SPC Series Solar Pumping VFD Quick Start Guide

This guide describes the instructions of operating INVT SPC series solar pumping variable-frequency drive (VFD), including information about the safety precautions, terminal functions, quick startup, common function parameters, keypad, external wiring, and common faults. Please scan the e-manual platform QR code provided in part 8 or marked on the VFD housing for more information.

If the product is ultimately used for military affairs or manufacture of weapon, it will be listed on the export control formulated by Foreign Trade Law of the People's Republic of China. Rigorous review and necessary export formalities are needed when exported.

1 Safety precautions

1.1 Warning signs

Sign	Name	Description	Abbreviation
Danger	Danger	Severe personal injury or even death can result if related requirements are not followed.	
Warning	Warning	Personal injury or device damage can result if related requirements are not followed.	
Do not	Electrostatic discharge	PCBA board damage can result if related requirements are not followed.	
Hot sides	Hot sides	The VFD base may be hot. Do not touch.	
5 min	Electric shock risk	High voltage may be present in bus capacitors after power off. To prevent electric shock, wait at least 5 or 15 or 25 minutes (depending on the device warning symbol) before operating the device that is just powered off.	5 min
Read manual	Read manual	Read the manual before operating.	
Note	Note	Actions are taken to ensure proper running.	Note

1.2 Safety guide

◇ Only trained and qualified electricians can operate on the VFD.
◇ Do not perform any wiring, inspection, or component changing when power is applied. Ensure all input power supplies are disconnected before wiring or checking, and always wait at least the time designated on the VFD or until the DC bus voltage is less than 36V. The following table lists the waiting time.

VFD model		Min. waiting time
3PH 220V	2.2kW	5 min
3PH 380V	4kW–7.5kW	5 min

◇ Do not refit the VFD unless authorized; otherwise, fire, electric shock or other injuries may result.
◇ The heat sink base may become hot during running. Do not touch it; otherwise, burns may result.
◇ The electronic components inside the VFD are electrostatic sensitive. Take measurements to avoid electrostatic discharge during related operation.

1.3 Environment

Environment	Requirement
Ambient temperature	◇ -25℃ to 60℃. ◇ If the ambient temperature exceeds 45°C, the machine is automatically derated. ◇ In order to improve device reliability, do not use the VFD if the ambient temperature changes sharply at a sudden. ◇ If the VFD is used in a closed space such as control cabinet, use a cooling fan or cooling air conditioner to lower the temperature inside the space to ensure that the temperature meets the requirement. ◇ When the temperature is too low, if the VFD needs to restart after a long stop, use an external heating device to increase the internal temperature; otherwise device damage may result.
Environmental conditions for operation	Install the VFD on a site described as follows: ◇ Far away from electromagnetic radiation sources. ◇ Without oil mist, corrosive gas, flammable gas, radioactive materials, harmful gas, or harmful liquid. ◇ Keeping foreign objects, such as metal power, dust, oil, and water, from dropping into the VFD (do not install it on the flammable materials such as wood). ◇ With less salt spray. ◇ Without direct sunlight.
Altitude	Below 3000 m
Vibration	The max. vibration amplitude cannot exceed 5.8m/s^2(0.6g).
Installation direction	Install the VFD vertically to ensure good heat dissipation effect.

2 Terminal function description

The following describes common terminals. Please scan the e-manual platform QR code provided in part 8 or marked on the VFD housing for details.

Table 2.1 Main circuit terminals

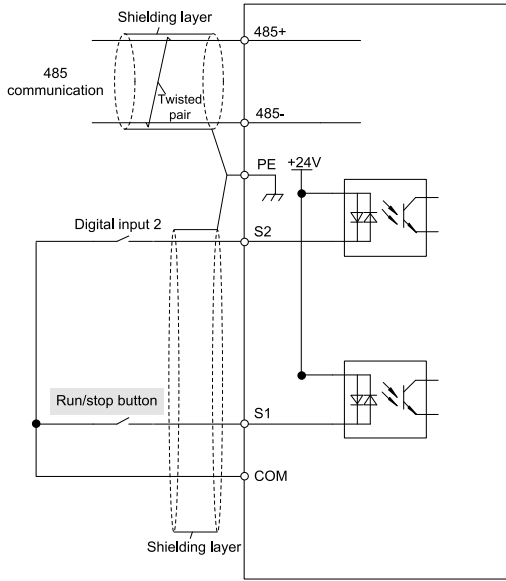| No.	Terminal name	Pin definition	Remarks
①	PV input terminal-	-DC INPUT	
②	PV input terminal+	+DC INPUT	
③	External keypad terminal	RJ45	Optional
④	Function terminal	1. S2 2. COM	Optional
⑤	AC output terminal, aviation plug or PG connector	1. V 2. W 3. U 4. PE	Optional
⑥	GPRS module connection terminal	1. + 24V 2. 485+ 3. 485- 4. COM	Optional
⑦	DC switch	/	Optional
⑧	RUN/STOP button	/	

Figure 2.1 SPC basic control circuit wiring

Table 2.2 Basic control circuit terminals

Terminal name	Description	Remarks
ROA ROB ROC	Relay output: ROA NO, ROB NC, ROC common terminal Contact capacity: 3A/AC250V, 1A/DC30V.	
COM	Common terminal of +24V	
485+ 485-	485 communication ports. If it is a standard 485 communication interface, use twisted pairs or shielded cables.	
PW	Input digital working power is provided from external to internal.	
24V	Power supply provided by the VFD. Max. output current: 200mA.	
S1	Digital input	RUN/STOP function
S2	Digital input	1. Internal impedance: 3.3kΩ 2. 12–30V voltage input is acceptable 3. Bi-directional input terminal, supporting NPN/PNP connection modes 4. Max. input frequency: 1kHz 5. All are programmable digital input terminals, for which functions can be set through function codes

3 Quick startup

After confirming the wiring and power are correct, close the air switch of the DC power supply at the VFD input side to power on the VFD. The keypad displays 8.8.8.8.8. When the characters displayed on the LED has changed to the set frequency, the VFD is initialized and ready for run.

8.8.8.8.8. ⟹ 0.00

LED displays "88888"   Ready to run "0.00"
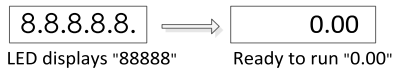
The quick startup diagram is as follows:
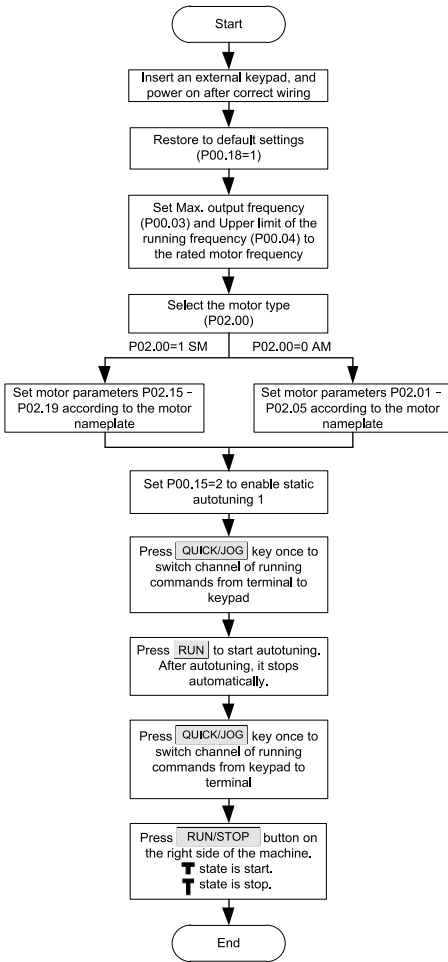
4 Common function parameters

The following lists only some common function parameters. For more function parameters, scan the e-manual platform QR code provided in part 8 or marked on the VFD housing to refer to the operation manual.

○: The parameter setting can be modified in both stopped and running states.

◎: The parameter setting cannot be modified in running state.

●: The parameter setting is the actually detected value and cannot be modified.

The VFD automatically checks and constrains the modification of parameters, helping prevent incorrect modifications.

Function code	Function name	Description	Default	Modify
P00 group Basic functions				
P00.01	Channel of running commands	Select the running command channel of the VFD. 0: Keypad ("LOCAL/REMOT" light off) Carry out the command control by RUN, STOP/RST on the keypad. Set the multi-function key QUICK/JOG to FWD/REVO shifting function (P07.02=3) to change the running direction. Press RUN and STOP/RST simultaneously in running state to make the VFD coast to stop. 1: Terminal ("LOCAL/REMOT" light flickering) 2: Communication ("LOCAL/REMOT" light on)	1	○
P00.03	Max. output frequency	This parameter is used to set the max. output frequency of the VFD. Users need to pay attention to this parameter because it is the foundation of the frequency setting and the speed of acceleration and deceleration. Setting range: P00.04–400.00 Hz	110.00Hz	◎
P00.04	Upper limit of the running frequency	The upper limit of the running frequency is the upper limit value of the output frequency of the VFD, which shall be less than or equal to the max. output frequency. The VFD runs at the upper limit frequency if the set frequency is higher than the upper limit. Setting range: P00.05–P00.03 (Max. output frequency)	110.00Hz	◎
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning. Perform comprehensive autotuning for motor paramters. It is	0	◎
		recommended to use rotary autotuning when high control accuracy is needed. 2: Static autotuning 1. Perform static autotuning in the cases where the motor cannot uncouple from the load. 3: Static autotuning 2. No autotuning for non-load current and mutual inductance.		
P00.18	Function parameter restoration	0: No operation 1: Restore to default settings 2: Clear fault history 3: Lock function codes **Note:** 1. The value of the function code will be automatically restored to 0 after selected function operations are completed. 2. Restoring to the default value will clear the user password, please use this function with caution.	0	◎
P02 group Motor 1 parameters				
P02.00	Motor type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	1	◎
P02.01	Rated power of AM	0.1–3000.0kW	Model depended	◎
P02.02	Rated frequency of AM	0.01Hz–P00.03	110.00Hz	◎
P02.03	Rated speed of AM	1–36000rpm	Model depended	◎
P02.04	Rated voltage of AM	0–1200V	Model depended	◎
P02.05	Rated current of AM	0.8–6000.0A	Model depended	◎
P02.15	Rated power of SM	0.1–3000.0kW 0.1–3000.0	Model depended	◎
P02.16	Rated frequency of SM	0.01Hz–P00.03 (max. frequency) 0.01–P00.03	110.00Hz	◎
P02.17	Pole pairs of SM	1–128 1–128	2	◎
P02.18	Rated voltage of SM	0–1200V 0–1200	Model depended	◎
P02.19	Rated current of SM	0.8–6000.0A 0.8–6000.0	Model depended	◎
P05 group Input terminals				
P05.01	Function of S1 terminal	0: No function 1: Forward running	1	◎
P05.02	Function of S2 terminal	2: Reverse running 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Operation pause 9: External fault input 30: ACC/DEC prohibition 34: DC brake 36: Shift the command to the keypad 37: Shift the command to terminals 38: Shift the command to communication 39: Pre-magnetized command 43: Full-water signal 44: Non-water signal	0	◎
P05.37	Lower limit of AI2	0.000s–10.000s	0.00V	○
P05.38	Corresponding setting of the lower limit of AI2	0.000s–10.000s	0.0%	○
P05.39	Upper limit of AI2	0.000s–10.000s	10.00V	○

The P02.01–P02.05 explanation (from the P02.01 Rated power of AM row onward): Set the parameters of the asynchronous motor. In order to ensure the controlling performance, please set values of P02.01–P02.05 properly according to the nameplate of the asynchronous motor. SPC provides the function of parameter autotuning. Correct parameter autotuning depends on correct motor name plate setting. In order to ensure the controlling performance, you need to configure a motor based on the standard motor configuration of the VFD. If the gap between the motor power and the standard one is huge, the controlling performance of the VFD will be degraded significantly. **Note:** You can reset the rated motor power (P02.01) to initialize the motor parameters of P02.02–P02.10.

Function code	Function name	Description	Default	Modify
P05.40	Corresponding setting of the upper limit of AI2	0.000s–10.000s	100.0%	○
P05.41	AI2 input filter time	0.000s–10.000s	0.100s	○

P06 Group Output terminals

Function code	Function name	Description	Default	Modify
P06.03	Relay RO1 output selection	0: Invalid 1: In operation 2: Forward rotation operation 3: Reverse rotation operation 4: Jogging operation 5: VFD fault 8: Frequency reached 9: In zero speed running 10: Upper limit of frequency reached 11: Lower limit of frequency reached 12: Ready for operation 13: Pre-magnetizing 14: Overload alarm 15: Underload alarm 20: External fault valid 22: Running time reached 23: Modbus communication virtual terminal output 26: DC bus voltage established 27: Weak light 28: Underload 29: Full water 30: Empty water	1	○

P07 Group HMI

Function code	Function name	Description	Default	Modify
P07.02	Key function selection	Ones: QUICK/JOG key function 1: Jogging 2: Switch the display state via the shifting key 3: Switch between FWD/REV rotation 4: Clear UP/DOWN setting 5: Coast to stop. 6: Switch the running command reference mode in order 7: Quick commissioning mode (based on non-default parameters) Tens: Key locking selection 0: Keys unlocked 1: Lock all keys 2: Lock part of the keys (lock PRG/ESC key only)	0x06	◎
P07.03	Sequence of switching running command channels via QUICK key	0: Keypad control → terminal control → communication control 1: Keypad control←→terminal control 2: Keypad control←→communication control 3: Terminal control ← → communication control	1	○
P07.12	Inverter module temperature	-20.0–120.0°		●

P14 Group Serial communication

Function code	Function name	Description	Default	Modify
P14.00	Local communication address	1–247	1	○
P14.01	Communication baud rate setting	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS 6: 57600BPS	3	○
P14.02	Data bit check setting	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 7: Even check (E, 7, 1) for ASCII 9: No check (N, 7, 2) for ASCII 10: Even check (E, 7, 2) for ASCII 11: Odd check (O, 7, 2) for ASCII 12: No check (N, 8, 1) for ASCII 13: Even check (E, 8, 1) for ASCII 14: Odd check (O, 8, 1) for ASCII 15: No check (N, 8, 2) for ASCII 16: Even check (E, 8, 2) for ASCII 17: Odd check (O, 8, 2) for ASCII	1	○

P15 Group   Functions special for solar inverters

Function code	Function name	Description	Default	Modify
P15.06	KP1	0.00–100.00 Proportion coefficient 1 of the target frequency	5.00	○

Function code	Function name	Description	Default	Modify
		The bigger the value is, the stronger the effect and faster the adjustment is.		
P15.07	KI1	0.00–100.00 Integral coefficient 1 of the target frequency The bigger the value is, the stronger the effect and faster the adjustment is.	5.00	○
P15.11	Water level control	0: Switch input of the water-level control 1: Reserved 2: Water-level signal is input through AI2	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	Current detection value of underload operation	0.0%: No detect during underload 0.1–100.0%	00.00%	○

P17 Group State viewing

Function code	Function name	Description	Default	Modify
P17.12	Switch input terminal state	0000–000F BIT1 / BIT0 S2 / S1 Range: 0x0000–0x000F	0	●
P17.13	Switch output terminal state	0000–000F BIT0 RO1 Range: 0x0000–0x000F	0	●

P18 Group State viewing special for solar inverters

Function code	Function name	Description	Default	Modify
P18.01	Present PV voltage	DC input voltage. Unit: V		●
P18.03	Present PV current	DC input current, Unit: A		●
P18.07	PV input power	PV input power. Unit: kW		●
P18.11	Current pump flow	$Q = Q_N * f / f_N$ Unit: m³/h	0.0	●
P18.12	Current pump lift	$H = 0.9 H_N * (f / f_N)^2$ Unit: m	0.0	●
P18.13	MSBs in total pump flow	P18.13 displays the 16 most significant bits (MSBs) in the total pump flow. Unit: m³	0	●
P18.14	LSBs in total pump flow	P18.14 displays the 16 least significant bits (LSBs) in the total pump flow. Unit: m³. Total pump flow = P18.13*65535 + P18.14	0.0	●
P18.15	Total pump flow resetting	Setting P18.15 to 1 can reset the total pump flow. P18.13 and P18.14 will accumulate the flow after resetting. After the resetting succeeds, P18.15 is automatically set to 0.	0	◎
P18.17	MSBs in total power supply	P18.17 displays the 16 most significant bits (MSBs) in the total power supply. Unit: kW·h	0	●
P18.18	LSBs in total power supply	P18.18 displays the 16 least significant bits (LSBs) in the total power supply. Unit: kW·h Total power flow = P18.17*65535 + P18.18	0.0	●
P18.19	Total power supply resetting	Setting P18.19 to 1 can reset the total power supply. P18.17 and P18.18 will accumulate the power supply after resetting. After the resetting succeeds, P18.19 is automatically set to 0.	0	◎
P18.21	MSBs in total running time	P18.21 displays the 16 most significant bits (MSBs) in the total running time. Unit: min	0	●
P18.22	LSBs in total running time	P18.22 displays the 16 least significant bits (LSBs) in the total running time. Unit: min Total running time = P18.21*65535+P18.22	0.0	●
P18.23	Total running time resetting	Setting P18.23 to 1 can reset the total running time. P18.21 and P18.22 will accumulate the flow after resetting. After the resetting succeeds, P18.23 is automatically set to 0.	0	◎

5 External keypad

Item		Description
Status indicator	RUN/TUNE	VFD running status indicator. LED off: The VFD is stopped. LED blinking: The VFD is autotuning parameters. LED on: The VFD is running.
	FWD/REV	Forward or reverse running indicator. LED off: The VFD is running forward. LED on: The VFD is running reversely.
	LOCAL/REMOT	Indicates whether the VFD is controlled through the keypad, terminals, or remote communication. LED off: The VFD is controlled through the keypad. LED blinking: The VFD is controlled through terminals. LED on: The VFD is controlled through remote communication.
	TRIP	Fault indicator. LED on: in fault state. LED off: in normal state. LED blinking: in pre-alarm state
Unit		Unit displayed currently.

Item	Description		
indicator		Hz	Frequency unit
		RPM	Rotational speed unit
		A	Current unit
		%	Percentage
		V	Voltage unit

Five-digit LED displays various monitoring data and alarm codes such as the set frequency and output frequency.

Display	Means	Display	Means	Display	Means
0	0	1	1	2	2
3	3	4	4	5	5
6	6	7	7	8	8
9	9	A.	A	b.	B
C.	C	d	d	E.	E
F.	F	H.	H	I.	I
L.	L	n.	N	n	n
o	o	P.	P	r	r
S.	S	t	t	U.	U
v	v	.	.	-	-

| Item			Description
Keys	PRG/ESC	Programming key	Press it to enter or exit level-1 menus or delete a parameter.
	DATA ENT	Entry key	Press it to enter menus in cascading mode or confirm the setting of a parameter.
	▲	Up key	Press it to increase data or move upward.
	▼	Down key	Press it to decrease data or move downward.
	SHIFT	Right-shifting key	Press it to select display parameters rightward in the interface for the device in stopped or running state or to select digits to change during parameter setting.
	RUN	Run key	Press it to run the device when using the keypad for control.
	STOP/RST	Stop/Reset key	Press it to stop the device that is running. The function of this key is restricted by P07.04. In fault alarm state, this key can be used for reset in any control modes.
	QUICK JOG	Shortcut multifunction key	The function is determined by P7.02.

6 VFD faults and solutions

The following lists common VFD faults and the solutions. Please scan the e-manual platform QR code provided in part 8 or marked on the VFD housing for more information.

Fault code	Fault type	Possible cause	Solution
OUt1	Phase-U protection of inverting unit	ACC is too fast. IGBT module is damaged. Misacts are caused by nterference. Drive wires are poorly connected.	Increase ACC time. Replace the power unit. Check the drive wires. Check whether there is strong interference surrounding peripheral equipment.
OUt2	Phase-V protection of inverting unit		
OUt3	Phase-W protection of inverting unit		
OV1	Overvoltage during ACC	DEC time is too short. Input voltage exception occurred. Large energy feedback occurred.	Check the input power supply; Check whether the load DEC time is too short. Check the settings of related function codes.
OV2	Overvoltage during DEC		
OV3	Overvoltage during constant speed running		
OC1	Overcurrent during ACC	ACC or DEC is too fast. Grid voltage is too low. VFD power is too small. Load transient or mutation occurred. Output phase loss occurred. Strong external interference sources exist. Overcurrent stall protection is disabled.	Increase ACC/DEC time. Check the input power supply. Select a VFD with higher power. Check whether the load encounters (line-to-line) short circuit or the rotation is blocked. Check the output wiring. Check whether there is strong interference. Check the settings of related function codes.
OC2	Overcurrent during DEC		
OC3	Overcurrent during constant speed running		
UV	Bus undervoltage	Grid voltage is too low. Overvoltage stall protection is disabled.	Check the input power supply. Check the settings of related function codes.
OL1	Motor overload	Grid voltage is too low. Rated motor current is set improperly. Motor stall or load jumps violently.	Check grid voltage. Reset motor rated current. Check the load and adjust the torque boost.
OL2	VFD overload	ACC is too fast. The motor in rotating is restarted. Grid voltage is too low.	Increase ACC time. Avoid restart after stop. Check grid voltage. Select a VFD with higher

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Fault code	Fault type	Possible cause	Solution
		Load is too large. Power is too small.	power. Select a proper motor.
SPO	Phase loss on output side	Phase loss occurred to U, V, and W (or the three phases of the load is asymmetrical)	Check output wiring. Check the motor and cable.
OH2	Inverting module overheat	Ambient temperature is too high. Long-time overload running.	Lower the ambient temperature.
EF	External fault	SI external fault input terminal acts.	Check external equipment input.
CE	RS485 communication fault	Incorrect baud rate setting. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check communication interface wiring. Set a proper communication address. Replace or change the wiring to enhance anti-interference capacity.
A-LS	Weak light alarm	The sunlight is weak, or the motor is locked-rotor.	Lower voltage threshold for weak light.
A-LL	Underload alarm	The water pump is idled, or water level is lower.	Set a proper underload threshold
A-tF	Water full alarm	Full-water condition is reached.	Set a proper water full threshold.
A-tL	Water empty alarm	Water empty condition is reached	Set a proper water empty threshold.

7 Peripheral wiring
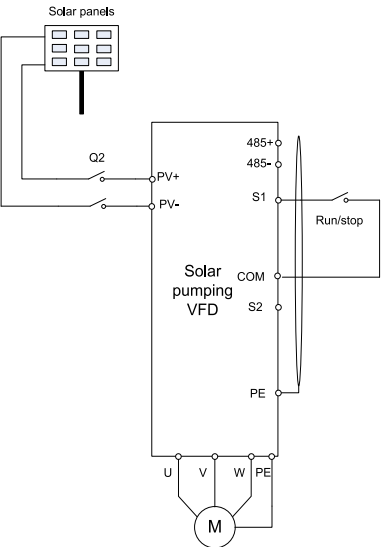
8 INVT e-manual platform QR code

Please scan the following e-manual platform QR code to refer to the required operation manual for more information.

9 More information

Please contact us for any information. 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.cn, or scan the following QR code of INVT:

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