Operation Manual

Goodrive170-PV Series
Solar Pump Inverter

SHENZHEN INVT ELECTRIC CO., LTD.

Contents

1 Safety precautions

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

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

1.1 Safety definition

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

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

Note: Actions taken to ensure proper running.

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

1.2 Warning

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

Symbol	Name	Description	Abbreviation
 Danger	Danger	Severe personal injury or even death can result if related requirements are not followed.	
 Warning	Warning	Personal injury or equipment damage can result if related requirements are not followed.	
 Forbid	Electrostatic discharge	PCBA board damage can result if related requirements are not followed.	
 Hot sides	Note Hot sides	The equipment base may become hot. Do not touch it.	
Note	Note	Actions taken to ensure proper running.	**Note**

1.3 Safety guidelines

- Only trained and qualified professionals are allowed to carry out related operations.
- Do not perform wiring, inspection or component replacement when power supply is applied. Ensure that all the input power supplies are disconnected before wiring and inspection, and always wait for at least the time designated on the inverter or until the DC bus voltage is less than 36V. The waiting time is shown as below.

Inverter model		Minimum waiting time
1PH 220V	0.4kW–2.2kW	5 minutes
3PH 220V	1.5kW–7.5kW	5 minutes
3PH 380V	0.75kW–110kW	5 minutes
3PH 380V	132kW–500kW	5 minutes

- Do not refit the inverter unless authorized; otherwise fire, electric shock or other injury may result.

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

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

1.3.1 Delivery and installation

- Do not install the inverter on inflammables. In addition, prevent the inverter from contacting or adhering to inflammables.
- Do not operate on the inverter if there is any damage or components loss to the inverter.
- Do not touch the inverter with wet items or body; otherwise, electric shock may occur.

- Select appropriate moving and installing tools to ensure a safe and normal running of the inverter and avoid physical injury or death. To ensure personal safety, the installer must take mechanical protective measures, such as wearing exposure shoes and working uniforms.
- Do not carry the inverter by its front cover only as the cover may fall off.
- Ensure the inverter suffers no physical impact or vibration during moving and installation.
- Installation site must be away from children and other public places.
- The leakage current of the inverter 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 (with the same cross sectional area).

- (+) and (-) are DC power supply input terminals, R, S, and T are AC power supply terminals, while U, V and W are the output motor terminals. Connect the input power cables and motor cables correctly; otherwise, damage to the inverter may occur.

1.3.2 Commissioning and running

- Cut off all power supplies connected to the inverter before terminal wiring, and wait for at least the time designated on the inverter after disconnecting the power supplies.
- High voltage presents inside the inverter during running. Do not carry out any operation on the inverter during running except for keypad setup.
- The inverter cannot be used as an "Emergency-stop device".
- If the inverter is used to brake the motor suddenly, a mechanical braking device shall be provided.

- Do not switch on or off the input power supply of the inverter frequently.
- For inverters that have been stored for a long time, check and fix the capacitance and try pilot run first before actual application.
- Close the front cover before running the inverter; otherwise, electric shock may occur.

1.3.3 Maintenance and component replacement

- Only well-trained and qualified professionals are allowed to carry out maintenance, inspection, and component replacement of the inverter.
- Disconnect all power supplies of the inverter before terminal wiring and wait for at least the designated time after disconnecting the power supply.
- Take proper measures to prevent screws, cables and other conductive objects from falling into the inverter during maintenance and component replacement.

- Use proper torque to tighten screws.
- Keep the inverter and its parts and components away from combustible materials during maintenance and component replacement.
- Do not carry out any insulation voltage-endurance test on the inverter or measure the control circuit of the inverter by megameter.

1.3.4 Scrap treatment

	● There are heavy metals in the inverter. Treat 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.

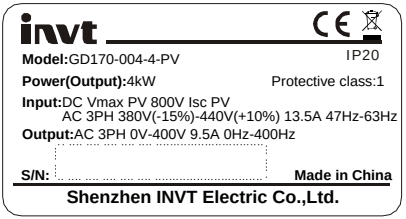
2 Product overview

2.1 Unpacking inspection

Check the following after receiving the product.

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

2.2 Product nameplate



Note: This is a nameplate example of a standard inverter product. The CE/IP20 marking on the top right will be marked according to actual certification conditions.

2.3 Model designation code

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

GD170 – 004 – 4 – PV
① ② ③ ④

Field	No.	Description	Content
Abbreviation of product series	①	Abbreviation of product series	GD is short for Goodrive.

Field	No.	Description	Content
Rated power	②	Power range + load type	004: 4kW
Voltage class	③	Voltage class	4: AC 3PH 380V(-15%)–440V(+10%) -2: AC 3PH 220V(-15%)–240V(+10%) -S2: AC 1PH 220V(-15%)–240V(+10%) -SS2: AC 1PH 220V(-15%)–240V(+10%)
Code	④	Industry code	PV: Photovoltaic water pump series products

2.4 Product specifications

Model	-SS2	-S2	-2	-4
AC input voltage (V)	220(-15%)–240(+10%) (1PH)		220(-15%)–240 (+10%) (3PH)	380(-15%)–440 (+10%) (3PH)
Max. DC voltage (V)	440	440	440	800
Start-up voltage (V)	200	200	200	300
Min. working voltage (V)	150	150	150	250
Recommended DC input voltage range (V)	200–400	200–400	200–400	300–750
Recommended MPP voltage (V)	330	330	330	550

2.5 Product ratings

Series	Model	Rated output power (kW)	Rated input current (A)	Rated output current (A)	Max. DC input current (A)
-SS2 model 1PH 220V input/output (0.4–2.2kW)	GD170-0R4-SS2-PV	0.4	6.5	4.2	9
	GD170-0R7-SS2-PV	0.75	9.3	7.2	9
	GD170-1R5-SS2-PV	1.5	15.7	10.2	12
	GD170-2R2-SS2-PV	2.2	24	14	12
-S2 model 1PH 220V input (0.4–2.2kW)	GD170-0R4-S2-PV	0.4	6.5	2.5	9
	GD170-0R7-S2-PV	0.75	9.3	4.2	9
	GD170-1R5-S2-PV	1.5	15.7	7.5	12
	GD170-2R2-S2-PV	2.2	24	10	12
-2 model 3PH 220V	GD170-1R5-2-PV	1.5	7.7	7.5	12
	GD170-2R2-2-PV	2.2	11	10	12

Series	Model	Rated output power (kW)	Rated input current (A)	Rated output current (A)	Max. DC input current (A)
(1.5–7.5kW)	GD170-004-2-PV	4	17	16	20
	GD170-5R5-2-PV	5.5	25	20	30
	GD170-7R5-2-PV	7.5	33	30	40
-4 model 3PH 380V (0.75–500kW)	GD170-0R7-4-PV	0.75	3.4	2.5	9
	GD170-1R5-4-PV	1.5	5.0	4.2	9
	GD170-2R2-4-PV	2.2	5.8	5.5	12
	GD170-004-4-PV	4.0	13.5	9.5	16.5
	GD170-5R5-4-PV	5.5	19.5	14	23.9
	GD170-7R5-4-PV	7.5	25	18.5	30.6
	GD170-011-4-PV	11	32	25	39.2
	GD170-015-4-PV	15	40	32	49
	GD170-018-4-PV	18.5	47	38	50
	GD170-022-4-PV	22	51	45	60
	GD170-030-4-PV	30	70	60	81
	GD170-037-4-PV	37	80	75	90
	GD170-045-4-PV	45	98	92	130
	GD170-055-4-PV	55	128	115	150
	GD170-075-4-PV	75	139	150	200
	GD170-090-4-PV	90	168	180	250
	GD170-110-4-PV	110	201	215	300
	GD170-132-4-PV	132	265	260	360
	GD170-160-4-PV	160	310	305	430
	GD170-185-4-PV	185	345	340	500
	GD170-200-4-PV	200	385	380	550
	GD170-220-4-PV	220	430	425	480
	GD170-250-4-PV	250	485	480	525
	GD170-280-4-PV	280	545	530	600
	GD170-315-4-PV	315	610	600	690
	GD170-355-4-PV	355	625	650	760
	GD170-400-4-PV	400	715	720	870
	GD170-450-4-PV	450	840	820	970
	GD170-500-4-PV	500	890	860	1100

3 Installation guidelines

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

- Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Please carry out operations according to instructions presented in Safety precautions. Ignoring these safety precautions may lead to physical injury or death, or equipment damage.
- Ensure the inverter power is disconnected before installation. If the inverter has been powered on, disconnect the inverter and wait for at least the time designated on the inverter, and ensure the POWER indicator is off.
- Installation must be designed and done according to applicable local laws and regulations. INVT does not assume any liability whatsoever for any installation which breaches local laws and regulations. If recommendations given by INVT are not followed, the inverter may experience problems that the warranty does not cover.

3.1 Mechanical installation

3.1.1 Installation environment

Installation environment is essential for the inverter to operate at its best in the long run.

Environment	Condition
Installation site	Indoors.
Ambient temperature	• -10°C–+50°C, and air temperature change shall be less than 0.5°C/minute. • When the ambient temperature exceeds 40˚C, derate 1% for every increase of 1˚C. • Do not use the inverter when the ambient temperature exceeds 50°C. • To improve reliability, do not use the inverter in the places where the temperature changes rapidly. • When the inverter is used in a closed space such as control cabinet, use a cooling fan or air conditioner for cooling, preventing the internal temperature from exceeding the temperature required. • When the temperature is too low, if you want to use the inverter that has been idled for a long time, it is required to install an external

Environment	Condition
	heating device before the use to eliminate the freeze inside the inverter. Otherwise, the inverter may be damaged.
Humidity	● The relative humidity (RH) of the air is less than 90%. ● Condensation is not allowed.
Storage temperature	-40°C–70°C, with the air temperature change rate less than 1°C/minute.
Running environment	Install the inverter in a place: ● Away from electromagnetic radiation sources. ● Away from oil mist, corrosive gases and combustible gases. ● Without the chance for foreign objects such as metal powder, dust, oil and water to fall into the inverter (do not install the inverter onto combustible objects such as wood). ● Without radioactive substances and combustible objects. ● Without hazard gases and liquids. ● With low salt content. ● Without direct sunlight.
Pollution degree	Degree 2
Altitude	● Lower than 1000m; ● When the altitude exceeds 1000m, derate 1% for every increase of 1°C. ● When the altitude exceeds 3000m, consult the local INVT dealer or office.
Vibration	Max. vibration acceleration: 5.8m/s^2 (0.6g).
Installation direction	Install the inverter vertically to ensure good heat dissipation performance.

Note:

- The inverter must be installed in a clean and well-ventilated environment based on the IP level.
- The cooling air must be clean enough and free from corrosive gases and conductive dust.

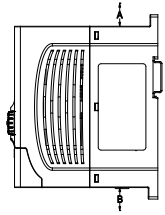
3.1.2 Installation direction

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

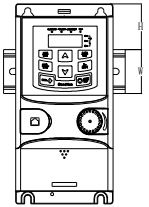
The inverter must be installed vertically. Check the installation position according to following requirements. See Appendix C “Dimension drawings”.

3.1.3 Installation mode

1. The inverters of ≤ 4kW support wall mounting and rail mounting.



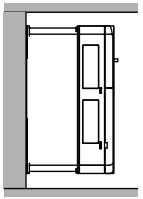
a) Wall mounting



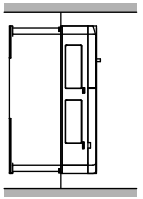
b) Rail mounting

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

2. The inverters of ≥ 5.5kW support wall mounting and flange mounting.



a) Wall mounting



b) Flange mounting

Step 1 Mark the position of the installation hole. See appendix for the position of installation hole.

Step 2 Mount the screws or bolts onto the designated position.

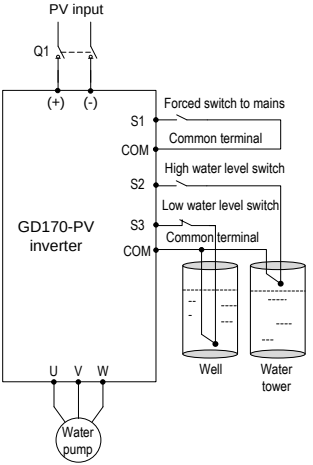
Step 3 Put the inverter on the wall.

Step 4 Tighten the fixing screws on the wall.

3.2 Standard wiring

3.2.1 Main circuit terminals

The figure below shows the standard wiring diagram of the inverter.

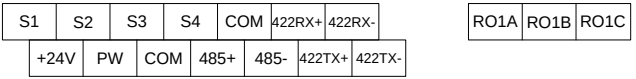


- The DC breaker Q1 must be installed as the protection switch for PV input.
- In parallel connection, the combination box special for PV must be used.
- When the distance between the PV cell module and inverter exceeds 10 meters, Type-II surge protection devices must be configured at the DC side.
- When the distance between the pump and inverter exceeds 50 meters, it is recommended to configure output reactors. See A.4 Reactor for the output reactor model selection.
- The inverter automatically runs after being powered on. If parameters need to be set, follow the parameter setting instructions in 5 Commissioning guidelines.

Terminal symbol	Terminal name	Terminal function description
R, S, T	AC input	3PH (1PH) AC input terminals, connected to the grid **Note:** Use the screws equipped with the inverter for wiring.
(+), (-)	PV DC input	Input terminals of photovoltaic panels.
U, V, W	Inverter output	3PH AC output terminals, connected to the pump motor in most cases.
⏚	Safety protection grounding	Grounding terminal for safe protection; each machine must be properly grounded.

3.2.2 Control circuit terminals

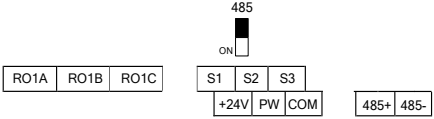
Figure 3-1 Control circuit terminal diagram for 4kW and lower inverters



Category	Terminal symbol	Terminal name	Terminal function description
Power supply	24V	24V power supply	Used to externally provide 24V±10% power supply. Max. output current: 200mA Generally used as the the working power supply of digital input/output or the external sensor power supply
	COM	Common terminal	
Digital input	S1	Forcibly switches to power frequency	Terminal feature parameters: 1. Internal impedance: 3.3kΩ 2. 12–24V voltage input is acceptable 3. Max. input frequency: 1kHz S1: Forcibly switches to power frequency (Switching-on indicates switching to power frequency, and switching-off indicates input controlled by the keypad.) S2: It connects to the high water
	S2	Full-water alarm	
	S3	Empty-water alarm	
	S4	1PH/2PH algorithm switching	

Category	Terminal symbol	Terminal name	Terminal function description
			level switch of NO contact by default. S3: It connects to the low water level switch of NC contact by default. S4: A high electrical level corresponds to the 1PH algorithm. A low electrical level corresponds to the 2PH algorithm.
Communication	RS485+ RS485-	RS485 communication	RS485 communication terminals, using the Modbus protocol
	422TX+ 422TX- 422RX+ 422RX-	422 communication	Communication terminals special for the boost module.
Relay output	RO1A (ROA)	NO contact of relay 1	1. Contact capacity: 3A/AC250V, 1A/DC30V 2. Do not use them as high-frequency switch outputs. During the application of power frequency & PV auto switching, the power frequency input contactor coil is controlled by the NC contact of the relay.
	RO1B (ROB)	NC contact of relay 1	
	RO1C (ROC)	Common terminal of relay 1	

Figure 3-2 Control circuit terminal diagram for 5.5kW and higher inverters



Note: The rectangular black mark indicates the shorting cap or DIP switch ex-factory selection position.

Category	Terminal symbol	Terminal name	Terminal function description
Upper communication	485+	485 communication	RS485 communication terminals, using the Modbus protocol
	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		
	PW	Digital working power	External digital power input terminal Power supply range: 12–30V
	COM	Digital output	Common terminal of open collector output
24V power supply	+24V	24V power supply	Used to externally provide 24V±10% power supply. Max. output current: 200mA Generally used as the the working power supply of digital input/output or the external sensor power supply
	COM		
Relay output	RO1A	Relay 1 NO contact	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V , 1A/DC30V
	RO1B	Relay 1 NC contact	
	RO1C	Relay 1 common contact	

3.2.3 Input/output signal connection figure

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

Figure 3-3 U-shaped jumper for 4kW and lower inverters

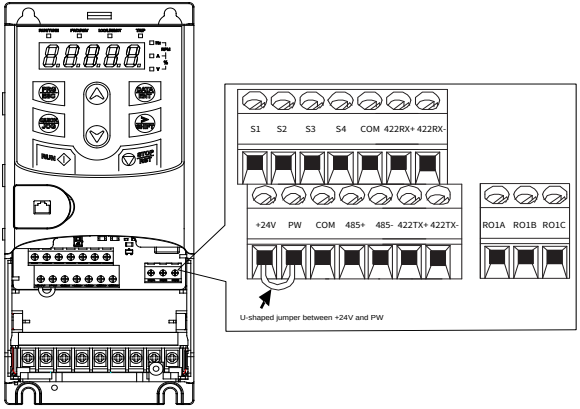
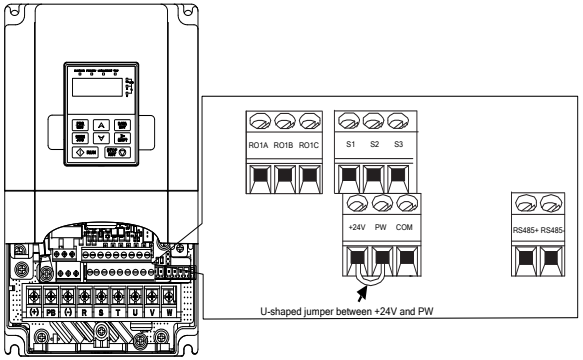
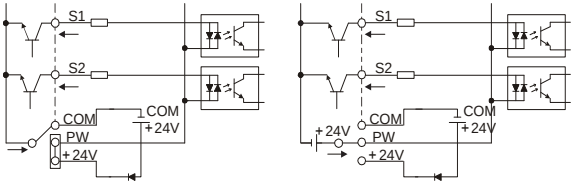


Figure 3-4 U-shaped jumper for 5.5kW and higher inverters



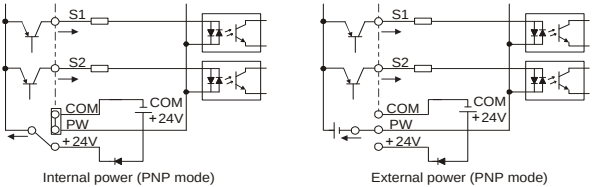
If input signal comes from NPN transistors, set the U-shaped jumper based on the power used according to the following figure.

Figure 3-5 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 3-6 PNP mode



4 Keypad operation guidelines

4.1 Keypad introduction

The keypad is used to control the inverter, read inverter status, and set parameters. If you need to install the keypad on another position rather than on the inverter, use a keypad extension cable with a standard RJ45 crystal head.

Figure 4-1 Keypad diagram for inverters of ≤ 4kW

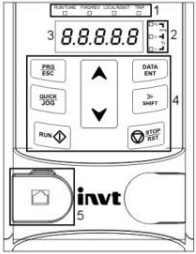
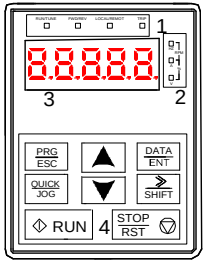
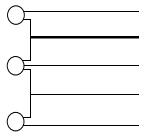


Figure 4-2 Keypad diagram for inverters of ≥ 5.5kW



Note: The inverter models of 380V ≤ 4kW support an optional extermal keypad, and the keypad of inverter models of 380V ≥ 5.5kW can be installed on another device.

No.	Item	Description	
1	Status indicator	RUN/TUNE	Inverter running status indicator. Off: The inverter is stopped. Blinking: The inverter is autotuning parameters.

<table>
<tr><th>No.</th><th>Item</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td></td><td colspan="2">On: The inverter is running.</td></tr>
<tr><td>FWD/REV</td><td colspan="2">Forward or reverse running indicator.
Off: The inverter is running forward.
On: The inverter is running reversely.</td></tr>
<tr><td>LOCAL/REMOT</td><td colspan="2">Indicates whether the inverter is controlled through the keypad, terminals, or communication.
Off: The inverter is controlled through the keypad.
Blinking: The inverter is controlled through terminals.
On: The inverter is controlled through remote communication.</td></tr>
<tr><td>TRIP</td><td colspan="2">Fault indicator
Off: in normal state
Blinking: in pre-alarm state
On: in fault state</td></tr>
<tr><td>2</td><td>Unit indicator</td><td colspan="3">Unit displayed currently
 
Hz — Frequency unit
RPM — Rotation speed unit
A — Current unit
% — Percentage
V — Voltage unit</td></tr>
<tr><td>3</td><td>Digital display zone</td><td colspan="3">Five-digit LED displays various monitoring data and alarm codes such as the frequency setting and output frequency.
<table>
<tr><th>Display</th><th>Means</th><th>Display</th><th>Means</th><th>Display</th><th>Means</th><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><td>3</td><td>3</td></tr>
<tr><td>4</td><td>4</td><td>5</td><td>5</td><td>6</td><td>6</td><td>7</td><td>7</td></tr>
<tr><td>8</td><td>8</td><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><td>f</td><td>F</td></tr>
<tr><td>h</td><td>H</td><td>i</td><td>I</td><td>l</td><td>L</td><td>n</td><td>N</td></tr>
<tr><td>n</td><td>n</td><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><td>v</td><td>v</td></tr>
<tr><td></td><td>.</td><td>-</td><td>-</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>4</td><td>Keys</td><td>PRG ESC</td><td>Programming key</td><td colspan="2">Press it to enter or exit level-1 menus or delete a parameter.</td></tr>
</table>

No.	Item	Description		
		DATA ENT	Confirmation key	Press it to enter menus in cascading mode or confirm the setting of a parameter.
		▲	UP key	Press it to increase data or move upward.
		▼	Down key	Press it to decrease data or move downward.
		SHIFT	Right-shifting key	Press it to select display parameters rightward in the interface for the inverter in stopped or running state or to select digits to change during parameter setting.
		RUN	Run key	Press it to run the inverter when using the keypad for control.
		STOP RST	Stop/ Reset key	Press it to stop the inverter that is running. The function of this key is restricted by P07.04. In fault alarm state, this key can be used for reset in any control modes.
		QUICK JOG	Multifunction shortcut key	The function of this key is determined by P07.02.
5	Keypad interface	External keypad interface. When the keypad is valid, the local keypad and external keypad light up simultaneously.		

4.2 Keypad display

The inverter keypad displays information such as the stopped-state parameters, running-state parameters, and fault status, and allows you to modify function codes.

4.2.1 Displaying stopped-state parameters

When the inverter is in stopped state, the keypad displays stopped-state parameters, as shown in Figure 4-3.

When the inverter is in stopped state, the keypad displays 4 stopped-state parameters, including set frequency, bus voltage, input terminal status, and output terminal status. You can press >>/SHIFT to shift parameters.

4.2.2 Displaying running-state parameters

After receiving a valid running command, the inverter 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 actual running direction, as shown in Figure 4-3.

In the running state, there are 6 parameters that can be displayed. There are: running

frequency, set frequency, bus voltage, output voltage, output current, and rotational speed. You can press the >>/SHIFT key to shift parameters.

4.2.3 Displaying fault information

After detecting a fault signal, the inverter 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. In the function parameter display interface, you can press the DATA/ENT key to save parameter settings or press the PRG/ESC key to exit the parameter display interface.

Figure 4-3 Status display

4.3 Operation procedure

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

4.3.1 Modifying function codes

The inverter provides three levels of menus, including:

• Function code group number (level-1 menu)

• Function code number (level-2 menu)

• 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.

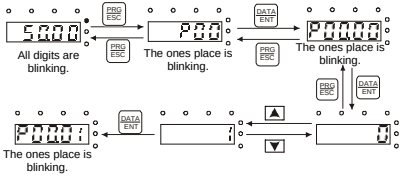
If you enter the level-3 menu but the parameter does not have a digit blinking, the parameter cannot be modified due to either of the following reasons:

• It is read only. Read-only parameters include actual detection parameters and running record parameters.

• 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 4-4 Modifying a parameter



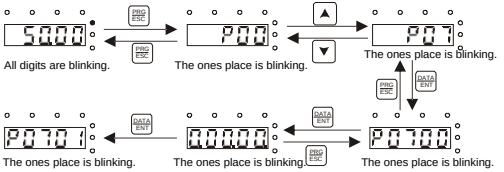
Note: When setting the value, you can press [>>] and [▲]+[▼] to modify the value.

4.3.2 Setting a password for the inverter

The inverter provides 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 4-5 Setting a password

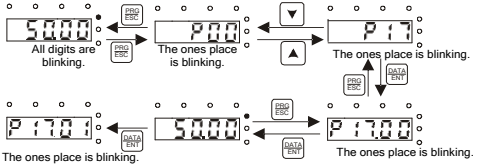


Note: When setting the value, you can press [>>] and [▲] +[▼] to modify the value.

4.3.3 Viewing inverter status

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

Figure 4-6 Viewing a parameter



Note: When setting the value, you can press [SHIFT], [▲] and [▼] to modify the value.

5 Commissioning guidelines

- Cut off all power supplies connected to the inverter before terminal wiring, and wait for at least the time designated on the inverter after disconnecting the power supplies.
- High voltage presents inside the inverter during running. Do not carry out any operation on the inverter during running except for keypad setup.
- By default, the inverter runs automatically after being powered on. If you need to set parameters, comply with the procedure described in this chapter.

5.1 Check before running

Ensure the following before powering on the inverter:

1. The inverter has been grounded reliably.
2. The wire connection is correct and reliable.
3. The AC/DC breaker is selected correctly.
4. The solar DC input voltage is within the range allowed by the inverter.
5. The motor type, voltage, and power match the inverter type, voltage, and power.

5.2 Trial run

Close the DC circuit breaker, and the inverter runs automatically after a delay of about 10s. Observe the water output of the pump. If the water output is normal, the trial run is successful; if the water output is small, run again after swapping the connection of any two motor wires.

5.3 Parameter settings

By default, the inverter runs automatically after being powered on. To set parameters, do as follows: If the inverter has not been powered on, power on the inverter, and press QUICK/JOG within 10s to enter the keypad-based control mode (LOCAL/REMOT off). If the inverter has been powered on (Run indicator is on), press the STOP/RST key to enter the parameter setting interface. After the parameters are set, turn off and turn on the inverter power.

5.4 Advanced settings

Note: The default settings of the inverter can be adapted to most working conditions, and advanced settings are not required in most cases.

5.4.1 Water discharge speed PI adjustment

If you have higher requirements on the water discharge speed, you can adjust the PI parameters (P15.06–P15.10) appropriately. Setting the PI parameters to larger values will result in a faster water discharge speed, but the motor frequency fluctuates greatly; conversely, setting the PI parameters to smaller values will result in a slower water discharge speed, but the motor running frequency is relatively smooth.

6 Function parameter list

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

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

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

Note: The inverter automatically checks and constrains the modification of parameters, which helps prevent incorrect modifications.

6.1 Function parameters related to control

P00 group Basic functions

Function code	Name	Description	Default	Modify
P00.00	Speed control mode	0: SVC mode 0 No need to install encoders. Applicable to scenarios with requirements for low frequency, great torque, and high speed control accuracy. Relative to SVC mode 1, SVC mode 0 is more applicable to the scenarios requiring small power. 1: SVC mode 1 Applicable to high-performance scenarios, featuring high rotation and torque accuracy, without the need to install pulse encoders. 2: Space voltage vector control mode Applicable to scenarios without demanding requirements on control accuracy, such as fan and pump. One inverter can drive multiple motors. **Note:** Before using a vector control mode, enable the inverter to perform motor parameter autotuning first.	2	◎
P00.01	Channel of running commands	Used to select the channel of running inverter control commands. The inverter control commands include the start, stop, forward run, reverse run, jog,	1	○

Function code	Name	Description	Default	Modify
		and fault reset commands. 0: Keypad (LOCAL/REMOT off) The commands are controlled through keypad keys, such as the RUN and STOP/RST keys. In running state, you can press both RUN and STOP/RST to enable the inverter to coast to stop. 1: Terminal (LOCAL/REMOT blinking) The running commands are controlled through forward rotation, reverse rotation, forward jogging, and reverse jogging of multi-function input terminals. 2: Communication (LOCAL/REMOT on) The running commands are controlled by the upper computer in communication mode.		
P00.03	Max. output frequency	Used to set the max. output frequency of the inverter. Pay attention to this parameter because it is the foundation of the frequency setting and the speed of acceleration (ACC) and deceleration (DEC). Setting range: P00.04–400.00Hz	50.00Hz	◎
P00.06	A frequency command selection	0: Keypad 1: AI1 (keypad panel potentiometer) 2–7: Reserved 8: Modbus communication Setting range: 0–8	0	○
P00.10	Set frequency through keypad	0.00 Hz–P00.03 (Max. output frequency)	50.00Hz	○
P00.11	ACC time 1	ACC time means the time needed if the inverter speeds up from 0Hz to the max. output frequency (P00.03). DEC time means the time needed if the inverter speeds down from the max. output frequency (P00.03) to 0Hz. The inverter has four groups of ACC/DEC	Model depended	○
P00.12	DEC time 1		Model depended	○

Function code	Name	Description	Default	Modify
		time, which can be selected by P05. The factory default ACC/DEC time of the inverter is the first group. Setting range of P00.11 and P00.12: 0.0–3600.0s		
P00.13	Running direction	0: Run at the default direction. The inverter runs in the forward direction. FWD/REV is off. 1: Run at the opposite direction. The inverter runs in the reverse direction. FWD/REV is on. Modify P00.13 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. For details, refer to parameter P07.02. **Note:** ● When the parameter is restored to the default value, the motor's running direction is restored to the default one. Exercise caution before using this function if the change of motor rotation direction is disallowed after commissioning. ● Do not change the setting of the parameter because reverse running is not allowed in water pump application scenarios. 2: Disable reverse running. It can be used in some special scenarios where reverse running is disallowed.	0	○
P00.14	Carrier frequency setting	1.0–15.0kHz	Model depended	○
P00.15	Motor	0: No operation	0	◎

Function code	Name	Description	Default	Modify
	parameter autotuning	1: Rotary autotuning Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is needed. 2: Static autotuning 1 Used in scenarios where the motor cannot be disconnected from load. 3: Static autotuning 2 Empty-load current and mutual inductance are not autotuned.		
P00.18	Function parameter restore	0: No operation 1: Restore default values 2: Clear fault records 3: Lock all function codes **Note:** ● After the selected operation is performed, the function code is automatically restored to 0. ● Restoring the default values may delete the user password. Exercise caution before using this function.	0	◎

P01 group Start and stop control

Function code	Name	Description	Default	Modify
P01.08	Stop mode	0: Decelerate to stop. When a stop command takes effect, the inverter lowers output frequency based on the DEC mode and the defined DEC time; when the frequency drops to 0Hz, the inverter stops. 1: Coast to stop. When a stop command takes effect, the inverter stops output immediately. And the load coasts to stop according to mechanical inertia.	0	○
P01.18	Terminal-based running	0: The terminal running command is invalid at power-on	1	○

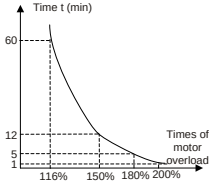
Function code	Name	Description	Default	Modify
	command protection at power-on	1: The terminal running command is valid at power-on		
P01.21	Power-off restart selection	0: Disable restart 1: Enable restart	1	○

P02 group Parameters of motor 1

Function code	Name	Description		Default	Modify
P02.00	Motor type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)		0	◎
P02.01	Rated power of AM	0.1–3000.0kW	Used to set AM parameters. To ensure the control performance, set P02.01–P02.05 correctly according to the information on the nameplate of the AM. The inverter provides the parameter autotuning function. Whether parameter autotuning can be performed properly depends on the settings of the motor nameplate parameters. In addition, you need to configure a motor according to the standard motor configuration of the inverter. If the power of the motor is greatly different from that of the	Model depended	◎
P02.02	Rated frequency of AM	0.01Hz–400.00Hz		50.00Hz	◎
P02.03	Rated speed of AM	1–36000rpm		Model depended	◎
P02.04	Rated voltage of AM	0–1200V		Model depended	◎
P02.05	Rated current of AM	0.8–6000.0A		Model depended	◎

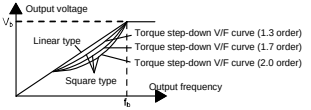
Function code	Name	Description		Default	Modify
			standard motor configuration, the control performance of the inverter degrades significantly. **Note:** Resetting the rated power of the motor (P02.01) can initialize the parameters P02.02–P02.10.		
P02.06	Stator resistance of AM	0.001–65.535Ω	After motor parameter autotuning is properly performed, the values of P02.06–P02.10 are automatically updated. These parameters are the benchmark parameters for high-performance vector control, directly affecting the control performance. **Note:** Do not modify these parameters unless it is necessary.	Model depended	○
P02.07	Rotor resistance of AM	0.001–65.535Ω		Model depended	○
P02.08	Leakage inductance of AM	0.1–6553.5mH		Model depended	○
P02.09	Mutual inductance of AM	0.1–6553.5mH		Model depended	○
P02.10	No-load current of AM	0.1–6553.5A		Model depended	○
P02.15	Rated power of SM	0.1–3000.0kW	Used to set SM parameters. To ensure the control performance, set P02.15–P02.19 correctly according to the information on the nameplate of the AM. The inverter provides the parameter autotuning function. Whether parameter	Model depended	◎
P02.16	Rated frequency of SM	0.01Hz–400.00Hz		50.00Hz	◎
P02.17	Number of pole pairs of SM	1–50		2	◎
P02.18	Rated voltage of SM	0–1200V		Model depended	◎
P02.19	Rated	0.8–6000.0A		Model	◎

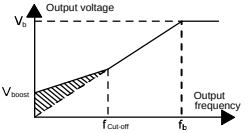
Function code	Name	Description		Default	Modify
	current of SM		autotuning can be performed properly depends on the settings of the motor nameplate parameters. In addition, you need to configure a motor according to the standard motor configuration of the inverter. If the power of the motor is greatly different from that of the standard motor configuration, the control performance of the inverter degrades significantly. **Note:** Resetting the rated power of the motor (P02.15) can initialize the parameters P02.02–P02.10.	depended	
P02.20	Stator resistance of SM	0.001–65.535Ω	After motor parameter autotuning is properly performed, the values of P02.20–P02.23 are automatically updated. These parameters are the benchmark parameters for high-performance vector control, directly affecting the control performance. **Note:** Do not modify these parameters unless it is necessary.	Model depended	○
P02.21	Direct-axis inductance of SM	0.01–655.35Mh		Model depended	○
P02.22	Quadrature-axis inductance of SM	0.01–655.35Mh		Model depended	○
P02.23	Counter-emf of SM	0–10000		300	○

Function code	Name	Description	Default	Modify
P02.27	Motor overload protection coefficient	Motor overload multiples M = Iout/(In*K) In is rated motor current, Iout is inverter output current, and K is motor overload protection coefficient. A smaller value of K indicates a bigger value of M. When M=116%, protection is performed after motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; when M=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%	100.0%	○

P04 group V/F control

Function code	Name	Description	Default	Modify
P04.00	V/F curve setting	This group of function code defines the V/F curve of motor 1 to meet the needs of different loads. 0: Straight-line V/F curve, applicable to constant torque loads 1: Reserved 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0)	0	◎

Function code	Name	Description	Default	Modify
		Curves 2–4 are applicable to the torque loads such as fans and water pumps. You can adjust according to the characteristics of the loads to achieve best performance. 5: Reserved **Note:** In the following figure, V_b is the motor rated voltage and f_b is the motor rated frequency.  		
P04.01	Torque boost	In order to compensate for low-frequency torque characteristics, you can make some boost compensation for the output voltage. P04.01 is relative to the max. output voltage V_b. P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated motor frequency f_b. Torque boost can improve the low-frequency torque characteristics in space voltage vector control mode. You need to select torque boost based on the load. For example, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which may cause increased output current and motor overheating, thus decreasing the efficiency. When torque boost is set to 0.0%, the inverter uses automatic torque boost. Torque boost cut-off threshold: Below this frequency threshold, torque boost is valid; exceeding this threshold will invalidate torque boost.	2.0%	○
P04.02	Torque boost cut-off		20.0%	○

Function code	Name	Description	Default	Modify
		 Setting range of P04.01: 0.0%: Automatic, 0.1%–10.0% Setting range of P04.02: 0.0% –50.0%		
P04.09	V/F slip compensation gain	Used to compensate for the motor rotating speed change caused by load change in the space voltage vector mode, and thus improve the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: $\Delta f=f_b-n*p/60$ Of which, f_b is the rated frequency of the motor, corresponding to function code P02.01. n is the rated rotating speed of the motor, corresponding to function code P02.02. p is the number of pole pairs of the motor. 100.0% corresponds to the rated slip frequency Δf of the motor. Setting range: 0.0–200.0%	0.0%	○
P04.10	Low-frequency oscillation control factor of motor 1	In space voltage vector control mode, the motor, especially the large-power motor, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even inverter overcurrent. You can adjust the two function codes properly to eliminate such phenomenon. Setting range of P04.10 and P04.11: 0–100 Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)	10	○
P04.11	High-frequency oscillation control factor of motor 1		10	○

Function code	Name	Description	Default	Modify
P04.12	Vibration control threshold		30.00Hz	○
P04.34	Two phase control selection of single-phase motor	Ones place: Reserved Tens place: Reversal of the secondary winding (V-phase) voltage 0: Not reversed; 1: Reversed Setting range: 0x00–0x11	0x00	◎
P04.35	Voltage ratio of V-phase and U-phase	0.00–2.00	1.40	○
P04.36	Reactive closed-loop KP	0–5000	50	○
P04.37	Reactive closed-loop KI	0–5000	50	○

P05 group Input terminals

Function code	Name	Description	Default	Modify
P05.01	Function of S1	0: No function 1: Run forward 2: Run reversely 3: Three-wire running control 4–5: Reserved 6: Coast to stop 7: Reset faults 8: Pause running 9: External fault input 10–35: Reserved 36: Switch the running command channel to keypad 37: Switch the running command channel to terminal 38: Switch the running command channel to communication	42	◎
P05.02	Function of S2		43	◎
P05.03	Function of S3		44	◎
P05.04	Function of S4		45	◎
P05.05	Function of S5		1	
P05.09	Function of HDI		46	◎

Function code	Name	Description	Default	Modify
		39: Reserved 40: Clear electricity consumption 41: Keep electricity consumption 42: Forcibly switches to power frequency (Switching-on indicates switching to power frequency, and switching-off indicates input controlled by the keypad.) 43: Full-water signal 44: Empty-water signal 45: Two phase control mode of single-phase motor 46: PV digital input without the boost module (used for automatic switching) 47–63: Reserved		
P05.10	Input terminal polarity	0x000–0x018 Bit3 Bit2 Bit1 Bit0 S4 S3 S2 S1	0x000	◎

P06 group Output terminals

Function code	Name	Description	Default	Modify
P06.03	RO1 output	0: Disable 1: Running 2: Running forward 3: Running reversely 4: Jogging 5: Inverter in fault 6: Frequency level detection FDT1 7: Frequency level detection FDT2 8: Frequency reached 9: Reserved 10: Upper limit frequency reached 11: Lower limit frequency reached 12: Ready for running 13: Reserved 14: Overload pre-alarm 15: Underload pre-alarm	30	○

Function code	Name	Description	Default	Modify
		16–19: Reserved 20: External fault is valid 21: Reserved 22: Running time reached 23: Modbus communication virtual terminal output 24–63: Reserved 27: In weak light 28: Automatically switches from automatic switching mode to power frequency input mode 29: Forcibly switches to power frequency input mode 30: Switches to PV input mode		
P06.10	RO1 switch-on delay	0.00–500.00s	10.00s	○
P06.11	RO1 switch-off delay	0.00–500.00s	10.00s	○

P07 group Human-machine interface

Function code	Name	Description	Default	Modify
P07.00	User password	0–65535 When you set the function code to a non-zero number, password protection is enabled. If you set the function code to 00000, the previous user password is cleared and password protection is disabled. After the user password is set and takes effect, you cannot enter the parameter menu if you enter an incorrect password. Please remember your password and save it in a secure place. After you exit the function code editing interface, the password protection function is	0	○

Function code	Name	Description	Default	Modify
		enabled within 1 minute. If password protection is enabled, "0.0.0.0.0" is displayed when you press the PRG/ESC key again to enter the function code editing interface. You need to enter the correct user password to enter the interface. **Note:** Restoring the default values may delete the user password. Exercise caution before using this function.		
P07.01	Parameter copy	0–4 0: No operation 1: Upload parameters from the local address to the keypad 2: Download parameters (including motor parameters) from the keypad to the local address 3: Download parameters (excluding group P02 and P12) from the keypad to the local address 4: Download parameters (only including group P02 and P12) from the keypad to the local address **Note:** After any operation among 1–4 is complete, the parameter restores to 0. The upload and download functions are not applicable to group P29. The function is valid only for an external keypad that is an optional part and provides the parameter copy function.	0	◎
P07.02	Function of QUICK/JOG	0: No function 1–5: Reserved 6: Switch command channels in sequence. 7: Quick commissioning mode (based on non-factory parameter settings)	6	○
P07.03	Sequence of switching running-com	When P07.02 =6, set the sequence of switching running-command channels by pressing this key.	1	○

Function code	Name	Description	Default	Modify
	mand channels by pressing QUICK/JOG	0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication		
P07.04	Stop function validity of STOP/RST	Used to specify the stop function validity of STOP/RST. For fault reset, STOP/RST is valid in any conditions. 0: Valid only for keypad control 1: Valid both for keypad and terminal control 2: Valid both for keypad and communication control 3: Valid for all control modes	3	○
P07.12	Inverter module temperature	-20.0–120.0℃		●
P07.13	Control board software version	1.00–655.35		●
P07.14	Local accumulative running time	0–65535h		●
P07.15	Inverter electricity consumption high-order bits	Used to display the electricity consumption of the inverter. Inverter electricity consumption = P07.15*1000 + P07.16 Setting range of P07.15: 0–65535kWh（*1000） Setting range of P07.16: 0.0–999.9kWh		●
P07.16	Inverter electricity consumption low-order bits			●
P07.27	Present 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)		●
P07.28	Last fault type			●

Function code	Name	Description	Default	Modify
P07.29	2nd-last 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: Inverter overload (OL2) 13: Phase loss on input side (SPI) 14: Phase loss on output side (SPO) 15: Boost module overheat (OH1) 16: Inverter module overheat (OH2) 17: External fault (EF) 18: RS485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback disconnection (PIDE) 23: Reserved 24: Running time reached (END) 25: Electronic overload (OL3) 26–31: Reserved 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 61: Light-weak pre-alarm (A-LS) 62: Underload pre-alarm (A-LL) 63: Full-water pre-alarm (A-tF) 64: Empty-water pre-alarm (A-tL) 65: Phase loss pre-alarm (A-SPI) **The inverter decelerates to stop when encountering the following faults:** (SPI): Phase loss on input side		●
P07.30	3rd-last fault type			●
P07.31	4th-last fault type			●
P07.32	5th-last fault type			●

Function code	Name	Description	Default	Modify
		(OH1): Rectifier module overheating (OH2): Inverter module overheating (CE): RS485 communication fault (EEP): EEPROM operation error (PIDE): PID feedback disconnection (END): Running time reached (OL3): Electronic overload (LL): Underload fault (tSF): Hydraulic probe damage fault (E-422): 422 communication fault (boost module) **Note:** The prealarm will be not recorded into the fault but can be read by Modbus.		
P07.33	Running frequency at present fault			●
P07.34	Ramp reference frequency at present fault			●
P07.35	Output voltage at present fault			●
P07.36	Output current at present fault			●
P07.37	Bus voltage at present fault			●
P07.38	Max. temperature at present fault			●
P07.39	Input terminal state at present fault			●

Function code	Name	Description	Default	Modify
P07.40	Output terminal state at present fault			●
P07.41	Running frequency at last fault			●
P07.42	Ramp reference frequency at last fault			●
P07.43	Output voltage at last fault			●
P07.44	Output current at last fault			●
P07.45	Bus voltage at last fault			●
P07.46	Max. temperature at last fault			●
P07.47	Input terminal state at last fault			●
P07.48	Output terminal state at last fault			●
P07.49	Running frequency at 2nd-last fault			●
P07.50	Ramp reference frequency at 2nd-last fault			●
P07.51	Output			●

Function code	Name	Description	Default	Modify
	voltage at 2nd-last fault			
P07.52	Output current at 2nd-last fault			●
P07.53	Bus voltage at 2nd-last fault			●
P07.54	Max. temperature at 2nd-last fault			●
P07.55	Input terminal state at 2nd-last fault			●
P07.56	Output terminal state at 2nd-last fault			●
P07.57	6th-last 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) 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: Inverter overload (OL2) 13: Phase loss on input side (SPI) 14: Phase loss on output side (SPO)		●
P07.58	7th-last fault type			●
P07.59	8th-last fault type			●
P07.60	9th-last fault type			●
P07.61	10th-last fault type			●
P07.62	11th-last fault type			●
P07.63	12th-last fault type			●
P07.64	13th-last fault type			●
P07.65	14th-last			●

Function code	Name	Description	Default	Modify
	fault type	15: Boost module overheat (OH1) 16: Inverter module overheat (OH2) 17: External fault (EF) 18: RS485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback disconnection (PIDE) 23: Reserved 24: Running time reached (END) 25: Electronic overload (OL3) 26–31: Reserved 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 61: Light-weak pre-alarm (A-LS) 62: Underload pre-alarm (A-LL) 63: Full-water pre-alarm (A-tF) 64: Empty-water pre-alarm (A-tL) 65: Phase loss pre-alarm (A-SPI) **The inverter decelerates to stop when encountering the following faults:** (SPI): Phase loss on input side (OH1): Rectifier module overheating (OH2): Inverter module overheating (CE): RS485 communication fault (EEP): EEPROM operation error (PIDE): PID feedback disconnection (END): Running time reached (OL3): Electronic overload (LL): Underload fault (tSF): Hydraulic probe damage fault (E-422): 422 communication fault (boost module) **Note:** The prealarm will be not recorded into the fault but can be read by Modbus.		
P07.66	15th-last fault type			●
P07.67	16th-last fault type			●
P07.68	17th-last fault type			●
P07.69	18th-last fault type			●
P07.70	19th-last fault type			●
P07.71	20th-last fault type			●

P08 group Enhanced functions

Function code	Name	Description	Default	Modify
P08.28	Auto fault reset count	0–10	5	○
P08.29	Auto fault reset interval	0.1–3600.0s	10.0s	○
P08.53	Enable hidden function codes	0: Disable 1: Enable Setting range: 0–1 **Note:** This function code is not saved in EEPROM, that is, it remains the disabled state by default after power failure recovery.	0	○

6.2 Function parameters special for solar pump

P11 group Protection parameters

Function code	Name	Description	Default	Modify
P11.00	Protection against phase loss	0x000–0x011 LED ones place: 0: Software protection against input phase loss disabled 1: Software protection against input phase loss enabled LED tens place: 0: Software protection against output phase loss disabled 1: Software protection against output phase loss enabled LED hundreds place: (Reserved)	Model depended	○
P11.01	Voltage point for frequency drop at transient power-off	20.0%–120.0%	80.0%	○
P11.02	Frequency drop rate at sudden	0.00Hz/s–P00.03 If the bus voltage drops to the sudden frequency decreasing point due to the	10.00Hz/s	○

Function code	Name	Description	Default	Modify
	power-off	power loss of the grid, the inverter begins to decrease the running frequency according to P11.02 to make the motor in power generation state. The regenerative power can maintain the bus voltage to ensure normal running of the inverter until the recovery of power. When this value is set to 0, frequency drop at power-off is disabled. When this value is not 0 and the PV is not enabled (P15.00=0), frequency drop at power-off can be enabled.		
P11.03	Overvoltage stall protection	0: Disable 1: Enable	0	○
P11.04	Overvoltage stall protection voltage	120–150% (standard bus voltage) (380V)	136%	○
		120–150% (standard bus voltage) (220V)	125%	
P11.05	Current limit selection	0x00–0x12 Ones place: Current limit action selection 0: Invalid 1: Always valid 2: Invalid during DEC Tens place: Hardware current limit overload alarm selection 0: Valid 1: Invalid	0x01	◎
P11.06	Automatic current limit level	50.0–200.0%	G type: 160.0%	◎
			P type: 110.0%	
P11.07	Frequency drop rate during current limit	0.00–50.00Hz/s	10.00Hz/s	◎
P11.08	Pre-alarm	0x0000–0x1131	0x000	○

Function code	Name	Description	Default	Modify
	selection for inverter/ motor OL/UL	LED ones place: 0: Motor overload/underload pre-alarm, relative to rated motor current; 1: inverter overload/underload pre-alarm, relative to rated inverter current. LED tens place: 0: The inverter continues running after overload/underload alarm; 1: The inverter continues running after underload alarm, and stops running after overload fault; 2: The inverter continues running after overload alarm, and stops running after underload fault; 3: The inverter stops running after overload/underload fault. LED hundreds place: 0: Always detect 1: Detect during constant-speed running		
P11.09	Overload pre-alarm detection level	P11.11–200%	G type: 150% P type: 110%	○
P11.10	Overload pre-alarm detection time	0.1–3600.0s	1.0s	○
P11.11	Underload pre-alarm detection level	0%–P11.09	50%	○
P11.12	Underload pre-alarm detection time	0.1–3600.0s	1.0s	○
P11.13	Fault output terminal action upon fault occurring	0x00–0x11 LED ones place: 0: Act at undervoltage 1: Do not act at undervoltage LED tens place:	0x00	○

Function code	Name	Description	Default	Modify
		0: Act during the automatic reset period 1: Do not act during the automatic reset period		
P11.14	Speed deviation detection value	0.0–50.0%	10.0%	○
P11.15	Speed deviation detection time	0.0–10.0s (0.0 indicates no speed deviation protection)	0.5s	○

P14 group Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	1–247, 0 indicates a broadcast address.	1	○
P14.01	Communication baud rate	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps	4	○
P14.02	Data bit check	0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU	1	○
P14.03	Communication response delay	0–200ms	5	○
P14.04	RS485 communication timeout period	0.0 (invalid), 0.1–60.0s	0.0s	○

P15 group Functions special for solar inverter

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P15.00</td><td>Solar inverter selection</td><td>0: Disable
1: Enable
The value 0 indicates solar control is invalid, and this function group is not used.
The value 1 indicates solar control is valid, this function group can be modified.</td><td>1</td><td>◎</td></tr>
<tr><td>P15.01</td><td>Vmpp voltage giving method</td><td>0: Voltage
1: Max. power tracking
The value 0 indicates using the voltage giving method, the reference voltage is P15.02, and it is a fixed value.
The value 1 indicates the reference voltage is given by tracking the max. power. The reference voltage keeps changing until the system becomes stable.
Note: This parameter is invalid when terminal function 43 is valid.</td><td>1</td><td>◎</td></tr>
<tr><td>P15.02</td><td>Vmpp voltage given through keypad</td><td>0.0–6553.5Vdc
When P15.01 is 0, this parameter determines the reference voltage. (During testing, the reference voltage value must be less than the PV input voltage. Otherwise, the system runs at the lower limit of frequency.)
The factory value depends on the model.
<table><tr><th>Model</th><th>Factory value</th></tr><tr><td>-4</td><td>450.0V</td></tr><tr><td>Other</td><td>250.0V</td></tr></table></td><td>Model depended</td><td>○</td></tr>
<tr><td>P15.03</td><td>PID control deviation limit</td><td>0.0–100.0% (100.0% corresponding to P15.02)
PI adjustment is performed only when the ratio of the difference between the actual voltage and reference voltage to</td><td>0.0%</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		the reference voltage, which is abs (Actual voltage – Reference voltage) * 100.0% / (Reference voltage), exceeds P15.03. The default value is 0.0%. abs: The absolute value is used.		
P15.04	PID output upper limit frequency	P15.05–100.0% (100.0% corresponding to P00.03) P15.04 is used to limit the Max. value of target frequency. 100.0% corresponds to P00.03. After PI adjustment, the target frequency cannot exceed the upper limit.	100.0%	○
P15.05	PID output lower limit frequency	0.0%–P15.04 (100.0% corresponding to P00.03) P15.05 is used to limit the Min. value of target frequency. 100.0% corresponds to P00.03. After PI adjustment, the target frequency cannot be less than the lower limit.	20.0%	○
P15.06	KP1	0.00–100.00 Proportional coefficient 1 of target frequency. A greater value indicates stronger effect and faster adjustment.	5.00	○
P15.07	KI1	0.00–100.00 Integral coefficient 1 of target frequency A greater value indicates stronger effect and faster adjustment.	5.00	○
P15.08	KP2	0.00–100.00 Proportional coefficient 2 of target frequency A greater value indicates stronger effect and faster adjustment.	35.00	○
P15.09	KI2	0.00–100.00 Integral coefficient 2 of target frequency A greater value indicates stronger effect and faster adjustment.	35.00	○

Function code	Name	Description	Default	Modify
P15.10	PI switchover point	0.0–6553.5Vdc When the absolute value of PV voltage minus reference voltage is greater than P15.10, P15.08 and P15.09 are used. Otherwise, P15.06 and P15.07 are used.	20.0V	○
P15.11	Water level control selection	0: Control through digital input The value 0 indicates the water level signal is controlled through digital input. For details, see S terminal functions 43 and 44 of P05. When the terminal input of full-water signal is valid, the system reports the full-water pre-alarm (A-tF) with a delay specified by P15.14 and then sleeps. In full-water alarm state, the full-water signal is invalid, the system clears the full-water alarm with a delay specified by P15.15 and then re-enters the running state. When the terminal input of empty-water signal is valid, the system reports the empty-water pre-alarm (A-tL) with a delay specified by P15.16 and then sleeps. In empty-water alarm state, the empty-water signal is invalid, the system clears the empty-water alarm with a delay specified by P15.17 and then re-enters the running state. When P15.11 is set to 1, 2 or 3, the water level signal is controlled through analog input. For details, see P15.12 and P12.13.	0	◎
P15.14	Full-water level delay	0–10000s Time setting on full-water level delay. (This parameter is still valid for digital full-water signal.)	5s	○
P15.15	Full-water level wake-up	0–10000s Time setting on full-water level wake-up	20s	○

Function code	Name	Description	Default	Modify
	delay	delay. (This parameter is still valid for digital full-water signal.)		
P15.16	Empty-water level delay	0–10000s Time setting on empty-water level delay. (This parameter is still valid for digital empty-water signal.)	5s	○
P15.17	Empty-water level wake-up delay	0–10000s Time setting on empty-water level wake-up delay. (This parameter is still valid for digital empty-water signal.)	20s	○
P15.18	Hydraulic probe damage	0.0–100.0% If P15.18 is 0.0%, it indicates P15.18 is invalid. If P15.18 is not 0.0%, when the detected water level control analog signal is greater than the value set in P15.18, the (tSF) fault is reported and the inverter stops.	0.0%	○
P15.19	Water pump run time in underload state	0.0–1000.0s Duration in which the water pump runs in underload state. In continuous underload condition, the underload alarm (A-LL) is reported when the run time is reached.	60.0s	○
P15.20	Current detection value at underload running	0.0%: Automatic detection on underload 0.1–100.0% The value 0.0% indicates it is determined by the underload detection mechanism of the inverter. A value rather than 0.0% indicates it is determined by P15.20. 100.0% corresponds to the motor rated current. When the absolute value of target frequency minus ramp frequency is less than or equal to 2.00Hz, if the actual current value at the actual frequency is continuously less than P15.20, the system reports the underload fault with a	0.0%	○

Function code	Name	Description	Default	Modify
		delay specified by P15.19. Otherwise, the system runs properly. In the non-continuous situation, the delay counter is automatically cleared.		
P15.21	Underload reset delay	0.0–6000.0s Underload reset delay. In underload state, the counting on the underload run time and that on the underload reset delay are performed synchronously. Generally, the value needs to be greater than P15.19 so that the system can report the underload alarm when the underload run time is reached and then reset can be performed when the time P15.21–P15.19 elapsed. If the value of P15.21 is the same as that of P15.19, auto reset is performed at the same time as the underload alarm is reported.	660.0s	○
P15.22	Underload protection selection	0–1 0: Underload judgement based on output power 1: Underload judgement based on output current	0	○
P15.23	Weak-light delay	0.0–3600.0s Time setting on weak-light delay. When the output frequency is less than or equal to the PI output frequency lower limit and the delay counting is started, which reaches the weak-light delay time, the system reports the weak-light alarm (A-LS) and then sleeps. In the non-continuous situation, the delay counter is automatically cleared. **Note:** ● When the bus voltage is lower than the undervoltage point or the PV	100.0s	○

Function code	Name	Description	Default	Modify
		voltage is lower than 70V, the system directly reports the weak-light alarm without any delay. ● When P15.32=0, in weak-light condition, the system automatically switch to the power-frequency input mode.		
P15.24	Weak-light wake-up delay	0.0–3600.0s Time setting on weak-light wake-up delay. If the weak-light pre-alarm is reported, when PV voltage is greater than the voltage set in P19.08, the system clears the pre-alarm with the weak-light wake-up delay and then re-enters the running state. When P15.32=0, if the PV voltage is greater than P15.34, the system switches from the power-frequency input mode to the PV input mode with the weak-light wake-up delay.	300.0s	○
P15.25	Initial actual reference voltage display	0.0–2000.0V	0	●
P15.26	Min. reference voltage in max. power tracking	0.00–1.00 Used to set the min. reference voltage in max. power tracking. Min. reference voltage in max. power tracking = (Open-circuit voltage of photovoltaic panels) * P15.26. Open-circuit voltage of photovoltaic panels = P15.25/P15.28 Track the max. power in the range of Min. reference voltage in max. power tracking–P15.27. P15.27 must be greater than the min. reference voltage. A smaller difference between them	0.50	○

<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>indicates a smaller range, which means faster tracking. The voltage corresponding to the max. power must be within the range. P15.26 and P15.27 must be adjusted according to the site situation.</td><td></td><td></td></tr>
<tr><td>P15.27</td><td>Max. reference voltage in max. power tracking</td><td>P15.26–P15.31
It is the max. voltage tracked when MPPT max. power tracking is valid.
The factory value depends on the model.<table><tr><th>Model</th><th>Factory value</th></tr><tr><td>-4</td><td>750.0V</td></tr><tr><td>Other</td><td>400.0V</td></tr></table></td><td>Model depended</td><td>○</td></tr>
<tr><td>P15.28</td><td>Adjustment of initial reference voltage</td><td>80–95%
Initial reference voltage = Voc*P15.28</td><td>88%</td><td>○</td></tr>
<tr><td>P15.29</td><td>Auto adjustment interval of Vmppt upper/lower limit</td><td>0.0–10.0s
When P15.29 = 0.0, auto adjustment of Vmppt upper/lower limit is invalid.
When it is not 0.0, Vmppt upper/lower limit is automatically adjusted at an interval specified by P15.29. The center after the adjustment is the actual PV voltage, and the upper/lower limit adjustment range is P15.30. That is:
Max./Min. reference voltage = (Actual PV voltage ± P15.30
This will be automatically updated to P15.26 and P15.27.</td><td>0.0s</td><td>○</td></tr>
<tr><td>P15.30</td><td>Auto adjustment range of Vmppt upper/lower limit</td><td>1.0–100.0V
Range in which Vmppt upper/lower limit can be automatically adjusted.</td><td>30.0V</td><td>○</td></tr>
<tr><td>P15.31</td><td>Vmppt max.</td><td>P15.27–6553.5V</td><td>Model</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>value</td><td>During the max. power tracking, the solar panel reference voltage upper limit will not exceed the value of P15.31.
The factory value depends on the model.<table><tr><th>Model</th><th>Factory value</th></tr><tr><td>-4</td><td>750.0V</td></tr><tr><td>Other</td><td>400.0V</td></tr></table></td><td>depended</td><td></td></tr>
<tr><td>P15.32</td><td>PV input and power frequency input selection</td><td>0: Automatic switching mode
1: Forced power frequency input mode
2: Forced PV input mode
If P15.32 is set to 0, the system switches between PV input and power frequency input according to the detected PV voltage and switching threshold. The keypad displays phase loss pre-alarm (A-SPI) when the mains power supply is not connected successfully.
If P15.32 is set to 1, the system forcibly switches to power frequency input when the mains power supply is connected successfully. Otherwise, the system still maintains the PV input mode, and the keypad displays the prompt of forced power frequency failure (-FAF-).
If P15.32 is set to 2, the system forcibly switches to PV input.
Note: P15.32 is invalid when terminal input function 42 is valid.</td><td>2</td><td>◎</td></tr>
<tr><td>P15.33</td><td>Threshold for switching to power frequency input</td><td>0.0V—P15.34
If PV voltage is lower than the threshold or the light is weak, it can switch to power frequency input through relay output.
Note: The starting voltage of the boost module is 80V, and the mini. working voltage is 70V.
If P15.33 is set to 0, it is invalid.</td><td>70.0V</td><td>○</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>For inverter models without boost modules, the switching voltage is determined by the external voltage detection circuit.
For inverter models with boost modules, the switching voltage is 70V.</td><td></td><td></td></tr>
<tr><td>P15.34</td><td>Threshold for switching to PV input</td><td>P15.33–400.0V
If PV voltage is greater than the threshold, the system can switch to PV input through relay output with the weak-light wake-up delay (P15.24). To avoid frequent switching, P15.34 shall be greater than P15.33. When P15.34 is set to 0.0, it is invalid.
For inverter models without boost modules, the switching voltage is determined by the external voltage detection circuit.
For inverter models with boost modules, the switching voltage is 100.0V.</td><td>100.0V</td><td>○</td></tr>
<tr><td>P15.35</td><td>Rated pump flow</td><td>The pump flow is Q_N when the pump runs at the rated frequency and lift. Unit: m^3/h</td><td>0.0</td><td>○</td></tr>
<tr><td>P15.36</td><td>Rated pump lift</td><td>The pump lift is H_N when the pump runs at the rated frequency and flow. Unit: m</td><td>0.0</td><td>○</td></tr>
<tr><td>P15.37</td><td>Voltage setting at PV undervoltage point</td><td>When the PV voltage is less than the value of this parameter, the system reports the PV undervoltage fault.
The factory value depends on the model.
<table>
<tr><th>Model</th><th>PV undervoltage point</th></tr>
<tr><td>-4</td><td>340.0V</td></tr>
<tr><td>Other</td><td>140.0V</td></tr>
<tr><td>Any model with the boost module</td><td>70V</td></tr>
</table></td><td>340.0V</td><td>○</td></tr>
<tr><td>P15.39</td><td>Product model</td><td>This function code is provided for users to change models. For example, if the user wants to use model -4 (default after</td><td>Model depended</td><td>◎</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>factory delivery) as model -2, P15.39 shall be set to 2.
0: Model -SS2, 220V 1PH input and 1PH output
1: Model -S2, 220V 1PH input and 3PH output
2: Model -2, 220V 3PH input and 3PH output
3: Model -4, 380V 3PH input and 3PH output
Setting range: 0–3
The factory value depends on the model.<table><tr><th>Model</th><th>Factory value</th></tr><tr><td>-4</td><td>3</td></tr><tr><td>-2</td><td>2</td></tr><tr><td>-S2</td><td>1</td></tr><tr><td>-SS2</td><td>0</td></tr></table></td><td></td><td></td></tr>
<tr><td>P15.40</td><td>PQ curve fitting enabling</td><td>0: Disable
1: Enable
Setting range: 0–1
Enable P15.40, and use the point between P15.41 and P15.50 for PQ curve fitting calculation. In this way, the flow calculation will be more accurate.
Setting range: 0.0–1000.0kW</td><td>0</td><td>◎</td></tr>
<tr><td>P15.41</td><td>Power point 1 of PQ curve</td><td>It indicates the power point corresponding to the pump input power at the 1st point of the PQ curve.
Setting range: 0.0–1000.0kW</td><td>0.0kW</td><td>◎</td></tr>
<tr><td>P15.42</td><td>Power point 2 of PQ curve</td><td>It indicates the power point corresponding to the pump input power at the 2nd point of the PQ curve.
Setting range: 0.0–1000.0kW</td><td>0.0kW</td><td>◎</td></tr>
<tr><td>P15.43</td><td>Power point 3 of PQ curve</td><td>It indicates the power point corresponding to the pump input power at the 3rd point of the PQ curve.
Setting range: 0.0–1000.0kW</td><td>0.0kW</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
P15.44	Power point 4 of PQ curve	It indicates the power point corresponding to the pump input power at the 4th point of the PQ curve. Setting range: 0.0–1000.0kW	0.0kW	◎
P15.45	Power point 5 of PQ curve	It indicates the power point corresponding to the pump input power at the 5th point of the PQ curve. Setting range: 0.0–1000.0kW	0.0kW	◎
P15.46	Flow point 1 of PQ curve	It indicates the flow point corresponding to the pump flow at the 1st point of the PQ curve. Setting range: 0.0–1000.0m³/h	0.0m³/h	◎
P15.47	Flow point 2 of PQ curve	It indicates the flow point corresponding to the pump flow at the 2nd point of the PQ curve. Setting range: 0.0–1000.0m³/h	0.0m³/h	◎
P15.48	Flow point 3 of PQ curve	It indicates the flow point corresponding to the pump flow at the 3rd point of the PQ curve. Setting range: 0.0–1000.0m³/h	0.0m³/h	◎
P15.49	Flow point 4 of PQ curve	It indicates the flow point corresponding to the pump flow at the 4th point of the PQ curve. Setting range: 0.0–1000.0m³/h	0.0m³/h	◎
P15.50	Flow point 5 of PQ curve	It indicates the flow point corresponding to the pump flow at the 5th point of the PQ curve. Setting range: 0.0–1000.0m³/h	0.0m³/h	◎
P15.51	Efficiency of pump	This function code indicates the overall efficiency of the pump. Setting range: 0.0–100%	80%	○

P17 group Status viewing

Function code	Name	Description	Default	Modify
P17.01	Output frequency	0.00Hz–P00.03	0.00A	●

Function code	Name	Description	Default	Modify
P17.03	Output voltage	0–1200V	0.00A	●
P17.04	Output current	0.0–5000.0A	0.00A	●
P17.08	Motor power	-300.0–300.0% (of the motor rated power)	0.00A	●
P17.11	DC bus voltage	0.0–2000.0V	0.00V	●
P17.12	Digital input terminal state	0000–00FF	0x0000	●
P17.13	Digital output terminal state	0000–000F	0x0000	●
P17.38	Current of the main winding	It is current of the main winding when applying capacitance-removing to control the single-phase motor. 0.00–100.00A	0.0A	●
P17.39	Current of the secondary winding	It is current of the secondary winding when applying capacitance-removing to control the single-phase motor. 0.00–100.00A	0.0A	●

P18 group Status viewing functions special for solar inverters

Function code	Name	Description	Default	Modify
P18.00	PV reference voltage	MPPT is performed at the inverter side. The value is given by the inverter side. 0–65535.0V	0.0V	●
P18.01	Actual PV voltage	It is transferred from the boost module or equal to bus voltage. 0–65535.0V	0.0V	●
P18.02	MPPT min. reference voltage display	The value displays the mini. voltage reference during max. power tracking. It equals to the solar cell panel open-circuit voltage multiplied P15.26. 0–65535.0V	0.0V	●
P18.04	Present inductive current	It is transferred from the boost module, and valid only in AC mode and invalid in PV mode.	0.0A	●

Function code	Name	Description	Default	Modify
P18.08	Output power	0.00–655.35kW	0.0kW	●
P18.09	Previous PV voltage	0.0–6553.5V	0.0V	●
P18.10	Device power supply display	0x00–0x11 LED ones place: 0: PV power supply 1: AC grid power supply LED tens place: 0: Detect that the system is configured with the boost module. 1: Detect that the system is not configured with the boost module.	0x00	●
P18.11	Actual pump flow	$Q = Q_N * f / f_N$ Unit: m³/h.	0.0m³/h	●
P18.12	Actual pump lift	$H = 0.9H_N * (f / f_N)^2$ Unit: m.	0.0m	●
P18.13	High-order bits in total pump flow	Used to display the 16 high-order bits of the total pump flow. Unit: m³.	0m³	●
P18.14	Low-order bits in total pump flow	Used to display the 16 low-order bits of the total pump flow. Unit: m³. Total pump flow = P18.13*65536 + P18.14	0.0m³	●
P18.15	Reset total pump flow	When it is set to 1, the total pump flow can be reset. P18.13 and P18.14 are cleared and then accumulated again. After the resetting succeeds, P18.15 is automatically changed to 0.	0	◎

P19 group Functions for voltage boost (inverter module communicates with boost module through RS485 communication)

Function code	Name	Description	Default	Modify
P19.00	Boost voltage loop KP	0.000–65.535	0.500	○
P19.01	Boost voltage loop KI	0.000–65.535	0.080	○

Function code	Name	Description	Default	Modify
P19.02	Boost current loop KP	0.000–65.535	0.010	○
P19.03	Boost current loop KI	0.000–65.535	0.010	○
P19.04	Output current upper limit of boost voltage loop PI	Output upper limit of mppt voltage loop PI, upper limit of the boost current loop reference current. P19.05–15.0A	12.0A	○
P19.05	Output current lowerr limit of boost voltage loop PI	Output lower limit of mppt voltage loop PI, lower limit of the boost current loop reference current. 0–P19.04	0.0A	○
P19.06	Bus reference voltage	This function code is used to set the reference voltage of bus voltage at PV input when the system is configured with the boost module. By default, the factory value for 220V models is 350V and the factory value for 380V models is 570V. Setting range: 300.0V–600.0V	330.0V	◎
P19.07	Boost voltage loop KP1	If the difference between the bus reference voltage and actual bus voltage is greater than 20V, the boost voltage loop uses PI parameters of this group. Otherwise, the boost voltage loop uses PI parameters of the first group. Setting range: 0.000–65.535	0.500	○
P19.08	Boost voltage loop KI1	If the difference between the bus reference voltage and actual bus voltage is greater than 20V, the boost voltage loop uses PI parameters of this group. Otherwise, the boost voltage loop uses PI parameters of the first group. Setting range: 0.000–65.535	0.080	○
P19.09	Boost starting voltage	The boost circuit starts when the PV voltage reaches the startup voltage value	80.0V	◎

Function code	Name	Description	Default	Modify
		and other starting conditions are met. 60.0–200.0		
P19.10	Boost software version	Once being powered, the boost module firstly sends its version information to the inverter side.	0.00	●
P19.11	Output voltage filter coefficient	0–10	2	○
P19.14	MPPT adjustment step length	0.0–10.0V If this value is 0, the step length is set automatically and is calculated based on "average voltage/100" in the range of [2.0V,5.0V]. If this value is not 0, the step length is set to this value.	0.0V	○
P19.15	MPPT adjustment time	0.0–120.0s	2.0s	○
P19.16	ΔP coefficient1	0.0%–5.0% This value affects the effect of tracking from right to left, with larger values being closer to the right.	0.3%	○
P19.17	ΔP coefficient2	0.0%–5.0% This value affects the effect of tracking from left to right, with larger values being closer to the right.	0.3%	○
P19.19	Fine-tune reference voltage time	0.00–60.00s When KP2/KI2 is used continuously to exceed this value, the reference voltage is slightly increased by 1V.	0.01s	◎

Note:

- The duration from when the inverter starts to when it runs at the PI output frequency lower limit is determined by the ACC time.
- Delay time counting follows the rules if multiple fault conditions are met simultaneously: For example, if all fault conditions of weak light, full water, and underload are met simultaneously, the delay time for each fault is counted

independently. When the delay time of a fault is reached, the fault is reported. The delay time counting for the other two faults is kept. If the reported faults is resolved bu the conditions of the other two faults persist, the delay time counting of the other two faults continues. If a fault condition is not met during counting, the delay time of this fault is cleared.

7 Fault diagnosis and solution

Do as follows if the inverter encounters a fault:

1. Check whether there is any exception on the keypad. If yes, contact the local INVT office.
2. If no, check function group P07 to view the fault record parameters and understand the actual condition.
3. See the following table for a detailed solution and check for exceptions.
4. Rectify the fault or ask for help.
5. Ensure the fault has been rectified, perform fault reset, and run the inverter again.

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

Fault code	Fault type	Possible cause	Solution
OUt1	[1] Inverter unit U-phase protection	• Acceleration is too fast. • IGBT module is damaged. • Misacts are caused by interference. • Drive wires are poorly connected. • To-ground short circuit occurs.	• Increase ACC time. • Replace the power unit. • Check drive wires. • Check whether there is strong interference surrounding the peripheral device.
OUt2	[2] Inverter unit V-phase protection		
OUt3	[3] Inverter unit W-phase protection		
OC1	[4] Overcurrent during acceleration	• Acceleration or deceleration is too fast. • The voltage of the grid is too low. • The power of the inverter is too low. • The load transients or is abnormal. • There is to-ground short circuit or output phase loss. • There is strong external interference.	• Increase the ACC time. • Check the input power. • Select the inverter with larger power. • Check whether there is short circuit (to-ground or inter-wire) in the load or the rotation is not smooth. • Check the output wiring. • Check whether there is strong interference. • Check the setting of related function codes.
OC2	[5] Overcurrent during deceleration		
OC3	[6] Overcurrent during constant speed running		

Fault code	Fault type	Possible cause	Solution
		• The overvoltage stall protection is not enabled.	• The output cable is too long. For a cable longer than 100m, it is required to configure the corresponding output reactor and debug certain parameters.
OV1	[7] Overvoltage during acceleration	• The input voltage is abnormal. • There is large energy feedback. • No braking components. • Dynamic brake is not enabled.	• Check the input power. • Check whether the loaded DEC time is too short or the inverter starts when the motor is rotating. • Install the braking components. • Check the setting of related function codes.
OV2	[8] Overvoltage during deceleration		
OV3	[9] Overvoltage during constant speed running		
UV	[10] Bus undervoltage	• The voltage of the grid is too low. • Overvoltage stall protection is not enabled.	• Check the grid input power; • Check the settings of related function code.
OL1	[11] Motor overload	• The grid voltage is too low. • The motor rated current is set incorrectly. • Motor stall or load jumps violently.	• Check the grid voltage; • Reset the rated current of the motor; • Check the load and adjust torque boost.
OL2	[12] Inverter overload	• Acceleration is too fast. • The rotating motor is reset. • The grid voltage is too low. • The load is too heavy. • The motor power is too small.	• Increase the ACC time. • Avoid the restarting after stop. • Check the grid voltage. • Select an inverter with larger power. • Select a proper motor.
SPI	[13] Phase loss on the input side	• Phase loss or violent fluctuation occurred on input R, S, T.	• Check the input power; • Check the installation wiring.

Fault code	Fault type	Possible cause	Solution
SPO	[14] Phase loss on output side	• Phase loss output occurs to U, V, W (or the three phases of the load are seriously asymmetrical)	• Check the output wiring; • Check the motor and cable.
OH1	[15] Rectifier module overheating	• Air duct jam or fan damage occurs. • Ambient temperature is too high. • The time of overload running is too long.	• Dredge the vent duct or replace the fan. • Lower the ambient temperature.
OH2	[16] Inverter module overheat		
EF	[17] External fault	• SI external fault input terminal action.	• Check the external device input.
CE	[18] RS485 communication fault	• The baud rate setting is incorrect. • A fault occurs to the communication wiring. • The communication address is incorrect. • Communication suffers from strong interference.	• Set a proper baud rate. • Check the communication interface wiring. • Set a proper communication address. • Replace or change the wiring to enhance the anti-interference capacity.
ItE	[19] Current detection fault	• The control board connector is in poor contact. • Hall device is damaged. • An exception occurs on the magnifying circuit.	• Check the connector and re-plug. • Replace the Hall device. • Change the main control board.
tE	[20] Motor autotuning fault	• The motor capacity does not match the inverter capacity. • Motor parameters are not set correctly. • The difference between the parameters obtained from autotuning and the standard parameters is great. • Autotuning timed out.	• Change the inverter model. • Set the motor type and nameplate parameters correctly. • Empty the motor load. • Check the motor wiring and parameter settings. • Check whether the upper limit frequency is higher than 2/3 of the rated frequency.

Fault code	Fault type	Possible cause	Solution
EEP	[21] EEPROM operation fault	● Error in reading or writing control parameters. ● EEPROM is damaged.	● Press STOP/RST for reset. Change the main control board.
PIDE	[22] PID feedback disconnection	● PID feedback is disconnected. ● The PID feedback source disappears.	● Check the PID feedback signal wires. ● Check the PID feedback source.
END	[24] Running time reached	● The actual running time of the inverter is longer than the internal set running time.	● Ask the supplier to adjust the preset running time.
OL3	[25] Electronic overload fault	● The inverter reports overload pre-alarm according to the setting.	● Check the load and overload pre-alarm threshold.
ETH1	[32] To-ground short-circuit fault 1	● Inverter output is short connected to the ground. ● There is a fault in the current detection circuit.	● Check whether the motor wiring is normal. ● Replace the Hall device. ● Change the main control board.
ETH2	[33] To-ground short-circuit fault 2		
dEu	[34] Speed deviation fault	● The load is too heavy or stalled.	● Check the load and increase the detection time if the load is normal. ● Check whether control parameters are set correctly.
STo	[35] Mal-adjustment fault	● SM control parameters are set incorrectly. ● Autotuned parameters are not accurate. ● The inverter is not connected to the motor.	● Check the load and ensure the load is normal. ● Check whether control parameters are set correctly. ● Increase the maladjustment detection time.
LL	[36] Electronic underload fault	● The inverter reports underload pre-alarm according to the setting.	● Check the load and overload pre-alarm threshold.
tSF	[37] Hydraulic	● Hydraulic probe damage	● Replace the hydraulic

Fault code	Fault type	Possible cause	Solution
	probe damage fault		probe
PINV	[38] PV reverse connection fault	● PV wiring is incorrect.	● Change the wiring direction of positive and negative terminals, and perform the wiring again.
PVOC	[39] PV overcurrent	● ACC/DEC is too fast. ● The power of the inverter is too low. ● The load transients or is abnormal. ● There is to-ground short circuit.	● Increase the ACC/DEC time. ● Select the inverter with a larger power. ● Check if the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth.
PVOV	[40] PV overvoltage	● Input voltage of the solar cell panel is too high. ● Model -4 is set as another model.	● Reduce the number of solar cell panels in series connection. ● Check and reset the model.
PVLV	[41] PV undervoltage	● The power of the solar cell panels in series connection is too low or it is cloudy and rainy weather. ● The starting current of the motor is too high.	● Increase the number of solar cell panels or perform the test in the normal sunlight. ● Replace the motor.
E-422	[42] Fault on 422 communication with the boost module	● Communication cables are in poor contact.	● Check four communication cables of 422 communication, ensuring that they are connected reliably.
OV	[43] Bus overvoltage detected on the boost side	● The sunlight changes sharply.	● Adjust the boost PI parameters, and enlarge the values of P19.07 and P19.08.
A-LS	Weak-light pre-alarm	● The sunlight is weak or the solar panel	● The device will automatically run when the

Fault code	Fault type	Possible cause	Solution
		configuration is insufficient.	light is sufficient. ● Check whether the solar panel configuration is sufficient.
A-LL	Underload pre-alarm	● The pumping pool has no water.	● Check the pumping pool.
A-tF	Full-water pre-alarm	● The pumping pool is full	● If you have configured the full-water pre-alarm function, the device automatically stops when the pre-alarm elapsed a period of time. Otherwise, check whether terminals are wired correctly.
A-tL	Empty-water pre-alarm	● The pumping pool has no water.	● If you have configured the empty-water pre-alarm function, the device automatically stops when the pre-alarm elapsed a period of time. Otherwise, check whether terminals are wired correctly.

8 Communication protocol

8.1 Brief instruction to Modbus protocol

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 send 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) form 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 inverter send the data only after receiving the command, then the inverter 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.

8.2 Application of the inverter

The inverter uses the Modbus RTU mode and the physical layer is 2-wire RS485.

8.2.1 2-wire RS485

2-wire RS485 interfaces works in half-duplex mode and send data signals in the differential transmission way, which is also referred to as balanced transmission. An RS485 interface

uses a twisted pair, in which one wire is defined as A (+), and the other B (-). Generally, if the positive electrical level between the transmission drives A and B ranges from +2 V to +6 V, the logic is "1"; and if it ranges from -2 V to -6 V, the logic is "0".

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

The communication baud rate (P14.01) indicates the number of bits sent in a second, and the unit is bit/s (bps). A higher baud rate indicates faster transmission and poorer anti-interference capability. When a twisted pair of 0.56mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

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

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

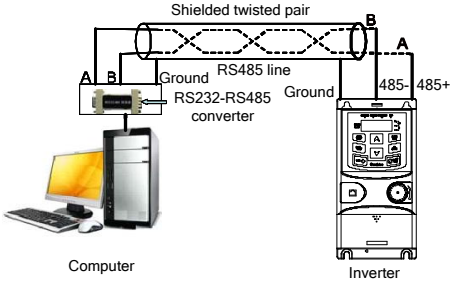
When there are fewer devices and the transmission distance is short, the whole network works well without terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120Ω terminal resistor when the transmission distance is long.

8.2.1.1 When one inverter is used

Figure 8-1 is the Modbus wiring diagram for the network with one inverter and PC. Generally, PCs do not provide RS485 interfaces, and therefore you need to convert an RS232 or USB interface of a PC to an RS485 interface through a converter. Then, connect end A of the RS485 interface to the 485+ port on the terminal block of the inverter, and connect end B to the 485- port. It is recommended that you use shielded twisted pairs. When an RS232-RS485 converter is used, the cable used to connect the RS232 interface of the PC and the converter cannot be longer than 15 m. Use a short cable when possible. It is recommended that you insert the converter directly into the PC. Similarly, when a USB-RS485 converter is used, use a short cable when possible.

When the wiring is completed, select the correct port (for example, COM1 to connect to the RS232-RS485 converter) for the upper computer of the PC, and keep the settings of basic parameters such as communication baud rate and data check bit consistent with those of the inverter.

Figure 8-1 RS485 wiring diagram for the network with one inverter



8.2.1.2 When multiple inverters are used

In the network with multiple inverters, chrysanthemum connection and star connection are commonly used. According to the requirements of the RS485 industrial bus standards, all the devices need to be connected in chrysanthemum mode with one 120 Ω terminal resistor on each end, as shown in Figure 8-2.

Figure 8-2 Practical application diagram of chrysanthemum connection

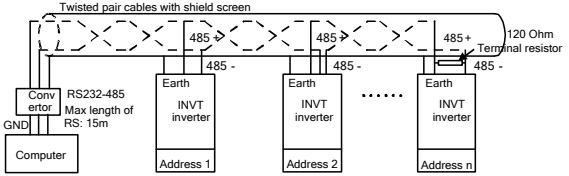
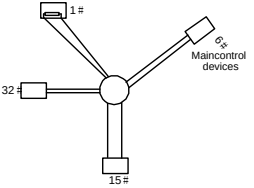


Figure 8-3 shows the start connection diagram. When this connection mode is adopted, the two devices that are farthest away from each other on the line must be connected with a terminal resistor (in this figure, the two devices are devices 1# and 15#).

Figure 8-3 Star connection



Use shielded cables, if possible, in multi-inverter connection. The baud rates, data bit check settings, and other basic parameters of all the devices on the RS485 line must be set consistently, and addresses cannot be repeated.

8.2.2 RTU mode

8.2.2.1 RTU communication frame structure

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

Code system

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

Error detection domain

- Cyclic redundancy check (CRC)

The following table describes the data format.

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

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

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

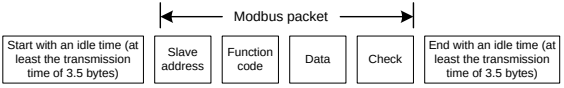
Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Check bit	Stop bit

In a character frame, only the data bits carry information. The start bit, check bit, and stop bit are used to facilitate the transmission of the data bits to the destination device. In practical

applications, you must set the data bits, parity check bits, and stop bits consistently.

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

RTU data frame format



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

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

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

8.2.2.2 RTU communication frame error check modes

During the transmission of data, errors may occur due to various factors (such as electromagnetic interference). For example, if the sending message is a 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". Without error check, the data receiving device cannot identify data errors and may make a wrong response. The wrong response may cause severe problems. Therefore, the data must be checked.

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

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

Bit check on individual bytes (odd/even check)

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

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

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

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

Cyclical Redundancy Check (CRC) method

A frame in the RTU format includes an error detection domain based on the CRC calculation. The CRC domain checks all the content of the frame. The CRC domain consists of two bytes, including 16 binary bits. It is calculated by the transmitter and added to the frame. The receiver

calculates the CRC of the received frame, and compares the result with the value in the received CRC domain. If the two CRC values are not equal to each other, errors occur in the transmission.

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

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

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

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

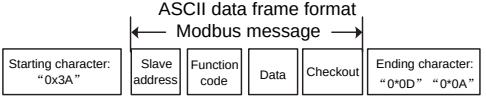
```
unsigned int crc_cal_value(unsigned char *data_value,unsigned char
data_length)
{
int i;
unsigned int crc_value=0xffff;
while(data_length--)
{   crc_value^=*data_value++;
           for(i=0;i<8;i++)
           {
if(crc_value&0x0001)crc_value=(crc_value>>1)^0xa001;
           else crc_value=crc_value>>1;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

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

8.2.3 ASCII mode

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td>Coding system</td><td>Communication protocol belongs to hexadecimal system. The meaning of message character in ASCII: "0"…"9", "A"…" F", each hex is represented by the ASCII message corresponds to the character.
<table>
<tr><td>Character</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>ASCII CODE</td><td>0x30</td><td>0x31</td><td>0x32</td><td>0x33</td><td>0x34</td><td>0x35</td><td>0x36</td><td>0x37</td></tr>
<tr><td>Character</td><td>"8"</td><td>"9"</td><td>"A"</td><td>"B"</td><td>"C"</td><td>"D"</td><td>"E"</td><td>"F"</td></tr>
<tr><td>ASCII CODE</td><td>0x38</td><td>0x39</td><td>0x41</td><td>0x42</td><td>0x43</td><td>0x44</td><td>0x45</td><td>0x46</td></tr>
</table></td></tr>
<tr><td>Data format</td><td>Starting bit, 7/8 data bit, check bit and stop bit. The data formats are listed as follows.
11-bit character frame:
<table>
<tr><td>Starting bit</td><td>Bit1</td><td>Bit2</td><td>Bit3</td><td>Bit4</td><td>Bit5</td><td>Bit6</td><td>Bit7</td><td>Bit8</td><td>Check bit</td><td>Stop bit</td></tr>
</table>10-bit character frame:
<table>
<tr><td>Starting bit</td><td>Bit1</td><td>Bit2</td><td>Bit3</td><td>Bit4</td><td>Bit5</td><td>Bit6</td><td>Bit7</td><td>Check bit</td><td>Stop bit</td></tr>
</table></td></tr>
</table>

In ASCII mode, the frame header is ":" ("0*3A"), frame end is "CRLF" ("0*0D" "0*0A") by default. In ASCII mode, all the data bytes, except for the frame header and frame end, are transmitted in ASCII code mode, in which four MSB groups will be sent out first and then, four LSB groups will be sent out. In ASCII mode, the data length is 8 bit. As for "A"–"F", its capital letters is adopted for ASCII code. The data now adopts LRC checkout which covers slave address to data information. The checksum equals to the complement of the character sum of all the participated checkout data.



Standard structure of ASCII frame:

START	":" (0x3A)
Address Hi	Communication address: 8-bit address is formed by the combination of two ASCII codes
Address Lo	
Function Hi	Function code: 8-bit address is formed by the combination of two ASCII codes
Function Lo	
DATA (N-1) … DATA (0)	Data content: nx8-bit data content is formed by combination of 2n (n≤16) ASCII codes
LRC CHK Hi	LRC check code:

LRC CHK Lo	8-bit check code is formed by the combination of two ASCII codes.
END Hi	End character:
END Lo	END Hi=CR (0x0D), END Lo=LF (0x0A)

8.2.3.1 ASCII mode check (LRC Check)

Check code (LRC Check) is the value combined of address and data content result. For instance, the check code of above 2.2.2 communication message is: 0x02+0x06+0x00+0x08+0x13+0x88=0xAB, then take the compliment of 2=0x55.

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

```
Static unsigned char
LRC(auchMsg,usDataLen)
unsigned char *auchMsg;
unsigned short usDataLen;
{
unsigned char uchLRC=0;
while(usDataLen--)
uchLRC+=*auchMsg++;
return((unsigned char)(-((char)uchLRC)));
}
```

8.3 Command code and communication data

8.3.1 RTU mode

8.3.1.1 Command code 03H (corresponding to binary 0000 0011), read N words (Word) (N≤16)

Command code 03H means that if the master read data from the inverter, 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 state of the inverter.

For example, read continuous 2 data content from 0004H from the inverter with the address of 01H (read the content of data address of 0004H and 0005H), the frame structure is as follows.

RTU master command (sent from the master to the inverter)		RTU slave response (sent from the inverter to the master)	
START	T1-T2-T3-T4	START	T1-T2-T3-T4
ADDR	01H	ADDR	01H
CMD	03H	CMD	03H
		Byte number	04H
MSB of the start address	00H	MSB of data in 0004H	13H
LSB of the start address	04H	LSB of data in 0004H	88H
MSB of data number	00H	MSB of data in 0005H	00H
LSB of data number	02H	LSB of data in 0005H	00H
LSB of CRC	85H	LSB of CRC CHK	7EH
MSB of CRC	CAH	LSB of CRC CHK	9DH
END	T1-T2-T3-T4	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 inverter with the address of 01H and ADDR occupies one byte

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

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

The meaning of the response is that:

ADDR = 01H means the command message is transmitted by the inverter whose address is 01H. The ADDR information occupies one byte.

CMD=03H means the message is received from the inverter to the master for the response of reading command The CMD information 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 "LSB of CRC CHK", which are "MSB of data in 0004H", "LSB of data in 0004H", "MSB of data in 0005H" and "LSB of data in 0005H".

There are 2 bytes stored in one data with the fact that the MSB is in the front and the LSB 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 LSB is in the front and the MSB is in the behind.

8.3.1.2 Command code 06H (corresponding to binary 0000 0110), write a word

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

For example, write 5000 (1388H) to 0004H from the inverter with the address of 02H, the frame structure is as follows.

RTU master command (sent from the master to the inverter)		RTU slave response (sent from the inverter to the master)	
START	T1-T2-T3-T4	START	T1-T2-T3-T4
ADDR	02H	ADDR	02H
CMD	06H	CMD	06H
MSB of data writing address	00H	MSB of data writing address	00H
LSB of data writing address	04H	LSB of data writing address	04H
MSB of to-be-written data	13H	MSB of to-be-written data	13H
LSB of to-be-written data	88H	LSB of to-be-written data	88H
LSB of CRC CHK	C5H	LSB of CRC CHK	C5H
MSB of CRC CHK	6EH	MSB of CRC CHK	6EH
END	T1-T2-T3-T4	END	T1-T2-T3-T4

Note: Sections 8.3.1.1 and 8.3.1.2 mainly describe the command format.

8.3.1.3 Command code 10H, continuous writing

Command code 10H means that if the master writes data to the inverter, 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 inverter whose slave address is 02H and 50 (0032H) to 0005H, the frame structure is as follows.

The RTU request command is:

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	02H

CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data quantity	00H
LSB of data quantity	02H
Byte number	04H
MSB of data in 0004H	13H
LSB of data in 0004H	88H
MSB of data in 0005H	00H
LSB of data in 0005H	32H
LSB of CRC	C5H
MSB of CRC	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

The RTU response command is:

START	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data quantity	00H
LSB of data quantity	02H
LSB of CRC	C5H
MSB of CRC	6EH
END	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

8.3.2 ASCII mode

8.3.2.1 Command code: 03H (0000 0011), read N words (Word) (max. number for continuous reading is 16 words)

For instance: As for the inverter whose slave address is 01H, the starting address of internal storage is 0004, read two words continuously, the structure of this frame is listed as follows.

ASCII master command (sent from the master to the inverter		ASCII slave response (sent from the inverter to the master)	
START	":"	START	":"
ADDR	"0"	ADDR	"0"

ASCII master command (sent from the master to the inverter)		ASCII slave response (sent from the inverter to the master)	
	"1"		"1"
CMD	"0"	CMD	"0"
	"3"		"3"
MSB of starting address	"0"	Byte number	"0"
	"0"		"4"
LSB of starting address	"0"	MSB of data address 0004H	"1"
	"4"		"3"
MSB of data number	"0"	LSB of data address 0004H	"8"
	"0"		"8"
LSB of data number	"0"	MSB of data address 0005H	"0"
	"2"		"0"
LRC CHK Hi	"F"	LSB of data address 0005H	"0"
LRC CHK Lo	"6"		"0"
END Hi	CR	LRC CHK Hi	"5"
END Lo	LF	LRC CHK Lo	"D"
		END Hi	CR
		END Lo	LF

8.3.2.2 Command code: 06H (0000 0110), write a word (Word)

For instance: Write 5000 (1388H) to the 0004H address of the inverter whose slave address is 02H, then the structure of this frame is listed as follows.

ASCII master command (sent from the master to the inverter)		ASCII slave response (sent from the inverter to the master)	
START	":"	START	":"
ADDR	"0"	ADDR	"0"
	"2"		"2"
CMD	"0"	CMD	"0"
	"6"		"6"
MSB of data writing address	"0"	MSB of data writing address	"0"
	"0"		"0"
LSB of data writing address	"0"	LSB of data writing address	"0"
	"4"		"4"
MSB of to-be-written data	"1"	MSB of to-be-written data	"1"
	"3"		"3"
LSB of to-be-written data	"8"	LSB of to-be-written data	"8"
	"8"		"8"

ASCII master command (sent from the master to the inverter)		ASCII slave response (sent from the inverter to the master)	
LRC CHK Hi	"5"	LRC CHK Hi	"5"
LRC CHK Lo	"9"	LRC CHK Lo	"9"
END Hi	CR	END Hi	CR
END Lo	LF	END Lo	LF

8.3.2.3 Command code: 10H, continuous writing

Command code 10H means the master write data to the inverter, the number of data being written is determined by the command "data number", the max. number of continuous writing is 16 words.

For instance: Write 5000 (1388H) to 0004H of the inverter whose slave address is 02H, write 50 (0032H) to 0005H of the inverter whose slave address is 02H, then the structure of this frame is listed as follows.

ASCII master command (sent from the master to the inverter)		ASCII slave response (sent from the inverter to the master)	
START	":"	START	":"
ADDR	"0"	ADDR	"0"
	"2"		"2"
CMD	"1"	CMD	"1"
	"0"		"0"
MSB of starting address	"0"	MSB of starting address	"0"
	"0"		"0"
LSB of starting address	"0"	LSB of starting address	"0"
	"4"		"4"
MSB of data number	"0"	MSB of data number	"0"
	"0"		"0"
LSB of data number	"0"	LSB of data number	"0"
	"2"		"2"
Byte number	"0"	LRC CHK Hi	"E"
	"4"	LRC CHK Lo	"8"
MSB of data to be written to 0004H	"1"	END Hi	CR
LSB of data to be written to 0004H	"3"	END Lo	LF
MSB of data to be written to 0005H	"8"	/	/
	"8"	/	/
MSB of data to be	"0"	/	/

ASCII master command (sent from the master to the inverter)		ASCII slave response (sent from the inverter to the master)	
written to 0004H LSB of data to be written to 0004H	"0"	/	/
MSB of data to be written to 0005H	"3"	/	/
	"2"	/	/
LRC CHK Hi	"1"	/	/
LRC CHK Lo	"7"	/	/
END Hi	CR	/	/
END Lo	LF	/	/

8.4 Data address definition

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

8.4.1 Function code address format rules

The parameter address occupies 2 bytes with the fact that the MSB is in the front and the LSB is in the behind. The range of MSB and LSB are: MSB—00–ffH; LSB—00–ffH. The MSB is the group number before the radix point of the function code and the LSB is the number after the radix point. But both the MSB and the LSB should be changed into hex. For example P05.05, the group number before the radix point of the function code is 05, then the MSB of the parameter is 05, the number after the radix point 05, then the LSB of the parameter is 05, then the function code address is 0505H and the parameter address of P11.01 is 0A01H.

Function code	Name	Description	Default	Modify
P11.01	Frequency decrease at sudden power loss	0: Disable 1: Enable	0	○

Note:

✧ P29 group is the factory parameter which cannot be read or changed. Some parameters cannot be changed when the inverter is in the running state and some parameters cannot be changed in any state. The setting range, unit and related 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 MSB of the function code form 0 to 1 can also realize the function. For example, the function code P00.13 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.

8.4.2 Description of other function addresses in Modbus

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

Below is the parameter list of other functions.

Function instruction	Address definition	Data meaning instruction	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 to stop	
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 to100.0%)	
	2003H	PID feedback, range (0–1000, 1000 corresponds to100.0%)	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	R/W

Function instruction	Address definition	Data meaning instruction	R/W characteristics
		rated current of the motor)	
	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 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	R/W
	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 inverter	2100H	0001H: Forward running	R
		0002H: Forward running	
		0003H: Stop	
		0004H: Fault	
		0005H: POFF state	
		0006H: Pre-exciting state	
SW 1 of the inverter	2101H	Bit0: =0: bus voltage is not established =1: bus voltage is established Bi1–2: =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:	R

Function instruction	Address definition	Data meaning instruction		R/W characteristics
		overload pre-alarm Bit5–Bit6: =00: keypad control =01: terminal control =10: communication control		
Fault code of the inverter	2102H	See the fault type instruction		R
Identifying code of the inverter	2103H	GD170-PV-----0x0190		R
Running frequency	3000H	0–Fmax (Unit: 0.01Hz)	Compatible with GD series, CHF100A, and CHV100 communication addresses	R
Set frequency	3001H	0–Fmax (Unit: 0.01Hz)		R
Bus voltage	3002H	0.0–2000.0V (Unit: 0.1V)		R
Output voltage	3003H	0–1200V (Unit: 1V)		R
Output current	3004H	0.0–3000.0A (Unit: 0.1A)		R
Rotating speed	3005H	0–65535 (Unit: 1RPM)		R
Output power	3006H	-300.0–300.0% (Unit: 0.1%)		R
Output torque	3007H	-250.0–250.0% (Unit: 0.1%)		R
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		
Output state	300BH	000–1FF		
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

Function instruction	Address definition	Data meaning instruction		R/W characteristics
PLC and current step of multi-step speed	3012H	0–15		R
External length	3013H	0–65535		R
External count value	3014H	0–65535		R
Torque setting	3015H	-300.0–300.0% (Unit: 0.1%)		R
Inverter 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 inverter 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 inverter 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.

The encoding rules for device codes (corresponding to identifying code 2103H of the inverter

MSB of code	Meaning	LSB of code	Meaning
0x01	Goodrive	0x93	Goodrive170-PV Series Solar Pump Inverter

Note: The code is consisted of 16 bit 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.

8.4.3 Fieldbus ratio values

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
P01.21	Power-off restart selection	0: Disable 1: Enable	0	○

The value specified in "Setting range" or "Default" contains one decimal, so the fieldbus scale is 10. If the value received by the upper computer is 50, the value of "Wake-up-from-sleep delay" of the inverter is 5.0 (5.0=50/10).

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

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

After receiving the command, the inverter converts 50 into 5.0 based on the fieldbus scale, and then sets "Wake-up-from-sleep delay" to 5.0s.

For another example, after the upper computer transmits the "Wake-up-from-sleep delay" parameter command, the master receives the following response from the inverter:

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

The parameter data is 0032H, that is, 50, so 5.0 is obtained based on the fieldbus scale (50/10=5.0). In this case, the master identifies that the "Wake-up-from-sleep delay" is 5.0s.

8.4.4 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 inverter returns an error message response. Error message responses are sent from the inverter 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 request.
02H	Invalid data	For the inverter, the data address in the request of the upper

Code	Name	Meaning
	address.	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 inverter.
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 inverter 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 inverter (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
Inverter 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 inverter will return fault response message as follows.

01	86	04	43 A3
Inverter 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.

8.5 Read/Write operation example

For details about the formats of the read and write commands, see section 8.3.

8.5.1 Examples of reading command 03H

Example 1: Read the state word 1 of the inverter whose address is 01H. See 8.4.2 Description of other function addresses in Modbus, the parameter address of the state word 1 of the inverter is 2100H.

RTU mode:

The command sent to the inverter:

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

If the response message is as follows.

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

ASCII mode:

The command sent to the inverter:

:	01	03	21 00	00 01	DA	CR LF
START	Inverter address	Read command	Parameters address	Data number	LRC check	END

If the operation is successful, the following response is returned:

:	01	03	02	00 03	F7	CR LF
START	Inverter address	Read command	Byte number	Data content	LRC check	END

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

8.5.2 Examples of writing command 06H

Example 1: Set the inverter whose address is 03H to be forward running. See 8.4.2 Description of other function addresses in Modbus, the address of "Communication control command" is 2000H, and 0001H indicates forward running.

Function instruction	Address definition	Data meaning instruction	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 (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	

RTU mode:

The command sent by the master:

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

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

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

ASCII mode:

The command sent to the inverter:

:	01	06	20 00	00 01	D6	CR LF
START	Inverter address	Write command	Parameters address	Data number	LRC check	END

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

:	01	06	20 00	00 01	D6	CR LF
START	Inverter address	Write command	Parameters address	Data number	LRC check	END

Example 2: set the max output frequency of the inverter with the address of 03H as 100Hz.

Function code	Name	Description	Default	Modify
P00.03	Max. output frequency	Used to set the max. output frequency of the inverter. 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 max. output frequency (P00.03) is 100. 100Hz timed by 100 is 10000 and the corresponding hex is 2710H.

RTU mode:

The command sent by the master:

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

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

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

ASCII mode:

The command sent to the inverter:

:	03	06	00 03	27 10	BD	CR LF
START	Inverter address	Write command	Parameters address	Parameter data	LRC check	END

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

:	03	06	00 03	27 10	BD	CR LF
START	Inverter address	Write command	Parameters address	Parameter data	LRC check	END

8.5.3 Examples of continuous writing command10H

Example 1: Set the inverter whose address is 01H to be forward running at the frequency of 10Hz. See 8.4.2 Description of other function addresses in Modbus, the address of "Communication control command" is 2000H, and 0001H indicates forward running. The address of "Communication frequency setting" is 2001H, and 10 Hz is 03E8H in the hexadecimal form.

Function instruction	Address definition	Data meaning instruction	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 (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging to stop	
Address of communication setting	2001H	Communication setting frequency (0–Fmax (unit: 0.01Hz))	R/W
	2002H	PID given, range (0–1000, 1000 corresponds to100.0%)	

RTU mode:

The command sent to the inverter:

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

If the operation is successful, the following response is returned:

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

ASCII mode:

The command sent to the inverter:

:	01	10	20 00	00 02	04	00 01	03 E8	BD	CR LF
START	Inverter address	Continuous writing command	Parameters address	Data number	Byte number	Forward running	10Hz	LRC check	END

If the operation is successful, the following response is returned:

:	01	10	20 00	00 02	CD	CR LF
START	Inverter address	Continuous writing command	Parameters address	Data number	LRC check	END

Example 2: Set ACC time of 01H inverter as 10s and DEC time as 20s.

Function code	Name	Description	Default	Modify
P00.11	ACC time 1	Setting range of P00.11 and P00.12:	Depend on model	○
P00.12	DEC time 1	0.0–3600.0s	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.

RTU mode:

The command sent to the inverter:

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

If the operation is successful, the following response is returned:

01	10	00 0B	00 02	30 0A
Inverter address	Continuous writing command	Parameters address	Data number	CRC check

ASCII mode:

The command sent to the inverter:

:	01	10	00 0B	00 02	04	00 64	00 C8	B2	CR LF
START	Inverter address	Continuous writing command	Parameters address	Data number	Number of bytes	10s	20s	LRC check	END

If the operation is successful, the following response is returned:

:	01	10	00 0B	00 02	E2	CR LF
START	Inverter address	Continuous writing command	Parameters address	Data number	LRC check	END

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.

8.6 Common communication faults

Common communication faults include the following:

✧ No response is returned.

✧ The inverter 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 inverter.

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

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

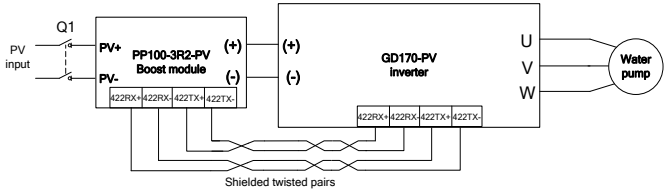
Appendix A Options

A.1 Boost module

The pump inverters of 2.2kW support an optional boost module (PP100-3R2-PV) to improve the utilization ratio of the PV cell module. The figure below shows the wiring method.

1. Connect PV+ and PV- of the boost module to positive and negative input terminals of the PV cell module respectively.
2. Connect output terminals (+) and (-) of the boost module to input terminals (+) and (-) of the pump inverter respectively.
3. Connect 422-communication receiving terminal RX of the boost module to 422-communication sending terminal TX of the pump inverter, connect 422-communication sending terminal TX of the boost module to 422-communication receiving terminal RX of the pump inverter, and use two sets of twisted pairs for wiring.
4. Ensure that the wiring is connected properly, and switch on the breaker Q1 at the DC side for automotive running.

Figure A-1 Connection between the boost module and the inverter



Boost module specifications:

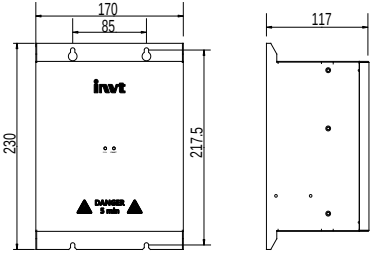
Model	PP100-3R2-PV
Input side	
Max. input power (W)	3200
Max. DC voltage (V)	600
Start voltage (V)	80
Min. working voltage (V)	70
Max. input current (A)	12
Output side	
Output voltage (V)	380V inverter: 570

Status indicator description:

Displayed status	Description
Green LED flickering	The boost module has been powered on, and the control circuit is working.
Green LED normally on	The boost module is running.
Red LED on	The boost module is faulty.

The following figure shows the installation dimension drawing of the boost module.

Figure A-2 Installation dimensions of the boost module

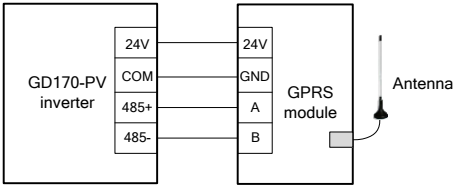


A.2 GPRS module and monitoring app

The pump inverter supports an optional GPRS module to implement remote monitoring, and the GPRS module connects to the inverter through RS485 communication. The running state of the inverter can be monitored in real time on the APP in the mobile phone or web page.

Method for connecting the GPRS module to the inverter:

Figure A-3 Connection between the GPRS module and the inverter



For details, see the *GPRS/GPS Adaptor Operation Manual* which comes with the GPRS module or contact the local INVT office. Provide the model and serial number of the

product you query about.

A.3 Cable

A.3.1 Powe cable

The sizes of the input power cables and motor cables must comply with local regulations.

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

A.3.2 Control cable

A relay cable needs to carry the metal braided shield layer.

Keypads need to be connected by using network cables. In complicated electromagnetic environments, shielded network cables are recommended.

A shielded twisted-pair cable is recommended for a communication cable.

Note:

- Analog signals and digital signals cannot share a same cable, and their cables must be routed separately.
- Before connecting the input power cable of the inverter, check the insulation conditions of the cable according to local regulations.

Recommended power cable sizes for standard inverter models:

Inverter model	Recommended cable size (mm^2)		Terminal screw	Tightening torque (Nm)
	(+)/(-), R/S/T, U/V/W	PE		
GD170-0R4-S2-PV	1.5	1.5	M4	0.8
GD170-0R7-S2-PV	1.5	1.5	M4	0.8
GD170-0R4-SS2-PV	1.5	1.5	M4	0.8
GD170-0R7-4-PV	1.5	1.5	M4	0.8
GD170-1R5-4-PV	1.5	1.5	M4	0.8
GD170-2R2-4-PV	1.5	1.5	M4	0.8
GD170-1R5-S2-PV	2.5	2.5	M4	0.8
GD170-2R2-S2-PV	2.5	2.5	M4	0.8
GD170-0R7-SS2-PV	2.5	2.5	M4	0.8
GD170-1R5-SS2-PV	2.5	2.5	M4	0.8
GD170-2R2-SS2-PV	2.5	2.5	M4	0.8
GD170-004-4-PV	2.5	2.5	M4	1.2–1.5
GD170-5R5-4-PV	2.5	2.5	M4	1.2–1.5
GD170-1R5-2-PV	2.5	2.5	M4	1.2–1.5
GD170-2R2-2-PV	2.5	2.5	M4	1.2–1.5
GD170-7R5-4-PV	4	4	M5	2–2.5

Inverter model	Recommended cable size (mm^2)		Terminal screw	Tightening torque (Nm)
	(+)/(-), R/S/T, U/V/W	PE		
GD170-004-2-PV	4	4	M5	2–2.5
GD170-011-4-PV	6	6	M5	2–2.5
GD170-5R5-2-PV	6	6	M5	2–2.5
GD170-015-4-PV	10	10	M5	2–2.5
GD170-7R5-2-PV	10	10	M5	2–2.5
GD170-018-4-PV	16	16	M5	2–2.5
GD170-022-4-PV	25	16	M5	2–2.5
GD170-030-4-PV	25	16	M6	4–6
GD170-037-4-PV	35	16	M6	4–6
GD170-045-4-PV	35	16	M8	10
GD170-055-4-PV	50	25	M8	10
GD170-075-4-PV	70	35	M8	10
GD170-090-4-PV	95	50	M12	31–40
GD170-110-4-PV	120	70	M12	31–40
GD170-132-4-PV	185	95	M12	31–40
GD170-160-4-PV	240	120	M12	31–40
GD170-185-4-PV	120*2P	150	M12	31–40
GD170-200-4-PV	120*2P	150	M12	31–40
GD170-220-4-PV	95*2P	95	M12	31–40
GD170-250-4-PV	95*2P	95	M12	31–40
GD170-280-4-PV	150*2P	150	M12	31–40
GD170-315-4-PV	150*2P	150	M12	31–40
GD170-355-4-PV	185*2P	185	M12	31–40
GD170-400-4-PV	150*3P	120*2P	M12	31–40
GD170-450-4-PV	185*3P	120*2P	M12	31–40
GD170-500-4-PV	185*3P	120*2P	M12	31–40

Note:

- The cables recommended for the main circuit can be used in scenarios where the ambient temperature is lower than 40°C, the wiring distance is shorter than 100 m, and the current is the rated current.
- If a control cable and power cable must cross each other, ensure that the angle between them is 90 degrees.
- If the inside of motor is moist, the insulation resistance is reduced. If you suspect the inside of motor is moist, dry and re-measure the motor.

A.4 Reactor

When the distance between the inverter and motor is longer than 50 m, the parasitic capacitance between the long cable and ground may cause large leakage current, and overcurrent protection of the inverter may be frequently triggered. To prevent this from happening and avoid damage to the motor insulator, compensation must be made by adding an output reactor. When the inverter is used to drive multiple motors, take the total length of the motor cables (that is, sum of the lengths of the motor cables) into account. When the total length is longer than 50 m, an output reactor must be added on the output side of the inverter. When the distance between the inverter and motor ranges from 50 m to 150 m, select the reactor according to the following table. If the distance is longer than 150 m, contact INVT's technical support technicians.

Output reactor model selection:

Inverter model	Output reactor
GD170-1R5-2-PV	OCL2-004-4
GD170-2R2-2-PV	OCL2-004-4
GD170-004-2-PV	OCL2-5R5-4
GD170-5R5-2-PV	OCL2-7R5-4
GD170-7R5-2-PV	OCL2-015-4
GD170-0R7-4-PV	OCL2-1R5-4
GD170-1R5-4-PV	OCL2-1R5-4
GD170-2R2-4-PV	OCL2-2R2-4
GD170-004-4-PV	OCL2-004-4
GD170-5R5-4-PV	OCL2-5R5-4
GD170-7R5-4-PV	OCL2-7R5-4
GD170-011-4-PV	OCL2-011-4
GD170-015-4-PV	OCL2-015-4
GD170-018-4-PV	OCL2-018-4
GD170-022-4-PV	OCL2-022-4
GD170-030-4-PV	OCL2-037-4
GD170-037-4-PV	OCL2-037-4
GD170-045-4-PV	OCL2-045-4
GD170-055-4-PV	OCL2-055-4
GD170-075-4-PV	OCL2-075-4
GD170-090-4-PV	OCL2-110-4
GD170-110-4-PV	OCL2-110-4
GD170-132-4-PV	OCL2-160-4
GD170-160-4-PV	OCL2-200-4

Inverter model	Output reactor
GD170-185-4-PV	OCL2-200-4
GD170-200-4-PV	OCL2-200-4
GD170-220-4-PV	OCL2-280-4
GD170-250-4-PV	OCL2-280-4
GD170-280-4-PV	OCL2-350-4
GD170-315-4-PV	OCL2-350-4
GD170-355-4-PV	OCL2-400-4
GD170-400-4-PV	OCL2-400-4
GD170-450-4-PV	OCL2-500-4
GD170-500-4-PV	OCL2-500-4

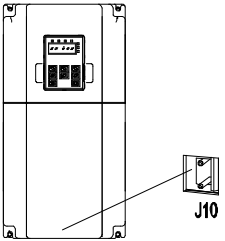
Note:

- The rated output voltage drop of output reactors is 1%±15%.
- All the options in the preceding table are externally configured. You need to specify whether the options are externally configured in your purchase order.

A.5 Filter

Goodrive170-PV series inverters of ≥ 5.5kW contain built-in C3 filters. You can use the jumper J10 to determine whether to connect it.

Connection method: Open the lower cover, find the location of J10, and insert the jumper terminals delivered with the inverter.



Note: The input EMI meets the C3 requirements after a filter is configured.

Appendix B Recommended solar module configuration

B.1 Recommended solar module configuration for solar pump inverters

Solar pump inverter model	Open-circuit voltage class of solar module			
	37±1V		45±1V	
	Module power ± 5Wp	Modules per string * Strings	Module power ± 5Wp	Modules per string * Strings
GD170-0R4-SS2-PV	250	11*1	300	9*1
GD170-0R7-SS2-PV	250	11*1	300	9*1
GD170-1R5-SS2-PV	250	11*1	300	9*1
GD170-2R2-SS2-PV	250	11*1	300	9*1
GD170-0R4-S2-PV	250	11*1	300	9*1
GD170-0R7-S2-PV	250	11*1	300	9*1
GD170-1R5-S2-PV	250	11*1	300	9*1
GD170-2R2-S2-PV	250	11*1	300	9*1
GD170-1R5-2-PV	250	11*1	300	9*1
GD170-2R2-2-PV	250	11*1	300	9*1
GD170-004-2-PV	250	11*2	300	9*2
GD170-5R5-2-PV	250	11*3	300	9*3
GD170-7R5-2-PV	250	11*4	300	9*4
GD170-0R7-4-PV	250	18*1	300	15*1
GD170-1R5-4-PV	250	18*1	300	15*1
GD170-2R2-4-PV	250	18*1	300	15*1
GD170-004-4-PV	250	20*1	300	16*1
GD170-5R5-4-PV	250	18*2	300	15*2
GD170-7R5-4-PV	250	18*2	300	15*2
GD170-011-4-PV	250	18*3	300	15*3
GD170-015-4-PV	250	18*4	300	15*4
GD170-018-4-PV	250	18*5	300	15*5
GD170-022-4-PV	250	18*6	300	15*6
GD170-030-4-PV	250	18*8	300	15*8
GD170-037-4-PV	250	18*9	300	15*9
GD170-045-4-PV	250	18*11	300	15*11
GD170-055-4-PV	250	18*14	300	15*14
GD170-075-4-PV	250	18*19	300	15*19
GD170-090-4-PV	250	18*22	300	15*22

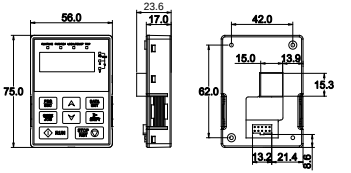
Solar pump inverter model	Open-circuit voltage class of solar module			
	37±1V		45±1V	
	Module power ± 5Wp	Modules per string * Strings	Module power ± 5Wp	Modules per string * Strings
GD170-110-4-PV	250	18*27	300	15*27
GD170-132-4-PV	250	18*38	300	15*38
GD170-160-4-PV	250	18*46	300	15*46
GD170-185-4-PV	250	18*53	300	15*53
GD170-200-4-PV	250	18*57	300	15*57
GD170-220-4-PV	250	18*63	300	15*63
GD170-250-4-PV	250	18*72	300	15*72
GD170-280-4-PV	250	18*81	300	15*81
GD170-315-4-PV	250	18*91	300	15*91
GD170-355-4-PV	250	18*103	300	15*103
GD170-400-4-PV	250	18*116	300	15*116
GD170-450-4-PV	250	18*130	300	15*130
GD170-500-4-PV	250	18*145	300	15*145

B.2 Recommended solar module configuration for inverters with boost module

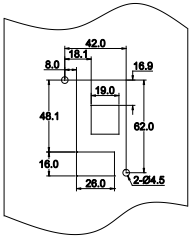
PP100-3R2-PV + Solar pump inverter	Max. DC input current	Open-circuit voltage class of solar module			
		37±1V		45±1V	
	(A)	Module power ± 5Wp	Modules per string * Strings	Module power ± 5Wp	Modules per string * Strings
GD170-0R4-SS2-PV	12	250	4*1	300	3*1
GD170-0R7-SS2-PV	12	250	5*1	300	4*1
GD170-1R5-SS2-PV	12	250	8*1	300	7*1
GD170-0R4-S2-PV	12	250	4*1	300	3*1
GD170-0R7-S2-PV	12	250	5*1	300	4*1
GD170-1R5-S2-PV	12	250	8*1	300	7*1
GD170-1R5-2-PV	12	250	8*1	300	7*1
GD170-2R2-2-PV	12	250	13*1	300	11*1
GD170-0R7-4-PV	12	250	5*1	300	4*1
GD170-1R5-4-PV	12	250	8*1	300	7*1
GD170-2R2-4-PV	12	250	13*1	300	11*1

Appendix C Dimension drawings

C.1 External keypad structure



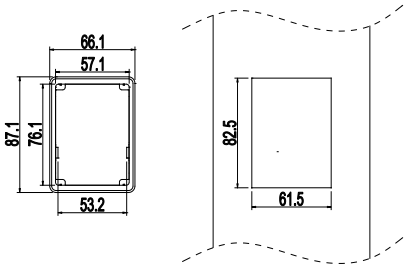
Keypad outline drawing



Keypad cut-out drawing (without bracket)

Note: The inverter models of 380V 4kW and lower support an optional external keypad, and the keypad of inverter models of 380V 5.5kW and higher can be installed on another device.

If the keypad is externally installed on an optional bracket, it can be 20 meters away from the inverter at most.



Keypad adapter bracket Installation dimensions

C.2 Dimensions of 0.4–4 kW models

Figure C-1 Wall mounting

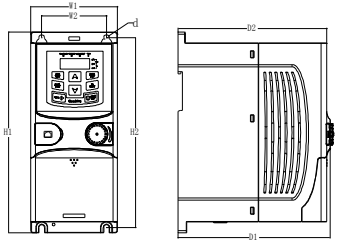


Table C-1 Wall-mounting dimensions (unit: mm)

Model	W1	W2	H1	H2	D1	D2	Installation hole diameter (d)
GD170-0R4-S2-PV	80.0	60.0	160.0	150.0	123.5	120.3	Ø 5
GD170-0R7-S2-PV	80.0	60.0	160.0	150.0	123.5	120.3	Ø 5
GD170-0R4-SS2-PV	80.0	60.0	160.0	150.0	123.5	120.3	Ø 5
GD170-1R5-S2-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-2R2-S2-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-0R7-SS2-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-1R5-SS2-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-2R2-SS2-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-0R7-4-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-1R5-4-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-2R2-4-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5
GD170-004-4-PV	80.0	60.0	185.0	175.0	140.5	137.3	Ø 5

Figure C-2 Rail mounting

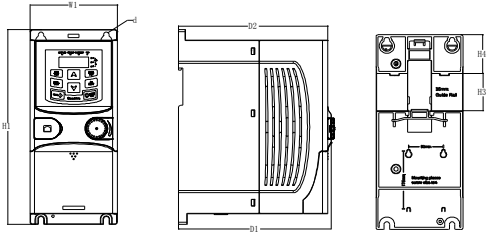


Table C-2 Rail-mounting dimensions (unit: mm)

Model	W1	H1	H3	H4	D1	D2	Installation hole diameter (d)
GD170-0R4-S2-PV	80.0	160.0	35.4	36.6	123.5	120.3	Ø 5
GD170-0R7-S2-PV	80.0	160.0	35.4	36.6	123.5	120.3	Ø 5
GD170-0R4-SS2-PV	80.0	160.0	35.4	36.6	123.5	120.3	Ø 5
GD170-1R5-S2-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-2R2-S2-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-0R7-SS2-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-1R5-SS2-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-2R2-SS2-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-0R7-4-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-1R5-4-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-2R2-4-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5
GD170-004-4-PV	80.0	185.0	35.4	36.6	140.5	137.3	Ø 5

C.3 Dimensions of 1.5–200kW models

Figure C-3 Wall mounting

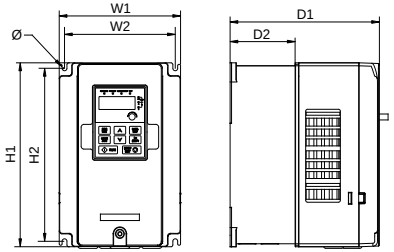


Table C-3 Wall-mounting dimensions (unit: mm)

Model	W1	W2	H1	H2	D1	D2	Installation hole diameter(d)
GD170-1R5-2-PV	146.0	131.0	256.0	243.5	167.0	84.5	Ø 6
GD170-2R2-2-PV	146.0	131.0	256.0	243.5	167.0	84.5	Ø 6
GD170-5R5-4-PV	146.0	131.0	256.0	243.5	167.0	84.5	Ø 6
GD170-7R5-4-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-011-4-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-015-4-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-004-2-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-5R5-2-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-7R5-2-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-011-4-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-015-4-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-018-4-PV	170.0	151.0	320.0	303.5	196.3	113.0	Ø 6
GD170-022-4-PV	200.0	185.0	340.6	328.6	184.3	104.5	Ø 6
GD170-030-4-PV	200.0	185.0	340.6	328.6	184.3	104.5	Ø 6
GD170-037-4-PV	250.0	230.0	400.0	380.0	202.0	123.5	Ø 6
GD170-045-4-PV	250.0	230.0	400.0	380.0	202.0	123.5	Ø 6
GD170-055-4-PV	282.0	160.0	560.0	542.4	238.0	138.0	Ø 9
GD170-075-4-PV	282.0	160.0	560.0	542.4	238.0	138.0	Ø 9
GD170-090-4-PV	338.0	200.0	554.0	534.0	326.2	/	Ø 9.5
GD170-110-4-PV	338.0	200.0	554.0	534.0	326.2	/	Ø 9.5
GD170-132-4-PV	500.0	360.0	870.0	850.0	360.0	/	Ø 11

Model	W1	W2	H1	H2	D1	D2	Installation hole diameter(d)
GD170-160-4-PV	500.0	360.0	870.0	850.0	360.0	/	Ø 11
GD170-185-4-PV	500.0	360.0	870.0	850.0	360.0	/	Ø 11
GD170-200-4-PV	500.0	360.0	870.0	850.0	360.0	/	Ø 11

Figure C-4 Flange mounting

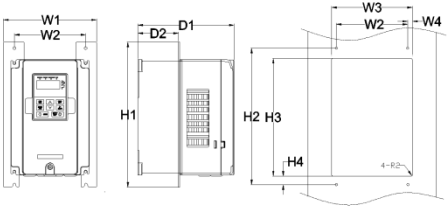


Table C-4 Flange-mounting dimensions (unit: mm)

Model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Installation hole diameter(d)	Nut specifications
GD170-5R5-4-PV	170.2	131	150	9.5	292	276	260	6	167	84.5	Ø 6	M5
GD170-7R5-4-PV	170.2	131	150	9.5	292	276	260	6	167	84.5	Ø 6	M5
GD170-011-4-PV	191.2	151	174	11.5	370	351	324	12	196.3	113	Ø 6	M5
GD170-015-4-PV	191.2	151	174	11.5	370	351	324	12	196.3	113	Ø 6	M5
GD170-1R5-2-PV	170.2	131	150	9.5	292	276	260	6	167	84.5	Ø 6	M5
GD170-2R2-2-PV	170.2	131	150	9.5	292	276	260	6	167	84.5	Ø 6	M5
GD170-004-2-PV	191.2	151	174	11.5	370	351	324	12	196.3	113	Ø 6	M5
GD170-5R5-2-PV	191.2	151	174	11.5	370	351	324	12	196.3	113	Ø 6	M5
GD170-7R5-2-PV	191.2	151	174	11.5	370	351	324	12	196.3	113	Ø 6	M5
GD170-018-4-PV	191.2	151	174	11.5	370	351	324	12	196.3	113	Ø 6	M5
GD170-022-4-PV	266	250	224	13	371	250	350.6	20.3	184.6	104	Ø 6	M5
GD170-030-4-PV	266	250	224	13	371	250	350.6	20.3	184.6	104	Ø 6	M5
GD170-037-4-PV	316	300	274	13	430	300	410	55	202	118.3	Ø 6	M5
GD170-045-4-PV	316	300	274	13	430	300	410	55	202	118.3	Ø 6	M5
GD170-055-4-PV	352	332	306	13	580	400	570	80	238	133.8	Ø 9	M8

Model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Installation hole diameter(d)	Nut specifications
GD170-075-4-PV	352	332	306	13	580	400	570	80	238	133.8	Ø 9	M8
GD170-090-4-PV	418.5	361	389.5	14.2	600	559	370	108.5	329.5	149.5	Ø9.5	M8
GD170-110-4-PV	418.5	361	389.5	14.2	600	559	370	108.5	329.5	149.5	Ø9.5	M8
GD170-132-4-PV	500	360	480	60	870	850	796	37	358	178.5	Ø 11	M10
GD170-160-4-PV	500	360	480	60	870	850	796	37	358	178.5	Ø 11	M10
GD170-185-4-PV	500	360	480	60	870	850	796	37	358	178.5	Ø 11	M10
GD170-200-4-PV	500	360	480	60	870	850	796	37	358	178.5	Ø 11	M10

Note: The flange mounting plate shall be used for flange mounting.

C.4 Dimensions of 220–500kW models

Figure C-5 Floor mounting for 220–315kW models

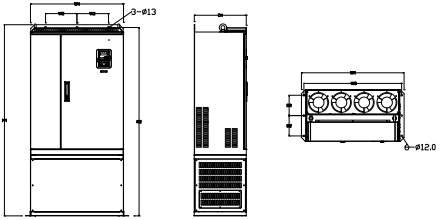


Table C-5 Floor mounting dimensions for 220–315kW models (unit: mm)

Model	W1	W2	W3	W4	H1	H2	D1	D2	Installation hole diameter(d)
GD170-220-4-PV	750	230	714	680	1410	1390	380	150	Ø13/12
GD170-250-2-PV	750	230	714	680	1410	1390	380	150	Ø13/12
GD170-280-4-PV	750	230	714	680	1410	1390	380	150	Ø13/12
GD170-315-4-PV	750	230	714	680	1410	1390	380	150	Ø13/12

Figure C-6 Floor mounting for 355–500kW models

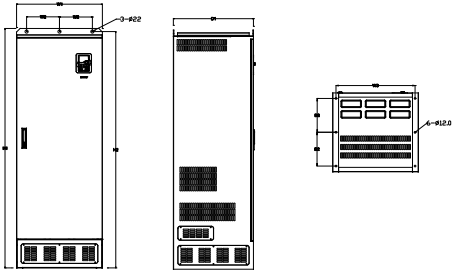


Table C-6 Floor mounting dimensions for 355–500kW models (unit: mm)

Model	W1	W2	W3	W4	H1	H2	D1	D2	Installation hole diameter(d)
GD170-355-4-PV	620	230	573	/	1700	1678	560	240	Ø 22/12
GD170-400-4-PV	620	230	573	/	1700	1678	560	240	Ø 22/12
GD170-450-4-PV	620	230	573	/	1700	1678	560	240	Ø 22/12
GD170-500-4-PV	620	230	573	/	1700	1678	560	240	Ø 22/12

Appendix D Further information

D.1 Product and service queries

If you have any queries about the product, contact the local INVT office. Please 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 inverter 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 the PDF format on the Internet. Visit www.invt.com, and choose **Support** > **Download**.

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INVT Power Electronics (Suzhou) Co.,Ltd. (origin code: 06)
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New Energy Vehicle Motor

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