does not include P29.	0	◎
P07.02	Key function	Ones place: QUICK/JOG key function	1	◎

Function code	Name	Description	Default	Modify
	selection	0: Null 1: Jogging 2: Switch display state via shift key 3: Switch between FWD/REV rotation 4: Clear UP/DOWN setting 5: Coast to stop 6: Switch running command ref. mode in order 7: Quick commission mode (based on non-default parameter) Tens place: 0: keys unlocked 1: Lock all keys 2: Lock part of the keys (lock PRG/ESC key only)		
P07.03	QUICK the shifting sequence of running command	When the ones place of P07.02=6, set the shifting sequence of running command channels. 0: Keypad control→terminals control →communication control 1: Keypad control←→terminals control 2: Keypad control←→communication control 3: Terminals control←→communication control	0	○
P07.04	STOP/RST stop function	Select the stop function by STOP/RST. STOP/RST is effective in any state for the keypad reset. 0: Only valid for the keypad control 1: Both valid for keypad and terminals control 2: Both valid for keypad and communication control 3: Valid for all control modes	0	○
P07.05	Displayed parameters 1 of running state	0x0000–0xFFFF BIT0: Running frequency (Hz on) BIT1: Set frequency (Hz flickering) BIT2: Bus voltage (V on) BIT3: Output voltage (V on) BIT4: Output current (A on)	0x03FF	○

Function code	Name	Description	Default	Modify
		BIT5: Running rotation speed (rpm on) BIT6: Output power (% on) BIT7: Output torque (% on) BIT8: PID reference (% flickering) BIT9: PID feedback value (% on) BIT10: Input terminals state BIT11: Output terminals state BIT12: Torque set value (% on) BIT13: Pulse counter value BIT14: Reserved BIT15: PLC and the current step of multi-step speed		
P07.06	Displayed parameters 2 of running state	0x0000–0xFFFF BIT0: Analog AI1 value (V on) BIT1: Analog AI2 value (V on) BIT2: Analog AI3 value (V on) BIT3: High speed pulse HDI frequency BIT4: Motor overload percentage (% on) BIT5: VFD overload percentage (% on) BIT6: Ramp frequency reference (Hz on) BIT7: Linear speed BIT8: AC inlet current (A on) BIT9–15: Reserved	0x0000	
P07.07	The parameter selection of the stop state	0x0000–0xFFFF BIT0: Set frequency (Hz on, frequency flickering slowly) BIT1: Bus voltage (V on) BIT2: Input terminals state BIT3: Output terminals state BIT4: PID reference (% flickering) BIT5: PID feedback (% on) BIT6: Torque reference (% flickering) BIT7: AI1 (V on) BIT8: AI2 (V on) BIT9: AI3 (V on) BIT10: High-speed pulse HDI frequency BIT11: PLC and the current step of multi-step speed	0x00FF	○

Function code	Name	Description	Default	Modify
		BIT12: Pulse counters BIT13–BIT15: Reserved		
P07.08	Frequency display coefficient	0.01–10.00 Displayed frequency=running frequency x P07.08	1.00	○
P07.09	Speed display coefficient	0.1–999.9% Mechanical rotation speed = 120 x (Displayed running frequency) × P07.09/(Number of motor poles)	100.0%	○
P07.10	Linear speed displayed coefficient	0.1–999.9% Linear speed= Mechanical rotation speed x P07.10	1.0%	○
P07.11	Rectifier bridge module temperature	-20.0–120.0°C	0.0°C	●
P07.12	Inverter module temperature	-20.0–120.0°C	0.0°C	●
P07.13	Software version	1.00–655.35	Depend on model	●
P07.14	Local accumulative running time	0–65535h	0h	●
P07.15	Most significant digit of power consumption	Display the power used by the VFD. The power consumption of the VFD = P07.15 x 1000 + P07.16 Setting range of P07.15: 0–65535kWh (x 1000) Setting range of P07.16: 0.0–999.9kWh	0kWh	●
P07.16	Least significant digit of power consumption		0.0kWh	●
P07.18	Rated power of the VFD	0.4–3000.0kW	0.4kW	●
P07.19	Rated voltage of the VFD	50–1200V	380V	●
P07.20	Rated current of the VFD	0.1–6000.0A	0.1A	●

Function code	Name	Description	Default	Modify
P07.21	Factory bar code 1	0x0000–0xFFFF	0xFFFF	●
P07.22	Factory bar code 2	0x0000–0xFFFF	0xFFFF	●
P07.23	Factory bar code 3	0x0000–0xFFFF	0xFFFF	●
P07.24	Factory bar code 4	0x0000–0xFFFF	0xFFFF	●
P07.25	Factory bar code 5	0x0000–0xFFFF	0xFFFF	●
P07.26	Factory bar code 6	0x0000–0xFFFF	0xFFFF	●
P07.27	Current fault type	0: No fault 1: Inverter unit U phase protection (OUt1) 2: Inverter unit V phase protection (OUt2) 3: Inverter unit W phase protection (OUt3)	0	●
P07.28	Previous fault type	4: Overcurrent during acceleration (OC1) 5: Overcurrent during deceleration (OC2) 6: Overcurrent during constant speed running (OC3) 7: Overvoltage during acceleration (OV1) 8: Overvoltage during deceleration (OV2) 9: Overvoltage during constant speed running (OV3) 10: Bus undervoltage (UV) 11: Motor overload (OL1) 12: VFD overload (OL2) 13: Phase loss on input side (SPI) 14: Phase loss on output side (SPO) 15: Rectifier module overheat (OH1) 16: Inverter module overheat (OH2) 17: External fault (EF) 18: 485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor antotuning fault (tE) 21: EEPROM operation fault (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END)	0	●
P07.29	Previous 2 fault type		0	●
P07.30	Previous 3 fault type		0	●
P07.31	Previous 4 fault type		0	●
P07.32	Previous 5 fault type		0	●

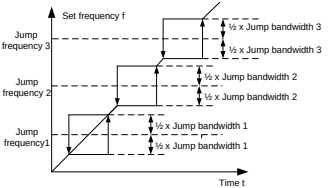
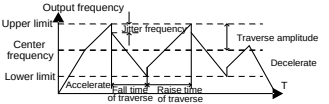
Function code	Name	Description	Default	Modify
		25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29–31: Reserved 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circu it fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment (STo) 36: Underload fault (LL)		
P07.33	Running frequency at present fault	0.00–630.00Hz	0.00Hz	●
P07.34	Ramp reference frequency at present fault	0.00–630.00Hz	0.00Hz	●
P07.35	Output voltage at present fault	0–1200V	0V	●
P07.36	Output current at present fault	0.0–6300.0A	0.0A	●
P07.37	Bus voltage at present fault	0.0–2000.0V	0.0V	●
P07.38	Temperature at present fault	0.0–120.0°C	0.0°C	●
P07.39	Input terminal state at present fault	0x0000–0xFFFF	0x0000	●
P07.40	Output terminal state at present fault	0x0000–0xFFFF	0x0000	●
P07.41	Reference frequency at the last fault	0.00–630.00Hz	0.00Hz	●

Function code	Name	Description	Default	Modify
P07.42	Ramp reference frequency at the last fault	0.00–630.00Hz	0.00Hz	●
P07.43	Output voltage at last fault	0–1200V	0V	●
P07.44	Output current at last fault	0.0–6300.0A	0.0A	●
P07.45	Bus voltage at last s fault	0.0–2000.0V	0.0V	●
P07.46	Temperature at last fault	0.0–120.0°C	0.0°C	●
P07.47	Input terminal state at last fault	0x0000–0xFFFF	0x0000	●
P07.48	Output terminal state at last fault	0x0000–0xFFFF	0x0000	●
P07.49	Running frequency at the last but one faults	0.00–630.00Hz	0.00Hz	●
P07.50	Ramp reference frequency at the last but one faults	0.00–630.00Hz	0.00Hz	●
P07.51	Output voltage at the last but one faults	0–1200V	0V	●
P07.52	Output current at the last but one faults	0.0–6300.0A	0.0A	●
P07.53	Bus voltage at the last but one faults	0.0–2000.0V	0.0V	●

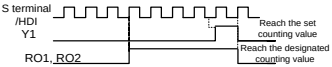
Function code	Name	Description	Default	Modify
P07.54	Temperature at the last but one faults	0.0–120.0°C	0.0°C	●
P07.55	Input terminal state at the last but one faults	0x0000–0xFFFF	0x0000	●
P07.56	Output terminal state at the last but one faults	0x0000–0xFFFF	0x0000	●

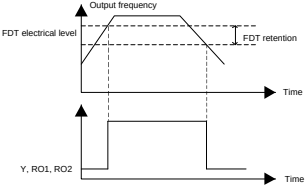
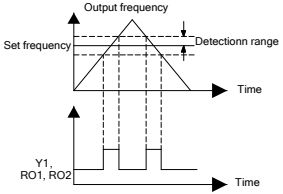
P08 group Enhanced functions

Function code	Name	Description	Default	Modify
P08.00	ACC time 2	Refer to P00.11 and P00.12 for detailed definition. Goodrive20-UL series define four groups of ACC/DEC time which can be selected by P5 group. The first group of ACC/DEC time is the factory default one. Setting range: 0.0–3600.0s	Depend on model	○
P08.01	DEC time 2		Depend on model	○
P08.02	ACC time 3		Depend on model	○
P08.03	DEC time 3		Depend on model	○
P08.04	ACC time 4		Depend on model	○
P08.05	DEC time 4		Depend on model	○
P08.06	Jogging running frequency	This parameter is used to define the reference frequency during jogging. Setting range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	○
P08.07	Jogging running ACC time	The jogging ACC time means the time needed if the VFD runs from 0Hz to the Max. Frequency. The jogging DEC time means the time needed if the VFD goes from the Max. Frequency (P00.03) to 0Hz. Setting range: 0.0–3600.0s	Depend on model	○
P08.08	Jogging running DEC time		Depend on model	○
P08.09	Jumping frequency	When the set frequency is in the range of jumping frequency, the VFD will run at the edge	0.00Hz	○

Function code	Name	Description	Default	Modify
	1	of the jumping frequency. The VFD can avoid the mechanical resonance point by setting the jumping frequency. The VFD can set three jumping frequency. But this function will be invalid if all jumping points are 0.  Setting range: 0.00–P00.03 (Max. output frequency)		
P08.10	Jumping frequency range 1		0.00Hz	○
P08.11	Jumping frequency 2		0.00Hz	○
P08.12	Jumping frequency range 2		0.00Hz	○
P08.13	Jumping frequency 3		0.00Hz	○
P08.14	Jumping frequency range 3		0.00Hz	○
P08.15	Traverse range	This function applies to the industries where traverse and convolution function are required such as textile and chemical fiber. The traverse function means that the output frequency of the VFD is fluctuated with the set frequency as its center. The route of the running frequency is illustrated as below, of which the traverse is set by P08.15 and when P08.15 is set as 0, the traverse is 0 with no function.  Traverse range: The traverse running is limited by upper and low frequency. The traverse range relative to the center frequency: traverse range AW = center frequency×traverse range P08.15. Sudden jumping frequency = traverse range AW×sudden jumping frequency range P08.16. When run at the traverse frequency, the value	0.0%	○
P08.16	Sudden jumping frequency range		0.0%	○
P08.17	Traverse boost time		5.0s	○
P08.18	Traverse declining time		5.0s	○

Function code	Name	Description	Default	Modify
		which is relative to the sudden jumping frequency. The raising time of the traverse frequency: The time from the lowest point to the highest one. The declining time of the traverse frequency: The time from the highest point to the lowest one. Setting range of P08.15: 0.0–100.0% (relative to the set frequency) Setting range of P08.16: 0.0–50.0% (relative to the traverse range) Setting range of P08.17: 0.1–3600.0s Setting range of P08.18: 0.1–3600.0s		
P08.20	Analog calibration function selection	0: Invalid 1: Valid	1	◎
P08.21	DEC time of emergency stop	0.0–6553.5 s 0.0 indicates coast to stop	0.0 s	○
P08.22	Delay to enter the sleep state	0.0–3600.0s It indicates the delay to enter the sleep state, and it is valid only when ones place of P01.19 is set to 2.	2.0s	○
P08.24	Energy braking for stop	0: Disable 1: Enable	1	○
P08.25	Set count value	The counter works by the input terminal signals of S terminal (set as "Counter trigger") or HDI (set P05.00 to 1). When the count value reaches the specified number, the multi-function output terminal sends the signal of "The specified count value is reached" and the counter continues to count; when the count value reaches the set number, the multi-function output terminal sends the signal of "The set count value is reached", and	0	○
P08.26	Specified count value		0	○

Function code	Name	Description	Default	Modify
		the counter will be reset to zero and recount when the next pulse occurs. The value of P08.26 cannot be greater than that of P08.25. The function is illustrated as below:  Setting range of P08.25: P08.26–65535 Setting range of P08.26: 0–P08.25		
P08.27	Setting running time	Pre-set running time of the VFD. When the accumulative running time achieves the set time, the multi-function digital output terminals will output the signal of "running time arrival". Setting range: 0–65535min	0m	○
P08.28	Time of fault reset	The time of the fault reset: set the fault reset time by selecting this function. If the reset time exceeds this set value, the VFD will stop for the fault and wait to be repaired. The interval time of the fault reset: The interval between the time when the fault occurs and the time when the reset action occurs. Setting range of P08.28: 0–10 Setting range of P08.29: 0.1–3600.0s	0	○
P08.29	Interval time of automatic fault reset		1.0s	○
P08.30	Frequency decreasing ratio in drop control	The output frequency of the VFD changes as the load. And it is mainly used to balance the power when several VFDs drive one load. Setting range: 0.00–50.00Hz	0.00Hz	○
P08.32	FDT1 electrical level detection value	When the output frequency exceeds the corresponding frequency of FDT electrical level, the multi-function digital output terminals will output the signal of "frequency level detect FDT" until the output frequency decreases to a value lower than (FDT electrical level—FDT retention detection value) the corresponding frequency, the signal is invalid. Below is the waveform diagram:	60.00Hz	○
P08.33	FDT1 retention detection value		5.0%	○

Function code	Name	Description	Default	Modify
P08.34	FDT2 electrical level detection value	 Setting range of P08.32: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.33 and P08.35: 0.0–100.0% Setting range of P08.34: 0.00Hz–P00.03 (Max. output frequency)	60.00Hz	○
P08.35	FDT2 retention detection value		5.0%	○
P08.36	Frequency arrival detection range	When the output frequency is among the below or above range of the set frequency, the multi-function digital output terminal will output the signal of "frequency arrival", see the diagram below for detailed information:  Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.37	Energy Braking enable	This parameter is used to control the internal braking unit. 0: Disabled 1: Enabled **Note:** It is only applicable to VFD models that are built in braking units.	0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P08.38</td><td>Energy braking threshold voltage</td><td>After setting the original bus voltage of energy braking, you can adjust the voltage to implement load braking. The factory changes with the voltage level.
Setting range: 200.0–2000.0V
In order to prevent customers set the value is too large, it is recommended setting range:<table><tr><th>Voltage</th><td>220V</td><td>460V</td></tr><tr><th>Range</th><td>375–400V</td><td>715–780V</td></tr></table></td><td>220V voltage: 380.0V
460V voltage: 740.0V</td><td>○</td></tr>
<tr><td>P08.39</td><td>Cooling fan running mode</td><td>Setting range: 0–2
0: Common running mode
1: The fan keeps running after being powered on
2: Running mode 2</td><td>0</td><td>○</td></tr>
<tr><td>P08.40</td><td>PWM selection</td><td>0x0000–0x1121
Ones place: PWM mode selection
0: PWM mode 1, 3PH modulation and 2PH modulation
1: PWM mode 2, 3PH modulation
Tens place: PWM low-speed carrier limit
0: Low-speed carrier limit mode 1
1: Low-speed carrier limit mode 2
2: No limit
Hundreds place: Reserved
Thousands place: PWM loading mode selection
0: Normal loading
1: Interruptive loading</td><td>0x0001</td><td>◎</td></tr>
<tr><td>P08.41</td><td>Over commission selection</td><td>0x00–0x11
Ones place: Whether to enable overmodulation
0: Disable overmodulation
1: Enable overmodulation
Tens place: Overmodulation mode
0: Mild overmodulation
1: Deepened overmodulation</td><td>0x01</td><td>◎</td></tr>
<tr><td>P08.42</td><td>Keypad data control setting</td><td>0x0000–0x1223
Ones place: frequency enable selection
0: Both ∧/∨ keys and analog potentiometer adjustments are valid
1: Only ∧/∨ keys adjustment is valid</td><td>0x0000</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		2: Only analog potentiometer adjustments is valid 3: Neither ∧/∨ keys nor digital potentiometer adjustments are valid Tens place: frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting manner 2: Invalid for multi-step speed when multi-step speed has the priority Hundreds place: action selection during stopping 0: Setting is valid 1: Valid during running, cleared after stopping 2: Valid during running, cleared after receiving the stop command Thousands place: ∧ / ∨ keys and analog potentiometer integral function 0: The Integral function is valid 1: The Integral function is invalid		
P08.43	Integral ratio of the keypad potentiometer	0.01–10.00s	0.10s	○
P08.44	UP/DOWN terminals control setting	0x000–0x221 Ones place: frequency control selection 0: UP/DOWN terminals setting valid 1: UP/DOWN terminals setting valid Tens place: frequency control selection 0: Only valid when P00.06=0 or P00.07=0 1: All frequency means are valid 2: When the multi-step are priority, it is invalid to the multi-step Hundreds place: action selection when stop 0: Setting valid 1: Valid in the running, clear after stop 2: Valid in the running, clear after receiving the stop commands	0x000	○

Function code	Name	Description	Default	Modify
P08.45	UP terminals frequency changing ratio	0.01–50.00s	0.50 s	○
P08.46	DOWN terminals frequency changing ratio	0.01–50.00s	0.50 s	○
P08.47	Action selection at power loss	0x000–0x111 Ones place: Action selection when power off. 0: Save when power off 1: Clear when power off Tens place: Action selection when Modbus set frequency off 0: Save when power off 1: Clear when power off Hundreds place:The action selection when other frequency set frequency off 0: Save when power off 1: Clear when power off	0x000	○
P08.48	Most significant digit of original power consumption	This parameter is used to set the original value of the power consumption. The original value of the power consumption =P08.48 x 1000 + P08.49 Setting range of P08.48: 0–59999 kWh (k) Setting range of P08.49:0.0–999.9 kWh	0 kWh	○
P08.49	Least significant digit of original power consumption		0.0 kWh	○
P08.50	Magnetic flux	This function code is used to enable magnetic flux.	0	○

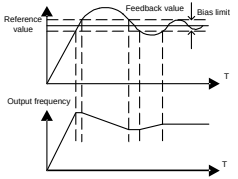
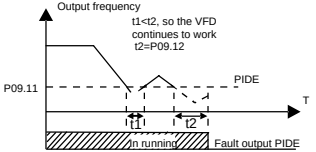
Function code	Name	Description	Default	Modify
	braking	0: Invalid. 100–150: the bigger the coefficient, the bigger the braking strength. This VFD can slow down the motor by increasing the magnetic flux. The energy generated by the motor during braking can be transformed into heat energy by increasing the magnetic flux. The VFD monitors the state of the motor continuously even during the magnetic flux period. So the magnetic flux can be used in the motor stop, as well as to change the rotation speed of the motor. Its other advantages are: Brake immediately after the stop command. It does not need to wait the magnetic flux weaken. The cooling is better. The current of the stator other than the rotor increases during magnetic flux braking, while the cooling of the stator is more effective than the rotor.		
P08.51	VFD input power factor	This function code is used to adjust the displayed current of the AC input side. Setting range: 0.00–1.00	0.56	○

P09 group PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source	When the frequency command selection (P00.06, P00. 07) is 7 or the voltage setting channel selection (P04.27) is 6, the running mode of the VFD is process PID control. The function code determines the target reference channel during the PID process. 0: P09.01 1: AI1 2: AI2 3: AI3 set 4: High speed pulse HDI 5: Multi-step running 6: Modbus communication	0	○

Function code	Name	Description	Default	Modify
		7–9:Reserved The set target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system always performs calculation by using a relative value (0–100.0%). **Note:** Multi-step running can be realized by setting P10 group parameters.		
P09.01	PID value reference	The function code is mandatory when P09.00=0. The basic value of the function code is the feedback of the system. Setting range:-100.0%–100.0%	0.0%	○
P09.02	PID feedback source	Select the PID channel by the parameter. 0: Analog channel AI1 feedback 1: Analog channel AI2 feedback 2: Analog channel AI3 feedback 3: High speed HDI feedback 4: Modbus communication feedback 5: MAX (|AI2|, |AI3|) 6–7: Reserved **Note:** The reference channel and the feedback channel can not coincide, otherwise, PID can not control effectively.	0	○
P09.03	PID output feature	0: PID output is positive: when the feedback signal exceeds the PID reference value, the output frequency of the VFD will decrease to balance the PID. For example, the strain PID control during wrapup 1: PID output is negative: When the feedback signal is stronger than the PID reference value, the output frequency of the VFD will increase to balance the PID. For example, the strain PID control during wrapdownk.	0	○
P09.04	Proportional gain at high frequency (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The parameter of 100 means that when the offset of PID feedback and reference	1.00	○

Function code	Name	Description	Default	Modify
		value is 100%, the adjusting range of PID adjustor is the Max. frequency (ignoring integral function and differential function). Setting range:0.00–100.00		
P09.05	Integral time at high frequency (Ti)	This parameter determines the speed of PID adjustor to carry out integral adjustment on the deviation of PID feedback and reference. When the deviation of PID feedback and reference is 100%, the integral adjustor works continuously after the time (ignoring the proportional effect and differential effect) to achieve the Max. Frequency (P00.03) or the Max. Voltage (P04.31). Shorter the integral time, stronger is the adjustment Setting range: 0.00–10.00s	0.10s	○
P09.06	Differential time at high frequency (Td)	This parameter determines the strength of the change ratio when PID adjustor carries out integral adjustment on the deviation of PID feedback and reference. If the PID feedback changes 100% during the time, the adjustment of integral adjustor (ignoring the proportional effect and differential effect) is the Max. Frequency (P00.03) or the Max. Voltage (P04.31). Longer the integral time, stronger is the adjusting. Setting range: 0.00–10.00s	0.00s	○
P09.07	Sampling cycle(T)	This parameter means the sampling cycle of the feedback. The modulator calculates in each sampling cycle. The longer the sapling cycle is, the slower the response is. Setting range: 0.001–10.000s	0.100s	○
P09.08	PID control deviation limit	The output of PID system is relative to the maximum deviation of the close loop reference. As shown in the diagram below, PID adjustor stops to work during the deviation limit. Set the function properly to adjust the accuracy and stability of the system.	0.0%	○

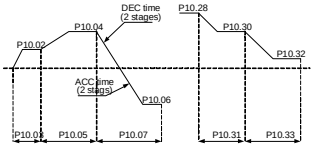
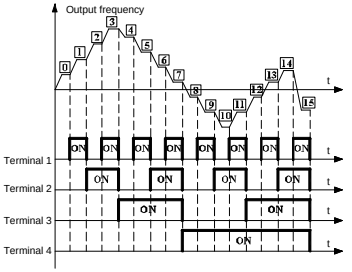
Function code	Name	Description	Default	Modify
		 Setting range: 0.0–100.0%		
P09.09	Output upper limit of PID	These parameters are used to set the upper and lower limit of the PID adjustor output. 100.0 % corresponds to Max. Frequency or the Max. Voltage of (P04.31) Setting range of P09.09: P09.10–100.0% Setting range of P09.10: -100.0%–P09.09	100.0%	○
P09.10	Output lower limit of PID		0.0%	○
P09.11	Feedback offline detection value	Set the PID feedback offline detection value, when the detection value is smaller than or equal to the feedback offline detection value, and the lasting time exceeds the set value in P09.12, the VFD will report "PID feedback offline fault" and the keypad will display PIDE.	0.0%	○
P09.12	Feedback offline detection time	 Setting range of P09.11: 0.0–100.0% Setting range of P09.12: 0.0–3600.0s	1.0s	○
P09.13	PID adjustment selection	0x0000–0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens place: 0: The same with the main reference direction 1: Opposite to the main reference direction	0x0001	○

Function code	Name	Description	Default	Modify
		Hundreds place: 0: Limit based on the max. frequency 1: Limit based on A frequency Thousands place: 0: A+B frequency, ACC/DEC of main reference A frequency source buffering is invalid 1: A+B frequency, ACC/DEC of main reference A frequency source buffering is valid, ACC and DEC are determined by P08.04.		
P09.15	PID command of ACC/DEC time	0.0–1000.0s	0.0s	○
P09.16	PID output filter time	0.000–10.000s	0.000s	○
P09.17	Proportional gain at low frequency (Kp)	0.00–100.00	1.00	○
P09.18	Integral time at low frequency (Ti)	0.00–10.00 s	0.10 s	○
P09.19	Differential time at low frequency (Td)	0.00–10.00 s	0.00 s	○
P09.20	Low-point frequency for switching PI parameters	0.00 Hz–P09.21 When the ramp frequency is less than or equal to P09.20, the present PID parameters range from P09.17 to P09.19. When the ramp frequency is greater than or equal to P09.21, the present PI parameters range from P09.04 to P09.06. The intermediate frequency band is the linear interpolation between high and low-point frequency.	5.00 Hz	○

Function code	Name	Description	Default	Modify
P09.21	High-point frequency for switching PI parameters	P09.20–P00.03	10.00 Hz	○

P10 group Simple PLC and multi-step speed control

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once; the VFD stops automatically after running for one cycle, and it can be started only after receiving running command. 1: Keep running in the final value after running once. The VFD keeps the running frequency and direction of the last section after a single cycle. 2: Cyclic running; the VFD enters the next cycle after completing one cycle until receiving stop command and stops.	0	○
P10.01	Simple PLC memory selection	0: No memory after power-off 1: Memory after power-off; PLC memories its running step and frequency before power-off.	0	○
P10.02	Multi-step speed 0	100.0% of the frequency setting corresponds to the Max. Frequency P00.03. When selecting simple PLC running, set P10.02–P10.33 to define the running frequency and direction of all stages. **Note:** The symbol of multi-step determines the running direction of simple PLC. The negative value means reverse rotation.	0.0%	○
P10.03	Running time of stage 0		0.0s	○
P10.04	Multi-step speed 1		0.0%	○
P10.05	Running time of stage 1		0.0s	○
P10.06	Multi-step speed 2		0.0%	○

Function code	Name	Description	Default	Modify
P10.07	Running time of stage 2		0.0s	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Running time of stage 3	Multi-step speeds are in the range of --f_{max}–f_{max}, and they can be set continuously.	0.0s	○
P10.10	Multi-step speed 4	Goodrive20-UL series VFDs can set 16 stages speed, selected by the combination of multi-step terminals 1–4, corresponding to the speed 0 to speed 15.	0.0%	○
P10.11	Running time of stage 4		0.0s	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Running time of stage 5		0.0s	○
P10.14	Multi-step speed 6		0.0%	○
P10.15	Running time of stage 6		0.0s	○
P10.16	Multi-step speed 7	When terminal 1= terminal 2= terminal 3= terminal 4=OFF, the frequency input manner is selected via code P00.06 or P00.07. When all terminal 1= terminal 2= terminal 3= terminal 4 terminals aren't off, it runs at multi-step which takes precedence of keypad, analog value, high-speed pulse, PLC, communication frequency input. Select at most 16 stages speed via the combination code of terminal 1, terminal 2, terminal 3, and terminal 4.	0.0%	○
P10.17	Running time of stage 7		0.0s	○
P10.18	Multi-step speed 8		0.0%	○
P10.19	Running time of stage 8		0.0s	○
P10.20	Multi-step speed 9	The start-up and stopping of multi-step running is determined by function code P00.06, the relationship between terminal 1, terminal 2, terminal 3, terminal 4 terminals and multi-step	0.0%	○
P10.21	Running time of stage 9		0.0s	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P10.22</td><td>Multi-step speed 10</td><td rowspan="15">speed is as following:
<table><tr><td>Terminal 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>Terminal 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>Terminal 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Terminal 4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr><tr><td>step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Terminal 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>Terminal 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>Terminal 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Terminal 4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr></table>Setting range of P10.(2n,1<n<17):
-100.0–100.0%
Setting range of P10.(2n+1, 1<n<17):
0.0–6553.5s (min)</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.23</td><td>Running time of stage 10</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.24</td><td>Multi-step speed 11</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.25</td><td>Running time of stage 11</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.26</td><td>Multi-step speed 12</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.27</td><td>Running time of stage 12</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.28</td><td>Multi-step speed 13</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.29</td><td>Running time of stage 13</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.30</td><td>Multi-step speed 14</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.31</td><td>Running time of stage 14</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.32</td><td>Multi-step speed 15</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.33</td><td>Running time of stage 15</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.34</td><td>Simple PLC 0–7 stage ACC/DEC time selection</td><td>Below is the detailed instruction:
<table><tr><th>Function code</th><th colspan="2">Binary bit</th><th>Step</th><th>ACC/DEC 0</th><th>ACC/DEC 1</th><th>ACC/DEC 2</th><th>ACC/DEC 3</th></tr><tr><td rowspan="2">P10.34</td><td>BIT1</td><td>BIT0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>BIT3</td><td>BIT2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr></table></td><td>0x0000</td><td>○</td></tr>
<tr><td>P10.35</td><td>Simple PLC 8–15</td><td>0x0000</td><td>○</td></tr>
</table>

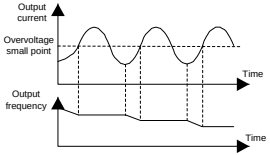
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>stage ACC/DEC time selection</td><td>
<table>
<tr><td rowspan="6"></td><td>BIT5</td><td>BIT4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td rowspan="8">P10.35</td><td>BIT1</td><td>BIT0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
After the users select the corresponding ACC/DEC time, the combining 16 binary bit will change into decimal bit, and then set the corresponding function codes.
Setting range: -0x0000–0xFFFF</td><td></td><td></td></tr>
<tr><td>P10.36</td><td>PLC restart mode</td><td>0: Restart from the first stage; stop during running (cause by the stop command, fault or power loss), run from the first stage after restart.
1: Continue to run from the stop frequency; stop during running (cause by stop command and fault), the VFD will record the running time automatically, enter into the stage after restart and keep the remaining running at the setting frequency.</td><td>0</td><td>◎</td></tr>
</table>

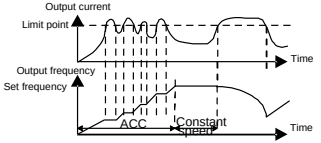
Function code	Name	Description	Default	Modify
P10.37	Multi-step time unit selection	0: Seconds; the running time of all stages is counted by second 1: Minutes; the running time of all stages is counted by minute	0	◎

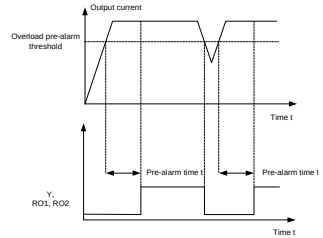
P11 group Protection parameters

Function code	Name	Description	Default	Modify
P11.00	Phase loss protection	0x000–0x111 Ones place: 0: Input phase loss protection disable 1: Input phase loss protection enable Tens place: 0: Output phase loss protection disable 1: Output phase loss protection enable Hundreds place: 0: Input phase loss hardware protection disable 1: Input phase loss hardware protection enable	0x010	○
P11.01	Frequency-decreasing at sudden power loss	0: Enabled 1: Disabled	1	○
P11.02	Frequency decreasing ratio at sudden power loss	Setting range: 0.00Hz/s–P00.03 (the Max. frequency) After the power loss of the grid, the bus voltage drops to the sudden frequency-decreasing point, the VFD begins to decrease the running frequency at P11.02, to make the VFD generate power again. The returning power can maintain the bus voltage to ensure a rated running of the VFD until the recovery of power.	10.00 Hz/s	○

Voltage class	110V	220V	460V
Frequency-decreasing point at sudden power loss	260V	240V	530V

Function code	Name	Description	Default	Modify
		Note: ✧ Adjust the parameter properly to avoid the stopping caused by VFD protection during the switching of the grid. ✧ Prohibit the input phase protection to enable this function.		
P11.03	Overvoltage stall protection	0: Disabled 1: Enabled 	1	○
P11.04	Overvoltage stall protection voltage	110–150% (standard bus voltage) (460V)	120%	○
		110–150% (standard bus voltage) (220V)	120%	
		110–130% (standard bus voltage) (110V)	125%	
P11.05	Current limit action	During the accelerating operation of the VFD, due to the large load, actual rising rate of the motor rotating speed is lower than rising rate of the output frequency. Measures shall be taken to avoid VFD tripping caused by overcurrent during acceleration. 0x00–0x11 Ones place: Current limit action setting 0: Invalid 1: Always valid Tens place: Hardware current limit overload alarm setting 0: Valid 1: Invalid	0x01	◎
P11.06	Automatic current limit level	Current limit protection function detects output current during running, and compares it with the current-limit level defined by P11.06, if it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or run in decreased	160.0%	◎
P11.07	Frequency-drop rate		10.00 Hz/s	◎

Function code	Name	Description	Default	Modify
	during current limit	frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching lower limit frequency. When the output current is detected to be lower than the current-limit level again, it will continue accelerated running.  Setting range of P11.06: 50.0–200.0% (relative to the percentage of rated current of the VFD) Setting range of P11.07: 0.00–50.00Hz/s		
P11.08	Pre-alarm selection for VFD/motor OL/UL	0x0000–0x1131 Ones place: 0: Motor overload/underload pre-alarm, relative to rated motor current; 1: VFD overload/underload pre-alarm, relative to rated VFD current. 2: Motor output torque overload/underload pre-alarm, relative to rated motor torque Tens place: 0: The VFD continues running after overload/underload alarm; 1: The VFD continues running after underload alarm, and stops running after overload fault; 2: The VFD continues running after overload alarm, and stops running after underload fault; 3: The VFD stops running after overload/underload fault. Hundreds place:	0x0000	○

Function code	Name	Description	Default	Modify
		0: Always detect 1: Detect during constant-speed running Thousands place: Overload integral function selection 0: Overload integral is invalid; 1: Overload integral is valid.		
P11.09	Overload pre-alarm detection level	Overload pre-alarm signal will be outputted if the output current of the VFD or motor is higher than overload pre-alarm detection level (P11.09), and the duration exceeds overload pre-alarm detection time (P11.10).	150%	○
P11.10	Overload pre-alarm detection time	 Setting range of P11.09: P11.11–200% (relative value determined by ones place of P11.08) Setting range of P11.10: 0.1–3600.0s	1.0s	○
P11.11	Detection level of the underload pre-alarm	If the VFD current or the output current is lower than P11.11, and its lasting time is beyond P11.12, the VFD will output underload pre-alarm. Setting range of P11.11: 0–P11.09 (relative value determined by ones place of P11.08) Setting range of P11.12: 0.1–3600.0s	50%	○
P11.12	Detection time of the underload pre-alarm		1.0s	○
P11.13	Output terminal action selection	Select the action of fault output terminals on undervoltage and fault reset. 0x00–0x11 Ones place:	0x00	○

Function code	Name	Description	Default	Modify
	during fault	0: Action under fault undervoltage 1: No action under fault undervoltage Tens place: 0: Action during the automatic reset 1: No action during the automatic reset		
P11.16	Extension function selection	0x00–0x11 Ones place: Automatic frequency drop selection at voltage drop 0: Disable 1: Enable Tens place: Second ACC/DEC time selection 0: Disable 1: Enable. When the running frequency exceeds P08.36, ACC/DEC time is switched to the second ACC/DEC time.	0x00	○

P13 group SM control

Function code	Name	Description	Default	Modify
P13.09	Frequency threshold of phase-lock loop switch-in	0.00–630.00	50.00	○
P13.13	Braking current of short circuit	After the VFD starts, when P01.00=0, set P13.14 to non-zero value and begin short circuit braking. After the VFD stops, when the operation frequency is less than P01.09, set P13.15 to non-zero value and begin stopping short-circuit braking and then DC braking. Setting range of P13.13: 0.0–150.0% (relative to the percentage of rated current of the VFD) Setting range of P13.14: 0.00–50.00s	0.0%	○
P13.14	Braking retention time of starting short circuit		0.00s	○
P13.15	Braking retention time of stopping short circuit		0.00s	○

P14 group Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	Setting range: 1–247 When the master is writing the frame, the communication address of the slave is set to 0. The broadcast address is the communication address. All slaves on the Modbus fieldbus can receive the frame, but the salve doesn't answer. The communication address of the VFD is unique in the communication net. This is the fundamental for the point to point communication between the upper monitor and the VFD. **Note:** The address of the slave cannot set to 0.	1	○
P14.01	Communication baud ratio	Set the digital transmission speed between the upper monitor and the VFD. 0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS 6: 57600BPS **Note:** The baud rate between the upper monitor and the VFD must be the same. Otherwise, the communication is not applied. The bigger the baud rate, the quicker the communication speed.	4	○
P14.02	Digital bit checkout	The data format between the upper monitor and the VFD must be the same. Otherwise, the communication is not applied. 0: No check (N,8,1) for RTU 1: Even check (E,8,1) for RTU 2: Odd check (O,8,1) for RTU 3: No check (N,8,2) for RTU 4: Even check (E,8,2) for RTU 5: Odd check (O,8,2) for RTU	1	○

Function code	Name	Description	Default	Modify
		6: No check (N,7,1) for ASCII 7: Even check (E,7,1) for ASCII 8: Odd check (O,7,1) for ASCII 9: No check (N,7,2) for ASCII 10: Even check (E,7,2) for ASCII 11: Odd check (O,7,2) for ASCII 12: No check (N,8,1) for ASCII 13: Even check (E,8,1) for ASCII 14: Odd check (O,8,1) for ASCII 15: No check (N,8,2) for ASCII 16: Even check (E,8,2) for ASCII 17: Odd check (O,8,2) for ASCII		
P14.03	Communication answer delay	0–200ms It means the interval time between the time the VFD receives the data and the time it sends it to the upper monitor. If the answer delay is shorter than the system processing time, then the answer delay time is the system processing time, if the answer delay is longer than the system processing time, then after the system deal with the data, waits until achieving the answer delay time to send the data to the upper monitor.	5	○
P14.04	RS485 communication overtime fault time	0.0 (invalid)–60.0s When the function code is set as 0.0, the communication overtime parameter is invalid. When the function code is set as non-zero, if the interval time between two communications exceeds the communication overtime, the system will report "485 communication faults" (CE).	0.0s	○
P14.05	Transmission fault processing	0: Alarm and stop freely 1: No alarm and continue to run 2: No alarm and stop according to the stop means (only under the communication control) 3: No alarm and stop according to the stop	0	○

Function code	Name	Description	Default	Modify
		means (under all control modes)		
P14.06	Communication processing	0x000–0x111 Ones place: Write operation 0: Write with response: the VFD will respond to all reading and writing commands of the upper monitor. 1: Write without response: the VFD only responds to the reading command of the upper monitor. The communication efficiency can be increased in this mode. Tens place: Communication encryption 0: Disabled 1: Enabled Hundreds place: Self-define the communication command address 0: Disabled 1: Enabled	0x000	○
P14.07	Self-defined address of the running command	0x0000–0xffff	0x1000	○
P14.08	Self-defined address of frequency setting	0x0000–0xffff	0x2000	○

P17 group Status viewing

Function code	Name	Description	Default	Modify
P17.00	Setting frequency	Display current set frequency of the VFD Range: 0.00Hz–P00.03	0.00Hz	●
P17.01	Output frequency	Display current output frequency of the VFD Range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp reference frequency	Display current ramp reference frequency of the VFD Range: 0.00Hz–P00.03	0.00Hz	●
P17.03	Output voltage	Display current output voltage of the VFD Range: 0–1200V	0V	●

Function code	Name	Description	Default	Modify
P17.04	Output current	Display current output current of the VFD Range: 0.0–5000.0A	0.0A	●
P17.05	Motor speed	Display the rotation speed of the motor. Range: 0–65535RPM	0 RPM	●
P17.06	Torque current	Display current torque current of the VFD Range: 0.0–5000.0A	0.0A	●
P17.07	Magnetized current	Display current magnetized current of the VFD Range: 0.0–5000.0A	0.0A	●
P17.08	Motor power	Display current power of the motor. Setting range: -300.0%–300.0% (the rated current of the motor)	0.0A	●
P17.09	Output torque	Display the current output torque of the VFD. Range: -250.0–250.0%	0.0%	●
P17.10	Motor frequency evaluation	Evaluate the motor rotor frequency on open loop vector Range: 0.00– P00.03	0.00Hz	●
P17.11	DC bus voltage	Display current DC bus voltage of the VFD Range: 0.0–2000.0V	0.0V	●
P17.12	Switch input terminals state	Display current Switch input terminals state of the VFD Range: 0x0000–0x00FF	0x0000	●
P17.13	Switch output terminals state	Display current Switch output terminals state of the VFD Range: 0x0000–0x000F	0x0000	●
P17.14	Digital adjustment	Display the adjustment through the keypad of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.15	Torque reference	Display the torque reference, the percentage to the current rated torque of the motor. Setting range: -300.0%–300.0% (of the rated motor current)	0.0%	●
P17.16	Linear speed	Display the current linear speed of the VFD. Range: 0–65535	0	●
P17.18	Counting value	Display the current counting number of the VFD. Range: 0–65535	0	●

Function code	Name	Description	Default	Modify
P17.19	AI1 input voltage	Display analog AI1 input signal Range: 0.00–10.00V	0.00V	●
P17.20	AI2 input voltage	Display analog AI2 input signal Range: 0.00–10.00V	0.00V	●
P17.21	AI3 input voltage	Display analog AI2 input signal Range: -10.00–10.00V	0.00V	●
P17.22	HDI input frequency	Display HDI input frequency Range: 0.000–50.000kHz	0.000kHz	●
P17.23	PID reference value	Display PID reference value Range: -100.0–100.0%	0.0%	●
P17.24	PID feedback value	Display PID feedback value Range: -100.0–100.0%	0.0%	●
P17.25	Power factor of the motor	Display the current power factor of the motor. Range: -1.00–1.00	0.00	●
P17.26	Current running time	Display the current running time of the VFD. Range: 0–65535min	0m	●
P17.27	Simple PLC and the current stage of the multi-step speed	Display simple PLC and the current stage of the multi-step speed Range: 0–15	0	●
P17.28	ASR controller output	The percentage of the rated torque of the relative motor, display ASR controller output Range: -300.0%–300.0% (the rated motor current)	0.0%	●
P17.32	Magnetic flux linkage	Display the magnetic flux linkage of the motor. Range: 0.0%–200.0%	0.0%	●
P17.33	Exciting current reference	Display the exciting current reference in the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Display the torque current reference in the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.35	AC input current	Display the input current in AC side. Range: 0.0–5000.0A	0.0A	●

Function code	Name	Description	Default	Modify
P17.36	Output torque	Display the output torque. Positive value is in the electromotion state, and negative value is in the power generating state. Range: -3000.0Nm–3000.0Nm	0.0Nm	●
P17.37	Motor overload counting	0–100 (Display the "OL1" fault when the count value is 100)	0	●
P17.38	PID output	Display PID output Range: -100.0–100.0%	0.0%	●
P17.39	Reserved			●
P17.40	PID proportional gain in the process	0.00–100.00	0.00	●
P17.41	PID integral time in the process	0.00–10.00s	0.00s	●
P17.42	PID differential time in the process	0.00–10.00s	0.00s	●

Chapter 6 Fault tracking

6.1 Fault prevention

This chapter describes how to carry out preventive maintenance on VFDs.

6.1.1 Periodical maintenance

If the VFD is installed in an environment that meets requirements, little maintenance is needed. The following table describes the routine maintenance periods recommended by INVT. For more detailed information on maintenance, please contact us.

Checking part		Checking item	Checking method	Criterion
Ambient environment		Check the ambient temperature, humidity and vibration and ensure there is no dust, gas, oil fog and water drop.	Visual examination and instrument test	Conforming to the manual
		Ensure there are no tools or other foreign or dangerous objects	Visual examination	There are no tools or dangerous objects.
Voltage		Ensure the main circuit and control circuit are normal.	Measurement by multimeter	Conforming to the manual
Keypad		Ensure the display is clear enough	Visual examination	The characters are displayed normally.
		Ensure the characters are displayed totally	Visual examination	Conforming to the manual
Main circuit	For public use	Ensure the screws are tightened scurrility	Tighten up	NA
		Ensure there is no distortion, crackles, damage or color-changing caused by overheating and aging to the machine and insulator.	Visual examination	NA

Checking part		Checking item	Checking method	Criterion
		Ensure there is no dust and dirtiness	Visual examination	NA **Note:** if the color of the copper blocks change, it does not mean that there is something wrong with the features.
	The lead of the conductors	Ensure that there is no distortion or color-changing of the conductors caused by overheating.	Visual examination	NA
		Ensure that there are no crackles or color-changing of the protective layers.	Visual examination	NA
	Terminals seat	Ensure that there is no damage	Visual examination	NA
	Filter capacitors	Ensure that there is no weeping, color-changing, crackles and cassis expansion.	Visual examination	NA
		Ensure the safety valve is in the right place.	Estimate the usage time according to the maintenance or measure the static capacity.	NA
		If necessary, measure the static capacity.	Measure the capacity by instruments.	The static capacity is above or equal to the original value x 0.85.
	Resistors	Ensure whether there is replacement and splitting caused by overheating.	Smelling and visual examination	NA

Checking part		Checking item	Checking method	Criterion
		Ensure that there is no offline.	Visual examination or remove one ending to coagulate or measure with multimeters	The resistors are in ±10% of the standard value.
	Transformers and reactors	Ensure there is no abnormal vibration, noise and smelling,	Hearing, smelling and visual examination	NA
	Electromagnetism contactors and relays	Ensure whether there is vibration noise in the workrooms.	Hearing	NA
		Ensure the contact is good enough.	Visual examination	NA
Control circuit	PCB and plugs	Ensure there are no loose screws and contactors.	Fasten up	NA
		Ensure there is no smelling and color-changing.	Smelling and visual examination	NA
		Ensure there are no crackles, damage distortion and rust.	Visual examination	NA
		Ensure there is no weeping and distortion to the capacitors.	Visual examination or estimate the usage time according to the maintenance information	NA
Cooling system	Cooling fan	Estimate whether there is abnormal noise and vibration.	Hearing and Visual examination or rotate with hand	Stable rotation
		Estimate there is no losses screw.	Tighten up	NA

Checking part		Checking item	Checking method	Criterion
		Ensure there is no color-changing caused by overheating.	Visual examination or estimate the usage time according to the maintenance information	NA
	Ventilating duct	Ensure whether there is stuff or foreign objection in the cooling fan, air vent.	Visual examination	NA

6.1.2 Cooling fan

The VFD's cooling fan has a minimum life span of 25,000 operating hours. The actual life span depends on the VFD usage and ambient temperature.

The operating hours can be found through P07.14 (accumulative hours of the VFD).

Fan failure can be predicted by the increasing noise from the fan bearings. If the VFD is operated in a critical part of a process, fan replacement is recommended once these symptoms appear. Replacement fans are available from INVT.

✧ Read and follow the instructions in Chapter 1 "Safety precautions". Ignoring the instructions would cause physical injury or death, or damage to the equipment.

1. Stop the VFD and disconnect it from the AC power source and wait for at least the time designated on the VFD.

2. Lever the fan holder off the VFD frame with a screwdriver and lift the hinged fan holder slightly upward from its front edge.

3. Disconnect the fan cable.

4. Remove the fan holder from the hinges.

5. Install the new fan holder including the fan in reverse order.

6. Restore power.

6.1.3 Capacitor

6.1.3.1 Capacitor reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the VFD is delivered.

Storage time	Operational instruction
Less than 1 year	No charging operation is required.
1 to 2 years	The VFD needs to be powered on for 1 hour before the first running command.
2 to 3 years	Use a voltage controlled power supply to charge the VFD: Charge the VFD at 25% of the rated voltage for 30 minutes, and then charge it at 50% of the rated voltage for 30 minutes, at 75% for another 30 minutes, and finally charge it at 100% of the rated voltage for 30 minutes.
More than 3 years	Use a voltage controlled power supply to charge the VFD: Charge the VFD at 25% of the rated voltage for 2 hours, and then charge it at 50% of the rated voltage for 2 hours, at 75% for another 2 hours, and finally charge it at 100% of the rated voltage for 2 hours.

The method of using power surge to charge for the VFD:

The right selection of power surge depends on the supply power of the VFD. Single phase 220V AC/2A power surge applied to the VFD with single/three-phase 220V AC as its input voltage. The VFD with single/three-phase 220V AC as its input voltage can apply Single phase 220V AC/2A power surge (L+ to R and N to S or T). All DC bus capacitors charge at the same time because there is one rectifier.

High-voltage VFD needs enough voltage (for example, 460V) during charging. The small capacitor power (2A is enough) can be used because the capacitor nearly does not need current when charging.

6.1.3.2 Electrolytic capacitor replacement

✧ Read and follow the instructions in Chapter 1 "Safety precautions". Ignoring the instructions may cause physical injury or death, or damage to the equipment.

The electrolytic capacitor of the VFD must be replaced if it has been used for more than 35,000 hours. For details about the replacement, contact the local INVT office or dial our national service hotline (400-700-9997).

6.1.4 Power cable

✧ Read and follow the instructions in Chapter 1 "Safety precautions". Ignoring the instructions may cause physical injury or death, or damage to the equipment.

1. Stop the VFD and disconnect it from the power line. Wait for at least the time designated on the VFD.

2. Check the tightness of the power cable connections.

3. Restore power.

6.2 Fault handling

✧ Only qualified electricians are allowed to maintain the VFD. Read the safety instructions in Chapter 1 "Safety precautions" before working on the VFD.

6.2.1 Indications of alarms and faults

Fault is indicated by LEDs. See Chapter 4 "Keypad operation". When TRIP light is on, an alarm or fault message on the panel display indicates abnormal VFD state. Using the information given in this chapter, most alarm and fault cause can be identified and corrected. If not, contact with the INVT office.

6.2.2 Fault reset

The VFD can be reset by pressing the keypad key STOP/RST, through digital input, or by switching the power light. When the fault has been removed, the motor can be restarted.

6.2.3 VFD faults and solutions

When a fault occurred, handle the fault as follows.

1. Check to ensure there is nothing wrong with the keypad. If not, please contact with the local INVT office.

2. If there is nothing wrong, please check P07 and ensure the corresponding recorded fault parameters to confirm the real state when the current fault occurs by all parameters.

3. See the following table for detailed solution and check the corresponding abnormal state.

4. Eliminate the fault and ask for relative help.

5. Check to eliminate the fault and carry out fault reset to run the VFD.

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	Solutions
OUt1	[1] Inverter unit U phase protection	● The acceleration is too fast. ● IGBT module fault. ● Misacts caused by	● Increase ACC time. ● Change the power unit. ● Check the driving
OUt2	[2] Inverter unit V phase protection		

Fault code	Fault type	Possible cause	Solutions
OUt3	[3] Inverter unit W phase protection	interference. ● The connection of the driving wires is not good. ● Grounding is not properly.	wires. ● Inspect external equipment and eliminate interference.
OC1	[4] Overcurrent during acceleration	● The acceleration or deceleration is too fast. ● The voltage of the grid is too low. ● The power of the VFD is too low. ● The load transients or is abnormal. ● The grounding is short circuited or the output is phase loss. ● There is strong external interference. ● The overvoltage stall protection is not open.	● Increase the ACC time. ● Check the input power. ● Select the VFD with a larger power. ● Check if the load is short circuited (the grounding short circuited or the wire short circuited) or the rotation is not smooth. ● Check the output configuration. ● Check if there is strong interference. ● Check the setting of relative function codes.
OC2	[5] Overcurrent during deceleration		
OC3	[6] Overcurrent during constant speed running		
OV1	[7] Overvoltage during acceleration	● The input voltage is abnormal. ● There is large energy feedback. ● No braking components. ● Braking energy is not open.	● Check the input power. ● Check if the DEC time of the load is too short or the VFD starts during the rotation of the motor or it needs to increase the energy consumption components. ● Install the braking components. ● Check the setting of relative function
OV2	[8] Overvoltage during deceleration		
OV3	[9] Overvoltage during constant speed running		

Fault code	Fault type	Possible cause	Solutions
			codes.
UV	[10] Bus undervoltage	● The voltage of the power supply is too low. ● The overvoltage stall protection is not open.	● Check the input power of the supply line. ● Check the setting of relative function codes.
OL1	[11] Motor overload	● The voltage of the power supply is too low. ● The motor setting rated current is incorrect. ● The motor stall or load transients is too strong.	● Check the power of the supply line. ● Reset the rated current of the motor. ● Check the load and adjust the torque lift.
OL2	[12] VFD overload	● The acceleration is too fast. ● Reset the rotating motor. ● The voltage of the power supply is too low. ● The load is too heavy. ● Close loop vector control, reverse direction of the code panel and long low-speed operation.	● Increase the ACC time. ● Avoid the restarting after stopping. ● Check the power of the supply line. ● Select a VFD with bigger power. ● Select a proper motor.
SPI	[13] Phase loss on input side	● Phase loss or fluctuation of input R,S,T.	● Check input power. ● Check installation distribution.
SPO	[14] Phase loss on output side	● U,V,W phase loss input (or serious asymmetrical three phase of the load).	● Check the output distribution. ● Check the motor and cable.

Fault code	Fault type	Possible cause	Solutions
OH1	[15] Rectifier module overheat	● Air duct jam or fan damage. ● Ambient temperature is too high. ● The time of overload running is too long.	● Dredge the vent duct or replace the fan. ● Low the ambient temperature.
OH2	[16] Inverter module overheat		
EF	[17] External fault	● SI external fault input terminals action.	● Check the external device input.
CE	[18] 485 communication fault	● The baud rate setting is incorrect. ● Fault occurs to the communication wiring. ● The communication address is wrong. ● There is strong interference to the communication.	● Set proper baud rate. ● Check the communication connection distribution. ● Set proper communication address. ● Chang or replace the connection distribution or improve the anti-interference capability.
ItE	[19] Current detection fault	● The control panel connector is in poor contact. ● An exception occurs on the magnifying circuit.	● Check the connector and re-plug. ● Change the main control panel.
tE	[20] Motor autotuning fault	● The motor capacity does not comply with the VFD capability. ● The rated parameter of the motor does not set correctly. ● The offset between the parameters from autotune and the	● Change the VFD mode. ● Set the rated parameter according to the motor name plate. ● Empty the motor load. ● Check the motor connection and set

Fault code	Fault type	Possible cause	Solutions
		standard parameter is huge. ● Autotune overtime.	the parameter. ● Check if the upper limit frequency is above 2/3 of the rated frequency.
EEP	[21] EEPROM operation fault	● Error of controlling the write and read of the parameters. ● Damage to EEPROM.	● Press STOP/RST to reset. ● Change the main control panel.
PIDE	[22] PID feedback offline fault	● PID feedback offline. ● PID feedback source disappear.	● Check the PID feedback signal. ● Check the PID feedback source.
bCE	[23] Braking unit fault	● Braking circuit fault or damage to the braking pipes. ● The external braking resistor is not sufficient.	● Check the braking unit and, change new braking pipe. ● Increase the braking resistor.
END	[24] Running time reached	● The actual running time of the VFD is above the internal setting running time.	● Ask for the supplier and adjust the setting running time.
OL3	[25] Electronic overload	● The VFD will report overload pre-alarm according to the set value.	● Check the load and the overload pre-alarm point.
PCE	[26] Keypad communication error	● The keypad is not in good connection or offline. ● The keypad cable is too long and there is strong interference. ● Part of the communication circuits of the keypad or main board have fault.	● Check the keypad cable and and ensure it is normal. ● Check the environment and eliminate the interference source. ● Change hardware and ask for maintenance service.

Fault code	Fault type	Possible cause	Solutions
UPE	[27] Parameter upload error	● The keypad is not in good connection or offline. ● The keypad cable is too long and there is strong interference. ● Part of the communication circuits of the keypad or main board have fault.	● Check the environment and eliminate the interference source. ● Change hardware and ask for maintenance service. ● Change hardware and ask for maintenance service.
DNE	[28] Parameter download error	● The keypad is not in good connection or offline. ● The keypad cable is too long and there is strong interference. ● Data storage error in keypad.	● Check the environment and eliminate the interference source. ● Change hardware and ask for maintenance service. ● Backup data in the keypad again.
ETH1	[32] To-ground short-circuit fault 1	● The output of the VFD is short circuited with the ground. ● There is fault in the current detection circuit. ● There is a great difference between the actual motorpower setting and the VFD power.	● Check if the connection of the motor is normal or not. ● Change the hall. ● Change the main control panel. ● Reset the correct motor parameter.
ETH2	[33] To-ground short-circuit fault 2		
dEu	[34] Speed deviation fault	● Load is too heavy, or stall occurred.	● Check the load to ensure it is proper, increase the detection time. ● Check whether control parameters are set properly.

Fault code	Fault type	Possible cause	Solutions
STo	[35] Mal-adjustment fault	● Control parameters of synchronous motor are set improperly. ● The parameter gained from autotuning is inaccurate. ● The VFD is not connected to motor.	● Check the load to ensure it is proper. ● Check whether control parameters are set correctly. ● Increase maladjustment detection time.
LL	[36] Electronic underload fault	● The VFD will report the underload pre-alarm according to the set value.	● Check the load and the underload pre-alarm point.

6.2.4 Other states

Fault code	Fault type	Possible cause	Solutions
PoFF	System power off	● System power off or low DC voltage.	● Check the grid.

Chapter 7 Communication protocol

7.1 Modbus protocol introduction

Modbus protocol is a software protocol and common language which is applied in the electrical controller. With this protocol, the controller can communicate with other devices via network (the channel of signal transmission or the physical layer, such as RS485). And with this industrial standard, the controlling devices of different manufacturers can be connected to an industrial network for the convenient of being monitored.

There are two transmission modes for Modbus protocol: ASCII mode and RTU (Remote Terminal Units) mode. On one Modbus network, all devices should select same transmission mode and their basic parameters, such as baud rate, digital bit, check bit, and stopping bit should have no difference.

Modbus network is a controlling network with single-master and multiple slaves, which means that there is only one device performs as the master and the others are the slaves on one Modbus network. The master means the device which has active talking right to sent message to Modbus network for the controlling and inquiring to other devices. The slave means the passive device which sends data message to the Modbus network only after receiving the controlling or inquiring message (command) from the master (response). After the master sends message, there is a period of time left for the controlled or inquired slaves to response, which ensure there is only one slave sends message to the master at a time for the avoidance of singles impact.

Generally, the user can set PC, PLC, IPC and HMI as the masters to realize central control. Setting certain device as the master is a promise other than setting by a bottom or a switch or the device has a special message format. For example, when the upper monitor is running, if the operator clicks sending command bottom, the upper monitor can send command message actively even it cannot receive the message from other devices. In this case, the upper monitor is the master. And if the designer makes the VFD send the data only after receiving the command, then the VFD is the slave.

The master can communicate with any single slave or with all slaves. For the single-visiting command, the slave should feedback a response message; for the broadcasting message from the master, the slave does not need to feedback the response message.

7.2 Application

The Modbus protocol of the VFD is RTU mode and the physical layer is 2-wire RS485.

7.2.1 2-wire RS485

The interface of 2-wire RS485 works on semiduplex and its data signal applies differential transmission which is called balance transmission, too. It uses twisted pairs, one of which is

defined as A (+) and the other is defined as B (-). Generally, if the positive electrical level between sending drive A and B is among +2–+6V, it is logic "1", if the electrical level is among -2V–-6V; it is logic "0".

485+ on the terminal board corresponds to A and 485- to B.

Communication baud rate means the binary bit number in one second. The unit is bit/s (bps). The higher the baud rate is, the quicker the transmission speed is and the weaker the anti-interference is. If the twisted pairs of 0.56mm (24AWG) is applied as the communication cables, the Max. Transmission distance is as below:

Baud rate	Max. transmission distance	Baud rate	Max. transmission distance	Baud rate	Max. transmission distance	Baud rate	Max. transmission distance
2400 BPS	1800m	4800 BPS	1200m	9600 BPS	800m	19200 BPS	600m

It is recommended to use shield cables and make the shield layer as the grounding wires during RS485 remote communication.

In the cases with less devices and shorter distance, it is recommended to use 120Ω terminal resistor as the performance will be weakened if the distance increase even though the network can perform well without load resistor.

7.2.1.1 When one VFD is used

Figure 7-1 is the site Modbus connection figure of single VFD and PC. Generally, the computer does not have RS485 interface, the RS232 or USB interface of the computer should be converted into RS485 by converter. Connect the A terminal of RS485 to the 485+ terminal of the VFD and B to the 485- terminal. It is recommended to use the shield twisted pairs. When applying RS232-RS485 converter, if the RS232 interface of the computer is connected to the RS232 interface of the converter, the wire length should be as short as possible within the length of 15m. It is recommended to connect the RS232-RS485 converter to the computer directly. If using USB-RS485 converter, the wire should be as short as possible, too.

Select a right interface to the upper monitor of the computer (select the interface of RS232-RS485 converter, such as COM1) after the wiring and set the basic parameters such as communication baud rate and digital check bit to the same as the VFD.

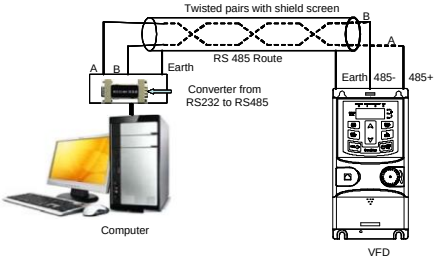


Figure 7-1 RS485 wiring diagram for the network with one VFD

7.2.1.2 When multiple VFDs are used

In real multi-applications, the chrysanthemum connection and star connection are commonly used.

Chrysanthemum chain connection is required in the RS485 industrial fieldbus standards. The two ends are connected to terminal resistors of 120Ω which is shown as Figure 7-2.

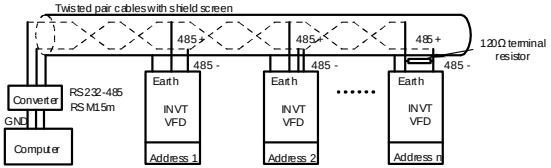


Figure 7-2 Practical application diagram of chrysanthemum connection

Figure 7-3 is the star connection. Terminal resistor should be connected to the two devices which have the longest distance. (1# and 15#device)

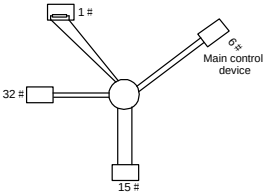


Figure 7-3 Star connection

It is recommended to use shield cables in multiple connection. The basic parameter of the devices, such as baud rate and digital check bit in RS485 should be the same and there should be no repeated address.

7.2.2 RTU mode

7.2.2.1 RTU communication frame structure

If the controller is set to communicate by RTU mode in Modbus network every 8bit byte in the message includes two 4Bit hex characters. Compared with ACSII mode, this mode can send more data at the same baud rate.

Code system

- 1 start bit
- 7 or 8 digital bit, the minimum valid bit can be sent firstly. Every 8 bit frame includes two hex characters (0...9, A...F)
- 1 even/odd check bit . If there is no checkout, the even/odd check bit is inexistent.
- 1 stop bit (with checkout), or 2 bit (no checkout)

Error detection domain

- CRC

The data format is illustrated as below:

11-bit character frame (BIT1–BIT8 are the digital bits)

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	BIT8	Check bit	Stop bit

10-bit character frame (BIT1–BIT7 are the digital bits)

Start bit	BIT1	BIT 2	BIT3	BIT4	BIT5	BIT6	BIT7	Check bit	Stop bit

In one character frame, the digital bit takes effect. The start bit, check bit and stop bit is used to send the digital bit right to the other device. The digital bit, even/odd checkout and stop bit should be set as the same in real application.

The Modbus minimum idle time between frames should be no less than 3.5 bytes. The network device is detecting, even during the interval time, the network bus. When the first field (the address field) is received, the corresponding device decodes next transmitting character. When the interval time is at least 3.5 byte, the message ends.

The whole message frame in RTU mode is a continuous transmitting flow. If there is an interval time (more than 1.5 bytes) before the completion of the frame, the receiving device will

renew the uncompleted message and suppose the next byte as the address field of the new message. As such, if the new message follows the previous one within the interval time of 3.5 bytes, the receiving device will deal with it as the same with the previous message. If these two phenomena all happen during the transmission, the CRC will generate a fault message to respond to the sending devices.

The standard structure of RTU frame:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	Communication address: 0–247 (decimal system) (0 is the broadcast address)
CMD	03H: read slave parameters 06H: write slave parameters
DATA (N-1) … DATA (0)	The data of 2 x N bytes are the main content of the communication as well as the core of data exchanging
CRC CHK low bit	Detection value: CRC (16 BIT)
CRC CHK high bit	
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

7.2.2.2 RTU communication frame error check modes

Various factors (such as electromagnetic interference) may cause error in the data transmission. For example, if the sending message is logic "1", A-B potential difference on RS485 should be 6V, but in reality, it may be -6V because of electromagnetic interference, and then the other devices take the sent message as logic "0". If there is no error checkout, the receiving devices will not find the message is wrong and they may give incorrect response which cause serious result. So the checkout is essential to the message.

The theme of checkout is that: the sender calculate the sending data according to a fixed formula, and then send the result with the message. When the receiver gets this message, they will calculate anther result according to the same method and compare it with the sending one. If two results are the same, the message is correct. If not, the message is incorrect.

The error checkout of the frame can be divided into two parts: the bit checkout of the byte and the whole data checkout of the frame (CRC check).

Bit check on individual bytes (odd/even check)

The user can select different bit checkouts or non-checkout, which impacts the check bit setting of each byte.

The definition of even checkout: add an even check bit before the data transmission to illustrate the number of "1" in the data transmission is odd number or even number. When it is even, the check byte is "0", otherwise, the check byte is "1". This method is used to stabilize

the parity of the data.

The definition of odd checkout: add an odd check bit before the data transmission to illustrate the number of "1" in the data transmission is odd number or even number. When it is odd, the check byte is "0", otherwise, the check byte is "1". This method is used to stabilize the parity of the data.

For example, when transmitting "11001110", there are five "1" in the data. If the even checkout is applied, the even check bit is "1"; if the odd checkout is applied; the odd check bit is "0". The even and odd check bit is calculated on the check bit position of the frame. And the receiving devices also carry out even and odd checkout. If the parity of the receiving data is different from the setting value, there is an error in the communication.

Cyclical Redundancy Check (CRC) method

The checkout uses RTU frame format. The frame includes the frame error detection field which is based on the CRC calculation method. The CRC field is two bytes, including 16 figure binary values. It is added into the frame after calculated by transmitting device. The receiving device recalculates the CRC of the received frame and compares them with the value in the received CRC field. If the two CRC values are different, there is an error in the communication.

During CRC, 0 x FFFF will be stored. And then, deal with the continuous 6-above bytes in the frame and the value in the register. Only the 8Bit data in every character is effective to CRC, while the start bit, the end and the odd and even check bit is ineffective.

The calculation of CRC applies the international standard CRC checkout principles. When the user is editing CRC calculation, he can refer to the relative standard CRC calculation to write the required CRC calculation program.

Here provided a simple function of CRC calculation for the reference (programmed with C language):

```
unsigned int crc_cal_value (unsigned char x data_value,unsigned char
data_length)

{

int i;

unsigned int crc_value=0xffff;

while(data_length--)

{   crc_value^= x data_value++;

           for(i=0;i<8;i++)

           {
```

```
if(crc_value&0x0001)crc_value=(crc_value>>1)^0xa001;

           else crc_value=crc_value>>1;

           }     }

return(crc_value);

}
```

In ladder logic, CKSM calculated the CRC value according to the frame with the table inquiry. The method is advanced with easy program and quick calculation speed. But the ROM space the program occupied is huge. So use it with caution according to the program required space.

7.3 RTU command code and communication data

7.3.1 Command code 03H

03H (correspond to binary 0000 0011), reading N words (continuously up to 16 words)

Command code 03H means that if the master read data from the VFD, the reading number depends on the "data number" in the command code. The Max. Continuous reading number is 16 and the parameter address should be continuous. The byte length of every data is 2 (one word). The following command format is illustrated by hex (a number with "H" means hex) and one hex occupies one byte.

The command code is used to read the working stage of the VFD.

For example, read continuous 2 data content from0004H from the VFD with the address of 01H (read the content of data address of 0004H and 0005H), the frame structure is as below:

RTU master command message (from the master to the VFD)

START	T1-T2-T3-T4
ADDR	01H
CMD	03H
High bit of the start address	00H
Low bit of the start address	04H
High bit of data number	00H
Low bit of data number	02H
CRC low bit	85H
CRC high bit	CAH
END	T1-T2-T3-T4

T1-T2-T3-T4 between START and END is to provide at least the time of 3.5 bytes as the leisure time and distinguish two messages for the avoidance of taking two messages as one message.

ADDR = 01H means the command message is sent to the VFD with the address of 01H and ADDR occupies one byte

CMD=03H means the command message is sent to read data from the VFD and CMD occupies one byte

"Start address" means reading data from the address and it occupies 2 bytes with the fact that the high bit is in the front and the low bit is in the behind.

"Data number" means the reading data number with the unit of word. If the "start address is 0004H and the "data number" is 0002H, the data of 0004H and 0005H will be read.

CRC occupies 2 bytes with the fact that the high bit is in the front and the low bit is in the behind.

RTU slave response message (from the VFD to the master)

START	T1-T2-T3-T4
ADDR	01H
CMD	03H
Byte number	04H
Data high bit of address 0004H	13H
Data low bit of address 0004H	88H
Data high bit of address 0005H	00H
Data low bit of address 0005H	00H
CRC CHK low bit	7EH
CRC CHK high bit	9DH
END	T1-T2-T3-T4

The meaning of the response is that:

ADDR = 01H means the command message is sent to the VFD with the address of 01H and ADDR occupies one byte

CMD=03H means the message is received from the VFD to the master for the response of reading command and CMD occupies one byte

"Byte number" means all byte number from the byte (excluding the byte) to CRC byte (excluding the byte). 04 means there are 4 byte of data from the "byte number" to "CRC CHK low bit", which are "digital address 0004H high bit", "digital address 0004H low bit", "digital address 0005H high bit" and "digital address 0005H low bit".

There are 2 bytes stored in one data with the fact that the high bit is in the front and the low bit

is in the behind of the message, the data of data address 0004H is 1388H, and the data of data address 0005H is 0000H.

CRC occupies 2 bytes with the fact that the high bit is in the front and the low bit is in the behind.

7.3.2 Command code 06H

06H (correspond to binary 0000 0110), writing a word

The command means that the master write data to the VFD and one command can write one data other than multiple dates. The effect is to change the working mode of the VFD.

For example, write 5000 (1388H) to 0004H from the VFD with the address of 02H, the frame structure is as below:

RTU master command message (from the master to the VFD)

START	T1-T2-T3-T4
ADDR	02H
CMD	06H
High bit of writing data address	00H
Low bit of writing data address	04H
High bit of data content	13H
Low bit of data content	88H
CRC CHK low bit	C5H
CRC CHK high bit	6EH
END	T1-T2-T3-T4

RTU slave response message (from the VFD to the master)

START	T1-T2-T3-T4
ADDR	02H
CMD	06H
High bit of writing data address	00H
Low bit of writing data address	04H
High bit of data content	13H

Low bit of data content	88H
CRC CHK low bit	C5H
CRC CHK high bit	6EH
END	T1-T2-T3-T4

Note: Sections 7.3.1 and 7.3.2 mainly describe the command formats.

7.3.3 Command code 10H, continuous writing

Command code 10H means that if the master writes data to the VFD, the data number depends on the "data number" in the command code. The Max. continuous reading number is 16.

For example, write 5000 (1388H) to 0004H of the VFD whose slave address is 02H and 50 (0032H) to 0005H, the frame structure is as below:

The RTU request command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
High bit of write data	00H
Low bit of write data	04H
High bit of data number	00H
Low bit of data number	02H
Byte number	04H
High bit of data 0004H	13H
Low bit of data 0004H	88H
High bit of data 0005H	00H
Low bit of data 0005H	32H
Low bit of CRC	C5H
High bit of CRC	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The RTU response command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of write data	00H
LSB of write data	04H
MSB of data number	00H

LSB of data number	02H
LSB of CRC	C5H
MSB of CRC	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

7.4 Data address definition

The address definition of the communication data in this part is to control the running of the VFD and get the state information and relative function parameters of the VFD.

7.4.1 Function code address format rules

The parameter address occupies 2 bytes with the high bit in the front and the low bit in the rear. The range of high and low byte are: high byte—00–ffH; low byte—00–ffH. The high byte is the group number before the radix point of the function code and the low byte is the number after the radix point. But both the high byte and the low byte should be changed into hex. For example P05.05, the group number before the radix point of the function code is 05, then the high bit of the parameter is 05, the number after the radix point 05, then the low bit of the parameter is 05, then the function code address is 0505H and the parameter address of P10.01 is 0A01H.

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once. 1: Keep running in the final value after running once. 2. Cyclic running.	0	○
P10.01	Simple PLC memory selection	0: No memory after power-off 1: Memory after power-off	0	○

Note: P29 group is the factory parameter which cannot be read or changed. Some parameters cannot be changed when the VFD is in the running state and some parameters cannot be changed in any state. The setting range, unit and relative instructions should be paid attention to when modifying the function code parameters.

Besides, EEPROM is stocked frequently, which may shorten the usage time of EEPROM. For users, some functions are not necessary to be stocked on the communication mode. The needs can be met on by changing the value in RAM. Changing the high bit of the function code from 0 to 1 can also realize the function. For example, the function code P00.07 is not stocked into EEPROM. Only by changing the value in RAM can set the address to 8007H. This address can only be used in writing RAM other than reading. If it is used to read, it is an invalid address.

7.4.2 Description of other function addresses in Modbus

The master can operate on the parameters of the VFD as well as control the VFD, such as running or stopping and monitoring the working state of the VFD.

Below is the parameter list of other functions.

Function	Address	Data description	R/W characteristics
Communication control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jogging stop	
The address of the communication setting value	2001H	Communication setting frequency (0–Fmax(unit: 0.01Hz))	R/W
	2002H	PID reference, range (0–1000, 1000 corresponds to 100.0%)	
	2003H	PID feedback, range (0–1000, 1000 corresponds to 100.0%)	R/W
	2004H	Torque setting value (-3000–3000, 1000 corresponds to the 100.0% of the rated current of the motor)	R/W
	2005H	The upper limit frequency setting during forward rotation (0–Fmax(unit: 0.01Hz))	R/W
	2006H	The upper limit frequency setting during reverse rotation (0–Fmax(unit: 0.01Hz))	R/W
	2007H	The upper limit torque of electromotion torque (0–3000, 1000 corresponds to the 100.0% of the rated current of the motor)	R/W
	2008H	The upper limit torque of braking torque (0–3000, 1000 corresponds to the 100.0% of the rated current of the motor)	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 prohibit =0: torque control prohibit invalid	R/W

Function	Address	Data description	R/W characteristics
		Bit3: =1 power consumption clear =0: no power consumption clear Bit4: =1 pre-exciting =0: pre-exciting prohibition Bit5: =1 DC braking =0: DC braking prohibition	
	200AH	Virtual input terminal command, range: 0x000–0x1FF	R/W
	200BH	Virtual output terminal command, range: 0x00–0x0F	R/W
	200CH	Voltage setting value (special for V/F separation) (0–1000, 1000 corresponds to the 100.0% of the rated voltage of the motor)	R/W
	200DH	AO output setting 1 (-1000–1000, 1000 corresponds to 100.0%)	R/W
	200EH	AO output setting 2 (-1000–1000, 1000 corresponds to 100.0%)	R/W
SW 1 of the VFD	2100H	0001H: Forward running	R
		0002H: Forward running	
		0003H: Stop	
		0004H: Fault	
		0005H: POFF state	
		0006H: Pre-exciting state	
SW 1 of the VFD	2101H	Bit0: =0: bus voltage is not established =1: bus voltage is established Bit1–2: =00: motor 1 =01: motor 2 =10: motor 3 =11: motor 4 Bit3: =0: asynchronous motor =1: synchronous motor Bit4: =0: pre-alarm without overload =1: overload pre-alarm Bit5–Bit6: =00: keypad control =01: terminal control =10: communication control	R
Fault code of the VFD	2102H	See the fault type instruction	R

Function	Address	Data description		R/W characteristics
Identifying code of the VFD	2103H	GD20-UL-----0x0106		R
Running frequency	3000H	0–Fmax, unit: 0.01Hz	Compatible with the communication addresses of GD, CHF100A, and CHV100 series.	R
Set frequency	3001H	0–Fmax, unit: 0.01Hz		R
Bus voltage	3002H	0.0–2000.0V, unit: 0.1V		R
Output voltage	3003H	0–1200V, unit: 1V		R
Output current	3004H	0.0–3000.0A, unit: 0.1A		R
Rotating speed	3005H	0–65535, unit: 1RPM		R
Output power	3006H	-300.0–300.0%, unit: 0.1%		R
Output torque	3007H	-250.0–250.0%, unit: 0.1%		R
PID setting	3008H	-100.0–100.0%, unit: 0.1%		R
PID feedback	3009H	-100.0–100.0%, unit: 0.1%		R
Input state	300AH	000–1FF		R
Output state	300BH	000–1FF		R
AI 1	300CH	0.00–10.00V, unit: 0.01V		R
AI 2	300DH	0.00–10.00V, unit: 0.01V		R
AI 3	300EH	-10.00–10.00V, unit: 0.01V		R
AI 4	300FH	Reserved		R
Read input of high speed pulse 1	3010H	0.000–50.000kHz, unit: 0.01Hz		R
Read input of high speed pulse 2	3011H	Reserved		R
PLC and current step of multi-step speed	3012H	0–15		R

Function	Address	Data description		R/W characteristics
External length	3013H	0–65535		R
External count value	3014H	0–65535		R
Torque setting	3015H	-300.0–300.0%, unit: 0.1%		R
VFD identification code	3016H			R
Fault code	5000H			R

R/W characteristics means the function is with read and write characteristics. For example, "communication control command" is writing chrematistics and control the VFD with writing command (06H). R characteristic can only read other than write and W characteristic can only write other than read.

Note: when operating on the VFD with the table above, it is necessary to enable some parameters. For example, the operation of running and stopping, it is necessary to set P00.01 to communication running command channel and set P00.02 to Modbus communication channel. And when operate on "PID reference", it is necessary to set P09.00 to "Modbus communication setting".

The encoding rules for device codes (corresponds to identifying code 2103H of the VFD)

MSB of code	Meaning	LSB of code	Meaning
01	Goodrive	06	Goodrive20-UL Vector VFD

Note: The code consists of 16 bits which is high 8 bits and low 8 bits. High 8 bits mean the motor type series and low 8 bits mean the derived motor types of the series. For example, 0110H means Goodrive20-UL vector VFDs.

7.4.3 Fieldbus scale

The communication data is expressed by hex in actual application and there is no radix point in hex. For example, 50.12Hz cannot be expressed by hex so 50.12 can be magnified by 100 times into 5012, so hex 1394H can be used to express 50.12.

A non-integer can be timed by a multiple to get an integer and the integer can be called fieldbus ratio values.

The fieldbus ratio values are referred to the radix point of the setting range or default value in the function parameter list. If there are figures behind the radix point (n=1), then the fieldbus

ratio value m is 10^n. Take the table as the example:

Function code	Name	Description	Default	Modify
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid when P01.19 is 2)	0.0s	○
P01.21	Restart after power off	0: Disable 1: Enable	0	○

If there is one figure behind the radix point in the setting range or the default value, then the fieldbus ratio value is 10. if the data received by the upper monitor is 50, then the "hibernation restore delay time" is 5.0 (5.0=50÷10).

If Modbus communication is used to control the hibernation restore delay time as 5.0s. Firstly, 5.0 can be magnified by 10 times to integer 50 (32H) and then this data can be sent.

01	06	01 14	00 32	49 E7
VFD address	Write command	Parameters address	Data number	CRC check

After the VFD receives the command, it will change 50 into 5 according to the fieldbus ratio value and then set the hibernation restore delay time as 5s.

Another example, after the upper monitor sends the command of reading the parameter of hibernation restore delay time ,if the response message of the VFD is as following:

01	03	02	00 32	39 91
VFD address	Read command	2-byte data	Parameters data	CRC check

Because the parameter data is 0032H (50) and 50 divided by 10 is 5, then the hibernation restore delay time is 5s.

7.4.4 Error message response

Operation errors may occur in communication-based control. For example, some parameters can only be read, but a write command is transmitted. In this case, the VFD returns an error message response. Error message responses are sent from the VFD to the master. The following table describes the codes and definitions of the error message responses.

Code	Name	Meaning
01H	Invalid command	The command code received by the upper computer is not allowed to be executed. The possible causes are as follows: • The function code is applicable only on new devices and is not implemented on this device. • The slave is in the faulty state when processing this

Code	Name	Meaning
		request.
02H	Invalid data address.	For the VFD, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and the number of the to-be-transmitted bytes is invalid.
03H	Invalid data 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 transmitted by the upper computer is incorrect, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the upper computer is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the upper computer cannot be modified during the running of the VFD.
09H	Password protection	A user password is set, and the upper computer does not provide the password to unlock the system when performing a read or write operation. The error of "system locked" is reported.

The slave uses functional code fields and fault addresses to indicate it is a normal response or some error occurs (named as objection response). For normal responses, the slave shows corresponding function codes, digital address or sub-function codes as the response. For objection responses, the slave returns a code which equals the normal code, but the first byte is logic 1.

For example: when the master sends a message to the slave, requiring it to read a group of address data of the VFD function codes, there will be following function codes:

0 0 0 0 0 0 1 1 (Hex 03H)

For normal responses, the slave responds the same codes, while for objection responses, it will return:

1 0 0 0 0 0 1 1 (Hex 83H)

Besides the function codes modification for the objection fault, the slave will respond a byte of abnormal code which defines the error reason.

When the master receives the response for the objection, in a typical processing, it will send the message again or modify the corresponding order.

For example, set the "running command channel" of the VFD (P00.01, parameter address is 0001H) with the address of 01H to 03, the command is as following:

01	06	00 01	00 03	98 0B
VFD address	Write command	Parameters address	Parameters data	CRC check

But the setting range of "running command channel" is 0–2, if it is set to 3, because the number is beyond the range, the VFD will return fault response message as below:

01	86	04	43 A3
VFD address	Abnormal response code	Fault code	CRC check

Abnormal response code 86H means the abnormal response to writing command 06H; the fault code is 04H. In the table above, its name is operation failed and its meaning is that the parameter setting in parameter writing is invalid. For example, the function input terminal cannot be set repeatedly.

7.5 Read/Write operation example

7.5.1 Examples of reading command 03H

Read the state word 1 of the VFD with the address of 01H (see section 7.4.2 "Description of other function addresses in Modbus"). The parameter address of the state word 1 of the VFD is 2100H.

The command sent to the VFD:

01	03	21 00	00 01	8E 36
VFD address	Read command	Parameters address	Data number	CRC check

If the response message is as below:

01	03	02	00 03	F8 45
VFD address	Read command	Data number	Data content	CRC check

The data content is 0003H. From the table 1, the VFD stops.

Watch "the current fault type" to "the previous 5 times fault type" of the VFD through commands, the corresponding function code is P07.27–P07.32 and corresponding parameter address is 071BH – 0720H (there are 6 from 071BH).

The command sent to the VFD:

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

If the response message is as below:

03	03	0C	00 23	00 23	00 23	00 23	00 23	00 23	5F D2
VFD address	Read command	Byte number	Type of current fault	Type of last fault	Type of last but one fault	Type of last but two fault	Type of last but three fault	Type of last but four fault	CRC check

See from the returned data, all fault types are 0023H (decimal 35) with the meaning of maladjustment (STo).

7.5.2 Examples of write command 06H

Set the VFD whose address is 03H to be forward running. See section 7.4.2 "Description of other function addresses in Modbus", the address of "Communication-based control command" is 2000H, and 0001H indicates forward running. See the table below.

Function	Address	Data description	R/W characteristics
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	

The command sent by the master:

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

If the operation is successful, the response may be as below (the same with the command sent by the master):

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

Set the Max. output frequency of the VFD with the address of 03H to 100Hz.

Function code	Name	Description	Default	Modify
P00.03	Max. output frequency	Used to set the max. output frequency of the VFD. It is the basis of frequency setup and the acceleration/deceleration. Setting range: P00.04–400.00Hz	50.00Hz	©

See the figures behind the radix point, the fieldbus ratio value of the Max. output frequency (P00.03) is 100. 100Hz timed by 100 is 10000 and the corresponding hex is 2710H.

The command sent by the master:

03	06	00 03	27 10	62 14
VFD address	Write command	Parameters address	Parameter data	CRC check

If the operation is successful, the response may be as below (the same with the command sent by the master):

03	06	00 03	27 10	62 14
VFD address	Write command	Parameters address	Parameter data	CRC check

Note: the blank in the above command is for illustration. The blank cannot be added in the actual application unless the upper monitor can remove the blank by themselves.

7.5.3 Examples of continuously writing command 10H

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10Hz. See section 7.4.2 "Description of other function addresses in Modbus", the address of "Communication-based control command" is 2000H, and 0001H indicates forward running.

The address of "Communication-based frequency setting" is 2001H and 10Hz corresponds to 03E8H. See the table below.

Function	Address	Data description	R/W characteristics
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging stop	
The address of communication setting	2001H	Communication-based frequency setting (0–Fmax (unit: 0.01Hz))	R/W
	2002H	PID reference, range (0–1000, 1000 corresponds to100.0%)	

Set P00.01 to 2 and P00.06 to 8.

The command sent to the VFD:

01	10	20 00	00 02	04	00 01	03 E8	3B 10
VFD address	Continuous writing command	Parameters address	Data number	Byte number	Forward running	10Hz	CRC check

If the response message is as below:

01	10	20 00	00 02	4A 08
VFD address	Continuous writing command	Parameters address	Data number	CRC check

Example 2: set the ACC time of 01H VFD as 10s and the DEC time as 20s.

P00.11	ACC time 1	ACC time means the time needed if the VFD speeds up from 0Hz to the Max. One (P00.03). DEC time means the time needed if the VFD speeds down from the Max. Output frequency to 0Hz (P00.03). Goodrive300 series VFDs define four groups of ACC/DEC time which can be selected by P05. The factory default ACC/DEC time of the VFD is the first group. Setting range of P00.11 and P00.12: 0.0–3600.0s	Depend on model	○
P00.12	DEC time 1		Depend on model	○

The corresponding address of P00.11 is 000B, the ACC time of 10s corresponds to 0064H, and the DEC time of 20s corresponds to 00C8H.

The command sent to the VFD:

01	10	00 0B	00 02	04	00 64	00 C8	F2 55
VFD address	Continuous writing command	Parameters address	Data number	Byte number	10s	20s	CRC check

If the response message is as below:

Note: The space between above commands is for instruction and there is no space between the commands during actual applications.

7.6 Common communication faults

Common communication faults include the following:

✧ No response is returned.

✧ The VFD returns an exception response.

Possible causes of no response include the following:

✧ The serial port is set incorrectly. For example, the converter uses the serial port COM1, but COM2 is selected for the communication.

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

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

✧ The RS485 wire cap on the terminal board of the VFD is not connected. This wire cap is at the back of the terminal block.

Appendix A Technical data

A.1 Derated application

A.1.1 Capacity

VFD sizing is based on the rated motor current and power. To achieve the rated motor power given in the table, the rated current of the VFD must be higher than or equal to the rated motor current. Also the rated power of the VFD must be higher than or equal to the rated motor power. The power ratings are the same regardless of the supply voltage within one voltage range.

Note:

✧ The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.

✧ The rated capacity is the capacity at the ambient temperature of 40°C.

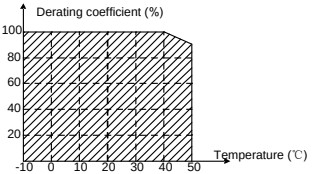
✧ You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

A.1.2 Derating

The load capacity decreases if the installation site ambient temperature exceeds 40°C, the altitude exceeds 1000 meters or the switching frequency is changed from 4 kHz to 8, 12 or 15 kHz.

A.1.2.1 Derating due to temperature

When the temperature ranges from +40°C to +50°C, the rated output current is derated by 1% for each increased 1°C. For the actual derating, see the following figure.



A.1.2.2 Derating due to altitude

When the altitude of the site where the VFD is installed is lower than 1000m, the VFD can run at the rated power. When the altitude exceeds 1000m, derate by 1% for every increase of 100m. When the altitude exceeds 3000m, consult the local INVT dealer or office for details.

A.2 Marking

A.2.1 CE marking

The CE mark is attached to the VFD to verify that the VFD follows the provisions of the European Low Voltage (2014/35/EU) and EMC Directives (2014/30/EU).

A.2.2 UL and CUL marking

The UL and CUL marks are attached to the VFD to verify that the VFD follows the provisions of the UL508C and C22.2 No. 274-13.

A.2.3 Compliance with the European EMC Directive

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (EN 61800-3) covers requirements stated for VFDs. See section A.3 "EMC regulations".

A.3 EMC regulations

The EMC product standard (EN 61800-3) describes the EMC requirements to the VFD.

First environment: domestic environment (includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes).

Second environment includes establishments connected to a network not directly supplying domestic premises.

Four categories of the VFD:

VFD of category C1: VFD of rated voltage less than 1000 V and used in the first environment.

VFD of category C2: VFD of rated voltage less than 1000 V other than pins, sockets and motion devices and intended to be installed and commissioned only by a professional electrician when used in the first environment.

Note: IEC/EN 61800-3 in EMC standard doesn't limit the power distribution of the VFD, but it defines the upstage, installation and commission. The professional electrician has necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

VFD of category C3: VFD of rated voltage less than 1000 V and used in the second environment other than the first one

VFD of category C4: VFD of rated voltage more than 1000 V or the nominal current is above or equal to 400A and used in the complicated system in second environment.

A.3.1 VFDs of category C2

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix C "Optional peripheral accessories" and install it following the description in the EMC filter manual.

2. Select the motor and control cables according to the description in the manual.

3. Install the VFD according to the description in the manual.

	✧ In a domestic environment, this product may cause radio inference, in which case supplementary mitigation measures may be required.

A.3.2 VFDs of category C3

The anti-interference performance of the VFD meets the requirements of environments Category II in the IEC/EN 61800-3 standard.

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix C "Optional peripheral accessories" and install it following the description in the EMC filter manual.

2. Select the motor and control cables according to the description in the manual.

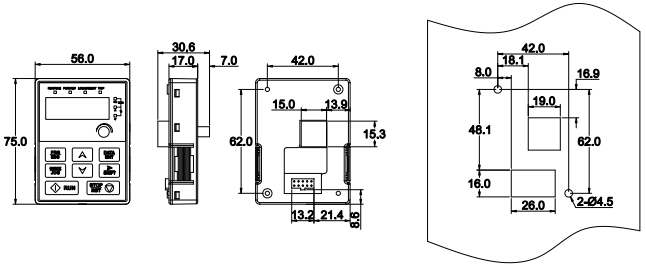
3. Install the VFD according to the description in the manual.

	✧ VFDs of C3 category cannot be applied to civilian low-voltage common grids. When applied to such grids, the VFDs may generate radio frequency electromagnetic interference.

Appendix B Dimension drawings

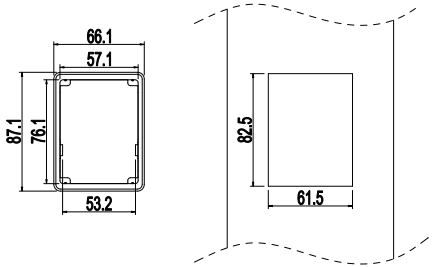
Dimension drawings of the Goodrive20-UL are shown as follows. The dimensions are given in mm.

B.1 External keypad (optional) structure



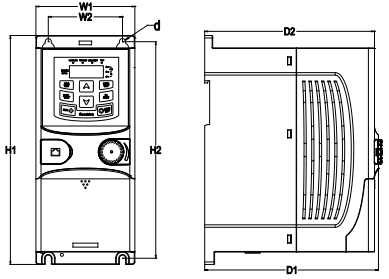
Overall drawing Hole drawing

The external keypad can be mounted on the installation bracket and the bracket is optional.



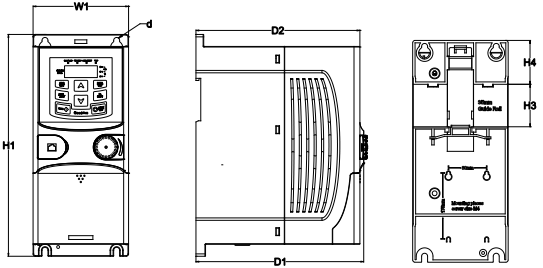
Installation bracket Installation dimension

B.2 VFD chart



Wall mounting (unit: mm)

Model	W1	W2	H1	H2	D1	D2	Mounting hole diameter (d)	Weight (kg)
GD20-0R4G-S12	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	0.9
GD20-0R7G-S12	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	0.9
GD20-1R1G-S12	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1.2
GD20-0R4G-S2-UL	80.0	60.0	160.0	150.0	123.5	120.3	Ø 5	0.9
GD20-0R7G-S2-UL	80.0	60.0	160.0	150.0	123.5	120.3	Ø 5	0.9
GD20-1R5G-S2-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1.2
GD20-2R2G-S2-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1.2
GD20-0R4G-2-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1
GD20-0R7G-2-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1
GD20-0R7G-4-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1
GD20-1R5G-4-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1
GD20-2R2G-4-UL	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5	1



Rail mounting (unit: mm)

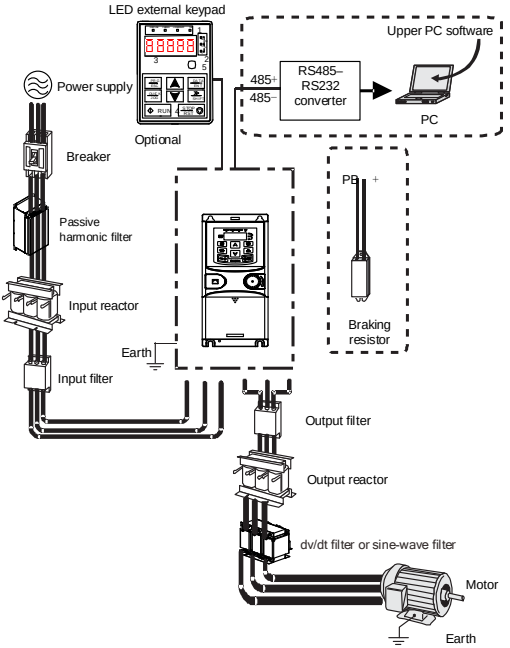
Model	W1	H1	H3	H4	D1	D2	Mounting hole diameter (d)	Weight (kg)
GD20-0R4G-S12	80.0	185	35.4	36.6	140.5	137.3	Ø 5	0.9
GD20-0R7G-S12	80.0	185	35.4	36.6	140.5	137.3	Ø 5	0.9
GD20-1R1G-S12	80.0	185	35.4	36.6	140.5	137.3	Ø 5	1.2
GD20-0R4G-S2-UL	80.0	160.0	35.4	36.6	123.5	120.3	Ø 5	0.9
GD20-0R7G-S2-UL	80.0	160.0	35.4	36.6	123.5	120.3	Ø 5	0.9
GD20-1R5G-S2-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1.2
GD20-2R2G-S2-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1.2
GD20-0R4G-2-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1
GD20-0R7G-2-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1
GD20-0R7G-4-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1
GD20-1R5G-4-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1
GD20-2R2G-4-UL	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5	1

Appendix C Optional peripheral accessories

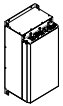
This chapter describes how to select optional accessories of the VFD.

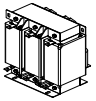
C.1 Wiring of peripheral accessories

The following figure shows the external wiring of the VFD.



Pictures	Name	Descriptions
	External keypad	External keypads include the external keypads with and without the function of parameter copying. When the external keypad with parameter copying is valid, the local keypad is off; when the external

Pictures	Name	Descriptions
		keypad without parameter copying is valid, the local and external keypads are on simultaneously.
	Cable	Accessory for signal transmission.
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30 mA.
	Passive harmonic filter	Device used to reduce the current distortion rate and harmonic content, thereby improving the power factor.
	Input reactor	Accessories used to improve the current adjustment coefficient on the input side of the VFD, and thus restrict high-order harmonic currents.
	Input filter	Accessory that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Try to install the input filter near the input terminal side of the VFD.
	Braking resistor	Accessories used to consume the regenerative energy of the motor to reduce the DEC time. The VFD models need only to be configured with braking resistors.
	Output filter	Accessory used to restrict interference generated in the wiring area on the output side of the VFD. Try to install the output filter near the output terminal side of the VFD.
	Output reactor	Accessory used to lengthen the valid transmission distance of the VFD, which effectively restrict the transient high voltage generated during the switch-on and switch-off of the IGBT module of the

Pictures	Name	Descriptions
		VFD.
	dv/dt filter	Device used to suppress voltage spikes, reduce traveling waves in long cables, and reflect dv/dt transient voltages, thereby reducing motor eddy current losses and noise, and providing motor insulation protection.
	Sine-wave filter	Device used to suppress and absorb high-order harmonic currents derived from switching frequency ripple currents, correcting the waveform to approximate a sine wave, significantly extending the length of the output cable, reducing motor eddy current losses and noise, and protecting motor insulation.
	Membrane of heat releasing holes at the side	Accessory applied in severe environment scenarios for improving protective effect. The VFD can be derated by 10% through using the membrane.

C.2 Power supply

	✧ Ensure that the voltage class of the VFD is consistent with that of the grid.

C.3 Cables

C.3.1 Power cables

The sizes of the input power cables and motor cables must meet the local regulation. Use 75°C CU wire only.

Note: If the conductivity of the shielding layer of the motor cables cannot meet the requirements, separate PE conductors must be used.

Required wire torque, type and range for field input and output terminals listed below:

Model No.	Terminal Type	Required Torque (in-lbs)	Wire Range	Wire Connector (##)
GD20-0R4G-S12	Input and Output Terminal	4.4	12 AWG	Required
GD20-0R7G-S12				
GD20-1R1G-S12				
GD20-0R4G-S2-UL	Input and Output Terminal	4.4	14 AWG	Optional
GD20-0R7G-S2-UL				

GD20-1R5G-S2-UL	Input and Output Terminal	4.4	12 AWG	Required
GD20-2R2G-S2-UL	Input and Output Terminal	4.4	12 AWG	Required
GD20-0R4G-2-UL	Input and Output Terminal	7	14 AWG	Optional
GD20-0R7G-2-UL				
GD20-0R7G-4-UL				
GD20-1R5G-4-UL				
GD20-2R2G-4-UL				
All models	Control Terminal Block	4.5	26-14 (Str/Sol) AWG	Optional
##: UL listed wire connector shall be used.				

The models GD20-0R4G-S2-UL/GD20-0R7G-S2-UL/GD20-1R5G-S2-UL use terminal blocks of DEGSON, and the tightening torque must be 4.4 in-lb (DEGSON) or equivalent.

The model GD20-2R2G-S2-UL uses terminal blocks of DEGSON, and the tightening torque must be 4.4 in-lb or equivalent.

The models GD20-0R4G-2-UL/GD20-0R7G-2-UL/GD20-0R7G-4-UL/GD20-1R5G-4-UL/

GD20-2R2G-4-UL use terminal blocks of SUCCEED, and the tightening torque must be 7 in-lb or equivalent.

Tightening torque and wire range for field grounding wiring terminals are marked adjacent to the terminal or on the wiring diagram.

Model No.	Required Torque (in-lbs)	Wire Range (AWG)
GD20-0R4G-S12	10	12
GD20-0R7G-S12		
GD20-1R1G-S12		
GD20-0R4G-S2-UL	10	14
GD20-0R7G-S2-UL	10	12
GD20-1R5G-S2-UL	10	12
GD20-2R2G-S2-UL	10	10
GD20-0R4G-2-UL	10	14
GD20-0R7G-2-UL		
GD20-0R7G-4-UL		
GD20-1R5G-4-UL		
GD20-2R2G-4-UL		

C.3.2 Control cables

All analog control cables and the cable used for the frequency input must be shielded.

The relay cable needs the cable type with braided metallic screen.

Note: Run analog and digital signals in separate cables.

C.4 Fuse

It is necessary to add fuse for the avoidance of overload.

It is appropriate to use a breaker (MCCB) which complies with the VFD power in the 3-phase AC power and input power and terminals. The capacity of the VFD should be 1.5-2 times of the rated current.

✧ Due to the inherent operating principle and construction of circuit breakers, independent of the manufacturer, hot ionized gases may escape from the breaker enclosure in case of a short-circuit. To ensure safe use, special attention must be paid to the installation and placement of the breakers. Follow the manufacturer's instructions.

It is necessary to install the electromagnetic contactor in the input side to control the switching on and off safety of the main circuit. It can switch off the input power supply when system faults.

For single phase: "Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 250 volts maximum when protected by fuse, see following table for fuse information." or equivalent.

Power Conversion Model Series	Fuse Class Type	Fuse Current Rating
GD20-0R4G-S12	CC	20 A/ 600 V
GD20-0R7G-S12	CC	20 A/ 600 V
GD20-1R1G-S12	CC	30A/ 600 V
GD20-0R4G-S2-UL	CC	10 A/ 600 V
GD20-0R7G-S2-UL	CC	20 A/ 600 V
GD20-1R5G-S2-UL	CC	20 A/ 600 V
GD20-2R2G-S2-UL	CC	30A/ 600 V
GD20-0R4G-2-UL	CC	10A/ 600 V
GD20-0R7G-2-UL	CC	20A/ 600 V

For 3-phase: "Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 600 volts maximum when protected by fuse, see following table for fuse information." or equivalent.

Power Conversion Model Series	Fuse Class Type	Fuse Current Rating
GD20-0R7G-4-UL	CC	10 A/ 600 V
GD20-1R5G-4-UL	CC	10 A/ 600 V
GD20-2R2G-4-UL	CC	20 A/ 600 V

Integral solid-state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

C.5 Harmonic filters

To enhance grid protection, reduce harmonic interference from the VFD to the grid, and improve input power factor, consider configuring external DC reactors, input reactors, or passive harmonic filters based on your specific application needs.

If you want to use long cables between the VFD and the motor, select external output reactors, dv/dt attenuation filters, or sine-wave filters based on the motor cable length. This helps mitigate excessive dv/dt, reducing voltage stress on the motor windings as well as protecting them, and extending the motor's lifespan. Refer to the table below for recommended output filter selections according to motor cable length.

Table C-1 Recommended output filter selections according to motor cable length

Non-shielded cable length	50m–150m	150m–450m	450m–1000m
Shielded cable length	30m–100m	100m–230m	230m–500m
Output reactor category	Output reactor (1%)	/	/
	/	dv/dt attenuation filter	/
	/	/	Sine-wave filter

Table C-2 Input and output reactor selections according to VFD model

Model	Input reactor	Output reactor
GD20-0R4G-S12	/	/
GD20-0R7G-S12		
GD20-1R1G-S12		
GD20-0R4G-S2-UL		
GD20-0R7G-S2-UL		
GD20-1R5G-S2-UL		
GD20-2R2G-S2-UL		
GD20-0R4G-2-UL	GDL-ACL0005-4CU	GDL-OCL0005-4CU
GD20-0R7G-2-UL	GDL-ACL0005-4CU	GDL-OCL0005-4CU
GD20-0R7G-4-UL	GDL-ACL0005-4CU	GDL-OCL0005-4CU

Model	Input reactor	Output reactor
GD20-1R5G-4-UL	GDL-ACL0005-4CU	GDL-OCL0005-4CU
GD20-2R2G-4-UL	GDL-ACL0006-4CU	GDL-OCL0006-4CU

Table C-3 Input and output filter selections according to VFD model

Model	Input filter	Output filter	
	Passive harmonic filter	dv/dt filter	Sine-wave filter
GD20-0R4G-S12	/	/	/
GD20-0R7G-S12			
GD20-1R1G-S12			
GD20-0R4G-S2-UL			
GD20-0R7G-S2-UL			
GD20-1R5G-S2-UL			
GD20-2R2G-S2-UL			
GD20-0R4G-2-UL	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
GD20-0R7G-2-UL	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
GD20-0R7G-4-UL	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
GD20-1R5G-4-UL	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
GD20-2R2G-4-UL	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL

Note:

✧ The rated derate voltage of the input reactor is 2%±15%.

✧ The power factor of the input side is above 90% after adding DC reactor.

✧ The rated derate voltage of the output reactor is 1%±15%.

✧ Above options are external, the customer should indicate when purchasing.

C.6 EMC Filter

C.6.1 C3 Filter model instruction

FLT-P04003L-C-G

A B C D E F G

Field identifier	Field description
A	FLT: Name of the VFD filter series
B	Filter type P: Power input filter L: Output filter

Field identifier	Field description
C	Voltage class S2: AC 1PH 220V–240V 04: AC 3PH 380V–480V
D	3-digit development serial number. For example, 003 stands for the serial number of C3 filters in development
E	Filter performance L: General H: High-performance
F	Filter application environment A: Environment Category I (IEC61800-3) category C1 (EN 61800-3) B: Environment Category I (IEC61800-3) category C2 (EN 61800-3) C: Environment Category II (IEC61800-3) category C3 (EN 61800-3)
G	Lot No. G: Special for external C3 filter

C.6.2 C3 filter

C3 filers are optional for Goodrive20-UL series VFDs.

The input interference filter can decrease the interference of the VFD to the surrounding equipments.

Output interference filter can decrease the radio noise cause by the cables between the VFD and the motor and the leakage current of the conducting wires.

Our company configured some filters for the convenient of the users.

Model	Input filter
GD20-0R4G-S12	FLT-PS2004L-C-G
GD20-0R7G-S12	
GD20-1R1G-S12	
GD20-0R4G-S2-UL	
GD20-0R7G-S2-UL	
GD20-1R5G-S2-UL	
GD20-2R2G-S2-UL	
GD20-0R4G-2-UL	FLT-P04008L-C-G
GD20-0R7G-2-UL	
GD20-0R7G-4-UL	
GD20-1R5G-4-UL	
GD20-2R2G-4-UL	

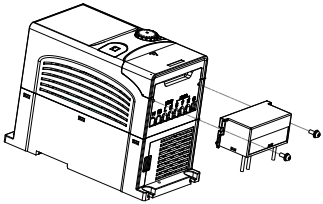
Note:

✧ The input EMI meet the requirement of C3 after adding input filters.

✧ Above options are external, the customer should indicate when purchasing.

✧ Do not connect C3 filters in IT power system.

C.6.3 Installation instruction for C3 filter



The installation procedures for C3 filter are below:

1. Connect the filter cable to the corresponding input terminal of the VFD according to the label.

2. Fix the filter onto the VFD with M3 x 10 screws (as shown in above picture).

C.6.4 C2 Filter type instruction

FLT-P04016L-B

A B C D E F

Field identifier	Field description
A	FLT: Name of the VFD filter series
B	Filter type P: Power input filter L: Output filter
C	Voltage class S2: AC 1PH 220V–240V 04: AC 3PH 380V–480V
D	3-digit code indicating the rated current. For example, 016 indicates 16A.
E	Filter performance L: General H: High-performance
F	Filter application environment

Field identifier	Field description
	A: Environment Category I (IEC61800-3) category C1 (EN 61800-3) B: Environment Category I (IEC61800-3) category C2 (EN 61800-3)

C.6.5 C2 filter model selection

Model	Input filter	Output filter
GD20-0R4G-S12	FLT-PS2010H-B	FLT-L04006L-B
GD20-0R7G-S12	FLT-PS2025L-B	FLT-L04016L-B
GD20-1R1G-S12	FLT-PS2025L-B	FLT-L04016L-B
GD20-0R4G-S2-UL	FLT-PS2010H-B	FLT-L04006L-B
GD20-0R7G-S2-UL		
GD20-1R5G-S2-UL	FLT-PS2025L-B	FLT-L04016L-B
GD20-2R2G-S2-UL		
GD20-0R4G-2-UL	FLT-P04006L-B	FLT-L04006L-B
GD20-0R7G-2-UL		
GD20-0R7G-4-UL		
GD20-1R5G-4-UL		
GD20-2R2G-4-UL	FLT-P04016L-B	FLT-L04016L-B

Note:

✧ The input EMI meets the C2 requirements after an input filter is configured.

✧ The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.

C.7 Braking resistors

C.7.1 Braking resistor selection

It is appropriate to use braking resistor or braking unit when the motor brakes sharply or the motor is driven by a high inertia load. The motor will become a generator if its actual rotating speed is higher than the corresponding speed of the reference frequency. As a result, the inertial energy of the motor and load return to the VFD to charge the capacitors in the main DC circuit. When the voltage increases to the limit, damage may occur to the VFD. It is necessary to apply braking unit/resistor to avoid this accident happens.

✧ Only qualified electricians are allowed to design, install, commission and operate on the VFD.
✧ Follow the instructions in "warning" during working. Physical injury or death or serious property may occur.
✧ Only qualified electricians are allowed to wire. Damage to the VFD or

	braking options and part may occur. Read carefully the instructions of braking resistors or units before connecting them with the VFD. ✧ Do not connect the braking resistor with other terminals except for PB and (-). Do not connect the braking unit with other terminals except for (+) and (-). Damage to the VFD or braking circuit or fire may occur.
	✧ Connect the braking resistor or braking unit with the VFD according to the diagram. Incorrect wiring may cause damage to the VFD or other devices.

Goodrive20-UL series VFDs have internal braking units.

Model	Type of braking unit	Braking resistor at 100% of the braking torque (Ω)	Consumed power of braking resistor			Min. braking resistor (Ω)
			10% braking	50% braking	80% braking	
GD20-0R4G-S12	Built-in braking unit	361	0.06	0.30	0.48	42
GD20-0R7G-S12		192	0.11	0.56	0.90	42
GD20-1R1G-S12		96	0.23	1.10	1.80	30
GD20-0R4G-S2-UL		361	0.06	0.30	0.48	42
GD20-0R7G-S2-UL		192	0.11	0.56	0.90	42
GD20-1R5G-S2-UL		96	0.23	1.10	1.80	30
GD20-2R2G-S2-UL		65	0.33	1.70	2.64	21
GD20-0R4G-2-UL		361	0.06	0.3	0.48	131
GD20-0R7G-2-UL		192	0.11	0.56	0.90	93
GD20-0R7G-4-UL		653	0.11	0.56	0.90	240
GD20-1R5G-4-UL		326	0.23	1.13	1.80	170
GD20-2R2G-4-UL		222	0.33	1.65	2.64	130

Note:

✧ Select the resistor and power of the braking unit according to the data our company provided.

✧ The braking resistor may increase the braking torque of the VFD. The resistor power in the above table is designed on 100% braking torque and 10% braking usage ratio. If the users need more braking torque, the braking resistor can decrease properly and the power needs to be magnified.

	✧ Never use a braking resistor with a resistance below the minimum value specified for the particular VFD. The VFD and the internal chopper are not able to handle the overcurrent caused by the low resistance.

	✧ Increase the power of the braking resistor properly in the frequent braking situation (the frequency usage ratio is more than 10%).

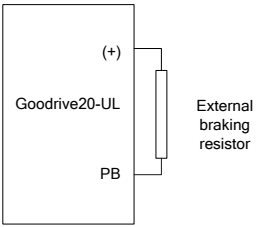
C.7.2 Braking resistor installation

Braking resistor cables need to be shielded cables.

Install all resistors in a place where they will cool.

	✧ The materials near the braking resistor must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. Protect the resistor against contact.

Goodrive20-UL series VFDs need only external braking resistors.



Appendix D Energy efficiency data

Table D–1 Power loss and IE class

Model	Relative loss (%)								Standby loss (W)	IE class
	(0;25)	(0;50)	(0;100)	(50;25)	(50;50)	(50;100)	(90;50)	(90;100)		
GD20-0R4G-S12	1.17	1.41	1.55	1.32	1.53	1.92	1.72	2.10	6.5	IE2
GD20-0R7G-S12	1.14	1.92	2.61	1.27	2.08	2.82	2.41	3.54	7	IE2
GD20-1R1G-S12	1.09	1.74	2.26	1.28	1.67	1.88	1.87	2.59	8	IE2
GD20-0R4G-S2-UL	2.11	2.13	2.56	2.00	1.73	2.21	1.26	2.17	5	IE2
GD20-0R7G-S2-UL	1.47	1.70	2.44	1.43	1.19	2.24	0.70	2.42	7	IE2
GD20-1R5G-S2-UL	1.23	1.56	2.32	0.97	1.34	2.05	0.99	2.74	8	IE2
GD20-2R2G-S2-UL	1.12	1.35	1.94	1.35	1.81	1.83	2.22	4.13	8	IE2
GD20-0R4G-2-UL	2.41	2.45	2.74	1.97	2.01	2.26	1.15	1.61	6	IE2
GD20-0R7G-2-UL	1.55	1.83	2.65	0.80	1.45	2.36	1.03	2.01	6	IE2
GD20-0R7G-4-UL	1.88	2.17	2.69	2.15	2.25	3.09	1.64	2.52	7	IE2
GD20-1R5G-4-UL	1.31	1.56	2.10	1.03	1.37	2.09	1.19	2.19	7	IE2
GD20-2R2G-4-UL	1.32	1.51	2.20	1.36	1.78	2.37	1.71	2.62	8	IE2

Table D–2 Rated specifications

Model	Apparent power (kVA)	Rated output power (kW)	Rated output current (A)	Max. working temperature (°C)	Rated power frequency (Hz)	Rated power voltage (V)
GD20-0R4G-S12	0.9	0.4	2.5	50°C Derate by 1% for every increase of 1°C when the temperature exceeds 40°C.	50Hz/60Hz Allowed range: 47–63Hz	1PH 110V
GD20-0R7G-S12	1.6	0.75	4.2			
GD20-1R1G-S12	2.2	1.1	5.8			
GD20-0R4G-S2-UL	0.9	0.4	2.5			1PH 220V
GD20-0R7G-S2-UL	1.6	0.75	4.2			
GD20-1R5G-S2-UL	2.8	1.5	7.5			
GD20-2R2G-S2-UL	3.8	2.2	10			
GD20-0R4G-2-UL	0.9	0.4	2.5			3PH 220V
GD20-0R7G-2-UL	1.6	0.75	4.2			
GD20-0R7G-4-UL	1.6	0.75	2.5			3PH 380V
GD20-1R5G-4-UL	2.7	1.5	4.2			
GD20-2R2G-4-UL	3.6	2.2	5.5			

Appendix E Further information

D.1 Product and service inquiries

Should you have any queries about the product, contact the local INVT office. Provide the model and serial number of the product you query about. You can visit www.invt.com to find a list of INVT offices.

D.2 Feedback on INVT VFD manuals

Your comments on our manuals are welcome. Visit www.invt.com, directly contact online service personnel or choose **Contact Us** to obtain contact information.

D.3 Documents on the Internet

You can find manuals and other product documents in PDF format on the Internet. Visit www.invt.com and choose **Support** > **Download**.

E-mail: overseas@invt.com.cn Website: www.invt.com

The products are owned by **Shenzhen INVT Electric Co.,Ltd.**
Two companies are commissioned to manufacture: (For product code, refer to the 2nd/3rd place of S/N on the name plate.)

Shenzhen INVT Electric Co.,Ltd. (origin code: 01)
Address: INVT Guangming Technology Building, Songbai Road, Matian, Guangming District, Shenzhen, China

INVT Power Electronics (Suzhou) Co.,Ltd. (origin code: 06)
Address: No. 1 Kunlun Mountain Road, Science & Technology Town, Gaoxin District, Suzhou, Jiangsu, China

Industrial Automation: ■ HMI ■ PLC ■ VFD ■ Servo System
■ Elevator Intelligent Control System ■ Rail Transit Traction System

Energy & Power: ■ UPS ■ DCIM ■ Solar Inverter ■ SVG
■ New Energy Vehicle Powertrain System ■ New Energy Vehicle Charging System
■ New Energy Vehicle Motor

66001-00392

202503(V2.0)