

Chapter 1. About this manual

This chapter provides an overview of the contents, purpose, compatibility, and the intended audience of this manual. This supplement manual intends to serve as a quick start guide for installing, commissioning and operating the SPD660 solar pump inverter. This manual includes all the required parameter settings and program features specific to the solar pump drive.

READ AND FOLLOW ALL INSTRUCTIONS!

When installing and using this electrical equipment, basic safety precautions should always be followed, including the following:



WARNING – To reduce the risk of injury, do not permit children to use this product unless they are closely supervised at all times.



WARNING – To reduce the risk of electric shock, replace damaged cord immediately.



WARNING – It must be assured that all grounding connections are properly made and that the resistances do meet local codes or requirements

Safety and cautions

1.1 General Warnings

The manual contains basic instructions which must be observed during installation, operation and maintenance. The manual should be carefully read before installation and start-up by the person in charge of the installation. The manual should also be read by all other technical personnel/ operators and should be available at the installation site at all times.

Personnel Qualification and Training – All personnel for the operation, maintenance, inspection and installation must be fully qualified to perform that type of job. Responsibility, competence and the supervision of such personnel must be strictly regulated by the user.

Should the available personnel be lacking the necessary qualification, they must be trained and instructed accordingly. If necessary, the operator may require the manufacturer/supplier to provide such training.

Furthermore the operator/user must make sure that the personnel fully understand the contents of the manual.

Dangers of Ignoring the Safety Symbols – Ignoring the safety directions and symbols may pose a danger to humans as well as to the environment and the equipment itself. Non-observance may void any warranties.

Non-observance of safety directions and symbols may for example cause the following: Failure of important functions of the equipment/plant; failure of prescribed methods for maintenance and repair; endangerment of persons through electrical, mechanical and chemical effects; danger to the environment because of leakage of hazardous material; danger of damage to equipment and buildings.

Safety-oriented Operation – The safety directions contained in the manual, existing national regulations for the prevention of accidents as well as internal guidelines and safety-regulations for the operator and user must be observed at all times.

General Safety Directions for the Operator/User– If hot or cold equipment parts pose a danger then they must be protected by the operator/user against contact with people. Protective covers for moving parts (e.g. couplings) must not be removed when the equipment is running. Leaks (e.g. at the shaft seal) of hazardous pumping media (e.g. explosive, toxic, hot liquids) must be disposed of in such a way that any danger to personnel and the environment is removed. All government and local regulations must be observed at all times. Any danger to persons from electrical energy must be excluded by using good installation practices and working according to local regulations.

Safety Directions for Maintenance, Inspection and Assembly Work– It is the user’s responsibility to make sure that all maintenance, inspection and assembly work is performed exclusively by authorized and qualified experts sufficiently informed through careful perusal of the Operating Instructions. The accident prevention regulations must be observed. All work on the equipment should be done when it is not operational and ideally electrically isolated. The sequence for shutting the equipment down is described in the manual and must be strictly observed. Pumps or pump units handling hazardous liquids must be decontaminated. Immediately upon completion of the work, all safety and protective equipment must be restored and activated. Before restarting the equipment, all points contained in chapter “Initial Start-up” must be observed.

Unauthorized Changes and Manufacturing of Spare Parts– Any conversion or changes of the equipment may only be undertaken after consulting the manufacturer. Original spare parts and accessories authorized by the manufacturer guarantee operational safety. Using non-authorized parts may void any liability on the part of the manufacturer.

Unauthorized Operation– The operational safety of the equipment delivered is only guaranteed if the equipment is used in accordance with the directions contained in this manual. Limits stated in the data sheets may not be exceeded under any circumstances.

Transportation and Intermediate Storage– Prolonged intermediate storage in an environment of high humidity and fluctuating temperatures must be avoided. Moisture and condensation may damage windings and metal parts. Non-compliance will void any warranty.

1.2 Purchase Inspection



CAUTION: Properly check the delivery before installation. Never install the drive when you find it damaged or lack a component. Incomplete or defective installation might cause accidents.

1.3 Installation



CAUTION: To ensure effective cooling, the drive must be installed vertically with at least 10 cm space above and below the casing.



CAUTION: When installed in an indoor location sufficient ventilation must be ensured by a vent or ventilator or similar device. Do not install in a place which is exposed to direct sunlight.



CAUTION: Do not let the drilling chips fall into the drive fin or fan during installation. This might affect the heat dissipation

1.4 Connection



WARNING: The connection of the drive must be carried out by qualified personnel only. Unqualified handling might lead to shock, burn, or death.



WARNING: Please double-check that input power has been disconnected before connecting the device, otherwise electrocution or fire can be caused.



WARNING: The earth terminal must be reliably grounded, otherwise touching the drive shell might lead to a shock.



WARNING: Selection of PV module type, motor load and drive must be adequate, or the equipment might get damaged.



WARNING: Grounding of this electrical equipment is mandatory. Never run the pump system when the ground wire is not connected to proper ground. Ignoring this instruction can lead to electrocution.

1.5 Operation



WARNING: The drive should only be connected to power after correct wiring, or the drive might get damaged.



WARNING: Do not modify the connection while the system is connected to power, or touching any part of it might cause electrocution



CAUTION: Adjust partial control parameters according to the steps indicated by the manual before the first operation. Do not change the control parameters of the drive by random, or it might damage the equipment.



CAUTION: The heat sink gets hot during operation. Do not touch it until it has cooled down again, or you might get burned.



CAUTION: At altitudes of more than 1,000 m above sea level, the drive should be derated for use. Output current should be derated by 10% for every 1,500 m increment of altitude



CAUTION: Never run the pump when it is not fully submerged in water. When the pump is installed the correct running direction can be determined by measuring the flow rates.

Chapter2. Solar pumping system introduction

2.1. Solar Pumping System overview

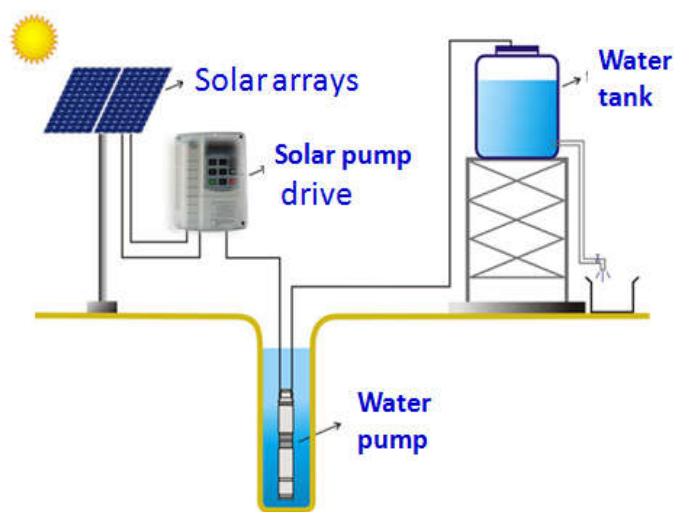
Solar pumping systems can be applied to all forms of daily use, water pumping for drinking water supply for remote villages and farms without connection to the water grid, for agricultural use such as livestock watering, agricultural irrigation, forestry irrigation, pond management, desert control, and industrial use such as wastewater treatment etc.

In recent years, with the promotion of the utilization of renewable energy resources, solar pumping systems are more and more used in municipal engineering, city centre squares, parks, tourist sites, resorts and hotels, and fountain systems in residential areas.

The system is composed of a PV panel, a pump and a solar pump drive. Based on the design philosophy that it is more efficient to store water rather than electricity, there is no energy storing device such as storage battery in the system. The system is prepared to be combined with a elevated water storage, e.g. water tower or an uphill tank installation.

The PV generator, an aggregation of PV modules connected in series and in parallel, absorbs solar irradiation and converts it into electrical energy, providing power for the whole system. The pump drive controls and adjusts the system operation and converts the DC produced by the PV module into AC to drive the pump, and adjusts the output frequency in real-time according to the variation of sunlight intensity to realize the maximum power point tracking (MPPT). The pump, driven by 3-phase AC motor, can draw water from deep wells, rivers and lakes and pour it into storage tanks or reservoirs, or be connected directly to the irrigation system, fountain system, etc. According to the actual system demand and installation condition, different types of pumps such as centrifugal pump, axial flow pump, mixed flow pump or deep well pump can be used.

Solar pump system constitution.



System wiring diagram

2.2. Solar pump drive features:

Save energy cost and maximize productivity

Solar pump drives ensure reliable power supply throughout the day with on and off-grid compatibility.

Protect environment

Harnessing the power of sun provides an environmentally friendly pumping without producing any CO2 emissions

Easy install and operation and little parameters configuration, end user who never used drive before, can install and operate it very well.

Reduce maintenance costs

The drives can be equipped with remote monitoring options, reducing maintenance trips to the site.

Reduce operational risk

Embedded pump-specific features such as dry run detection, minimum power input protection, maximum current protection, stop frequency running protection.

Chapter3. Solar pump drive overview

SPD660 series solar pump drive is one low voltage AC drive of 0.4 to 315KW power range designed to make use of energy drawn from solar panel or photovoltaic cells (PV). The drive is customized to operate in dual supply mode, so the grid connected supply is used in the absence of energy from PV cells. This drive functions with the latest in technology maximum power point tracking (MPPT) algorithm to derive maximum power from the PV cells at any instant. The drive is specifically designed to meet the requirements of pump manufacturers and the original equipment manufacturers (OEM).

3.1 Product Features

Control modes

The solar pump drive operates in local control mode and in remote control mode: identical to the ordinary SPD660 AC drive.

- Local control—interfaces through the operation panel (keypad)
- Remote control—interfaces through external terminals control.

Note: Ensure that the drive is in local control before starting or stopping the inverter using the control panel.

- ✓ Maximum power point tracking (MPPT) with fast response speed and stable operation
- ✓ Dry run (under load) protection
- ✓ Motor maximum current protection
- ✓ Input power protection
- ✓ Low stop frequency protection
- ✓ The PQ (power/flow) performance curve enables calculating the flow output from the pump
- ✓ Digital control for fully automatic operation, data storage and protective functions
- ✓ Intelligent power module (IPM) for the main circuit
- ✓ LED display operating panel and support remote control
- ✓ Dual mode AC and DC power supply input is available
- ✓ Low water probe sensor, and water level control function
- ✓ Ambient temperature for using: -10 to +50°C.

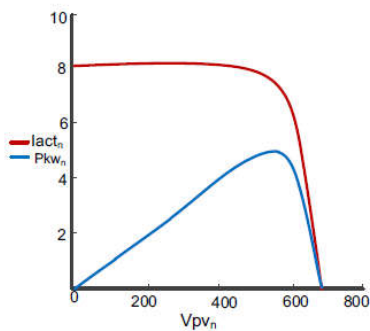
3.2. Solar pump drive operation theory

The solar pump drive uses the maximum power point tracking (MPPT) control program to improve the efficiency of solar energy systems. The output of the photovoltaic (PV) cell is proportional to its area and intensity, while the output voltage is limited by p-n junction from 0.6 to 0.7 V. Therefore when the output voltage is constant, output power is proportional to intensity and surface area. The current and voltage at which the PV cell generates maximum power is known as the maximum power point.

The MPPT controller follows different strategies to derive the maximum power from the PV array. The internal MPPT algorithm is used to derive maximum power from the PV cell at any instant. This is achieved by modifying the operating voltage or current in the PV cell until the maximum power is obtained.

When the output voltage is zero, the PV cells create short circuit current. If the PV cells are not connected to any load, the output voltage is equal to the open circuit voltage. The maximum power point is obtained at the knee of the I-V curve. See the I-V characteristics shown below.

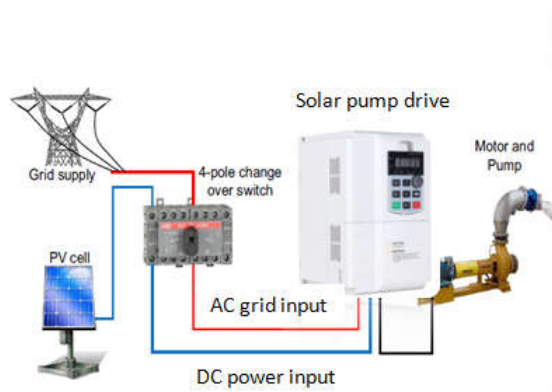
■ I-V characteristics



The I-V curve is not constant since intensity and temperature changes during day time. Under constant temperature, current changes linearly with intensity and voltage changes logarithmically with intensity. Since the voltage variation is small with respect to intensity changes, maximum power varies proportionally with intensity

3.3. SPD660 series solar pump drive compatible with dual supply mode

The solar pump drive operates in dual supply mode either with a three phase input supply from the grid or with DC input supply from PV cells. A four-pole changeover switch enables switching between the two supply modes. At a given time only one supply (PV cell or grid) will be connected to the drive.



Note: Use two poles of the changeover switch in series to ensure that the voltage applied across each pole is half of the full DC voltage

3.4. SPD660 series solar pump drive model description

The user can learn the specification from the nameplate.

SPD660 2K2GB 4T M
 ① ② ③ ④

Mark	Description	Contents
1	Products model	SPD for solar pump drive. 660 for Mode code.
2	Drive power	7K5GB stand for 7.5kw, submersible pump type 1K5GB stands for 1.5kw, submersible pumps type 7K5GP stands for 7.5kw, general pumps type
3	Voltage specification	1: = 80 to 350 V DC or 110 to 220VAC input 2: = 150 to 450 V DC or 200 to 240 V AC input 4: = 250 to 900 V DC or 380 to 480 V AC input S: single phase output T: three phase output
4	Size mode	M:mini mode Null: general mode

3.5. SPD660 series solar pump drive technical specification

Recommended MPPT voltage range	80 ~350V DC input for 110V/160V/220V pumps, 0.75kw 150~450VDC for 220VAC/240V pumps with 0.75Kw to 4kw 250~900VDC, for 380VAC pumps with1.5kw to 160kw
Recommended input voltage	170Vmp DC for 110V AC pumps. 260Vmp DC for 160V AC pumps 350Vmp DC for 220V AC pumps, 620Vmp DC for 380V AC pumps
Motor type	Control for permanent magnet synchronous motor and asynchronous motor pumps
Maximum DC power input	1. 450VDC for 220AC output 2. 800VDC for 380V AC output
Rated output voltage	1 phase, 110V/160V/220V. 3 phase, 220V/380V/480V
Output frequency range	0~50/60Hz
MPPT efficiency	99%,
Ambient temperature range	-10~+50°C
Solar pump control special performance	MPPT (maximum power point tracking), CVT (constant voltage tracking), auto/manual operation, dry run protection, low stop frequency protection, minimum power input, motor maximum current protection, flow calculating, energy generated calculating and water tank level detected, etc
Protection function	Stall protection, phase loss protection, phase short circuit protection , ground to phase short circuit protection , input and output short circuit protection, over-temperature protection, etc
Protection degree	IP20, Air force cooling
Running mode	MPPT or CVT
Altitude	Below 1000m; above 1000m, derated 1% for every additional 100m.
Standard AC input backup circuit	CE, Design base on IEC standard.

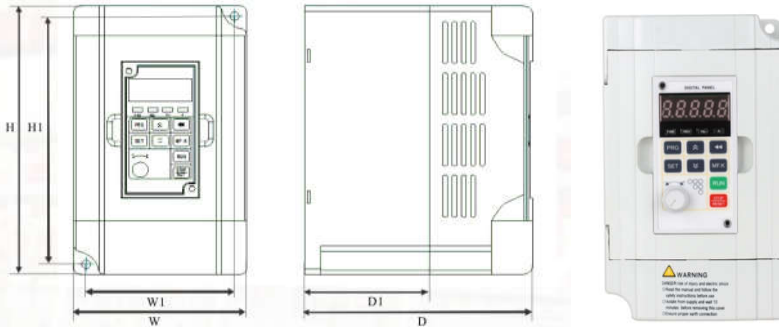
3.6. Models and specification

SN	Models	Rate current (A)	DC input range (VDC)	Output voltage (VAC)	Applicable for pumps (KW)	Installation size (mm)	IGBT module	Fig
Mini type: 80 to 350 VDC or 110 to 240VAC								
1	SPD660-0K7GB-1T-M	7.5A	80to350	110to160	0.75KW	143*86*114	IPM	Fig 1
Mini type:150 to 450 VDC or 220 to 240VAC								
2	SPD660-0K7GB-2T-M	4.0A	150 to 450	220to 240	0.75KW	143*86*114	IPM	Fig 1
3	SPD660-1K5GB-2T-M	7.5A	150 to 450	220to240	1.5KW	143*86*114	IPM	Fig 1
Mini type: 250 to 900 VDC or 380 to 440 VAC								
4	SPD660-0K7GB-4T-M	2.5A	250 to 900	380to440	0.75KW	143*86*114	module	Fig 1
5	SPD660-1K5GB-4T-M	3.7A	250 to 900	380to 440	1.5KW	143*86*114	module	Fig 1
6	SPD660-2K2GB-4T-M	5.0A	250 to 900	380to 440	2.2KW	143*86*114	module	Fig 1
General type: 150 to 450 V DC or 200 to 240 V AC								
7	SPD660-0K7GB-2T	4.0A	150 to 450	220to 240	0.75KW	185*118*157	module	Fig 2
8	SPD660-1K5GB-2T	7.5A	150 to 450	220to 240	1.5KW	185*118*157	module	Fig 2
9	SPD660-2K2GB-2T	10A	150 to 450	220to 240	2.2KW	185*118*157	module	Fig 2
10	SPD660-4K0GB-2T	16A	150 to 450	220to 240	4.0KW	247*160*178	module	Fig 2
General type: 250 to 900 VDC or 380 to 480VAC								
11	SPD660-0K7GB-4T	2.5A	250 to 900	380to 440	0.75KW	185*118*157	module	Fig 2
12	SPD660-1K5GB-4T	3.7A	250 to 900	380to 440	1.5KW	185*118*157	module	Fig 2
13	SPD660-2K2GB-4T	5.0A	250 to 900	380to 440	2.2KW	185*118*157	module	Fig 2
14	SPD660-4K0GB-4T	10A	250 to 900	380to 440	4.0KW	185*118*157	module	Fig 2
15	SPD660-5K5GB-4T	13A	250 to 900	380to 440	5.5KW	247*160*178	module	Fig 2
16	SPD660-7K5GB-4T	17A	250 to 900	380to440	7.5KW	247*160*178	module	Fig 2
17	SPD660-011GB-4T	25A	250 to 900	380to 440	11KW	247*160*178	module	Fig 2
18	SPD660-015GB-4T	33A	250 to 900	380to 440	15KW	247*160*178	module	Fig 2
19	SPD660-018GB-4T	38A	250 to 900	380to 440	18.5KW	335*217*190	module	
20	SPD660-022GB-4T	45A	250 to 900	380to 440	22KW	360*230*225	module	
21	SPD660-030GB-4T	60A	250 to 900	380to 440	30KW	463*285*225	module	
22	SPD660-037GB-4T	75A	250 to 900	380to 440	37KW	463*285*225	module	
23	SPD660-045GB-4T	91A	250 to 900	380to 440	45KW	600*385*270	module	
24	SPD660-055GB-4T	110A	250 to 900	380to 440	55KW	600*385*270	module	
25	SPD660-075GB-4T	150A	250 to 900	380to 440	75KW	600*385*270	module	
26	SPD660-090GB-4T	180A	250 to 900	380to 440	90KW	700*473*307	module	

27	SPD660-110GB-4T	210A	250 to 900	380to 440	110KW	700*473*307	module	
28	SPD660-132GB-4T	250A	250 to 900	380to 440	132KW	930*579*375	module	
29	SPD660-160GB-4T	310A	250 to 900	380to 440	160KW	930*579*375	module	

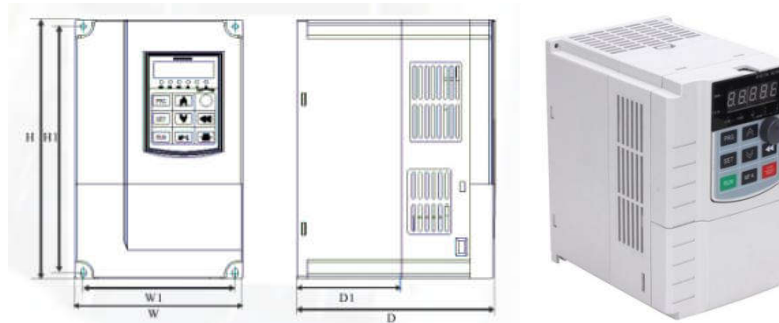
3.7. SPD660 series solar pump drive dimensions

Power	H	H1	W	W1	D	D1	Hole
0.4~1.5KW	143	132	86	74	114	62.5	Ø4.5



Mini type Fig 1

Power	H	H1	W	W1	D	D1	hole
0.75~4KW	185	175	118	105	157	80	Ø5
5.5kw -15kw	247	235	160	147	178	101	Ø5



General type Fig 2

Chapter 4. Operation control panel description

4.1 Press function key description

Key symbol	Name	Function description
PRG	Menu key	Enter menu or exit
SET	Confirm key	Enter to menu step by step and confirm the setting value
⬆	UP increase key	Data and function code increase

▽	DW reduce key	Data and function code reduce
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Symbol	Indicator description
Hz	Unit of frequency (Hz)
A	Unit of current (Amp)
V	Unit of voltage (V)
FWD	Forward run indicator
REV	Reverse run indicator FWD, REV both flash in stand for DC braking
ALM	Fault indicator (alarm for over current, over voltage but that don't reach the level of fault limit)

◀◀	Shift	In the monitor status, press this key can select display monitoring parameter in circulation.
RUN	Running key	Use to start drive in keypad control mode
MF.K	Multiple function key	Programmed by P4-31 setting. Default is reverse running
<u>STOP</u> RESET	Stop and reset	In running status, this key can use to stop operation (P0-02). Reset malfunction in alarm mode.

4.2. Indicator description

4.3. Digital display area

5 digit LED display, it can use to display frequency reference, output frequency and kinds of monitoring data and fault alarm code.

4.4. Function code operation

There are 3 level menu in respectively.

1. Function code parameters (First level menu)
2. Function code name (The second level menu)
3. Setting value of function code (the third level menu)

Note: If in the third level menu, you can press PRG or SET key to return second menu.

The difference is that press SET key will set parameter in controller board and then return to the second menu, press PRG key an return second menu directly without parameters storing.

4.5. Monitor parameters inquiry.

There two ways to inquiry monitoring parameters.

1. Press “◀◀”to inquiry 6 solar pump control common parameters (It is set by P4-26, P4-27, P4-28)(Output frequency, output current, output voltage, DC voltage, Dc current and input power)
2. User also can go to d parameters to inquiry relative parameters.

Example: Inquiry d-02 (output current value of drive), see below fig.

4.6. Common parameters display

Press shift button of keypad can display output current, output frequency, output voltage, DC bus voltage, DC bus current and input power 6 parameters in circulation in monitor status.

4.7. Fault reset

Solar pump drive will display relative fault information if there are any alarm occurs.

User can reset it by “STOP/RESET” or external terminals (P5 group setting). Once reset, drive place on standby status.

If drive place in fault status and without any reset, it is located in protection status and can't working.

Note: Solar pump drive perform itself initialize when power on.

The system of drive will initialize by itself when power on. The LED of keypad display -SGd- when DC bus of dive from low to high.

When DC bus reach start point, LED will display the frequency reference and flash all the time, means drive place on standby status.

Chapter 5. SPD660 series solar pump drive installation

5.1 About this chapter

This chapter includes the basic information about the mechanical and electrical installation of solar pump drive and also provides steps to quickly operate the inverter.

For general instructions on installation and maintenance of SPD660 Drives, see *User's manual*.

Safety instructions

WARNING! All electrical installation and maintenance work on the drive must be carried out by qualified electricians only. Follow the safety instructions listed below.

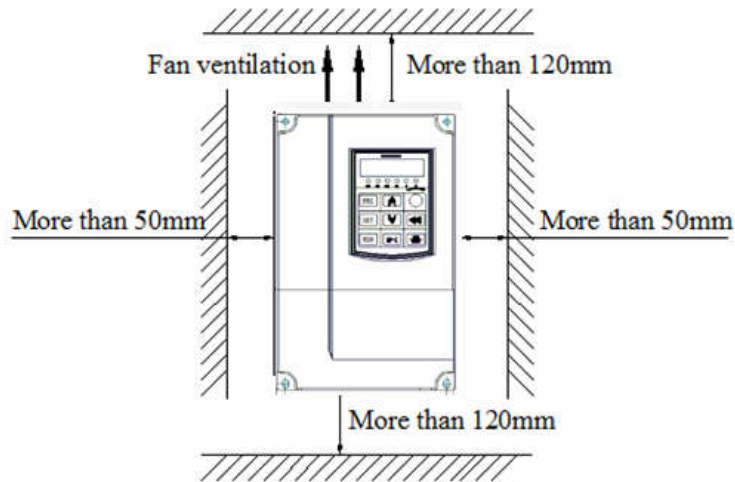
- **Never work on the inverter, the braking chopper circuit, the motor cable or the motor when input power is applied to the inverter.**
 - **After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge. Always ensure by measuring that no voltage is actually present.**
 - **A rotating permanent magnet motor generates a dangerous voltage. Always ensure to lock the motor shaft mechanically before connecting a permanent magnet motor to the inverter, and before doing any work on a drive system connected to a permanent magnet motor.**
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5.2 Mechanical installation

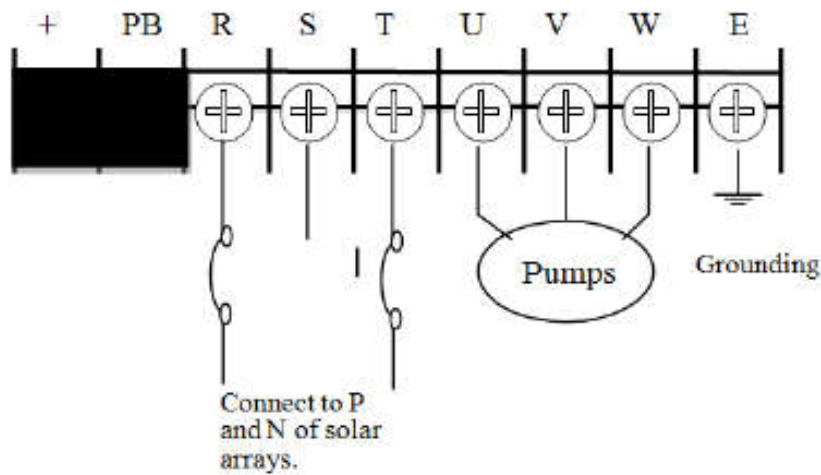
In back mounting, fasten the drive to the wall with screws using four mounting holes.

Note: Installation Environment Requirements

1. Ambient temperature, the surrounding environment temperature take great effect for service life span of solar pump drive, don't allow surrounding temperature over than allowable temperature above (-10°C to +50°C)
2. Heat dissipation, install the solar drive on the surface of an incombustible object, and ensure that there is sufficient space around for heat dissipation. Install the solar pump drive vertically on the support using screws.
3. Vibration, it should be less than 0.6G, far away from the punching machine or the like.
4. Free from direct sunlight, high humidity and condensation
5. Free from corrosive, explosive and combustible gas
6. Free from oil dirt, dust and metal powder



5.3. Installation and wiring



R, T terminals of drive received solar DC power from PV.

Note:

- Do not use an asymmetrically constructed motor cable.
- Route the motor cable, input power cable and control cables separately.
- Make sure that the maximum cable lengths are not exceeded. For detailed information, see the user's manual.

5.4 Main circuit terminals description

Terminals symbol	Function description
+ -	Positive and negative terminals of DC bus voltage
PB	P, PB connect braking resistor
R, S, T	AC input connecting or DC input connect
U, V, W	Connect to motor
E	Grounding terminals

5.5. Connection procedure

1. Strip the input power cable. Ground the bare shield of the cable (if any) 360 degrees under the grounding clamp. Fasten the grounding conductor (E) of the input power cable under the screw of the grounding clamp. Connect the phase conductors to the R,T terminals from PV solar panel.
2. Strip the motor cable. Ground the bare shield of the cable 360 degrees under the grounding clamp. Twist the shield to form as short a pigtail as possible and fasten it under the screw of the grounding clamp. Connect the phase conductors to the U, V and W terminals.
4. Secure the cables outside the drive mechanically.

5.6 .Control circuit terminals

5.6.1 Control circuit terminals diagram



5.6.2. Control circuit terminals function description

Type	Terminals symbol	Terminals function	Remark
Power supply output	12V	12V/100mA power supply	
	GND	Frequency reference voltage signal common point (12, GND), analog current signal input negative point	
	24V	Output 24V/50mA power supply (24V, GND)	
Analog input	AI1	Analog voltage signal input terminals 1	0~10V
	AI2	Analog voltage signal input terminals 2	0~10V/0~20mA
Digital input terminals	PM	Terminal active level selection	If PM connect with power supply point, the multi-function terminals and GND connecting is active. If PM connect with GND, the multi-function terminals and power supply points connecting is active. The function defined by parameter (P5-16~P5-21)
	X1	Multi-function input terminals 1	
	X2	Multi-function input terminals 2	
	X3	Multi-function input terminals 3	
	X4	Multi-function input terminals 4	
	X5	Multi-function input terminals 5	
Analog output	AO1	Programmable voltage and current signal output terminal (Defined by P5-34 ~ P5-36 parameters)	Output voltage 0~10V
	AO2	Programmable frequency, voltage and current output (Defined by P5-39 ~ P5-43 parameters).	Maximum output high frequency is 50KHz, output voltage 0~10V, current 0~20mA
Programmable transistor Output	Y	Programmable open collector output, set by parameter P5-27	The maximum load current 50mA, maximum withstand voltage of 24V
Programmable relay output	TA-TB-TC1 TA-TB-TC2	Programmable relay output, set by parameter P5-28 P5-29	Contact capacity: AC250V 1A, Resistive load
RS485 communication	485A 485B	RS485 communication	

5.6.3. Jumper Description

SW1 Dial switch

Switch on the 0 ~ 10V, while setting [P5-39] = 0, AO2 output 0 ~ 10V.

Switch on the 4 ~ 20mA, while setting [P5-39] = 0, AO2 output 0 ~ 20mA.

Switch on the PWM, while setting [P5-39] = 1, AO2 output pulse signal.

SW2 Dial switch

Switch on the 0 ~ 10V, AI2 input 0 ~ 10V.

Switch on the 4 ~ 20mA, AI2 input 0 ~ 20mA.

Chapter 6. Solar pump drive commissioning guide

6.1 Wiring and commission steps

6.1.1 Commissioning steps

1. Wiring according to the diagram and check the wiring if correct or not
2. Check the solar power input DC voltage if matching rated of drive. (4T series need Voc 620DCV, 2T series need Voc 350V)
3. Switchover to solar DC power input if DC voltage is correct.
4. Parameters setting and motor trial starting.

(a) Solar pump control parameters is PA, PB and PC group. Only two parameters need to be confirmed by first time using.

FA-00=2 for MPPT function in default. If FA-00 is 0, it only allow for AC grid input, not solar power input.

FA-01=0 means for operating by manual with keypad in default. If needs run automatically, please set FA-01 for 1.

(b) Set motor group parameters P2-00 to P2-05 according motor nameplate for asynchronous induction motor.

(c) Perform motor trial running with press RUN key to starts pump and observe the running frequency and the water yield. If the sunlight radiation is good, and frequency goes up, but water flow is very small. Might the direction of pumps running is not correct, please to change motor wiring phase.

(d) Set the low stop frequency protection, low voltage sleep protection, dry run (under-load) protection, motor maximum protection and water tank level function if need according user request.

(e) If the output frequency is a little fluctuation, user can set PA-05 (Frequency adjust gain) to smaller, and set PA-07 to smaller value. Otherwise if E. LU alarm occurs frequently, please set PA-05 bigger, and increase the PA-07 value.

(f) If solar pump drive runs well, and system working is stable, the commissioning is finished. Set FA-01 to 1 for automatically running control. The solar pump system can work with MPPT function according sunlight radiation automatically.

Note: If user need start pumps with AC grid input, please connect AC power supply to R, S,T. and set FA-00 for 0, or switch on X? (X3 and GND short circuit connection) to disable solar pump control function.

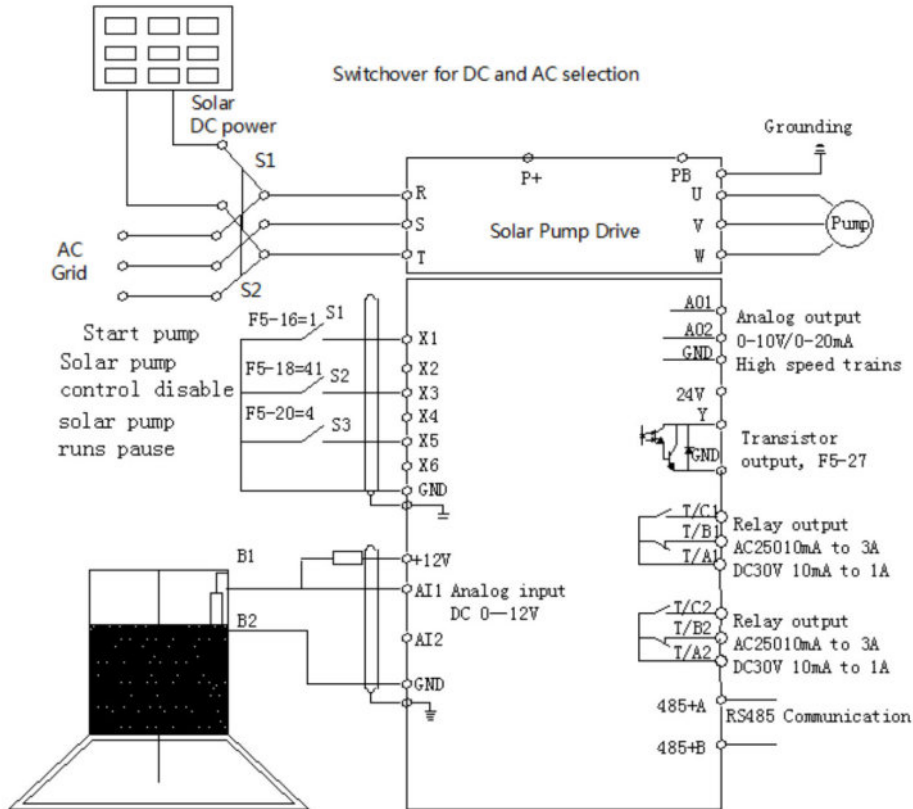
Excluded functions

The following features of SPD660 solar pump drive firmware are not supported in the solar pump inverter.

- Frequency input
- Sequential programming
- Jogging

- Constant speed
- speed slip compensation
- Mechanical brake

Solar pump drive wiring with dual mode AC grid and solar DC power input.



Note.1:

1. Use a switch over to select solar power DC input or AC grid input.
Only allow one power input at the same time.
2. Switch on X1, and P5-16 set for 1, it will use to start pumps.
3. Switch on X2 to disable solar pump control when AC grid input.
4. If external fault or water is enough, user can switch X3 to make system pause.
5. AI and GND analog input ports can receive water level detect analog signal to control water level.

Note.2

Note: The required input solar panel voltage is 1.15 times of solar drive DC bus voltage.

For example: In 4T series, recommend $540V \times 1.15 = 621V$;

in 2T series, recommend $311 \times 1.15 = 357V$.

The required power of solar arrays is 1.3 times of rated power of drives, shouldn't less than 1.2 times of rated power of inverter.

For example, 7K5G, the required power is $7500 \times 1.3 = 9750w$.

Chapter 7. Simple parameter list

Table Symbol Description:

☆ - indicates that the parameter can be changed in the process of stopping and running.

✕ - indicates that the parameter can be changed in stop mode, can not be changed during running;

* - Indicates that the initial parameters related to the drives model

Below list all parameters for AC drives, not only for solar pump control but also for motor speed and torque control. Blue and bold words stands for parameters which may relative to solar pump control function.

1. P0. parameters for basic running control

Code	Name	Description	Unit	Default setting	Property
P0-00	Model selection	0: General purpose 1: P type (variable torque load)	1	0	✕
P0-01	Control mode	0: VF control 1: Vectorized VF control 2: Open loop vector control 1 3: High performance open loop vector control 2	1	0	✕
P0-02	Running command channel selection	0: Operation panel (keypad) 1: External terminals 2: RS485terminals	1	1	☆
P0-03	Main frequency reference source A	0: Potentiometer of keypad 1: UP, DOWN of keypad. 2: AI1 (0-10V) 3: AI2 (0-10V/0-20mA) 5: PID close loop reference 6: Multi-segment speed control 7: Simple PLC 8: UP/DW of terminals 9: Communication 11: High speed pulse trains	1	0	☆
P0-04	Auxiliary frequency reference source B	0: Potentiometer of keypad 1: AI1 (0- 10V) 2: AI2 (0-10V) 3: P0-07 4: High speed pulse trains reference 5: Multi-segment speed	1	1	☆
P0-05	The reference source selection of auxiliary frequency source B	0: Upper limit frequency 1: Main frequency source A	1	0	☆

P0-06	The operation of frequency source A and B combination setting	0: Main frequency source A 1: Auxiliary frequency source B 2: A+B 3: MAX (A, B) 4: MIN (A, B) 5: A-B	1	0	☆
P0-07	UP and Down key of keypad setting	0~Upper limit frequency	0.01	50.00	☆
P0-08	Upper limit frequency	5.00~650.00 Hz	0.01	50.00	×
P0-09	Lower limit frequency	0.00Hz ~ P0-08	0.01	0.50	×
P0-10	Running mode under low limit frequency	0: Running with lower limit frequency 1: Stop 2: Sleep mode in stand by	1	0	×
P0-11	Wake up time in sleep mode	0.0~6000.0 S	0.1	0.0	×
P0-12	Acceleration mode 1	0.1~6000.0 s	0.1	*	☆
P0-13	Deceleration mode 1	0.1~6000.0s	0.1	*	☆
P0-14	Carrier frequency	1 ~ 10KHz	1	*	☆
P0-15	Ac drive running direction	0: Runs as forward direction 1: Runs as reverse direction 2: Reverse direction is forbidden	1	0	☆
P0-16	Parameters display in standby mode	0~39 (corresponding with d parameters)	1	3	☆
P0-17	Factory restore to factory setting	0: No operation 11: Parameters initialization 22: Clear fault record	1	0	×
P0-18	Parameters modify protection	0: No protection 1: Disable modify	1	0	×
P0-19	STOP operation range	0: Enable on keypad operation mode 1: Enable on all command mode	1	0	×

2. P1 parameters for start and stop parameters

Code	Name	Description	Unit	Default setting	Property
P1-00	Start up mode	0: Start up with starting frequency 1: Start up after DC braking 2: Start up with speed tracking	1	0	×
P1-01	Starting frequency	0.00~10.00Hz	0.01	0.50	×
P1-02	Starting frequency holding time	0.0~20.0s	0.1	0.0	×
P1-03	DC braking current when starting	0~150.0%	1	50.0	×
P1-04	DC braking time when starting	0.0~30.0s	0.1	0.0	×

P1-05	Stop mode	0: Deceleration to stop 1: Free stop	1	1	☆
P1-06	Dc braking start frequency when stop	0.00~50.00Hz	0.01	3.00	×
P1-07	Dc braking current when stop	0~150.0%	1	50.0	×
P1-08	DC braking holding time when stop	0.0~60.0s	0.1	0.0	×
P1-09	Speed tacking arithmetic Selection	0: Minimum current arithmetic 1: Voltage/frequency arithmetic.	1	0	×
P1-10	Waiting time of speed tacking	0.0 ~ 10.0s	0.1	1.0	×
P1-11	Speed tacking search time	3.0 ~ 100.0s	0.1	6.0	×
P1-12	Current setting of speed tacking finished	1.00~50.00%	0.01	15.00	×
P1-13	Starting voltage when braking	105.0~140.0%	0.1	123.0	☆
P1-14	Final voltage when braking	105.0~150.0%	0.1	128.0	☆
P1-15	Terminals running command detect when power on	0: Running command is disable when power on 1: Running command enable when power on	1	0	×
P1-16	Stop speed	0.00~100.00%	0.01	1.00	☆
P1-17	Stop speed detect mode	0: Detect as speed reference 1: Detect as actual speed (for vector control)	1	1	☆

3. P2 motor parameters group

Code	Name	Description	Unit	Default setting	Property
P2-00	Motor type	0: Asynchronous motor 1: Permanent magnet synchronous motor	1	0	×
P2-01	Motor rated voltage	1~700V	1	*	×
P2-02	Motor rated frequency	5.00~600.00Hz	0.01	50.00	×
P2-03	Motor rated current	0.1~3000.0A	0.1	*	×
P2-04	Rated slip frequency	0.00~5.00Hz	0.01	*	×
P2-05	Poles pair	1~50	1	2	×
P2-06	No load current	10.0~ 80.0%	0.1	*	×
P2-07	Stator resistor	0.00~50.00%	0.01	*	×
P2-08	Rotor resistance	0.00~50.00%	0.01	*	×
P2-09	Leakage inductance	0.00~50.00%	0.01	*	×
P2-10	Motor parameter auto-tuning	0: No operation 1: static auto tuning 2: Completely auto tuning	1	0	×

P2-11	Rated frequency of PMSM	5.00~600.00Hz	0.01	50.00	x
P2-12	Rated voltage of PMSM	1~700V	1	*	x
P2-13	Rated current of PMSM	0.1~3000.0A	0.1	*	x
P2-14	Rated back EMF of PMSM	1~700V	1	*	x
P2-15	Stator resistance of PMSM	0.00~50.00%	0.01	*	x
P2-16	Active damping detection time	2~100	1	10	x
P2-17	Active damping 1	0~1000	1	100	x
P2-18	Active damping 2	0~1000	1	100	x
P2-19	Active damping switching frequency	0.00~100.00Hz	0.01	100.00	x
P2-20	Active damping limiter	0.00~3.00Hz	0.01	1.00	x

PMSM stands for Permanent magnet synchronous motor

4. P3 group parameters for Vector control and V/f control

Code	Name	Description	Unit	Default setting	Property
P3-00	Low speed ASR proportional coefficient	0.01 ~ 30.00	0.01	0.60	☆
P3-01	Low speed ASR integral coefficient	0.01 ~ 10.00	0.01	1.00	☆
P3-02	ASR switching frequency 1	1.00~7.50Hz	0.01	5.00	☆
P3-03	High speed ASR proportional coefficient	0.01 ~ 30.00	0.01	0.60	☆
P3-04	High speed ASR integral coefficient	0.01 ~ 10.00	0.01	1.00	☆
P3-05	ASR switching frequency 2	8.00~50.00Hz	0.01	10.00	☆
P3-06	Current loop proportional coefficient	1~1000	1	20	x
P3-07	Current loop integral coefficient	1~100	1	10	x
P3-08	Slip compensation coefficient	50~200%	1	100	x
P3-09	Speed feedback filter time constant	1~100 millisecond	1	6	x
P3-10	Torque limit	0~200%	1	150	x
P3-11	Cross compensation coefficient	0.00 ~ 0.50	0.01	0.20	x
P3-12	Closed-loop voltage proportional coefficient	0~ 1.00	0.01	0.20	x
P3-13	Voltage closed-loop integral coefficient	0~ 1.00	0.01	0.20	x
P3-14	Magnetic field control proportional coefficient	10~1000	1	50	x
P3-15	Magnetic field control integral coefficient	1~500	1	50	x
P3-16	Current reference filter time constant	1~100millisecond	1	10	x
P3-17	Whether torque control	0: Torque control disable 1: Torque control enable	1	0	☆

P3-18	Torque reference	0: Torque reference set by P3-19 1: AI1 2: AI2 3: Multi-segment speed 4: RS485 5: HDI	1	0	☆
P3-19	Torque reference by keypad setting	0.0~200.0%	0.1	50.0	☆
P3-20	Torque reference direction	0: Forward direction 1: Reverse direction	1	0	☆
P3-21	Upper limit frequency reference source set selection	0: Upper limit frequency 1: AI1 2: AI2 3: Multi-segment speed 4: RS485 5: HDI 6: Potentiometer of keypad	1	0	☆
P3-22	V/F curve selection	0: Standard V/F curve, V/F=constant 1: Square V/f curve 2: User defined V/f curve	1	0	×
P3-23	Custom curve F1	0.0 ~100.0%	0.1	0.0	×
P3-24	Custom curve V1	0.0 ~100.0%	0.1	0.0	×
P3-25	Custom curve F2	0.0 ~100.0%	0.1	0.0	×
P3-26	Custom curve V2	0.0 ~100.0%	0.1	0.0	×
P3-27	Custom curve F3	0.0 ~100.0%	0.1	0.0	×
P3-28	Custom curve V3	0.0 ~100.0%	0.1	0.0	×
P3-29	Torque boost	0.0~20.0%	0.1	2.0	×
P3-30	Low frequency oscillation suppression strength	0~1000	1	100	×
P3-31	High frequency oscillation suppression strength	0~1000	1	0	×
P3-32	High and low frequency turning point	5.00~50.00 Hz	0.01	20.00	×
P3-33	V / F control slip compensation coefficient	0~200%	1	0	×

5. P4 group parameters for auxiliary running control

Code	Name	Description	Unit	Default setting	Property
P4-00	Forward /reverse dead time	0.0~5.0s	0.1	0.1	☆
P4-01	Skip frequency 1	0.00 ~Upper limit frequency	0.01	0.00	☆
P4-02	Skip frequency 1 range	0.00 ~5.00Hz	0.01	0.00	☆
P4-03	Skip frequency 2	0.00 ~ Upper limit frequency	0.01	0.00	☆
P4-04	Skip frequency 2 range	0.00 ~5.00Hz	0.01	0.00	☆
P4-05	Skip frequency 3	0.00 ~ Upper limit frequency	0.01	0.00	☆
P4-06	Skip frequency 3 range	0.00 ~5.00Hz	0.01	0.00	☆
P4-07	Jog frequency	0.00~ Upper limit frequency	0.01	5.00	☆

P4-08	Jog acceleration time	0.1~6000.0s	0.1	10.0	☆
P4-09	Jog deceleration time	0.1~6000.0s	0.1	10.0	☆
P4-10	Acceleration time 2	0.1~ 6000.0S	0.1	*	☆
P4-11	Deceleration time 2	0.1~ 6000.0S	0.1	*	☆
P4-12	Acceleration time 3	0.1~ 6000.0S	0.1	*	☆
P4-13	Deceleration time 3	0.1~ 6000.0S	0.1	*	☆
P4-14	Acceleration time 4	0.1~ 6000.0S	0.1	*	☆
P4-15	Deceleration time 4	0.1~ 6000.0S	0.1	*	☆
P4-16	Acceleration /deceleration mode	0: Linear, 1: S curve	1	0	×
P4-17	Terminal UP/DW rate	0.01~100.00Hz/s	0.01	1.00	☆
P4-18	FDT 1 (frequency detect level) setting	0.00~upper limit frequency	0.01	50.00	☆
P4-19	FDT 1 lag detection value	0.0~100.0%	0.1	5.0	☆
P4-20	FDT 2 (frequency detect level) setting	0.00~upper limit frequency	0.01	50.00	☆
P4-21	FDT 2 lag detection value	0.0~100.0%	0.1	5.0	☆
P4-22	Frequency arrival detection range	0 0.00~20.00Hz	0.01	1.00	☆
P4-23	PWM modulation	Unit 's digit: if over modulation 0: Not modulation 1: Modulation Ten's digit: Modulation mode 0: Three phase modulation at low speed, two phase modulation at high speed 1: Always three phase modulation Hundred's digit: Low speed deal with 0: When the low speed carrier frequency large than 3Khz, runs with within 3Khz. 1: Carrier frequency runs with previous setting	1	0	×
P4-24	AVR (auto voltage regulation)	0: no operation 1: Enable 2: Disable in deceleration	1	0	×
P4-25	Drop control	0.0~10.00Hz	0.01	0.0	×
P4-26	Operation monitoring items selection	0~3939: Low two bit and high two bit, each stands for one d parameters. 3 parameters can determine 6 monitor parameters, press Shift key to circulation display in running.	1	0100	☆
P4-27	Operation monitoring items selection 2		1	0502	☆
P4-28	Operation monitoring items selection 3		1	3226	☆
P4-29	Speed display coefficient	0.1~999.9%	0.1	100.0	☆
P4-301	Linear speed display coefficient	0.01~99.99	0.01	1.00	☆

P4-31	Multifunction key MF.K set	0: REV 1: Jog forward 2: Jog Reverse 3: Running command switchover	1	0	x
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6. P5 group parameters for external terminals input and output

Code	Name	Description	Unit	Default setting	Property
P5-00	AI1 minimum input	0.00~10.00V	0.01	0.00	☆
P5-01	AI1 minimum input corresponding value	-100.00~100.0%	0.1	0.0	☆
P5-02	AI1 maximum input	0.00~10.00V	0.01	10.00	☆
P5-03	AI1 maximum input corresponding value	-100.00~100.0%	0.1	100.0	☆
P5-04	AI1 filter time constant value	0.01~50.00s	0.01	0.10	☆
P5-05	AI2 minimum input	0.00~10.00V	0.01	0.00	☆
P5-06	AI2 minimum input corresponding value	-100.00~100.0%	0.1	0.0	☆
P5-07	AI2 maximum input	0.00~10.00V	0.01	10.00	☆
P5-08	AI2 maximum input corresponding value	-100.00~100.0%	0.1	100.0	☆
P5-09	AI2 filter time constant value	0.01~50.00s	0.01	0.10	☆
P5-10	PLUSE minimum input	0.00~50.00KHz	0.01	0.10	☆
P5-11	PLUSE minimum input corresponding value	-100.00~100.0%	0.1	0.0	☆
P5-12	PLUSE maximum value	0.00~50.00KHz	0.01	50.00	☆
P5-13	PLUSE Maximum value corresponding value	-100.00~100.0%	0.1	100.0	☆
P5-14	PULSE filter time constant value	0.01~50.00s	0.01	0.10	☆
P5-15	External terminal command control mode	0: Two lines control mode 1 1: Two lines control mode 2 2: Three lines control mode 1 3: Three lines control mode 2	1	1	x
P5-16	X1 terminals function selection (0~50)	0: No function 1: FWD Forward command		1	x
P5-17	X2 terminals function selection (0~50)	2: REV Reverse command 3: External fault input (normally open)		2	x
P5-18	X3 terminals function selection (0~50)	4: DC braking		7	x
P5-19	X4 terminals function selection (0~50)	5: Emergency stop input (solar pump pause)		8	x
P5-20	X5 terminals function selection (0~50)	6: Fault reset input 7: Multi-speed input 1 8: Multi-speed input 2		1	x
P5-21	X6 terminals function selection (0~50)	9: multispeed input 3 10: Multi-speed input 4		10	x

		11: three-line control 12: Terminal UP 13: Terminal DOWN 14: Terminal reset 15: Acceleration and deceleration selection terminal 1 16: Acceleration and deceleration selection terminal 2 17: PLC Pause running 18: PLC state reset (modes 1, 2) 19: Forward jog 20: reverse jog 21: Traverse suspend operation 22: Traverse reset 23: PID suspend operation 24: Interior timer enable 25: The internal timer is cleared 26: Counter trigger input 27: Counter Reset (reset to 0) 28: Frequency reference given A and B switchover 29: Frequency reference given A and A + B switchover 30: Frequency reference given B and A + B switchover 31: deceleration to stop 32: Torque control prohibition 33: Length counter input 34: The length of the counter is cleared 35: Command given source is forcibly set by keypad 36: Command given source is forcibly set by terminal 37: Command given source is forcibly set by the communication. 38: PID parameters 39: External fault normally closed input 40: Pulse input (only valid for X6) 41: Solar control prohibition 42: Switch display parameter 43: Normally Open point alarm 44: Normally closed point alarm			
P5-27	Y transistor output selection	0: No function	1	1	☆
P5-28	Relay 1 output selection	1: Run state	1	1	☆
P5-29	Relay 2 output selection	2: Fault output 3: Frequency arrival	1	1	☆

		<p>4: detection frequency FDT1 arrival</p> <p>5: detection frequency FDT2 arrival</p> <p>6: Zero speed running</p> <p>7: Lower limit frequency arrival</p> <p>8: Upper limit frequency arrival</p> <p>9: Counter reaches the specified value (greater than the specified value, output ON)</p> <p>10: Counter reach final value (equal to the final value, output a ON clock cycle counter signal)</p> <p>11: Internal timer reaches (Output a ON timer unit signal)</p> <p>12: Running time is reached (greater than the set time Output ON)</p> <p>13: PLC a segment operation is completed (Output a 0.5s ON signal)</p> <p>14: PLC run cycle is complete (Output a 0.5s ON signal)</p> <p>15: Over-torque warning</p> <p>16: Drive standby</p> <p>17: Length arrive</p> <p>18: Place in sleep mode</p> <p>19: AI1 input over limit</p> <p>20: Module temperature reaches</p>			
P5-34	AO1 output selection	<p>0: Frequency reference</p> <p>1: Run Frequency</p> <p>2: Output current</p> <p>3: DC bus voltage</p> <p>4: Output voltage</p> <p>5: output power (100% corresponds to 200% of rated power)</p> <p>6: Torque current</p> <p>7: AI1</p> <p>8: AI2</p> <p>9: Reserved</p> <p>10: High-speed pulse input</p> <p>11: RS485 set</p> <p>12: Length</p> <p>13: count value</p> <p>14 to 20 Reserved</p>	1	0	☆
P5-35	AO1 analog output corresponding to 0%	0.0~100.0%, output 0~10V, 100.00% corresponding to 10V, output 0~20mA, 100.00%	0.1	0.0	☆

		corresponding to 20mA.			
P5-36	AO1 analog output corresponding to 100.00%	0.0~100.0%	0.1	100.0	☆
P5-39	AO2 output type selection	0: Analog 1: HDO pulse trains output	1	0	☆
P5-40	HDO pulse train upper limit	0.10~50.00KHz	0.01	50.00	☆
P5-41	AO2 output selection	As same as AO1 selection	1	1	☆
P5-42	AO2 analog output corresponding to 0%	0.0~100.0%, when output 0~10V, 100.0% corresponding to 10V; when output is high speed pulse train , 100.0% correspond to 50.00KHz	0.1	0.0	☆
P5-43	AO2 analog output corresponding to 100.00%	0.0~100.0%	0.1	100.0	☆

7. P6 group parameters for PID control

Code	Name	Description	Unit	Default setting	Property
P6-00	Select PID reference command source	0: Potentiometer of keypad 1: PB.0 reference 2: P6.01 reference 3: AI1 4: AI2 5: RS485 6: PLUSE trains 7: multi-speed	1	0	☆
P6-01	PID reference	0~100.0%	0.1	50.0	☆
P6-02	PID feedback channel selection	0: AI1 1: AI2 2: HDI 3: RS485	1	0	☆
P6-03	Regulation characteristics	0: Positive 1: Negative	1	0	☆
P6-04	Proportional gain	0.0~50.0	0.1	5.0	☆
P6-05	Integration time constant	0.1~100.0s	0.1	10.0	☆
P6-06	Differential Gain	0.0~5.0	0.1	0.0	☆
P6-08	Preset frequency	0.0~100.0% upper limit frequency	0.1	50.0	☆
P6-09	Preset frequency holding time	0.0 ~ 3000.0S	0.1	0.0	☆
P6-10	Feedback disconnection detection threshold	0.0~100.0%	0.1	5.0	☆
P6-11	Feedback disconnection judgment time	0.0~3000.0s, 0.0 means not perform disconnect judge.	0.1	0.0	☆
P6-12	PID limited negative output	0~100.0%	0.1	0.0	☆
P6-13	Twice the maximum output deviation	0.00~100.00%	0.01	1.00	☆

8. P7 group parameters for multi-speed and simple PLC control

Code	Name	Description	Unit	Default setting	Property
P7-00	Programmable multi segment	Unit' digit:	1	2	x

	speed running setting	<p>0: Single segment running finished stop 1: Single segment running finished and keep the final setting 2: cycle running continue</p> <p>Ten's digit 0: Running time unit is second 1: Running time unit is minute</p> <p>Hundred's digit: Reserve Thousand's digit: restart selection</p> <p>0: Every restart from 0 segment point 1: Every restart from break off point frequency.</p>			
P7-01	Multi-speed frequency 0	0.0 ~ 100.0%	0.1	10.0	☆
P7-02	Multi-speed frequency 1	0.0 ~ 100.0%	0.1	20.0	☆
P7-03	Multi-speed frequency 2	0.0 ~ 100.0%	0.1	30.0	☆
P7-04	Multi-speed frequency 3	0.0 ~ 100.0%	0.1	40.0	☆
P7-05	Multi-speed frequency 4	0.0 ~ 100.0%	0.1	50.0	☆
P7-06	Multi-speed frequency 5	0.0 ~ 100.0%	0.1	70.0	☆
P7-07	Multi-speed frequency 6	0.0 ~ 100.0%	0.1	80.0	☆
P7-08	Multi-speed frequency 7	0.0 ~ 100.0%	0.1	100.0	☆
P7-09	Multi-speed frequency 8	0.0 ~ 100.0%	0.1	10.0	☆
P7-10	Multi-speed frequency 9	0.0 ~ 100.0%	0.1	20.0	☆
P7-11	Multi-speed frequency 10	0.0 ~ 100.0%	0.1	30.0	☆
P7-12	Multi-speed frequency 11	0.0 ~ 100.0%	0.1	40.0	☆
P7-13	Multi-speed frequency 12	0.0 ~ 100.0%	0.1	50.0	☆
P7-14	Multi-speed frequency 13	0.0 ~ 100.0%	0.1	70.0	☆
P7-15	Multi-speed frequency 14	0.0 ~ 100.0%	0.1	80.0	☆
P7-16	Multi-speed frequency 15	0.0 ~ 100.0%	0.1	100.0	☆
P7-17	Speed 0 running time	0.0~3000.0	0.1	10.0	☆
P7-18	Speed 0 running direction and acceleration/deceleration	<p>Unit's digit: 0: Forward 1: Reverse</p> <p>Ten's digit: 0: Acceleration/deceleration 1 1: Acceleration/deceleration 2 2: Acceleration/deceleration 3 3: Acceleration/deceleration 4</p>	1	0	☆
P7-19	Speed 1 running time	0.0~3000.0	0.1	10.0	☆
P7-20	Speed 1 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-21	Speed 2 running time	0.0~3000.0	0.1	10.0	☆
P7-22	Speed 2 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆

P7-23	Speed 3 running time	0.0~3000.0	0.1	10.0	☆
P7-24	Speed 3 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-25	Speed 4 running time	0.0~3000.0	0.1	10.0	☆
P7-26	Speed 4 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-27	Speed 5 running time	0.0~3000.0	0.1	10.0	☆
P7-28	Speed 5 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-29	Speed 6 running time	0.0~3000.0	0.1	10.0	☆
P7-30	Speed 6 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-31	Speed 7 running time	0.0~3000.0	0.1	10.0	☆
P7-32	Speed 7 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-33	Speed 8 running time	0.0~3000.0	0.1	10.0	☆
P7-34	Speed 8 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-35	Speed 9 running time	0.0~3000.0	0.1	10.0	☆
P7-36	Speed 9 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-37	Speed 10 running time	0.0~3000.0	0.1	10.0	☆
P7-38	Speed 10 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-39	Speed 11 running time	0.0~3000.0	0.1	10.0	☆
P7-40	Speed 11 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-41	Speed 12 running time	0.0~3000.0	0.1	10.0	☆
P7-42	Speed 12 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-43	Speed 13 running time	0.0~3000.0	0.1	10.0	☆
P7-44	Speed 13 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-45	Speed 14 running time	0.0~3000.0	0.1	10.0	☆
P7-46	Speed 14 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆
P7-47	Speed 15 running time	0.0~3000.0	0.1	10.0	☆
P7-48	Speed 15 running direction and acceleration/deceleration	As same as speed 1 description	1	0	☆

9. P8 group parameters for communication

Code	Name	Description	Unit	Default setting	Property
P8-00	Baud selection	0: 300bps 1: 600bps 2: 1200bps 3: 2400bps 4: 4800bps 5: 9600bps 6: 19200bps 7: 38400bps	1	5	☆
P8-01	Data format	0: No parity	1	0	☆

		1: Odd 2: Even parity			
P8-02	Address	0~247 0: Broadcast address does not return data	1	1	☆
P8-03	The machine response delay	0~100ms	1	5	☆
P8-04	Timeout judgment time	0.0~100.0s; 0.0 means time out	0.1	0.0	☆
P8-05	Master-Slave Select	0: Slave port 1: Master port	1	0	☆
P8-06	RS485 frequency reference scale factor	0~999.9%	0.1	100.0	☆
P8-07	Writing operation if return data	0: Return 1: No return	1	0	☆

10. Advanced P9 group parameters

Code	Name	Description	Unit	Default setting	Property
P9-00	Swing frequency amplitude	0.0~100.0%	0.1	0.0	☆
P9-01	Kick frequency amplitude	0.0~50.0%	0.1	0.0	☆
P9-02	Triangular wave rise time	0.1~3600.0s	0.1	5.0	☆
P9-03	Triangular wave fall time	0.1~3600.0s	0.1	5.0	☆
P9-04	Specify the value of the counter	0~65535	1	1000	☆
P9-05	Counter final value	0~65535	1	2000	☆
P9-06	Setting length	0~65535meter	1	1000	☆
P9-07	The number of pulses per meter	0.1~6553.5	0.1	100.0	☆
P9-08	Internal timer timer unit	0.01~99.99s	0.01	1.00	☆
P9-09	internal timer cycle period	1~65535	1	10	☆
P9-10	Setting the running time	0~65535hour	1	65535	☆
P9-101	X1 switch-on delay time	0.0~3600.0S	0.1	0.0	☆
P9-12	X1 off delay time	0.0~3600.0S	0.1	0.0	☆
P9-13	X2 switch-on delay time	0.0~3600.0S	0.1	0.0	☆
P9-14	X2 off delay time	0.0~3600.0S	0.1	0.0	☆
P9-15	X3 switch-on delay time	0.0~3600.0S	0.1	0.0	☆
P9-16	X3 off delay time	0.0~3600.0S	0.1	0.0	☆
P9-17	Y1 output delay time	0.0~3600.0S	0.1	0.0	☆
P9-18	Relay 1 output delay time	0.0~3600.0S	0.1	0.0	☆
P9-19	Relay 2 output delay time	Relay 1 output delay time	0.1	0.0	☆

11. FA group parameters for solar pump control

Code	Name	Description	Unit	Default setting	Property
PA-00	Select solar pump control mode	0: Variable frequency drive control (AC grid input) 1:CVT (constant voltage tracking) 2: MPPT (maximum power point tracking)	1	2	×
PA-01	Auto run selection	0: Manual by keypad control 1: Automatically running	1	0	☆
PA-02	CVT object voltage	0.0~100.0% of Voc	0.1	80.0	☆

PA-03	MPPT upper limit voltage	0.0~200.0% of Voc	0.1	95.0	☆
PA-04	MPPT lower limit voltage	0.0~100.0% of Voc	0.1	50.0	☆
PA-05	Frequency adjust gain	1~1000	1	40	☆
PA-06	Frequency adjusting allowable deviation	1~5	1	3	☆
PA-07	MPPT Control period	0.01~10.00S	0.01	1.00	×
PA-08	Dc current correction offset	0.00~50.00A	0.01	0.00	☆
PA-09	Dc current correction gain	0.0~100.0%	0.1	100.0	☆
PA-10	Water level detect control	0: Disable 1: AI1 takes as water level detect signal 2: AI2 takes as water level detect signal Only PA-10 not 0 set, the PA-11 to PA-14 is enable	1	0	☆
PA-11	Water level threshold	0.0~100.0%	0.1	25.0	☆
PA-12	Full water delay	0.0~3000.0S If the detected water level less than PA-11, and lasting for PA-12 delay time. It will give out water full alarm and display A.Ful, and go to sleep. If the time is not reached, the signal is bigger than water level threshold, the time will be reset automatically.	0.1	60.0	☆
PA-13	Empty water delay	0.0~3000.0S After full water level alarmed, if the detected valued greater than PA-11, and lasting more than PA-13 delay time, system restore to running state from sleep mode.	0.1	600.0	☆
PA-14	Hydraulic detection probe damage threshold	0.0~100.0% 0.0: No detected If the detected water level signal large than PA-14, the solar pump drive consider water probe is damaged and sent alarm directly and go to sleep.	0.1	0.0	☆

12. Pb group parameters for solar pump protection and monitoring

Code	Name	Description	Unit	Default setting	Property
Pb-00	Sleep voltage threshold	0~1000V	1	*	☆
Pb-01	Restore running state voltage threshold	0~1000V	1	*	☆
Pb-02	Awake waiting time	0.0~3000.0S	0.1	120.0	☆
Pb-03	Stop frequency when low speed	0.00~300.00Hz	0.01	5.00	☆

Pb-04	stop delay time when reach stop frequency	0.0~3000.0S	0.1	30.0	☆
Pb-05	Automatic recovery time in stop frequency protection mode	0.0~3000.0S	0.1	120.0	☆
Pb-06	Dry run protection current threshold (under-load protection)	0.0~100.0A	0.1	1.0	☆
Pb-07	Dry run detect delay time	0.0~3000.0S	0.1	60.0	☆
Pb-08	Automatic recover time in dry run protection mode	0.0~3000.0S	0.1	120.0	☆
Pb-09	Motor over current protection threshold	0~3000.0A	0.1	*	☆
Pb-10	Over current detect delay time	0.0~3000.0S	0.1	30.0	☆
Pb-11	Automatic recovery time in over current protection mode	0.0~3000.0S	0.1	30.0	☆
Pb-12	Minimum power input protection threshold	0.00~100.00KW	0.01	0.00	☆
Pb-13	Minimum power input detect delay time	0.0~3000.0S	0.1	10.0	☆
Pb-14	Automatic recovery time in minimum power input protection mode	0.0~3000.0S	0.1	10.0	☆
Pb-15	Alarm action mode	0: Sending alarm and automatically rest 1: Reset by manual Unit's digit: Low stop frequency Ten's digit: Dry run (under load) Hundred's digit: Motor over current protection Thousand's digit: Minimum power input protection	1	0000	☆
Pb-16	PQ CURVE P0 (Input power of pump at point 0)	0.00~300.00KW	0.01	0.50	☆
Pb-17	PQ CURVE P1 (Input power of pump at point 1)	0.00~300.00KW	0.01	1.00	☆
Pb-18	PQ CURVE P2 (Input power of pump at point 2)	0.00~300.00KW	0.01	1.50	☆
Pb-19	PQ CURVE P3 (Input power of pump at point 3)	0.00~300.00KW	0.01	2.00	☆
Pb-20	PQ CURVE P4 (Input power of pump at point 4)	0.00~300.00KW	0.01	2.50	☆
Pb-21	PQ CURVE Q 0 (Flow rate at point 0)	0.0~3000.0m ³ /h	0.1	0.0	☆
Pb-22	PQ CURVE Q 1 (Flow rate at point 1)	0.0~3000.0m ³ /h	0.1	5.0	☆

Pb-23	PQ CURVE Q 2 (Flow rate at points 2)	0.0~3000.0m ³ /h	0.1	10.0	☆
Pb-24	PQ CURVE Q 3 (Flow rate at point 3)	0.0~3000.0m ³ /h	0.1	15.0	☆
Pb-25	PQ CURVE Q 4 (Flow rate at point 4)	0.0~3000.0m ³ /h	0.1	20.0	☆
Pb-26	Today flow / generated energy day reset period	0.0~24.0hour	0.1	8.0	☆
Pb-27	Flow measured offset	0.00~1000.0m ³ /h	0.1	0.0	☆
Pb-28	Flow measured gain	0.0~100.0%	0.1	100.0	☆
Pb-29	Cumulative flow/ generated energy reset setting	0: No operation 1: Flow reset 2: Generated energy reset 3: Both flow and generated energy reset	0	0	×

13. PC group parameters for supplementary solar pump control

Code	Name	Description	Unit	Default setting	Property
PC-00	Open circuit voltage (Voc) detect mode	0: Self detect when power on 1: Set by user with Pc-01 value	1	1	×
PC-01	User Voc setting by manual	0~1000	1	660	×
PC-02	Deceleration time2 when work For solar pump control	0.1~6000.0S	0.1	5.0	☆
PC-03	Pump efficiency	0.1~100.0%	1	100.0	☆
PC-04	Power display filter time	0.01~100.00S	1	2.00	☆
PC-05	Single phase pump control method.	0: Normal control with starting capacitance. 1: Control method without starting capacitance. The connection method: U ,W : L N (the leading out terminals of single phase motor) V : the terminal of capacitance	1	0	×
PC-06	Auxiliary winding coefficient	0.1~500.0%	0.1	100.0	×
PC-07	User password	0~9999 0:passwordless access.	1	0	☆
PC-08	Float ball alarm (A.Fb.C and A.Fb.o) selfreset delay time	0.1~100.0S	0.1	10.0	☆

14. Pd group parameters for protection

Code	Name	Description	Unit	Default setting	Property
Pd-00	Current limit value	100.0~200.0%	0.1	*	☆
Pd-01	Frequency drop time when over current	1.0~200.0s	0.1	5.0	☆
Pd-02	Over voltage limit	110.0~145.0%	1	130.0	☆

Pd-03	Overvoltage suppression gain	0~10	1	2	☆
Pd-04	Phase loss protection	Unit's digit: Input phase limit 0: No protection 1: Protection Ten's digit: Output phase limit 0: No protection 1: Protection	1	11	☆
Pd-05	Motor overload protection	20.0~100.0%	0.1	100.0%	☆
Pd-06	Pre-alarm value of over torque	20.0~200.0%	0.1	*	☆
Pd-07	Over torque detect delay time	0.0~60.0s	0.1	0.1	☆
Pd-08	Fault auto reset times	0~5	1	0	☆
Pd-09	Failure self-reset interval time	0.1~600.0s	0.1	1.0	☆
Pd-10	Fault relay output during reset	0: No output 1: Output	1	0	☆
Pd-11	AI1 input voltage low limit	0.00~10.00V	0.01	2.00	☆
Pd-12	AI1 input voltage upper limit	0.00~11.00V	0.01	8.00	☆
Pd-13	Module temperature reaches	25.0~90.0℃	0.1	70.0	☆
Pd-14	Previous two faults	0~30	1	0	×
Pd-15	Previous faults	0~30	1	0	×
Pd-16	Current fault	0~30	1	0	×
Pd-17	Output frequency at current fault	0 ~Upper limit frequency	0.01	0.00	×
Pd-18	Output current at current fault	0 ~ 3000.0A	0.1	0.0	×
Pd-19	DC bus voltage at current fault	0 ~ 800V	1	0	×

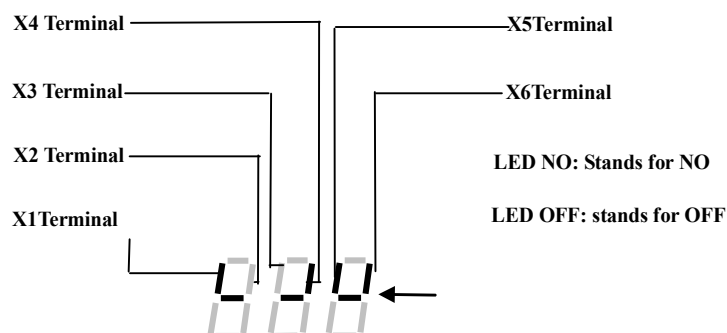
D Group parameters for working status monitor

Note: Press shift button of keypad can display output current, output frequency, output voltage, DC bus voltage, DC bus current and input power 6 parameters in circulation in monitor status.

Monitor code	Contents	Mini. Unit
d-00	Current output frequency	0.01Hz
d-01	Current output voltage	1V
d-02	Current output current	0.1A
d-03	Current frequency reference	0.01Hz
d-04	Current output frequency 2	0.01Hz
d-05	DC bus voltage value	1V
d-06	Module temperature	0.1℃
d-07	PID reference value	0.1%
d-08	PID feedback	0.1%
d-09	Speed	rmp
d-10	Running liner frequency	0.01*
d-11	External pulse train input	0.01KHz
d-12	RS485 reference	
d-13	Reserve	
d-14	AI1	0.1V
d-15	AI2	0.1V
d-16	DI terminals status	

d-17	DO terminals status	
d-18	Single continuous run time	1H
d-19	Total running time	1H
d-20	External pulse count value	
d-21	Internal timer count	
d-22	Actual length	m
d-23	Pressure reference	MPa
d-24	Actual pressure	MPa
d-25	Open circuit voltage	1V
d-26	DC bus current	0.01A
d-27	MPPT tracking voltage	0.1%
d-28	Calculate flow rate	0.1m3/h
d-29	Today flow	0.1m3
d-30	Cumulative flow 1	0.1m3
d-31	Cumulative flow 2	1Km3
d-32	Input power	0.01KW
d-33	Today generated energy	0.1KWH
d-34	Cumulative generated energy 1	0.1KWH
d-35	Cumulative generated energy 2	1MWH
d-36	Working status	1
d-37	Rated voltage of Drive	1V
d-38	Rated current of Drive	0.1A
d-39	Software version	

XI input terminals status description: The last three to five digital display digital input status



2) DO Terminals status: The lowest bit stands for Y, the second bit stands for relay output 1, the high bit stands for relay output 2.

Y is the lowest position, the output relay 1 followed by 2 relay outputs as a binary number consisting of the highest level, is converted into a decimal display.

3) d-36 working status display introduction:

0: Stop mode

1: Running

2: **A.LUo** means on low voltage sleep mode ,

3: **A.LFr** means on low stop frequency sleep mode,

4: **A.LCr** means on dry run protection

5: **A.OCr** means on motor over current mode,

6: **A.Lpr** means on minimum power input mode,

7: **A.FuL** water full sleep mode.

Chapter 8. Parameters description in detail

Some parameters description which may relative with solar pump control.

P0-00	Model selection	0: General purpose 1: P type (variable torque load)	1	0	x
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0: Suitable for driving general purpose constant torque heavy load

For solar submersible pump we need select G type models because of large torque in deep well.

1: Suitable for driving fans pumps, etc variable torque light load

The power of P type mode for fans, pumps light load lower than G constant torque model one range.

Note: This value can't change after factory leaving.

For some fans pumps application, such as boost fans, deep well pump, which load is heavy. Select the AC Drive should according to the actual current.

The tolerance capacitors of G type: 150% rated current for 1 minute, 180% rated current for 2 seconds.

The tolerance capacitors of P type: 120% rated current for 1 minute, 150% rated current for 2 seconds.

P0-01	Control mode	0: VF control 1: Vectorized VF control 2: Open loop vector control 1 3: High performance open loop vector control 2	1	0	x
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0: V/F control

No need install encoder, good compatibility and stable running. Suits for the applications, which no high request for loads, and one drive for more than one motors, and motor auto-tuning cannot be performed or the motor's parameters can be acquired through other methods, such as fans, pumps load.

Always select VF control for solar pump control application for asynchronous motor.

1: Vectorized VF control,

Do vectorized for V/F control to enhanced control accuracy, stability of control and improved the torque output at low speed. Not sensitive to motor parameters.

2: Open loop sensorless vector control 1:

Unique method vector control, vector control versatility relatively strong, has steady performance, but the dynamic indicators worse than the high performance open loop vector control 2, insensitive to motor parameters.

3: High performance sensorless vector control 2

It uses a rotor field oriented vector control, with high static and dynamic performance control, sensitive to motor parameters. This control mode suits for high performance general purpose application without encoder, such as machine, centrifugal machine, drawbench, injection mold machine, etc. one drive only allow to control one motor.

Please configure motor group parameters carefully, and performance ID auto tuning when apply this control mode.

P0-02	Running command channel selection	0: Operation panel (keypad) 1: External terminals 2: RS485terminals	1	1	☆
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Selects AC Drive running command input channel,

The AC Drive control command includes starting, stop, forward, reverse, jog function.

0: Keypad (operation panel); The running command is controlled by RUN, STOP, MF.K (through P4-31) by keypad.

1: External terminals The running command controlled by multiple function terminals. It can achieved to forward, reverse, Jog, reverse running with two lines or three lines control, see P0-15, P5-15~P5-21 function code in detail.

2: communication command

The running command is given by communication, see the communication protocol P8 group description.

P0-03	Main frequency reference source A	0: Potentiometer of keypad 1: UP, DOWN of keypad. 2: AI1 (0-10V) 3: AI2 (0-10V/0-20mA) 5: PID close loop reference 6: Multi-speed control 7: Simple PLC 8: UP/DW of terminals 9: Communication 11: High speed pulse trains	1	0	☆
P0-04	Auxiliary frequency reference source B	0: Potentiometer of keypad 1: AI1 (0- 10V) 2: AI2 (0-10V) 3: P0-07 (UP and Down of keypad reference setting) 4: High speed pulse trains reference 5: Multi-segment speed	1	1	☆
P0-05	The reference source selection of auxiliary frequency source B	0: Upper limit frequency 1: Main frequency source A	1	0	☆
P0-06	The operation of frequency source A and B combination setting	0: Main frequency source A 1: Auxiliary frequency source B 2: A+B 3: MAX (A, B) 4: MIN (A, B) 5: A-B	1	0	☆

There are two frequency reference source of main and auxiliary reference (A and B). The user can select frequency reference according actual application request.

These parameters are invalid in solar pump control mode, because the output frequency is controlled by inner MPPT algorithm.

P0-08	Upper limit frequency	5.00~650.00 Hz	0.01	50.00	×
P0-09	Lower limit frequency	0.00Hz ~ P0-08	0.01	0.50	×
P0-10	Running mode under low limit frequency	0: Running with lower limit frequency 1: Stop 2: Sleep mode in stand by	1	0	×

P3-21	Upper limit frequency reference source set selection	0: Upper limit frequency 1: AI1 2: AI2 3: Multi-segment speed 4: RS485 5: HDI 6: Potentiometer of keypad	1	0	☆
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The upper limit frequency is upper limit value of output frequency of AC Drive. When frequency reference is set by the external analog reference, multiple speed and simple PLC, the given value is percent %, their reference value is upper limit frequency.

Use P3-21 to set the value of upper limit frequency source.

In solar pump control, if sunlight radiation is good, output is 50Hz. The user can limit frequency output according application request with this P0-08 and P3-21 parameters configuration.

P0-09, lower limit frequency used to defined lower limit output frequency of AC drive.

P0-10 running mode selection used to select stop, running and go to sleep mode when output frequency is lower than P0-09.

Note: If P0-10 set for 1, Ac drive stop when output frequency lower than P0-09. It request confirm STOP command again to start Ac drive when control by terminals or RS485 mode, when starting command is open.

If controlled by keypad or pulse terminals, it need trigger starting signal again to start AC drive. In terminals control mode, only terminals signal is disable, and enable again to make AC drive start again.

P0-12	Acceleration time1	0.1~6000.0 s	0.1	*	☆
P0-13	Deceleration time1	0.1~6000.0s	0.1	*	☆

Acceleration time is the output frequency from 0Hz to motor rated frequency ramp up time.

Deceleration time is the output frequency from motor rated frequency to 0Hz ramp down time.

P0-14	Carrier frequency	1 ~ 10KHz	1	*	☆
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Carrier frequency mainly affects the operation of the audio noise and thermal effects.

When the ambient temperature is high, the motor load is heavy, it should be appropriate to reduce the carrier frequency in order to improve the thermal characteristics of the Ac drive.

P0-15	Ac drive running direction	0: Runs as forward direction 1: Runs as reverse direction 2: Reverse direction is forbidden	1	0	☆
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This parameter is used to change the AC drive output direction, thereby to check the motor running direction as well.

0: Running direction as same as setting

1: Running direction is reverse as setting.

2: Reverse running direction is forbidden.

If the output frequency is big, but output water yield is low in good sunlight condition, please used this parameters to change pump running direction or change motor wiring phase.

P0-17	Factory restore to factory setting	0: No operation 11: Parameters initialization 22: Clear fault record	1	0	x
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To modify the parameters of the AC drive to factory default.

0: No operation

11: Parameters initialization, restore all parameters setting back to default setting.

22: Clear fault records

Note: Set P0-00 (AC drive modes G/P type selection properly) according to the actual situation before initialization. This parameter can't be restore.

P0-18	Parameters modify protection	0: No protection 1: Disable modify	1	0	x
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0: No protection

1: All parameters under protection, can't modify. But P0-07 in monitor status can changed by UP and DOWN button of keypad.

P1-00	Start up mode	0: Start up with starting frequency 1: Start up after DC braking 2: Start up with speed tracking	1	0	x
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0: Start up with starting frequency P1-01 setting.

1: Performance DC braking first, and then start from still for application which need starting from still.

2: Start up with speed tracking for fans application.

P1-15	Terminals running command detect when power on	0: Running command is disable when power on 1: Running command enable when power on	1	1	x
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0: Start running command is invalid when power on.

If the running command selection source is terminal control when AC drive power on. Even if terminals command is enable, the AC drive will not response to start, to avoid bring damaged when AC drive starting suddenly. If need start system, user have to disable terminals first and then start it.

1: Starting running command is enable.

Ac drive starts immediately when power on if terminals command is enable.

P2-00	Motor type	0: Asynchronous motor 1: Permanent magnet synchronous motor	1	0	x
P2-01	Motor rated voltage	1~700V	1	*	x
P2-02	Motor rated frequency	5.00~600.00Hz	0.01	50.00	x
P2-03	Motor rated current	0.1~3000.0A	0.1	*	x
P2-04	Rated slip frequency	0.00~5.00Hz	0.01	*	x
P2-05	Poles pair	1~50	1	2	x
P2-06	No load current	10.0~ 80.0%	0.1	*	x

When the asynchronous motor is first time using, the user need to configuration these motor parameters according to nameplate of motor.

Performance sensorless vector control (P0-01 for 2 or3), it must performance motor auto tuning first.

If driving solar PMSM (permanent magnet synchronous motor) pumps, it must perform motor auto tuning first.

Select P2-10 for 1 or 2 to performance auto tuning.

Before performance auto tuning need configuring P2-11 to P2-15 PMSM parameters.

P2-10	Motor parameter auto-tuning	0: No operation 1: Static auto tuning	1	0	x
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		2: Completely auto tuning			
P2-11	Rated frequency of PMSM	5.00~600.00Hz	0.01	50.00	x
P2-12	Rated voltage of PMSM	1~700V	1	*	x
P2-13	Rated current of PMSM	0.1~3000.0A	0.1	*	x
P2-14	Rated back EMF of PMSM	1~700V	1	*	x
P2-15	Stator resistance of PMSM	0.00~50.00%	0.01	*	x

P2-06~P2-09 these parameters in generally can't find in nameplate of motor. Please perform motor auto tuning to get these parameters. only get P2-07~P2-09 from static auto-tuning. If the load can easy disconnect from motor, please to performance completely auto tuning to get accuracy motor parameters.

If the load can't disconnect from motor, set P2-10 for 1 to performance auto tuning.

P3-29	Torque boost	0.0~20.0%	0.1	2.0	x
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To compensate the low frequency torque characteristics of V/F control, you can boost the output voltage of AC drive at low frequency by modifying P3-29. If the torque boost is set to too large, the motor may overheat, and the AC drive may suffer over current.

If set it for 0, it will performance auto torque boost.

P4-29	Speed display coefficient	0.1~999.9%	0.1	100.0	☆
P4-30	Linear speed display coefficient	0.01~99.99	0.01	1.00	☆
P4-31	Multifunction key MF.K set	0: REV 1: Jog forward 2: Jog Reverse 3: Running command switchover	1	0	x

P4-29 Speed display coefficient that used for correct the speed display.

P4-31 used to define the function of multiple function key on keypad.

P5-15	External terminal command control mode	0: Two lines control mode 1 1: Two lines control mode 2 2: Three lines control mode 1 3: Threes lines control mode 2	1	1	x
P5-16 to P5-21	X1 to X6 terminals function selection (0~44)	1: FWD Forward command 2: REV Reverse command 5: Emergency stop input (solar pump pause) 41: Solar control prohibition 42:Switch display parameter 43:Normally open point alarm (A.Fb.o) 44:Normally closed point alarm (A.Fb.C)	1		x

The P5-15 parameter used to select terminals control mode, there are 4 control modes in drives.

FWD stands for running in forward direction control by external terminal, and marks for FWD.

REV stands for running in reverse direction control by external terminal, and marks for REV.

0: Two line control mode 1

Construction	Stop	Running	Forward	Reverse
Terminals status				

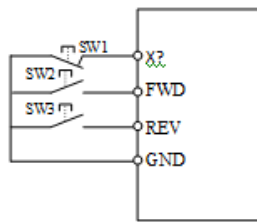
1: Two lines control

mode 2

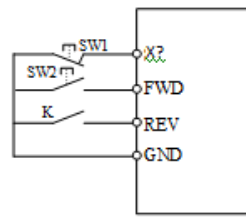
Construction	Stop command	Forward	Reverse
Terminals status			

2: Three lines control mode 1

It must be defined one input terminal for 3 lines control mode (one of terminals of P5-16~P5-21 set to 11). Refer to the 3 lines control mode as following wiring.



a) 3 lines control mode 1



b) 3 lines control mode 2

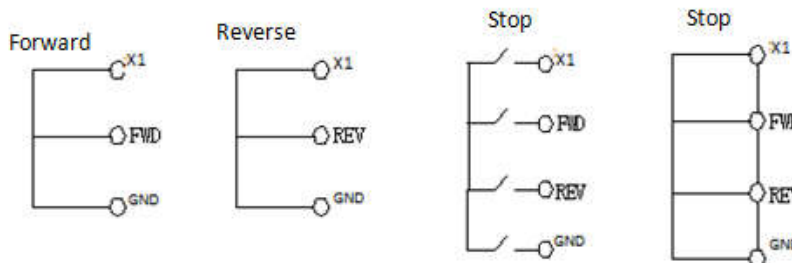
3 lines control mode wiring

X? is programmed for 3 line control, we can take one terminals of X1~X6 (P5-16~P5-21) set to 11. SW1 is drive stop trigger switch. SW2 is forward trigger switch, and SW3 is reverse trigger switch.

3: 3 lines control mode 2.

X? is programmed for 3 line control, we can take one terminals of X1~X6 (P5-16~P5-21) set to 11. SW1 is stop trigger switch, SW2 is forward trigger switch, K is reverse selection switch.

If selection X1 for 3 lines control mode, see below wiring diagram.



3 lines control mode description

There are X1 to X6 programmable digital input terminals in this drive, used P5-16 to P5-21 parameters to express it. Each terminal can be defined 44 functions.

In solar pump control mode, 1: FWD Forward command 5: Emergency stop input (solar pump

pause) and 41: Solar control prohibition are popular in using.

When one of X1 to X6 is set for 41 (solar control prohibition), the solar pump control function is disable, and AC drive variable frequency mode is activated, as same as PA.00 set for 0.

PA group parameters for solar pump control

PA-00	Select solar pump control mode	0: variable frequency drive control (AC grid input) 1:CVT (constant voltage tracking) 2: MPPT (maximum power point tracking)	1	2	×
PA-01	Auto run selection	0: No run every time power on when keypad control (P0-02=0) 1: Auto run every time power on when keypad control (P0-02=0)	1	0	☆

PA-00 parameter is used to select AC drive variable frequency control mode or solar pump control. There are two solar pump control modes, which are constant voltage tracking (CVT) and maximum power point tracking (MPPT). MPPT solar pump control mode is default setting. In very good sunlight radiation area, user can select CVT mode for better frequency stable output, because the DC bus voltage is control target in this mode. PA-02 (CVT object voltage) is used to set target control voltage of DC bus. The suggest value setting is 75% to 90%.

PA-01 Auto run selection is used to set auto run every time power on when keypad control (P0-02=0). In the first time using after installation, suggesting select PA-01 for 0, drive control by manual with keypad. Once the commissioning is finished and tested well, we can switch to auto terminal control (P0-02=1) or to auto run every time power on when keypad control (PA-01=1). In the auto terminal control mode, one programmable digital terminal from X1 to X6 should set for 1 (forward running control).

Compare to P0-02 parameter setting, this parameter has priority level, and make P5-16 and P5-20 set to 1 (FWD running control) as the same time.

Once X1 short circuit to GND (X1 and GND is ON) or X5 short circuit GND (X5 and GND is ON), the drive system will be work automatically.

PA-02	CVT object voltage	0.0~100.0% of Voc	0.1	80.0	☆
PA-03	MPPT control upper limit voltage	0.0~200.0% open loop circuit voltage	0.1	95.0	×
PA-04	MPPT control lower limit voltage	0.0~100.0% open loop circuit voltage	0.1	50.0	×
PA-05	Frequency adjusting gain	1~1000	1	40	×
PA-06	Frequency adjusting allowable deviation	1~5	1	3	×
PA-07	MPPT Control period	0.01~10.00S	0.01	1.00	×

Uses PA-03 and PA-04 to define MPPT upper limit and lower limit voltage. In generally, the default setting 50% to 95% is OK.

PA-05 (Frequency adjusting gain) parameter is used for making MPPT performance quick or slow during operation. If this value is big, the MPPT performance is quickly, and might cause the output frequency a little fluctuation. if this value is set too small, and might cause A.Luo fault in bad sunlight condition. User can set this value bigger, but not larger than 200 in good sunlight condition area. In generally, the default 40 setting is OK.

PA-06 (Frequency adjusting allowable deviation), change this parameters will effect output frequency stability with MPPT function. If change it bigger, the output frequency might seem a little fluctuation. In generally, no need change this parameters.

We suggest user modify PA-05 parameter first, and don't changed PA-06 setting in generally

case.

PA-07 parameter uses to limit MPPT searching period. No need to modify in generally case.

PA-08	Dc current correction offset	0.00~50.00A	0.01	0.00	☆
PA-09	Dc current correction gain	0.0~999.9%	0.1	100.0	☆

PA-08 and PA-09 both parameters are used for correcting DC output current display.

Because the output DC current is calculated by software, it needs parameters to correct it when it is not correct.

PA-10 to PA-14 parameters use to set water tank level detecting, it compatible analog signal input.

Pb group parameters for solar pump protection and monitoring

Pb-00	Sleep voltage threshold	0~1000V	1	*	☆
Pb-01	Restore running state voltage threshold	0~1000V	1	*	☆
Pb-02	Awake waiting time	0.0~3000.0S	0.1	120.0	☆

Pb-00~Pb-02 is used for making solar pump drive go to sleep state when input DC voltage is low, and wakes up automatically when DC bus voltage raises again.

When the DC voltage lower than Pb-00 value for a system default time, it will go to stop sleep mode and sent out an alarm with A.Luo code display in the keypad.

When DC bus voltage raises again and higher than Pb-01 value for a Fb-02 setting time, the drive will recover to running state.

Pb-03	Stop frequency when low speed	0.00~300.00Hz	0.01	5.00	☆
Pb-04	stop delay time when reach stop frequency	0.0~3000.0S	0.1	30.0	☆
Pb-05	Automatic recovery time in stop frequency protection mode	0.0~3000.0S	0.1	120.0	☆

If the output frequency is lower than Pb-03 (stop frequency when low speed) for Pb-04 (stop frequency delay time), the solar pump drive will go into stop mode to protection pumps.

After Pb-05(automatic recover time), the drive will recover to running status again. If Pb-15 (Alarm action mode)unit's digit is 0 in default setting. If Pb-15 unit's digit is set to 1, needs to reset it by press STOP/RESET button by manual.

Pb-06	Dry run protection current threshold (under-load protection)	0.0~100.0A	0.1	0.0	☆
Pb-07	Dry run detect delay time	0.0~3000.0S	0.1	60.0	☆
Pb-08	Automatic recover time in dry run protection mode	0.0~3000.0S	0.1	120.0	☆

If the output current is lower than Pb-06 (Dry run current) for Pb-07 (dry run detect delay time), the drive will go to dry run protection mode.

After Pb-08 (recover time of dry run), the drive will restore to running status if Pb-15 (Alarm action mode) ten's digit is 0 in default setting. If Pb-15 ten's digit is set to 1, needs to reset it by press STOP/RESET button by manual.

Pb-09	Motor over current protection threshold	0~3000.0A	0.1	*	☆
Pb-10	Over current detect delay time	0.0~3000.0S	0.1	30.0	☆
Pb-11	Automatic recovery time in over current protection mode	0.0~3000.0S	0.1	30.0	☆

Pb-09 to Pb-11 parameters is used for setting motor over current protection.

If the current is bigger than Pb-09 for Pb-10 time, the drive will go to stop mode for providing motor protection.

After Pb-11 recover time, the drive will recover to work again if the hundred's digit of Pb-15 set

to 0 in default. If Pb-15 hundred 's digit is set to 1, need to reset it by press STOP/RESET button by manual.

Pb-12	Minimum power input protection threshold	0.00~100.00KW	0.01	0.00	☆
Pb-13	Minimum power input detect delay time	0.0~3000.0S	0.1	10.0	☆
Pb-14	Automatic recovery time in minimum power input protection mode	0.0~3000.0S	0.1	10.0	☆

Pb-12 to Pb-15 parameters is used for setting minimum power input power protection.

When the input power from solar panel is lower than Pb-13 (minimum power input) for Pb-13 time, the drive will be stop.

After Pb-14 time, the drive will start working again if thousand's digit of Pb-15 set for 0 in default.

If Pb-15 thousand 's digit is set to 1, need to reset it by press STOP/RESET button by manual.

Pb-15	Alarm action mode	0: Sending alarm and automatically rest	1	0000
		1: Reset by manual		
		Unit's digit: Low frequency stop mode		
		Ten's digit: Dry run (under load)		
		Hundred's digit: Motor over current protection		
		Thousand's digit: Minimum power input protection		

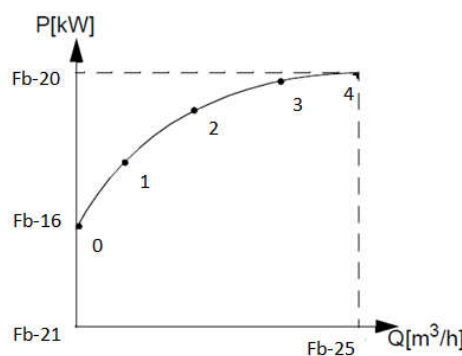
Pb-15 is used for setting low frequency stop mode, dry run mode, motor over current and minimum input power protection, etc 4 kinds of protection reset mode, automatically or manual.

Pb-16 to Pb-29 parameters provide flow rate calculation by PQ curve programming.

Flow calculation

The flow calculation function provides a reasonably accurate flow calculation method without separate flow meter. The function defines the estimated flow using the pump performance curve and drive actual load. The PQ (power/flow) performance curve enables calculating the flow output from the pump. The performance curve is provided by the pump manufacturer. The user saves five operating points (P,Q) of the performance curve to drive parameters.

PQ curve



The solar pump drive records and stores the flow rate on each day and provides the required data for current day flow rate and total flow rate.

Note:

- Do not use the flow calculation function outside the normal operating range of the pump.
- Do not use the flow calculation function for invoicing purposes.
- Ensure that power and flow points are in incremental order with non-zero values.

Pb-16 to Pb-20 use to define input power of pump at points 1...5 on the PQ performance curve.

Pb-21 to Pb-25 use to define flow rate at points 1...5 on the PQ curve respectively.

Pb-27	Flow measured offset	0.00~1000.0m ³ /h	0.1	0.0	☆
Pb-28	Flow measured gain	0.0~999.9%	0.1	100.0	☆
Pb-29	Cumulative flow/ generated energy reset setting	0: No operation 1: Flow reset 2: Generated energy reset 3: Both flow and generated energy reset	0	0	×

Pb-27 and Pb-28 are used for correctting flow calculating for difference pumps.

Pb-29 used to cumulative flow and generated energy reset.

d-00	Current output frequency	0.01Hz
d-01	Current output voltage	1V
d-02	Current output current	0.1A
d-05	DC bus voltage value	1V
d-26	DC bus current	0.01A
d-32	Input power	0.01KW

Note. Press the Shift button of keypad can display d-00, d-01,d-02, d-05, d-26, d-32, etc 6 common monitoring parameters in circulation.

d-25	Open circuit voltage	1V
d-27	MPPT tracking voltage	0.1%
d-28	Calculate flow rate	0.1m ³ /h
d-29	Today flow	0.1m ³
d-30	Cumulative flow 1	0.1m ³
d-31	Cumulative flow 2	1Km ³
d-32	Input power	0.01KW
d-33	Today generated energy	0.1KWH
d-34	Cumulative generated energy 1	0.1KWH
d-35	Cumulative generated energy 2	1MWH
d-36	Working status	1
d-37	Rated voltage of Drive	1V
d-38	Rated current of Drive	0.1A
d-39	Software version	

User also can learn solar drive working status from above list. See the flow calculating from d-28 to d-31 parameters, see the generated energy from d-33 to d-35.

User also can check the solar drive working status from D-36.

0: Stop mode

1: Running

2: **A.LUo** means on low voltage sleep mode ,

3: **A.LFr** means on low stop frequency sleep mode,

4:**A.LCr** means on dry run protection

5: **A.OCr** means on motor over current mode,

6: **A.Lpr** means on minimum power input mode,

7: **A.FuL** water full sleep mode.

Chapter9. Troubleshooting and Countermeasures

The below table lists all types of faults of SPD660 series solar pump drive possibly. Before contacting manufacturer for technical support, you can first determine the fault type through following table description and record your treating process and phenomena. If the fault can not be resolved, please seek for the manufacturer service support.

Troubleshooting table

Fault code	Fault description	Possible reason	Countermeasures	Value
E. SC	Output short circuit	1:Output short circuit or grounding short circuit 2: The load too heavy	1.Check the output connection 2. seek for service support	1
E. OC1	Over current in acceleration	1. Acceleration time is too short 2. too high torque boost or VF curve setting is not correct	1. Extend the acceleration time 2. low the torque boost voltage, and adjust the V/F curve.	2
E. OC2	Over current in deceleration	The deceleration time is too short	Extend the deceleration time	3
E.OC3	Over current in running	The load changed suddenly or fluctuation is too big	Reduce the load fluctuation	4
E.OC4	Soft ware over current	As same as E.OC1, E.OC2, E.OC3 description	As same as E.OC1, E.OC2, E.OC3	5
E.232.	Inner communication fault	Hardware problem	Seek for manufacturer support	6
E.Gnd	Grounding fault	1: Output grounding of motor or drive, 2: Input and output connection of drive	1. Check the connection 2. check the motor if aging or insulation is not good	7
E.OU1	Over voltage in acceleration	1.Input voltage is too high 2. Power supply open and close frequently	Check the Dc input voltage or AC grid condition	8
E. OU2	Over voltage in deceleration	1.Deceleration time is too short 2. Input voltage is abnormal	1.Extend deceleration time 2. Check the input voltage 3. Install braking unit or resistor	9
E.OU3	Over voltage in running	1. Power supply is abnormal 2. load feedback energy	1. Check the voltage of power supply 2. Install braking unit or resistor	10
E. UL	Under voltage	1. Output connection is loss 2. Load suddenly missing	1. Check the output wiring 2. Check the drive load	14
E.OL1	Over load of drive	1. Load is too big 2. Acceleration is too short 3.Torque boost voltage is high, and VF curve is not properly 4.Input voltage is too low	1. reduce the load or change bigger power drive for instead 2. Extend the acceleration time 3. Low the torque boost voltage, and adjust the V/F curve. 4. Check the grid voltage	15
E.OL2	Motor overload	1. The load is too big 2. Acceleration time is too short 3. Protection coefficient	1. reduce the load 2. Extend the acceleration time 3. Low the torque boost	16

		setting is too small 4. Torque boost voltage is high, and VF curve is not properly	voltage, and adjust the V/F curve. 4.set the motor protection coefficient bigger	
E.CUr	Current detect is correct	1. Current detect parts or circuit is problem 2. Auxiliary power supply has problem	Seek for manufacturer support	17
E. LU	Under voltage	1. Power supply voltage is abnormal 2. power supply is fluctuation	1. check the power supply 2. separate power supply 3. added the solar panel to increase Dc voltage input.	18
E.EF1	External equipment normal open terminal fault	External fault input terminal of the drive signal input	Check the signal source and related equipment	19
E.EF2	External equipment normal close terminal fault	External fault input terminal of the drive signal input	Check the signal source and related equipment	20
E.OH	Drive over heat	1. duct obstruction 2. The ambient temperature is too high 3. Fan damage	1. Clean the duct or improved ventilation 2. Reduce the carrier frequency 3. Replace the fan	21
E.SP1	Input phase loss	1. Input voltage phase loss 2. Input voltage is too low	1. Check the connection 2. Check power supply of phase loss	22
E.SP0	Output phase loss	The connection between drive and motor is broken	Check the wiring	23
E.EEP	Memory fault	Hard ware problem	See for support	24
E.End	Running time is reached	The allowable running time setting is reach	Contact vendor	25
E. PID	PID feedback fault	1. PID feedback single is broken 2. sensor has problem 3. feedback signal parameters setting is not correct	1. Check the feedback channel 2. Check whether the fault sensor 3. Verify the feedback signal meets the set requirements	26
E.485	RS485 communication fault	Send and receive data error occurs in serial communication	1. Check the connection 2. Seek for support	27
E.doG	EMC interference	Since the ambient electromagnetic interference caused by malfunction	Install the absorb circuit	28
E.232	Inner upper communication fault	Hardware problem	Seek for support from vendor	29

Note:

The series drive records the latest three times fault occurs code and output parameters of drive when latest fault occurs. Query information to help find the cause of the fault.

