

# Quick start guide of SP100 series solar pump inverter

This guide describes the instructions of operating INVT SP100 series solar pump inverter, including information about the safety precautions, terminal function description, quick startup, common function parameters, keypad, external wiring, and common faults. Please scan the e-manual platform QR code provided in chapter 8 or marked on the inverter housing to see the full version of e-manual.

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

## 1 Safety precautions

### 1.1 Warning

Sign	Name	Description	Abbreviation
	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.	
	Electrostatic discharge	The PCBA may be damaged if related requirements are not followed.	
	Hot	Do not touch. The inverter base may become hot.	
	Electric shock	As high voltage still presents in the bus capacitor after power off, wait for at least five minutes (or 15 min / 25 min, depending on the warning symbols on the machine) after power off to prevent electric shock.	
	Read manual	Read the operation manual before operating the equipment.	
<b>Note</b>	<b>Note</b>	Actions taken to ensure proper running.	<b>Note</b>

### 1.2 Safety guidelines

	<ul style="list-style-type: none"> <li>Only trained and qualified professionals are allowed to carry out related operations.</li> <li>Do not perform wiring, inspection or component replacement when power supply is applied. Ensure all the input power supplies have been disconnected before wiring or inspection, and wait for at least the time designated on the inverter or until the DC bus voltage is less than 36V. The minimum waiting time is listed in the following.</li> </ul>				
	<table border="1"> <thead> <tr> <th>Inverter model</th> <th>Minimum waiting time</th> </tr> </thead> <tbody> <tr> <td>&lt;55kW</td> <td>5 minutes</td> </tr> </tbody> </table>	Inverter model	Minimum waiting time	<55kW	5 minutes
Inverter model	Minimum waiting time				
<55kW	5 minutes				
	Do not refit the inverter unless authorized; otherwise fire, electric shock or other injury may result.				
	The base may become hot when the machine is running. Do not touch. Otherwise, you may get burnt.				
	The electrical parts and components inside the inverter are electrostatic sensitive. Take measurements to prevent electrostatic discharge when performing related operations.				

### 1.3 Environment condition

Item	Condition
Ambient temperature	<ul style="list-style-type: none"> <li>-25°C~60°C</li> <li>When the ambient temperature exceeds 45°C, derate 1% for every increase of 1°C.</li> <li>To improve reliability, do not use the inverter in the places where the temperature changes rapidly.</li> <li>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.</li> <li>When the temperature is too low, if you want to use the inverter that has been idled for a long time, install an external heating device before the use to eliminate the freeze inside the inverter. Otherwise, the inverter may be damaged.</li> </ul>
Running environment	<ul style="list-style-type: none"> <li>Install the inverter in a place:                             <ul style="list-style-type: none"> <li>Away from electromagnetic radiation sources</li> <li>Without oil mist, corrosive gas, flammable gas, radioactive gas, contaminative air, or contaminative liquid.</li> </ul> </li> <li>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)</li> <li>With low salt content</li> <li>Without direct sunlight</li> </ul>
Altitude	Lower than 1000m
Vibration	Max. vibration acceleration: 5.8m/s <sup>2</sup> (0.6g)
Installation direction	Install the inverter vertically to ensure good heat dissipation performance.

## 2 Terminal function

This section describes some common terminals. For more information, please scan the QR code provided in chapter 8 or marked on the inverter housing for details.

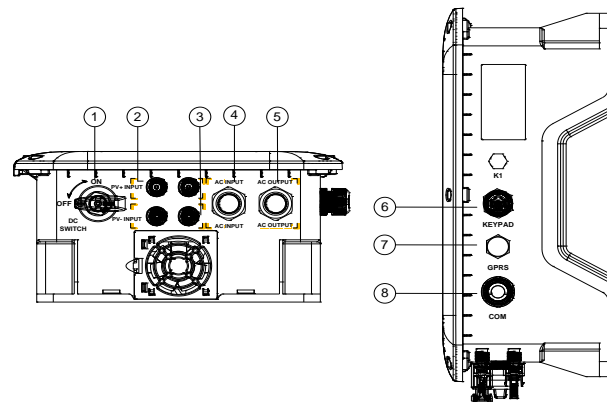


Table 2.1 Main circuit terminals

No.	Terminal name	Remarks
①	DC switch	-
②	PV input terminal +	-
③	PV input terminal -	-
④	AC input PG connector	-
⑤	AC output PG connector	-
⑥	External keypad terminal	-
⑦	-	-
⑧	Function terminal PG connector	-

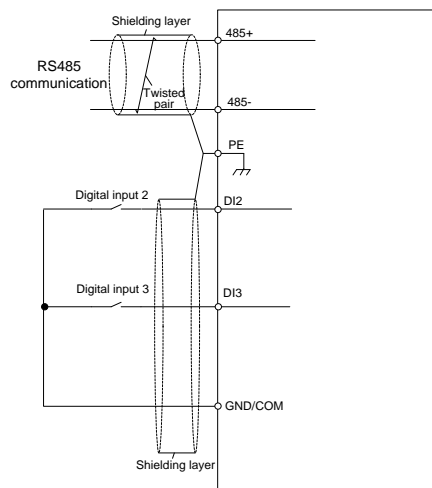


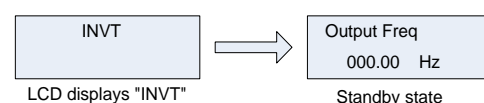
Figure 2.1 Wiring diagram of basic control circuit

Table 2.2 Control circuit terminals

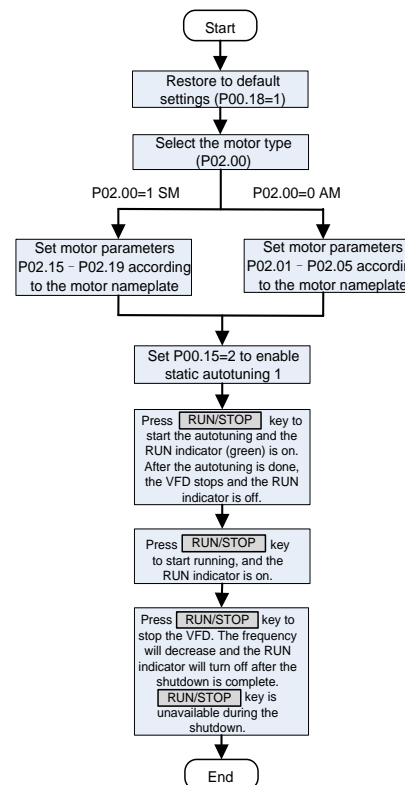
Terminal name	Description
ROA	Relay output. ROA: NO; ROB: NC; ROC: common;
ROB	Contact capacity: 3A/AC250V, 1A/DC30V
ROC	
DI1	1. The terminal supports switch signal only.
DI2	2. Max. input frequency: 1kHz
DI3	3. All of them are programmable digital input terminals. Users can set the terminal function by function code. (Select DI2-DI3 terminals for the running commands. The DI1 terminal is valid only when the running command is set to jogging. It is reserved for the local button.)
GND/COM	Common point of digital signals DI1-DI3, digital power ground
5V	5V power supply
485+	RS485 communication port. Standard RS485 communication port must use shielded twisted pairs.
485-	
GND/COM	5V power GND

## 3 Quick startup

After confirming the wiring and power are correct, close the air switch of the DC power supply at the inverter input side to power on the inverter. The LCD keypad displays "INVT" first. If the displayed character changes to the output frequency, indicating that the inverter is ready for run.



The quick startup flowchart is as follows:



## 4 Common function parameter setup

The following table lists some common function codes. For more information, please scan the QR code provided in chapter 8 or marked on the inverter housing to see the full version of e-manual.

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

Function code	Name	Description	Default	Modify
<b>Group P00 Basic functions</b>				
P00.01	Channel of running commands	The function code is used to select the channel of running inverter control commands. 0-2 0: Keypad 1: Terminal 2: Communication	1	○
P00.03	Max. output frequency	The function code is used to set the max. output frequency of the inverter. Pay attention to the function code because it is the foundation of the frequency setting and the speed of acceleration (ACC) and deceleration (DEC). Setting range: Max(P00.04, 10.00Hz) - 599.00Hz	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 max. output 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	◎
P00.06	Setting channel of A frequency command	0: Keypad 1: AI1 2: Reserved 3: Reserved 4: Reserved 5: Reserved 6: Reserved 7: Reserved 8: Modbus communication	0	○
P00.18	Factory reset	0-4 0: No operation 1: Restore to the default values 2: Clear fault records 3: Clear pre-alarm records 4: Back up parameters	0	◎

Function code	Name	Description	Default	Modify
		<b>Note:</b> Restoring to default values will delete the user password. After the selected operation is performed, the function code is automatically restored to 0.		
<b>Group P02 Parameters of motor 1</b>				
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.	Model depended	◎
P02.02	Rated frequency of AM	0.01Hz-P00.03 The inverter provides the parameter autotuning function. Whether parameter autotuning can be performed properly depends on the settings of the motor nameplate parameters.	50.00Hz	◎
P02.03	Rated speed of AM	1-36000rpm The inverter provides the parameter autotuning function. Whether parameter autotuning can be performed properly depends on the settings of the motor nameplate parameters.	Model depended	◎
P02.04	Rated voltage of AM	0-1200V 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.	Model depended	◎
P02.05	Rated current of AM	0.8-6000.0A <b>Note: Resetting the rated power of the motor (P02.01) can initialize the parameters P02.02-P02.10.</b>	Model depended	◎
P02.15	Rated power of SM	0.1-3000.0kW	Model depended	◎
P02.16	Rated frequency of SM	0.01Hz-P00.03 (max. output frequency)	50.00Hz	◎
P02.17	Number of pole pairs of SM	1-128	2	◎
P02.18	Rated voltage of SM	0-1200V	Model depended	◎
P02.19	Rated current of SM	0.8-6000.0A	Model depended	◎
<b>Group P05 Input terminal functions</b>				
P05.01	DI1 terminal function selection	0: No function 1: FWD run 2-3: Reserved 4: FWD jogging 5: Reserved 6: Coast to stop 7: Fault reset 8: Pause running 9: External fault input 10-35: Reserved	42	◎
P05.02	DI2 terminal function selection	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 switch to power frequency 43: Full-water signal 44: Empty-water signal 45-63: Reserved	43	◎
P05.03	DI3 terminal function selection		44	◎
P05.04	DI4 terminal function selection		0	◎
P05.32	AI1 lower limit	0.00V-P05.34	0.00V	○
P05.33	Corresponding setting of AI1 lower limit	-100.0%-100.0%	0.0%	○
P05.34	AI1 upper limit	P05.32-10.00V	10.00V	○
P05.35	Corresponding setting of AI1 upper limit	-100.0%-100.0%	100.0%	○
P05.36	AI1 input filter time	0.000s-10.000s	0.100s	○
<b>Group P06 Output terminal functions</b>				
P06.03	RO1 output selection	0-33 0: Invalid 1: Running 2: FWD running 3: REV running 4: Jogging 5: Inverter in fault 6-13: Reserved 14: Overload pre-alarm 15: Idle running pre-alarm 16-19: Reserved 20: External fault is valid 21: Reserved 22: Running time reached 23-25: Reserved	1	○

Function code	Name	Description	Default	Modify
		26: DC bus voltage established 27: Weak-light pre-alarm 28: Switch to power frequency through threshold determination 29: Switch to power frequency through S terminal determination 30: Switch to power frequency (threshold determination or S input determination) 31: Idle running pre-alarm 32: Full-water pre-alarm 33: Empty-water pre-alarm		

**Group P07 Human-machine interface**

P07.12	Inverter module temperature	-20.0~120.0°C	-	●
--------	-----------------------------	---------------	---	---

**Group P14 Serial communication**

P14.00	Local communication address	1~247	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 6: No check (N, 7, 1) for ASCII	1	○
--------	----------------	---	---	---

**Group P15 Functions special for solar pump**

P15.00	MPPT function	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	◎
--------	---------------	---	---	---

P15.05	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. 100.0% corresponds to P00.03. After PI adjustment, the target frequency cannot be less than the lower limit.	20.0%	○
--------	----------------------------------	---	-------	---

P15.12	Full-water level threshold	0.0~100.0%	25.0%	○
P15.13	Empty-water level threshold	0.0~100.0%	75.0%	○
P15.20	Dry pumping threshold	0.0~100.0%	00.00%	○

**Group P17 Status viewing functions**

P17.03	Output voltage	0~1200V	0V	●
P17.04	Output current	0.0~3000.0V	0.0A	●

P17.08	Motor power	Displays the present motor power. 100% corresponds to the rated motor power. The positive value is the motoring state while the negative value is the generating state. Range: -300.0~300.0% (relative to the rated motor power)	0.0%	●
--------	-------------	---	------	---

P17.12	Digital input terminal status	Range: 0x0000~0x000F BIT3 BIT2 BIT1 BIT0 DI4 DI3 DI2 DI1	0x0000	●
--------	-------------------------------	--	--------	---

**Group P18 Status viewing functions special for solar pump**

P18.01	PV voltage	DC input voltage (V)		●
P18.03	DC bus current	DC input current (A)		●
P18.07	PV input power	PV input power (kW)		●
P18.11	Actual pump flow	$Q = Q_N * f / f_N$ Unit: m³/h	0.0	●
P18.12	Actual pump lift	$H = 0.9H_N * (f / f_N)^2$ Unit: m	0.0	●
P18.13	High-order bits in total pump flow	Used to display the 16 high-order bits of the total pump flow. Unit: m³	0	●
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	0.0	●
P18.15	Reset total pump flow	When it is set to 1, the duration of this run 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	◎
P18.17	High-order bits in total power supply amount	Used to display the 16 high-order bits of the total power supply amount. Unit: kW·h	0	●
P18.18	Low-order bits in total power supply amount	Used to display the 16 low-order bits of the total power supply amount. Unit: kW·h Total pump electricity consumption = P18.17*65535 + P18.18	0.0	●
P18.19	Reset total power supply amount	When it is set to 1, the total power supply amount can be reset. P18.17 and P18.18 are cleared and then accumulated again. After the resetting succeeds, P18.19 is automatically changed to 0.	0	◎

Function code	Name	Description	Default	Modify
P18.21	High-order bits of duration of this run	Used to display the 16 high-order bits of duration of this run. Unit: min	0	●
P18.22	Low-order bits of duration of this run	Used to display the 16 low-order bits of duration of this run. Unit: min Duration of this run = P18.21*65535 + P18.22	0.0	●
P18.23	Reset duration of this run	When it is set to 1, the duration of this run can be reset. P18.21 and P18.22 are cleared and then accumulated again. After the resetting succeeds, P18.23 is automatically changed to 0.	0	◎

**5 Keypad introduction**

Name	Description
Status indicator	<b>RUN</b> Off: The inverter is stopped. On: The inverter is running. <b>FAULT</b> Fault indicator On: The inverter is in fault state. Off: The inverter is in normal state.
Keys	<b>PRG ESC</b> Menu/Exit key Press it to enter or exit level-1 menus or delete a parameter.
	<b>ENT SHIFT</b> Confirmation/Shifting key Press it to enter menus in cascading mode or confirm the setting of a parameter. Alternatively, press it to select digits to change during parameter setting, and press and hold to move the cursor left.
	<b>▲</b> Up key Press it to increase data or move upward.
	<b>▼</b> Down key Press it to decrease data or move downward.
	<b>STOP/ RST</b> Run/Stop/Reset key Press it to run, stop, or reset the inverter.

**6 Faults and solutions**

This section describes some common fault and solutions. Please scan the e-manual platform QR code provided in part 8 or marked on the inverter housing for more information.

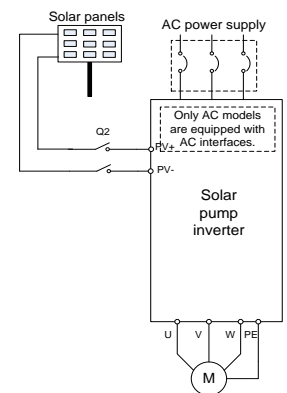
New fault code	Old fault code	Fault type	Possible cause	Solution
E1	OUt1	Inverter unit U-phase protection	●ACC/DEC is too fast. ●IGBT module is damaged	●Increase ACC/DEC time. ●Change the inverter unit.
E2	OUt2	Inverter unit V-phase protection	●Misoperation caused by interference. ●Drive wires are poorly connected.	●The device and system has been grounded reliably. ●Check that the drive wires properly.
E3	OUt3	Inverter unit W-phase protection	●To-ground short circuit occurred. ●Sparks occurred inside due to poor use environment conditions	●Check the motor wiring and ensure that there is no short circuit between the motor and ground ●Remove the dust or oil stain inside the inverter regularly
E4	OC1	Overcurrent during acceleration	●ACC/DEC is too fast.	●Increase ACC/DEC time.
E5	OC2	Overcurrent during deceleration	●Grid voltage is too low. ●Inverter power is too small. ●Load transient or exception occurred. ●3PH output current imbalance ●Strong external interference sources (contactor switchover or improper grounding)	●Increase grid input voltage. ●Select an inverter with larger power. ●Check for motor stalling, short connection, and load device exceptions. ●Check that the inverter 3PH output voltage is normal and that the motor 3PH resistance is balanced, and there is no output phase loss ●Check that there is no strong interference (whether motor cable is far away from contactor and system is grounded reliably).
E6	OC3	Overcurrent during constant speed running	●ACC/DEC is too fast. ●Abnormal input voltage. ●Start during motor rotating. ●Load energy regeneration is too large.	●Increase ACC/DEC time. ●Check the input voltage. ●Adopt speed tracking startup ●Add dynamic braking devices or regenerative units. ●Set dynamic braking function parameters.
E7	OV1	Overvoltage during acceleration	●ACC/DEC time is too short.	●Increase ACC/DEC time.
E8	OV2	Overvoltage during deceleration	●Start during motor rotating. ●Load energy regeneration is too large.	●Check the input voltage. ●Adopt speed tracking startup ●Add dynamic braking devices or regenerative units. ●Set dynamic braking function parameters.
E9	OV3	Overvoltage during constant speed running	●Dynamic brake is not enabled.	●Set dynamic braking function parameters.
E10	UV	DC bus undervoltage	●Grid voltage is too low.	●Check the grid input power.
E11	OL1	Motor overload	●Grid voltage is too low. ●Motor rated current is set incorrectly. ●Motor stall or load jumps violently	●Increase grid input voltage. ●Reset the motor rated current in the motor parameter group. ●Check the load and adjust torque boost.
E12	OL2	Inverter overload	●ACC is too fast ●The motor is restarted during rotating. ●The grid voltage is too low	●Increase ACC time. ●Avoid restarting after stop or starting after speed tracking ●Increase grid input voltage

New fault code	Old fault code	Fault type	Possible cause	Solution
			●Load is too heavy. ●Inverter power is too small.	●Select an inverter with larger power.
E13	SPI	Phase loss on input side	●Phase loss or violent fluctuation occurred on inputs RST ●The screws on the input side are loose.	●Check that the input power is normal and the input cable connection is not loose. ●Set P11.00 to screen out the fault.
E14	SPO	Output phase loss	●Output cables are broken or short connected to the ground. ●UVW phase loss (or the three phases of load are seriously asymmetrical).	●Check for loose or broken output cables. ●Check for sharp load fluctuation and motor 3PH resistance imbalance.
E16	OH2	Inverter module overheat	●Air duct is blocked or fan is damaged. ●Ambient temperature is too high. ●Long-time overload running.	●Ventilate the air duct or replace the fan. ●Keep good ventilation to lower ambient temperature. ●Select an inverter with larger power.
E17	EF	External fault	●The terminal is set to external fault function and the function is triggered.	●Check the terminal settings and the closure of external switches.
E18	CE	RS485 communication fault	●External device communication is disconnected.	●Check if the external connected devices have lost communication or if the communication timeout is set improperly.
E19	IE	Current detection fault	●Abnormal motor cable or motor insulation. ●Hall cable is in poor contact. ●Hall component or current sampling optocoupler damaged.	●Remove motor cables to check. ●Check the Hall cable connector. ●Contact the manufacturer.
E20	IE	Motor-autotuning fault	●Motor capacity does not match with the inverter capacity. This fault may occur if the capacity difference exceeds five power classes. ●Incorrect motor parameter setting.	●Change the inverter model, or adopt the V/F mode for control. ●Check motor wiring, motor type, and parameter settings. ●Empty the motor load and re-perform autotuning. ●Check whether the upper limit frequency is larger than 2/3 of the rated frequency. ●Decrease the pulse current setting properly.
E21	EEP	EEPROM operation fault	●Error in reading or writing control parameters ●EEPROM is damaged.	●Press the STOP/ RST key to reset. ●Replace the main control board.
E22	PIDE	PID feedback disconnected	●PID feedback is disconnected. ●PID feedback source disappears.	●Check PID feedback signal wires. ●Check PID feedback source.
E25	OL3	Electrical overload	●The inverter reports overload pre-alarm according to the setting.	●Check whether the overload pre-alarm point is set properly.
E32	ETH1	To-ground short-circuit fault	●The output of the inverter is short circuited to the ground. ●Current detection circuit is faulty. ●Actual motor power setup deviates sharply from the inverter power.	●Check whether the motor is short circuited to the ground and wiring is normal. ●Check whether the motor wiring is normal. ●Replace the hall component. ●Replace the main control board. ●Reset the motor parameters properly.
E34	dEu	Speed deviation fault	●The load is too heavy or stalled.	●Check for the load. If the load is normal, increase speed deviation detection time or prolong the ACC/DEC time. ●Check motor parameter settings and re-perform motor parameter autotuning. ●Check speed loop control parameter settings.
E36	LL	Underload fault	●The inverter reports underload pre-alarm according to the setting.	●Check the load and underload pre-alarm thresholds.
E96	E-PAO	No upgrade bootloader	●The software does not have a bootloader.	●Contact the manufacturer.
E536	tSF	Hydraulic probe damaged	●Hydraulic probe is damaged.	●Check the hydraulic probe feedback signal.
E537	PINV	PV reverse connection	●PV wiring is incorrect.	●Confirm the correct PV polarity and rewire.

New fault code	Old fault code	Fault type	Possible cause	Solution
E538	PVOC	PV overcurrent	●ACC/DEC is too fast ●VFD power is too low ●Load transient or exception occurred ●Short circuit to ground.	●Increase ACC/DEC time. ●Select a VFD with a higher power rating. ●Check the load for short circuits (to ground or phase-to-phase) or a locked-rotor condition.
E539	PVOV	PV overvoltage	●PV input voltage is too high. ●P 380V model is incorrectly set as a 220V model.	●Reduce the number of PV panels in series. ●Check the model type and re-configure the parameters.
E540	PVLV	PV undervoltage	●Insufficient PV string power or poor weather (rainy/cloudy). ●Excessive motor starting current.	●Increase the number of PV panels or test under normal sunlight. ●Replace the motor.
E576	LSE	Lightning strike fault	●Lightning strike	●Contact the manufacturer.

Alarm code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.
A9020	Weak-light alarm	Insufficient solar light.	Check the solar light condition.
A9021	Dry pumping alarm	No water in the well.	Check the submersion status of the water pump.
A9022	Full-water alarm	The water tank is full of water.	Check the water level of the tank.
A9023	Empty-water alarm	The water tank is empty.	Check the water level of the tank.
A9024	Mains power not connected alarm	The mains power is not connected successfully.	Check whether the mains power is connected normally.

**7 External wiring diagram**



**8 E-manual QR code**

Please scan the following QR code to view the full version of the e-manual:



**9 More information**

Please contact us for any information about the product. It is necessary to provide the product model and serial number during consultation. To obtain more information, you can:

Contact INVT local office, visit www.invt.com, or scan the following QR code of INVT:

