ETAKE

ETAKE INVERTER

High Performance Sensorless Vector Control AC Drive

ED120 Series

User Manual

www.etakeco.com / info@etakeco.com

اینورتر پمپ خورشیدی برای موتور سه فاز و تکفازسری ED125

سیم‌بندی

- ورودی خورشیدی DC را به ترمینال‌های مثبت و منفی اینورتر وصل کنید و قبل از وصل، مطمئن شوید ولتاژ آرایه پنل داخل محدوده مجاز درایو است.
- خروجی موتور را به U/V/W وصل کنید؛ اگر بعد از راه‌اندازی آبدهی کم بود، جای هر دو فاز از سه سیم موتور را عوض کنید.
- ارت اینورتر باید حتما مطمئن و صحیح وصل شود.
- کلید/بریکر AC یا DC باید متناسب با درایو انتخاب شود.
- نوع، ولتاژ و توان موتور باید با مدل و توان اینورتر هم‌خوانی داشته باشد.

راه‌اندازی اولیه

- قبل از سیم‌بندی، همه تغذیه‌ها را قطع کنید و بعد از قطع برق، به اندازه زمان تخلیه خازن‌ها که روی دستگاه ذکر شده صبر کنید.
- با وصل بریکر DC، اینورتر به صورت پیش‌فرض حدود 10 ثانیه بعد به شکل خودکار راه می‌افتد.
- اگر آبدهی پمپ نرمال بود، راه‌اندازی موفق است؛ اگر کم بود، دو سیم موتور را جابه‌جا کنید.
- اگر بخواهید قبل از اجرای خودکار پارامترها را تنظیم کنید، بعد از روشن شدن، تا 10 ثانیه کلید QUICK/JOG را بزنید تا وارد کنترل از روی کی‌پد شوید.
- بعد از تغییر پارامترها، برق اینورتر را یک بار خاموش و روشن کنید.

پارامترهای مهم

- P15.06 تا P15.10: پارامترهای PI برای سرعت واکنش آبدهی. عدد بزرگ‌تر یعنی رسیدن سریع‌تر به دبی، ولی نوسان فرکانس موتور بیشتر می‌شود. عدد کوچک‌تر یعنی کار نرم‌تر ولی واکنش کندتر.
- P04.00=1: فعال‌سازی تنظیم منحنی V/F برای موتورهای تک‌فاز در صورت عملکرد نامناسب.
- P04.03 تا P04.08: تنظیم نقاط منحنی V/F در موتور تک‌فاز. اگر موتور استارت نمی‌زند، ولتاژ را بیشتر کنید؛ اگر جریان زیاد است، ولتاژ را کمتر کنید.
- P15.28: اختلاف ولتاژ اولیه شروع. اگر نور مناسب است ولی سیستم دیر استارت می‌کند، این مقدار را کمی افزایش دهید.
- P02.04: ولتاژ نامی موتور. برای موتور تک‌فاز با کنترل دوفاز، توصیه شده کمتر از V200 تنظیم شود.
- P17.38 و P17.39: مشاهده جریان سیم‌پیچ‌ها در موتور تک‌فاز دوفاز. برای بررسی تعادل و رفتار سیم‌پیچ‌ها کاربرد دارد.
- P04.35: تغییر نسبت جریان خروجی سیم‌پیچ اصلی و کمکی در موتور تک‌فاز. این پارامتر حساس است و بهتر است فقط توسط فرد باتجربه تنظیم شود.

نکات مهم برای موتور تک‌فاز

- اگر موتور تک‌فاز بد کار می‌کند، اول P04.00 و سپس P04.03 تا P04.08 را تنظیم کنید.
- در موتور تک‌فاز دوفاز، حداکثر ولتاژ خروجی باید کمتر از 1/1.6 ولتاژ باس DC باشد.
- چون امپدانس سیم‌پیچ‌ها فرق دارد، طبیعی است که در یک ولتاژ مساوی، جریان دو سیم‌پیچ برابر نباشد.

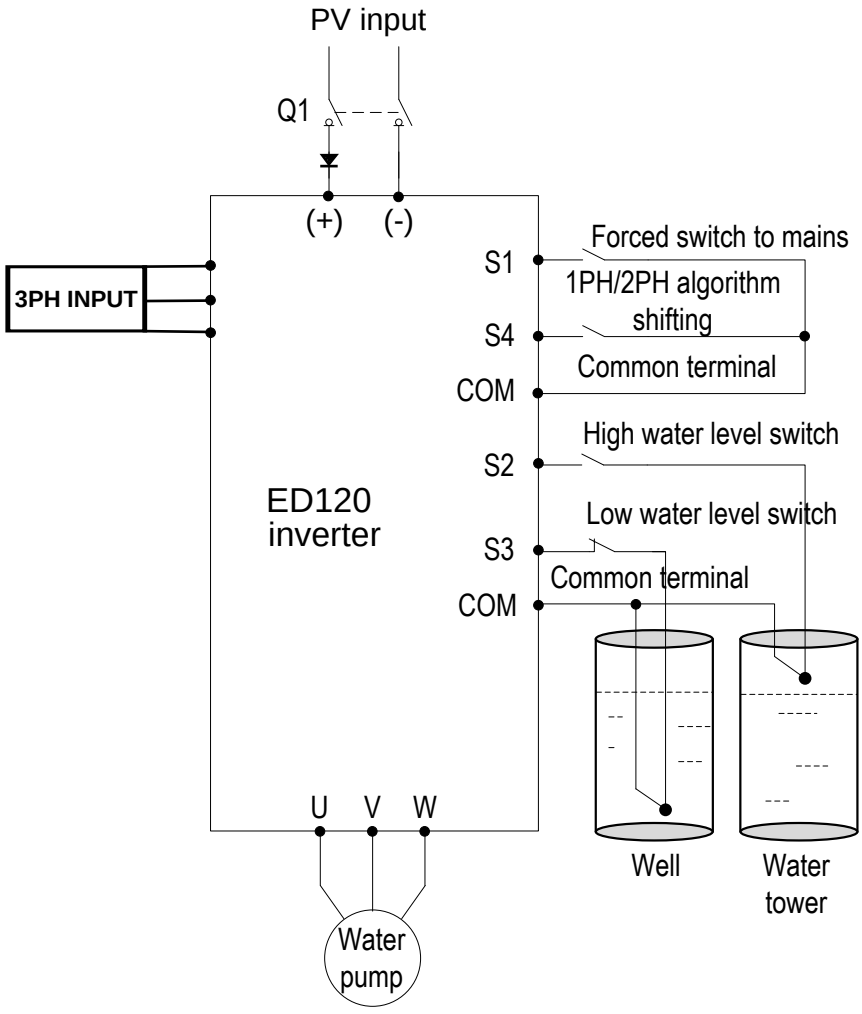
چک‌لیست قبل از روشن کردن

- ارت صحیح
- سیم‌بندی صحیح و محکم
- بریکر مناسب
- ولتاژ DC پنل در محدوده مجاز
- تطابق توان/ولتاژ/نوع موتور با اینورتر

3.2 Standard wiring

3.2.1 Main circuit terminals

The figure below shows the standard wiring of inverter.



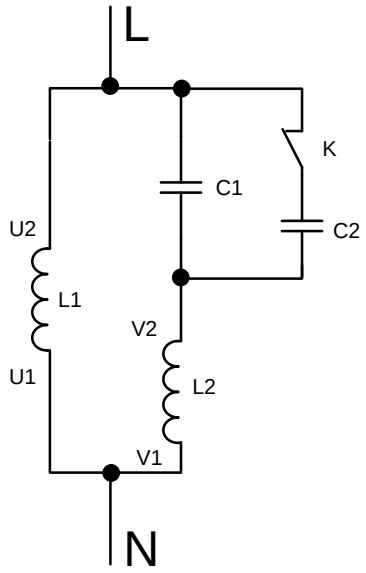
⚠	● The DC breaker Q1 must be installed as the protection switch for PV input. ● In parallel connection, the combination box special for PV must be used. ● When the distance between the PV input component and inverter exceeds 10 meters, Type-II surge protection devices must be configured at the DC side. ● When the distance between the pump and inverter exceeds 50 meters, it is recommended to configure output reactors. See A.4 Harmonic filter 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	Name	Function
R, S, T (L, N)	AC input	3PH (1PH) AC input terminals, connected to the grid **Note:** Use the screws equipped with the inverter for wiring.
(+), (-)	PV input	Solar cell panel input terminals
U, V, W	Inverter output	3PH/1PH AC output terminals, connected to the pump motor **Note**: 1PH motors must connect to terminals U and W.
⏚	Safety grounding	Safety protection grounding terminal. Each inverter must be grounded

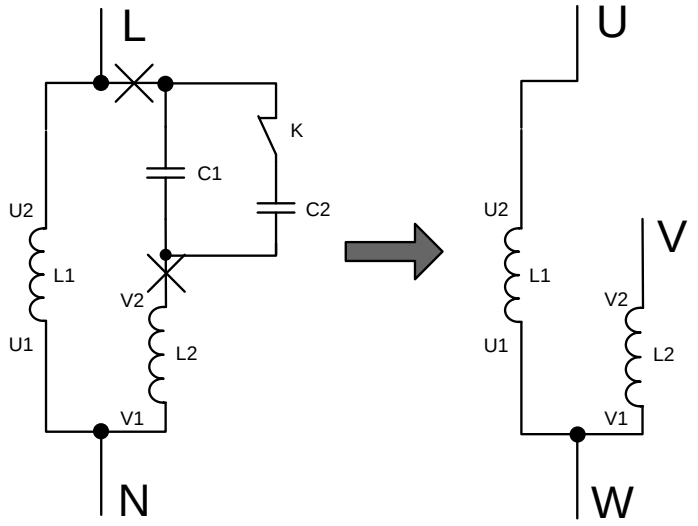
Description for -SS2 single-phase output models

1) Generally, the output terminals U and W of the inverter connect to the phase cables of the single-phase motor.

2) If the single-phase pump cannot be started, the two-phase control method must be used, and the start-up and running capacitors (if any) of the motor must be removed. The figure below shows the internal wiring of the common single-phase motor. In the figure, L1, L2, C1, and C2 indicate the running winding, start-up winding, running capacitor, and start-up capacitor. When the motor speed exceeds 75% of the rated speed, the start-up capacitor is switched off.



Internal wiring of the single-phase motor winding after removing the starting and running capacitor:



U1 and V1 are the common terminals of the windings. Connect them to the output terminal W of the solar pump inverter. Connect U2 to the output terminal U of the inverter. Connect V2 to the output terminal V of the inverter. (**Note:** Use the screws equipped with the inverter.) Connect S4 of the inverter to COM in short circuited manner.

3.2.2 Control circuit terminals

S1	S2	S3	S4	COM	422RX+	422RX-
+24V	PW	COM	485+	485-	422TX+	422TX-

RO1A	RO1B	RO1C

Figure 3–1 Control circuit terminal diagram for 2.2kW and lower inverters

Category	Terminal symbol	Terminal name	Terminal function
Power supply	24V	24V power supply	It provides the power of 24V±10% and maximum current of 200mA.
	COM	Common terminal	It functions as the working power supply of digital input and output or externally connects to the sensor power supply.
Digital input	S1	Forced switch to power frequency	Terminal feature parameters: 1. Internal impedance: 3.3kΩ 2. Acceptable voltage input: 12–24V 3. Maximum input frequency: 1kHz S1: Forcible switch to power frequency (Switching-on indicates
	S2	Full-water alarm	

Category	Terminal symbol	Terminal name	Terminal function
	S3	Empty-water alarm	switching to power frequency, and switching-off indicates input controlled by the keypad.)
	S4	Single/two phase algorithm switching	S2: It connects to the high-water switch of the normally open contact by default. S3: It connects to the low-water switch of the normally closed contact. S4: A high electrical level corresponds to the single-phase algorithm. A low electrical level corresponds to the two-phase algorithm.
Communication	RS485+ RS485-	485 communication	485 communication terminals, using the Modbus protocol
	422TX+ 422TX- 422RX+ 422RX-	422 communication	Communication terminals special for the boost module.
Relay output	RO1A (ROA)	Normally open contact of relay 1	1. Contact capacity: 3A/AC250V, 1A/DC30V 2. They cannot be used for high frequency switch output. During the application of auto power frequency & PV switching, the AC input contactor coil is controlled by the normally closed contact of the relay.
	RO1B (ROB)	Normally closed contact of relay 1	
	RO1C (ROC)	Common terminal of relay 1	

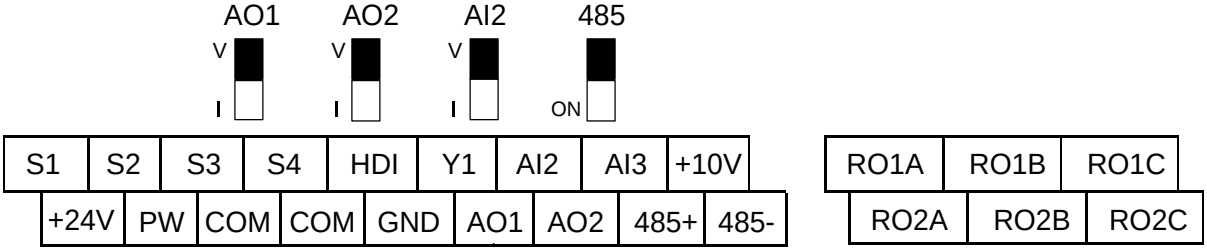


Figure 3–2 Control circuit terminal diagram for 4kW and higher inverters

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

Type	Terminal name	Function description	Technical specifications
Communication	485+	485 communication	485 communication interface
	485-		
Digital input/output	S1	Digital input	1. Internal impedance: 3.3kΩ 2. 12–30V voltage input is available 3. The terminal is the dual-direction input terminal 4. Max. input frequency: 1kHz
	S2		
	S3		
	S4		
	HDI	High frequency input channel	1. Except for S1–S4, this terminal can be used as high frequency input channel. 2. Max input frequency: 50kHz 3. Duty cycle: 30%–70%
	PW	Digital power supply	External power input terminal for digital input circuits Voltage range: 12–30V
	Y1	Digital output	1. Switch capacity: 50 mA/30V; 2. Range of output frequency: 0–1kHz.
	COM		Common terminal of open collector output
24V power supply	+24V	24V power supply	External 24V±10% power supply and the maximum output current is 200mA. Generally used as the operation power supply of digital input and output or external sensor power supply.
	COM		
Analog input/output	+10V	External 10V reference power supply	10V reference power supply; Max. output current: 50 mA; As the adjusting power supply of the external potentiometer; Potentiometer resistance: 5kΩ above.
	AI2	Analog input	1. Input range: AI2 voltage and current can be chosen: 0–10V/0–20mA; AI3: -10V–+10V. 2. Input impedance: voltage input: 20kΩ; current input: 500Ω. 3. Voltage or current input can be set by dip switch. 4. Resolution: the minimum AI2/AI3 is
	AI3		

Type	Terminal name	Function description	Technical specifications
			10mV/20mV when 10V corresponds to 50Hz.
	GND	Analog reference ground	Analog reference ground
	AO1	Analog output	1. Output range: 0–10V or 0–20mA. 2. The voltage or the current output is depended on the dip switch. 3. Deviation±1%, 25°C when full range.
	AO2		
Relay output	RO1A	Relay 1 NO contact	Relay output RO1 RO1A is in the NO state, RO1B is in the NC state, and RO1C is the common terminal. Relay output RO2 RO2A is in the NO state, RO2B is in the NC state, and RO2C is the common terminal. Contact capacity: 3A/AC250V, 1A/DC30V
	RO1B	Relay 1 NC contact	
	RO1C	Relay 1 common contact	
	RO2A	Relay 2 NO contact	
	RO2B	Relay 2 NC contact	
	RO2C	Relay 2 common contact	

3.2.3 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.

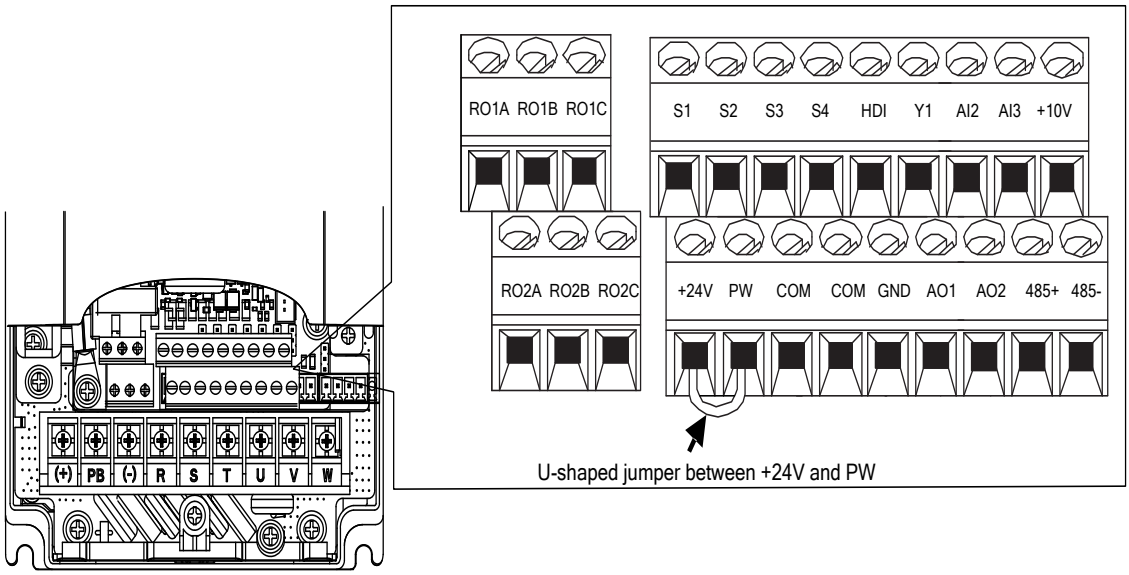


Figure 3–3 U-shaped jumper and lower inverters

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	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, and fault reset commands. 0: Keypad (LOCAL/REMOT off) The commands are controlled through keypad keys, such as the RUN and STOP/RST keys. The running direction can be changed through setting the multi-function shortcut key QUICK/JOG to FWD/REV shifting function (P07.02=3). In	1	○

Function code	Name	Description	Default	Modify
		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	◎
P00.04	Upper limit of running frequency	The upper limit of the running frequency is the upper limit of the output frequency of the inverter which is lower than or equal to the maximum frequency. When the set frequency is higher than the upper limit of the running frequency, the upper limit of the running frequency is used for running. Setting range: P00.05–P00.03 (Max. output frequency)	50.00Hz	◎
P00.05	Lower limit of running frequency	The lower limit of the running frequency is that of the output frequency of the inverter. The inverter runs at the lower limit frequency if the set frequency is lower than the lower limit. **Note:** Max. output frequency ≥ Upper limit frequency ≥ Lower limit frequency Setting range: 0.00Hz–P00.04 (Upper limit of running frequency)	0.00Hz	◎

Function code	Name	Description	Default	Modify
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 to 0Hz (P00.03). The inverter has four groups of ACC/DEC 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	Model depended	○
P00.12	DEC time 1		Model depended	○
P00.13	Running direction	0: Run at the default direction. The inverter runs in the forward direction. FWD/REV indicator is off. 1: Run at the opposite direction. The inverter runs in the reverse direction. FWD/REV indicator 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. 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	○

Function code	Name	Description	Default	Modify
P00.15	Motor parameter autotuning	0: No operation 1: Rotation autotuning Comprehensive motor parameter autotuning. It is recommended to use rotation autotuning when high control accuracy is needed. 2: Static autotuning Used in scenarios where the motor cannot be disconnected from load. 3: Static autotuning 2 Empty-load current and mutual inductance are not autotuned.	0	◎
P00.18	Function parameter restore	0: No operation 1: Restore default values 2: Clear fault records **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	○

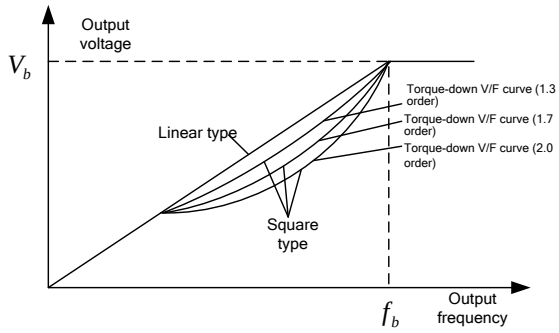
P02 group Parameters of motor 1

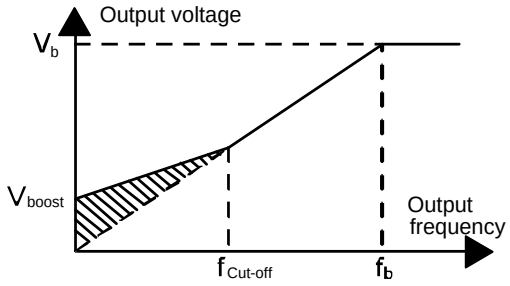
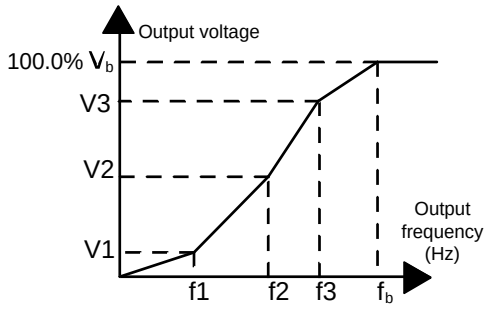
Function code	Name	Description		Default	Modify
P02.00	Motor type	0: Asynchronous motor (AM) 1: Reserved		0	◎
P02.01	Rated power of AM	0.1–3000.0kW	Used to set AM parameters. To ensure the control performance, set P02.01–P02.05 correctly according to the information on the nameplate of the AM. The inverter 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 standard motor configuration, the control	Model depended	◎
P02.02	Rated frequency of AM	0.01Hz–P00.03		50.00 Hz	◎
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
			performance of the inverter degrades significantly. **Note:** Resetting the rated power (P02.01) of the motor 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	Non-load current of AM	0.1–6553.5A		Model depended	○

P04 group Space voltage vector 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: Multi-dots V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) Curves 2–4 are applicable to the torque loads such as fans and water pumps. You	4	◎

Function code	Name	Description	Default	Modify
		can adjust according to the characteristics of the loads to achieve best performance. 5: Customized V/F(V/F separation); in this mode, V can be separated from f and f can be adjusted through the frequency given channel set by P00.06 or the voltage given channel set by P04.27 to change the feature of the curve. **Note:** In the following figure, Vb is the motor rated voltage and fb 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	2.0%	○
P04.02	Torque boost cut-off		20.0%	○

Function code	Name	Description	Default	Modify
		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.  Setting range of P04.01: 0.0%: (automatic) 0.1%–10.0% Setting range of P04.02: 0.0%–50.0%		
P04.03	V/F frequency point 1 of motor 1	If P04.00 =1, the user can set V//F curve by P04.03–P04.08. V/F is set to the motor load. **Note:** V1＜V2＜V3; f1＜f2＜f3. If the low-frequency voltage is high, overtemperature and burning may occur and the overcurrent stall and protection may occur to the inverter.  Setting range of P04.03: 0.00Hz–P04.05 Setting range of P04.04: 0.0%–110.0% (rated voltage of motor1) Setting range of P04.05: P04.03–P04.07 Setting range of P04.06: 0.0%–110.0% (rated voltage of motor1) Setting range of P04.07: P04.05–P02.02 (rated frequency of motor1) or P04.05–	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1		0.0%	○
P04.05	V/F frequency point 2 of motor 1		0.00Hz	○
P04.06	V/F voltage point 2 of motor 1		0.0%	○
P04.07	V/F frequency point 3 of motor 1		0.00Hz	○

Function code	Name	Description	Default	Modify
P04.08	V/F voltage point 3 of motor 1	P02.16 (rated frequency of motor1) Setting range of P04.08: 0.0%–110.0% (rated voltage of motor1)	00.0%	○
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: △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 △f of the motor. Setting range: 0.0–200.0%	0.0%	○
P04.34	Two phase control selection of single-phase motor	Ones: Reserved Tens: Reversal of the secondary winding (V-phase) voltage 0: Not reversed; 1: Reversed Setting range: 0–0x11	0x00	◎
P04.35	Voltage ratio of V-phase and U-phase	0.00–2.00	1.40	○

P05 group Input terminals

Function code	Name	Description	Default	Modify
P05.00	HDI input type	0: Reserved 1: HDI is digital input	1	◎
P05.01	S1 terminals function selection	0: No function 1: Run forward 2: Run reversely	42	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P05.02</td><td>S2 terminals function selection</td><td rowspan="5">3: Reserved
4: Jog forward
5: Jog reversely
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
39–41: Reserved
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: Terminal frequency increment by 1
48: Terminal frequency decrement by 1
49–63: Reserved</td><td>43</td><td>◎</td></tr>
<tr><td>P05.03</td><td>S3 terminals function selection</td><td>44</td><td>◎</td></tr>
<tr><td>P05.04</td><td>S4 terminals function selection</td><td>45</td><td>◎</td></tr>
<tr><td>P05.05</td><td>S5 terminals function selection</td><td>1</td><td></td></tr>
<tr><td>P05.09</td><td>HDI terminals function selection</td><td>46</td><td>◎</td></tr>
<tr><td>P05.10</td><td>Input terminal polarity</td><td>0x000–0x10F<table><tr><th>BIT8</th><th>BIT3</th><th>BIT2</th><th>BIT1</th><th>BIT0</th></tr><tr><td>HDI</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr></table></td><td>0x000</td><td>◎</td></tr>
</table>

P06 group Output terminals

Function code	Name	Description	Default	Modify
P06.03	RO1 output	0: Disable 1: Running	30	○
P06.04	RO2 output		5	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>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: Zero-speed running
10: Upper limit frequency reached
11: Lower limit frequency reached
12: Ready for running
13: Pre-magnetizing
14: Overload alarm
15: Underload alarm
16–19: Reserved
20: External fault is valid
21: Reserved
22: Running time reached
23: Modbus communication virtual terminal output
24–25: Reserved
26: DC bus voltage established
27: In weak light
28–29: Reserved
30: Switches to PV input mode</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>Used to set the polarity of output terminals.
When a bit is 0, the output terminal is positive.
When a bit is 1, the output terminal is negative.
<table><tr><th>BIT1</th><th>BIT0</th></tr><tr><td>RO2</td><td>RO1</td></tr></table>Setting range: 0–F</td><td>0</td><td>○</td></tr>
<tr><td>P06.10</td><td>RO1 switch-on delay</td><td>0.000–50.000s</td><td>10.000s</td><td>○</td></tr>
<tr><td>P06.11</td><td>RO1 switch-off delay</td><td>0.000–50.000s</td><td>10.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
P06.12	RO2 switch-on delay	0.000–50.000s	0.000s	○
P06.13	RO2 switch-off delay	0.000–50.000s	0.000s	○

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 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.	0	○
P07.02	Function of QUICK/JOG	0: No function 1: Jogging running. Press QUICK/JOG to begin the jogging running. 2: Switch the display state by the shifting key. Press QUICK/JOG to shift the displayed function code from right to left.	6	○

Function code	Name	Description	Default	Modify
		3: Switch between forward rotations and reverse rotations. Press QUICK/JOG to shift the direction of the frequency commands. This function is only valid in the keypad commands channels. 4: Clear UP/DOWN settings. Press QUICK/JOG to clear the set value of UP/DOWN. 5: Coast to stop. Press QUICK/JOG to coast to stop. 6: Switch command channels in sequence. Press QUICK/JOG key to switch the running command reference mode in sequence. 7: Quick commissioning mode (based on non-factory parameters) **Note:** Press QUICK/JOG to shift between forward rotation and reverse rotation, the inverter does not record the state after shifting during powering off. The inverter will run according to parameter P00.13 during next powering on.		
P07.03	Sequence of switching running-command channels by pressing QUICK/JOG	When P07.02=6, set the sequence of switching running-command channels by pressing this key. 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication	1	○
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	1	○

Function code	Name	Description	Default	Modify
P07.11	Boost module temperature	Setting range: -20.0–120.0°C	0.0°C	●
P07.12	Inverter module temperature	Setting range: -20.0–120.0°C	0.0°C	●
P07.13	Control board software version	Setting range: 1.00–655.35	Version depended	
P07.14	Local accumulative running time	Setting range: 0–65535h	0h	
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: 0–65535kkWh (*1000) Setting range of P07.16: 0.0–999.9 kWh	0kkWh	●
P07.16	Inverter electricity consumption low-order bits		0.0kWh	●
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) 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)	0	●
P07.28	Last fault type		0	●
P07.29	2nd-last fault type		0	●
P07.30	3rd-last fault type		0	●
P07.31	4th-last fault type		0	●
P07.32	5th-last fault type		0	●

Function code	Name	Description	Default	Modify
		18: RS485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor antotune fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback disconnection (PIDE) 23: Braking unit fault (bCE) 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 (STo) 36:Underload fault (LL) 37: Hydraulic probe damage (tSF) 38: PV reverse connection fault (PINV) 39: PV overcurrent (PVOC) 40: PV overvoltage (PVOV) 41: PV undervoltage (PVLV) 42: Fault on 422 communication with the boost module (E-422) 43: Bus overvoltage detected on the boost module (OV) 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:** Faults 38–40 are only detected in		

Function code	Name	Description	Default	Modify
		boost. The boost module stops working immediately after detecting a fault, while returning the fault information to the inverter module in the next data returning. Alarms: 61: Light-weak alarm (A-LS) 62: Underload alarm (A-LL) 63: Full-water alarm (A-tF) 64: Empty-water alarm (A-tL) 65: Mains power not connected alarm (A-SPI) **Note:** The alarm will be not recorded into the fault but can be read by Modbus.		
P07.33	Running frequency at present fault		0.00Hz	●
P07.34	Ramp reference frequency at present fault		0.00Hz	●
P07.35	Output voltage at present fault		0V	●
P07.36	Output current at present fault		0.0A	●
P07.37	Bus voltage at present fault		0.0V	●
P07.38	Max. temperature at present fault		0.0℃	●
P07.39	Input terminal state at present fault		0	●
P07.40	Output terminal state at present fault		0	●
P07.41	Running frequency at last fault		0.00Hz	●
P07.42	Ramp reference frequency at last fault		0.00Hz	●
P07.43	Output voltage at last fault		0V	●
P07.44	Output current at last fault		0.0A	●
P07.45	Bus voltage at last fault		0.0V	●
P07.46	Max. temperature at last fault		0.0℃	●
P07.47	Input terminal state at last fault		0	●
P07.48	Output terminal state at last fault		0	●
P07.49	Running frequency at 2nd-last fault		0.00Hz	●
P07.50	Ramp reference frequency at 2nd-last fault		0.00Hz	●
P07.51	Output voltage at 2nd-last fault		0V	●
P07.52	Output current at 2nd-last fault		0.0A	●
P07.53	Bus voltage at 2nd-last fault		0.0V	●
P07.54	Max. temperature at 2nd-last fault		0.0℃	●
P07.55	Input terminal state at 2nd-last fault		0	●
P07.56	Output terminal state at 2nd-last fault		0	●

Function code	Name	Description	Default	Modify
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) 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 antotune fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback disconnection (PIDE) 23: Braking unit fault (bCE) 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 (STo) 36:Underload fault (LL) 37: Hydraulic probe damage (tSF) 38: PV reverse connection fault (PINV) 39: PV overcurrent (PVOC) 40: PV overvoltage (PVOV) 41: PV undervoltage (PVLV) 42: Fault on 422 communication with the	0	●
P07.58	7th-last fault type		0	●
P07.59	8th-last fault type		0	●
P07.60	9th-last fault type		0	●
P07.61	10th-last fault type		0	●
P07.62	11th-last fault type		0	●
P07.63	12th-last fault type		0	●
P07.64	13th-last fault type		0	●
P07.65	14th-last fault type		0	●
P07.66	Present alarm type		0	●
P07.67	Last alarm type		0	●
P07.68	2nd-last alarm type		0	●
P07.69	3rd-last alarm type		0	●
P07.70	4th-last alarm type		0	●
P07.71	5th-last alarm type		0	●

Function code	Name	Description	Default	Modify
		boost module (E-422) 43: Bus overvoltage detected on the boost module (OV) 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:** Faults 38–40 are only detected in boost. The boost module stops working immediately after detecting a fault, while returning the fault information to the inverter module in the next data returning. Alarms: 61: Light-weak alarm (A-LS) 62: Underload alarm (A-LL) 63: Full-water alarm (A-tF) 64: Empty-water alarm (A-tL) 65: Mains power not connected alarm (A-SPI) **Note:** The alarm will be not recorded into the fault but can be read by Modbus.		

P08 group Enhanced functions

Function code	Name	Description	Default	Modify
P08.28	Auto fault reset count	0–10	5	○

Function code	Name	Description	Default	Modify
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: 0: Software protection against input phase loss disabled 1: Software protection against input phase loss enabled LED tens: 0: Software protection against output phase loss disabled 1: Software protection against output phase loss enabled LED hundreds: Reserved 000–111	Model depended	○
P11.01	Voltage point for frequency drop at transient power-off	20.0%–120.0%	80.0%	○
P11.02	Frequency decrease ratio at sudden	Setting range: 0.00–P00.03 (Hz) If the bus voltage drops to the sudden frequency decreasing point due to the power	10.00Hz	○

Function code	Name	Description	Default	Modify
	power loss	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	0–1 0: Disable 1: Enable	0	○
P11.04	Overvoltage stall protection voltage	110–150(%)	Model depended	○
P11.05	Current limit selection	0x00–0x12 Ones: Current limit action selection 0: Invalid 1: Always valid 2: Invalid during DEC Tens: Hardware current limit overload alarm selection 0: Valid 1: Invalid	0x01	◎
P11.06	Automatic current limit level	50.0–200.0(%)	Model depended	◎
P11.07	Frequency drop rate during current limit	0.00–50.00(Hz/s)	10.00	◎
P11.08	Pre-alarm selection for inverter/motor OL/UL	0x0000–0x1131 LED ones: 0: Motor overload/underload pre-alarm, relative to rated motor current; 1: Inverter overload/underload pre-alarm, relative to rated inverter current. LED tens: 0: The inverter continues running after overload/underload alarm; 1: The inverter continues running after underload alarm, and stops running after	0x000	○

Function code	Name	Description	Default	Modify
		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: 0: Always detect 1: Detect during constant-speed running		
P11.09	Overload pre-alarm detection level	P11.11–200%	Model depended	○
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: 0: Act at undervoltage 1: Do not act at undervoltage LED tens: 0: Act during the automatic reset period 1: Do not act during the automatic reset period	0x00	○
P11.14	Speed deviation detection value	0.0–50.0%	10.0%	○
P11.15	Speed deviation detection time	0.0–10.0s	0.5s	○

P14 group Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	Setting range: 1–247 When the master writes the slave communication address to 0 indicating a broadcast address in a frame, all the salves on the Modbus bus receive the	1	○

Function code	Name	Description	Default	Modify
		frame but do not respond to it. Local communication address is unique in the communication network, which is the basis for point-to-point communication between the upper computer and the inverter. **Note:** The communication address of a slave cannot be set to 0.		
P14.01	Communication baud rate	The function code is used to set the data transmission speed between upper computer and the inverter. 0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS 6: 57600BPS **Note:** The baud rate set on the inverter must be consistent with that on the upper computer. Otherwise, the communication fails. A greater baud rate indicates faster communication.	4	○
P14.02	Data bit check	The data format set on the inverter must be consistent with that on the upper computer. Otherwise, the communication fails. 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 The function code indicates the communication response delay, that is, the interval from when the inverter completes receiving data to when it sends response data to the upper	5	○

Function code	Name	Description	Default	Modify
		computer. If the response delay is shorter than the inverter processing time, the inverter sends response data to the upper computer after processing data. If the delay is longer than the inverter processing time, the inverter does not send response data to the upper computer until the delay is reached although data has been processed.		
P14.04	RS485 communication timeout period	0.0 (invalid)–60.0s When the function code is set to 0.0, the communication timeout time is invalid. When the function code is set a non-zero value, the rectifier reports the "485 communication fault" (CE) if the communication interval exceeds the value. In general, the function code is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status.	0.0s	○

P15 group Functions special for solar inverter

Function code	Name	Description	Default	Modify
P15.00	Solar inverter selection	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.	1	◎
P15.01	Vmpp voltage giving method	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	1	◎

Function code	Name	Description	Default	Modify
		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.		
P15.02	Vmpp voltage given through keypad	0.0–6553.5 Vdc 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.)	Model depended	○
P15.03	PI control deviation limit	0.0–100.0% (100.0% corresponds to P15.02) PI adjustment is performed only when the ratio of the difference between the actual voltage and reference voltage to the reference voltage, which is abs (Actual voltage – Reference voltage) * 100.0% / (Reference voltage), exceeds P15.03. The default value is 0.0%. abs: absolute value	0.0%	○
P15.04	PID output upper limit frequency	P15.05–100.0% (100.0% corresponds to P00.03) P15.04 is used to limit the Max. value of target frequency, and 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% corresponds to P00.03) P15.05 is used to limit the Min. value of target frequency, and 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 Proportion coefficient 1 of the target	5.00	○

Function code	Name	Description	Default	Modify
		frequency. A greater value indicates stronger effect and faster adjustment.		
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 Proportion 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 the target frequency. A greater value indicates stronger effect and faster adjustment.	35.00	○
P15.10	PI switching point	0.0–6553.5Vdc If the absolute value of PV voltage minus reference value 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 1: AI1(the water-level signal is input through AI1, not supported currently) 2: AI2 (the water-level signal is input through AI2, not supported currently) 3: AI3 (the water-level signal is input through AI3, not supported currently) If the function code is 0, the water-level signal is controlled by the digital input. See 43 and 44 functions of S terminals in group P05 for detailed information. If the full-water signal is valid, the system will report the alarm (A-tF) and sleep after the time of P15.14. During the alarm, the full-water signal is invalid and the system will clear the alarm after the time of P15.15. If the empty-water signal is valid, the system will report the alarm (A-tL) and sleep after the time of	0	◎

Function code	Name	Description	Default	Modify
		P15.16. During the alarm, the empty -water signal is invalid and the system will clear the alarm after the time of P15.17. If the function code is 1–3, it is the reference of water-level control analog signal. For details, see P15.12 and P12.13.		
P15.12	Full-water level threshold	0.0–100.0% This code is valid when P15.11 water level control is based on analog input. If the detected water level control analog signal is less than the water level threshold P15.12 and keeps in the state after the delay time P15.14, the system reports A-tF and sleeps. If the delay time is not reached, the signal is bigger than the water level threshold, the time will be cleared automatically. When the measured water level control analog signal is less than the water level threshold, the delay time will be counted again. 0 is full water and 1 is no water. During the full-water alarm, if the detected water level signal is higher than the threshold of P15.12 and the delay counts, the alarm is cleared after the time set by P15.15 is reached in this continuous state continues. During the non-continuous application, the delay timing will clear automatically.	25.0%	○
P15.13	Empty-water level threshold	0.0–100.0% This code is valid when P15.11 water level control is based on analog input. If the detected water level control analog signal is greater than the water level threshold P15.13 and keeps in the state after the delay time P15.16, the system reports A-tL and sleeps. If the delay time is not reached (that means non-continuous), the delay time is automatically cleared. When	75.0%	○

Function code	Name	Description	Default	Modify
		the detected water level control analog signal is less than the water level threshold, the delay counts. During the empty-water alarm, if the detected water level control analog signal is less than the water level threshold P15.13 and delay counts, the empty-water alarm is cleared after the delay time set by P15.17 in this continuous state. In the non-continuous state, the delay time is automatically cleared.		
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 delay	0–10000s Time setting on full-water level wake-up delay. (This parameter is still valid for digital full-water signal.)	20s	○
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	Running time of dry pumping protection	0.0–1000.0s Duration in which the water pump runs in dry pumping state. In continuous dry pumping condition, the underload alarm (A-LL) is	60.0s	○

Function code	Name	Description	Default	Modify
		reported when the running time is reached.		
P15.20	Running detection value of dry pumping protection	0.0–100.0% The value 0.0% indicates the dry pumping protection function is disabled. A value rather than 0.0% indicates it is determined by P15.20 When the absolute value of target frequency minus ramp frequency is less than or equal to 2.00Hz, if the actual detection value is continuously less than P15.20, the system reports the underload alarm with a delay specified by P15.19. Otherwise, the system runs properly. In the non-continuous situation, the delay counter is automatically cleared.	0.0%	○
P15.21	Dry pumping reset delay	0.0–6000.0s Dry pumping protection reset delay. In dry pumping state, the counting on the dry pumping protection running time and that on the dry pumping protection reset delay is performed synchronously. Generally, the value needs to be greater than P15.19 so that the system can report the underload alarm when the dry pumping protection running 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	Dry pumping protection selection	0–1 0: Dry pumping protection is determined based on output power. 1: Dry pumping protection is determined 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	100.0s	○

Function code	Name	Description	Default	Modify
		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 voltage is lower than 70V, the system directly reports the weak-light alarm without any delay. ● If 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 alarm is reported, the system clears the 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–	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>P15.27. P15.27 must be greater than the min. reference voltage. A smaller difference between them 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>Min. reference voltage in max. power tracking–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>Max. voltage reference</th><th>Max. Vmppt</th></tr>
<tr><td>-SS2</td><td>400</td><td>400</td></tr>
<tr><td>-S2</td><td>400</td><td>400</td></tr>
<tr><td>-2</td><td>400</td><td>400</td></tr>
<tr><td>-4</td><td>750</td><td>750</td></tr>
</table></td><td>400.0V</td><td>○</td></tr>
<tr><td>P15.28</td><td>Adjustment of initial reference voltage</td><td>80–95%
Reference voltage = PV voltage * 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:
Maximum/Minimum reference 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>
</table>

Function code	Name	Description	Default	Modify
P15.30	Auto adjustment range of Vmppt upper/lower limit	5.0–100.0V Range in which Vmppt upper/lower limit can be automatically adjusted.	30.0V	○
P15.31	Vmppt max. value	P15.27–6553.5V During the max. power tracking, the upper limit of the solar panel reference voltage will not exceed the value of P15.31. The factory value depends on the model. By default, the value for the -4 models is 750V and the value for other models is 400V.	Model depended	○
P15.32	PV input and power frequency input selection	0: Automatic mode 1: Hybrid power supply mode 2: 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. If P15.32 is set to 1, the system switches to power frequency input when it detects successful AC power connection; otherwise, it switches to PV input. 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.	2	◎
P15.33	Threshold for switching to power frequency input	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 the relay output. If the value is 0, it is invalid. For inverters without boost modules, the switching voltage is determined by the external voltage detection circuit. For inverters with boost modules, the switching voltage is 70V.	70.0V	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></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.
The default value depends on model.</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: cubic meter/hour.</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: meter</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>-SS2</td><td>140.0V</td></tr>
<tr><td>-S2</td><td>140.0V</td></tr>
<tr><td>-2</td><td>140.0V</td></tr>
<tr><td>-4</td><td>340.0V</td></tr>
<tr><td>Any model with the boost module</td><td>70.0V</td></tr>
</table>
Setting range: 0.0–400.0</td><td>70.0</td><td>○</td></tr>
<tr><td>P15.38</td><td>Output frequency selection</td><td>In PV mode, this parameter is used to select whether the system prioritizes PID constant pressure water supply or analog frequency setting.
0: MPPT priority
1: PID constant pressure supply priority
2: Set frequency priority</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		Potentiometer usage: P15.38=2, P00.06=1 UP/DN keypad usage: P15.38=2, use the UP/DN key on the LED keypad to adjust the frequency. UP/DN terminal usage: P15.38=2, P05.01=47/48, jog the S terminal to adjust the frequency.		
P15.40	Enable PQ curve fitting	0: Disable 1: Enable Setting range: 0–1 When P15.40=1, the flow calculation uses the point between P15.41 and P15.50 for PQ curve fitting calculation, which is more accurate.	0	◎
P15.41	PQ curve power point 1	Corresponding power point when the input power of water pump is at the first point of PQ curve. Setting range: 0.0–1000.0kW	0.0kW	◎
P15.42	PQ curve power point 2	Corresponding power point when the input power of water pump is at the second point of PQ curve. Setting range: 0.0–1000.0kW	0.0kW	◎
P15.43	PQ curve power point 3	Corresponding power point when the input power of water pump is at the third point of PQ curve. Setting range: 0.0–1000.0kW	0.0kW	◎
P15.44	PQ curve power point 4	Corresponding power point when the input power of water pump is at the fourth point of PQ curve. Setting range: 0.0–1000.0kW	0.0kW	◎
P15.45	PQ curve power point 5	Corresponding power point when the input power of water pump is at the fifth point of PQ curve. Setting range: 0.0–1000.0kW	0.0 kW	◎
P15.46	PQ curve flow point 1	Corresponding flow point when the flow of water pump is at the first point of PQ curve.	0.0m³/h	◎

Function code	Name	Description	Default	Modify
		Setting range: 0.0–1000.0m³/ h		
P15.47	PQ curve flow point 2	Corresponding flow point when the flow of water pump is at the second point of PQ curve. Setting range: 0.0–1000.0m³/ h	0.0m³/h	◎
P15.48	PQ curve flow point 3	Corresponding flow point when the flow of water pump is at the third point of PQ curve. Setting range: 0.0–1000.0m³/ h	0.0m³/h	◎
P15.49	PQ curve flow point 4	Corresponding flow point when the flow of water pump is at the fourth point of PQ curve. Setting range: 0.0–1000.0m³/ h	0.0m³/h	◎
P15.50	PQ curve flow point 5	Corresponding flow point when the flow of water pump is at the fifth point of PQ curve. Setting range: 0.0–1000.0m³/ h	0.0m³/h	◎
P15.51	Water pump efficiency	The function code indicates the overall efficiency of water pump Setting range: 0–100%	80%	○
P15.55	Hybrid power voltage suppression	In hybrid power supply mode, this parameter is used to suppress the bus voltage when AC power supply is disconnected. Setting range: 0.0–800.0V -2 model: 240.0V -4 model: 460.0V	Model depended	○
P15.56	Frequency fine-tuning saving through the UP/DN key	This parameter is used to set whether frequency adjustments made through the UP/DN key are saved. 0: Not saved 1: Saved	0	○
P15.57	Frequency fine-tuning through the UP/DN key	Setting range: 0.00–10.00Hz	1.00Hz	○
P15.60	Weak-light wake-up	0: Previous method 1: New method	0	○

Function code	Name	Description	Default	Modify
	mode	**Note:** If this parameter is set to 0, use the fixed interval (P15.24) for restart. If it is set to 1, use the new method: non-fixed intervals (P15.61–P15.63) for restart.		
P15.61	Weak-light wake-up delay 1	Setting range: 0–3600s	300s	○
P15.62	Weak-light wake-up delay 2	Setting range: 0–3600s	600s	○
P15.63	Weak-light wake-up delay 3	Setting range: 0–3600s	1200s	○
P15.64	Weak-light fault detection time	Setting range: 0–3600s	7200s	○
P15.65	Max. weak-light fault count	Setting range: 0–10	0	○
P15.66	Weak-light solution selection	Setting range: 0x000–0x224 Ones place (light sensor selection): 0: None 1: AI1 2: AI2 3: AI3 4: 485 (reserved) Tens place (sleep selection): 0: Based on PV voltage 1: Based on weak-light sleep point 2: Based on PV voltage or weak-light sleep point Hundreds place (wake-up selection): 0: Based on PV voltage 1: Based on weak-light wake-up point 2: Based on PV voltage or weak-light wake-up point **Note:** All weak-light wake-ups undergo delays set by P15.24/P15.61–P15.63.	0x000	○

Function code	Name	Description	Default	Modify
P15.67	Weak-light sleep point	0%–P15.68	20%	○
P15.68	Weak-light wake-up point	P15.67–100%	30%	○

P17 group Status viewing

Function code	Name	Description	Default	Modify
P17.38	Current of the main winding	It is the current of the main winding when applying capacitance-removing to control the single phase motor. 0.00–100.00A	0.00A	●
P17.39	Current of the secondary winding	It is the current of the secondary winding when applying capacitance-removing to control the single phase motor. 0.00–100.00A	0.00A	●

P18 group Status viewing functions special for solar inverters

Function code	Name	Description	Default	Modify
P18.00	PV reference voltage	MPPT is implemented at the inverter side. This value is determined at the inverter side.	0.0V	●
P18.01	Actual PV voltage	It is transferred from the boost module or equal to the bus voltage.	0.0V	●
P18.02	MPPT min. reference voltage display	The value displays the mini. voltage reference during max. power tracking. It equals the solar cell panel open-circuit voltage multiplied P15.26.	0.0V	●
P18.04	Present inductive current	It is transferred from the boost module. This function code is valid only in AC mode and invalid in PV mode.	0.0A	●
P18.08	Output power	0.00–655.35kW	0.0kW	●
P18.09	Previous PV voltage	0.00–655.35kW	0.0V	●
P18.10	Device power	0x00–0x11	0x00	●

Function code	Name	Description	Default	Modify
	supply display	LED ones: 0: PV power supply 1: AC grid power supply LED tens: 0: Detect that the system is configured with the boost module. 1: Detect that the system is not configured with the boost module.		
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*65535 + 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 RS422 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	○
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	Output upper limit of mppt voltage loop PI,	12.0A	○

Function code	Name	Description	Default	Modify
	upper limit of boost voltage loop PI	upper limit of the boost current loop reference current. P19.05–15.0A		
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	350.0V	◎
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 the PI parameters of this group. Otherwise, the boost voltage loop uses the PI parameters of the first group. Setting range: 0.000–65.535	0.080	○
P19.09	Boost starting voltage	60.0–200.0V	80.0V	●
P19.10	Boost software version	Once being powered, the boost module sends its version information to the inverter module.	0.00	●

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 after the inverter encounters a fault:

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

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

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

4. Eliminate the fault and ask for relative help.

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

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 the 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. ● The overvoltage stall protection is disabled.	● 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. ● The output cable is too long. For a cable longer than 100m, it
OC2	[5] Overcurrent during deceleration		
OC3	[6] Overcurrent during constant speed running		

Fault code	Fault type	Possible cause	Solution
			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 disabled.	● 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 disabled.	● Check the grid input power. ● Check the setting of related function codes.
OL1	[11] Motor overload	● The grid voltage is too low. ● The rated current of the motor 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.
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	● Dredge the vent duct or replace the fan. ● Lower the ambient
OH2	[16] Inverter module		

Fault code	Fault type	Possible cause	Solution
	overheat	high. ● The time of overload running is too long.	temperature.
EF	[17] External fault	● SI external fault input terminals 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 capability.
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 mode. ● 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.
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.

Fault code	Fault type	Possible cause	Solution
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	● The inverter reports overload alarm according to the setting.	● Check the load and overload 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 proper. ● 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	● The inverter reports underload alarm according to the setting.	● Check the load and underload alarm threshold.
tSF	[37] Hydraulic probe damage	● Hydraulic probe damage.	● Replace the hydraulic 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 or 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/DCC time. ● Select the inverter with larger power. ● Check if the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth.

Fault code	Fault type	Possible cause	Solution
PVOV	[40] PV overvoltage	● The solar cell panel input voltage 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 alarm	● The sunlight is weak or the solar panel configuration is insufficient.	● The device will automatically run when the light is sufficient. ● Check whether the solar panel configuration is sufficient.
A-LL	Underload alarm	● The pumping pool has no water.	● Check the pumping pool.
A-tF	Full-water alarm	● The pumping pool is full.	● If you have configured the full-water alarm function, the device automatically stops when the alarm elapsed a period of time. Otherwise, check whether terminals are wired correctly.
A-tL	Empty-water alarm	● The pumping pool has no water.	● If you have configured the empty-water alarm function, the device automatically stops when the alarm elapsed a period of time. Otherwise, check whether terminals are wired correctly.