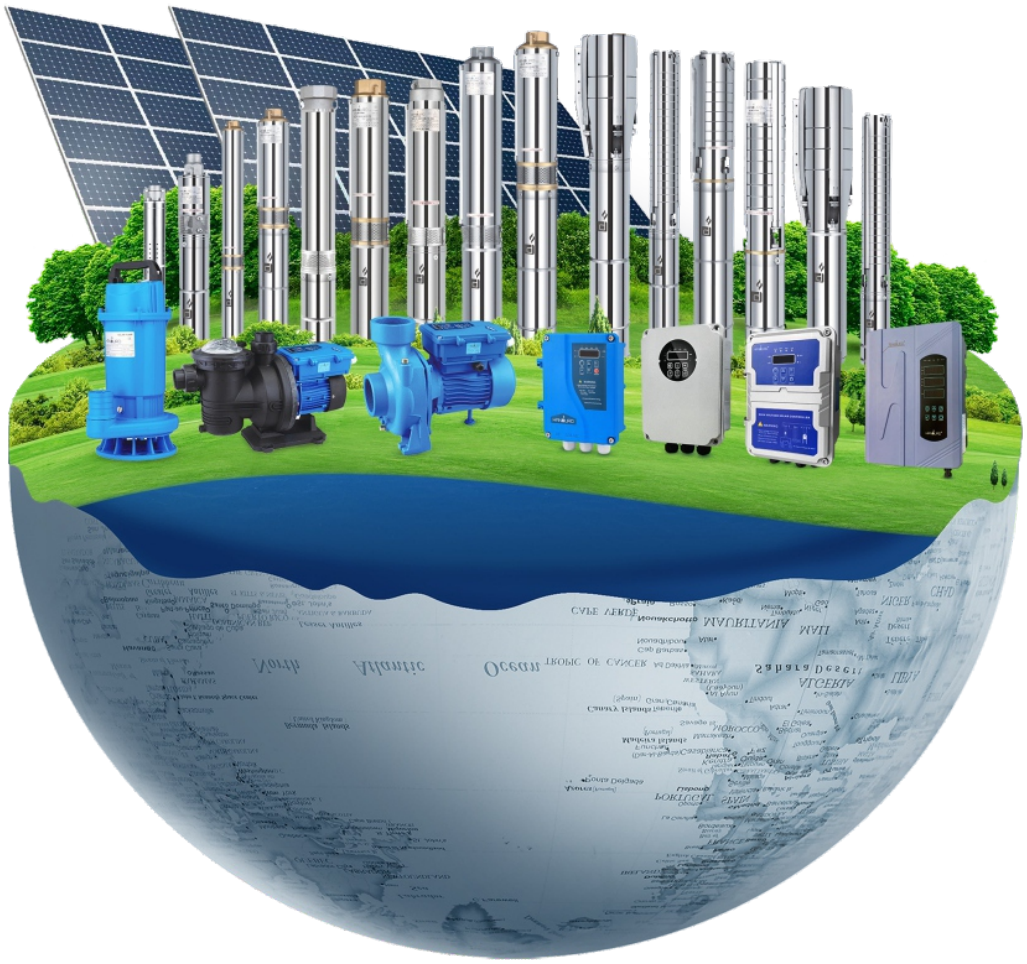
HANDURO®

DC SOLAR WATER PUMPS

Instruction Book

LV SOLAR CONTROLLER



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Application in 12V~110V DC pumps

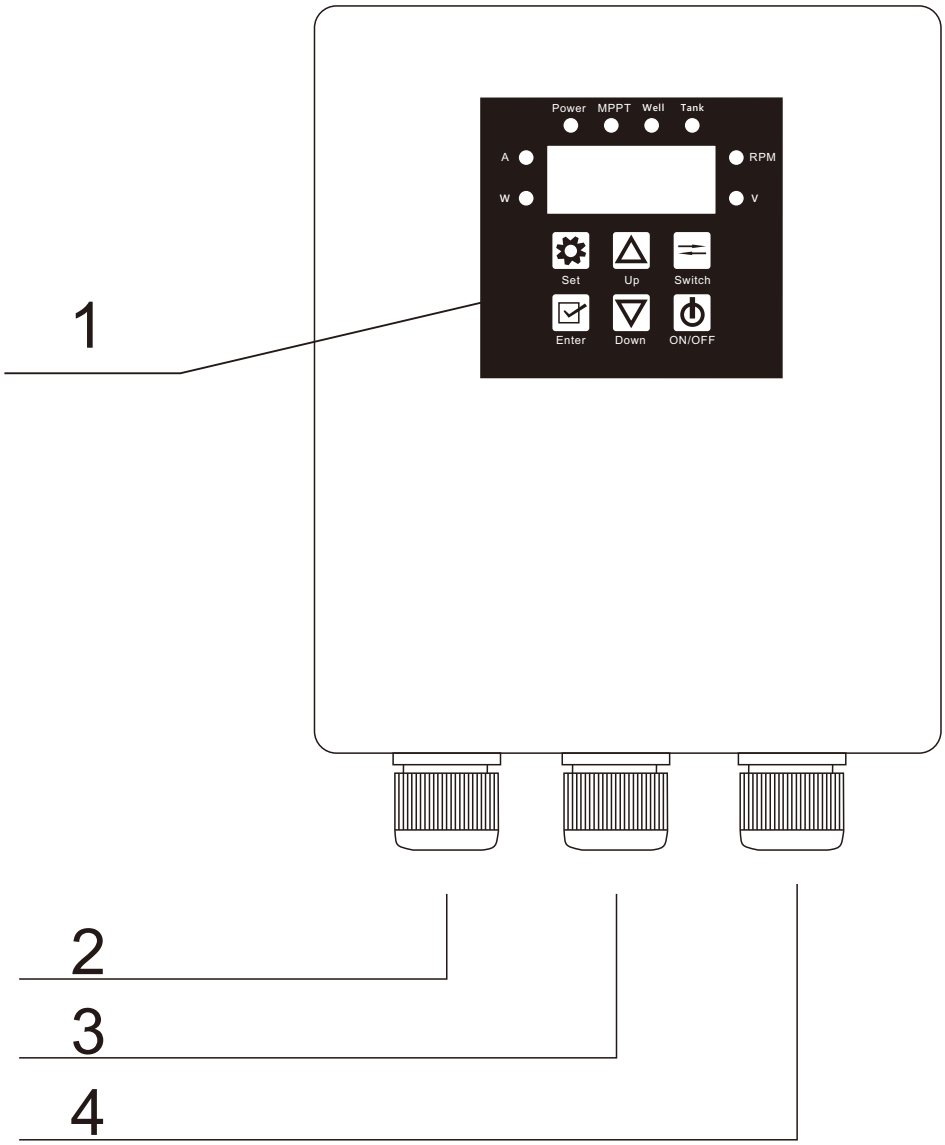
Solar Panel selection

1. Solar Panel Connection Knowledge

Solar panel can be divided into mono-crystalline silicon solar cell, polycrystalline silicon solar cell and thin-film photocell. Mono type is the most efficient one but the price is highest; the thin-film photocell is the cheapest one. Normally, the power of solar cell is 150W per square meter. The open-circuit voltage (Voc) marked on solar cell means the max electromotive force before working. The voltage will decrease when working, its voltage called working voltage (Vmp). Common open-circuit voltage is 21V, 36V, 44V etc, it changes along with the change of area and temperature, the lower the temperature, the higher the voltage. Another important index is power. It is proportional to the panel area. There need some solar cell to connect in series if the voltage is not enough, total voltage equals to adding each panel's voltage.

The working voltage of solar cell need to select according to the controller's working voltage, and then to confirm the open-circuit voltage of solar panel. Then select the solar power according to the pump power after the voltage confirmed. The power of solar water pump is input power and the generating efficiency of solar panel is under 70% usually. In order to ensure the rated working time of 4hours at day, the solar panel power equals to input power multiply 1.5 which is also the minimum power. If the solar panel power is smaller than this value, the pump can not reach its rated flow and head even through it can still work normally. Using more panels for the pump is better if condition permits, because that is able to ensure more time for the pump to running and reach the rated flow and head.

Wiring Diagram



1. Operation panel
2. DC electric cable entrance.
3. Water level sensor cable entrance.
4. P ump electric cable entrance.

Solar panel recommendation for 24V-110V DC solar pump

Control box Type	MODEL	SOLAR PANEL PARAMETER								control box parameter	
		375W		400W		450W		545W			
		Working Voltage	Open Voltage	Working Voltage	Open Voltage	Working Voltage	Open Voltage	Working Voltage	Open Voltage	Best Working Voltage	Open Voltage
		34.20V	41.50V	38.6V	46.4V	41V	49V	41.80V	49.75V		
DC Type	120W-24V 180W-24V 210W-24V 210W-36V	1 pcs		1 pcs		1 pcs		1 pcs		30V-48V	<60V
	280W-24V 300W-24V	1 pcs		1 pcs		1 pcs		1 pcs		30V-48V	<60V
	400W-48V	2 pcs in series		2 pcs in series		2 pcs in series		2 pcs in series		60V-90V	<110V
	500W-48V 550W-48V	2 pcs in series		2 pcs in series		2 pcs in series		2 pcs in series		60V-90V	<110V
	600W-48V	2 pcs in series		2 pcs in series		2 pcs in series		2 pcs in series		60V-90V	<110V
	600W-72V	3 pcs in series		3 pcs in series		3 pcs in series		2 or 3 pcs in series		90V-120V	<170V
	750W-72V	3 pcs in series		3 pcs in series		3 pcs in series		3 pcs in series		90V-120V	<170V
	900W-72V	3 pcs in series		3 pcs in series		3 pcs in series		3 pcs in series		90V-120V	<170V
	1100W-110V	4 pcs in series		4 pcs in series		4 pcs in series		3 pcs in series		110V-150V	<220V
	1200W-110V 1300W-110V	total 8pcs, 4pcs in series and in 2 parallels		4 pcs in series		4 pcs in series		4 pcs in series		110V-150V	<220V
	1500W-110V	total 8pcs, 4pcs in series and in 2 parallels		total 8pcs, 4pcs in series and in 2 parallels		total 8pcs, 4pcs in series and in 2 parallels		4 pcs in series		110V-150V	<220V

Tips:

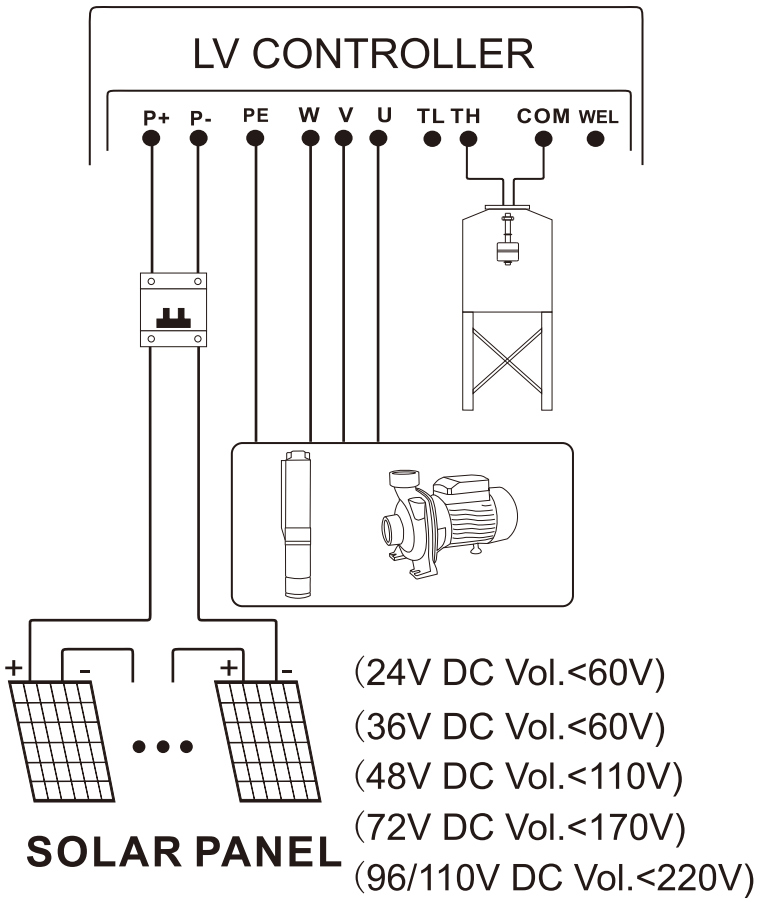
When it's series connection,the voltage is addded, but the current is't changed;when it's parallel connection, the voltage is unchanged,but the current is added.

Before the power is on,you must use the instrument to detect the open circuit voltage of solar panels,or apply for series,parallel knowledge to calculate the solar panel open circuit voltage.The open-circuit voltage of solar array must be less than the maximum input voltage of the controller,otherwise is will cause irreversible damage.

Wire the pump, panels to the control box as per the wiring diagram below. Please connect the pump to the controller making sure they do not touch each other. Later when we test the system if the wiring is incorrect the pump will run backwards and you will only have to swap over two wires to get it running correctly.

When connection with battery, ma ke sure the polarity is correct, plus to plus, minus to minus. Charge controllers generally have the following connections. Battery, Panel and Load either written or in pictorial form. The pump controller solar PV input is connected to the load terminals of the pump controller. As a safety margin we recommend the charge controller be able to supply at least 1. 5 times the pump requirements. Selection way is mentioned above.

Caution. If wiring a battery be very careful not to reverse or short the terminals.We advise you remove all metal wrist bands or watches before you start. Solar PV panels when connected together can also produce a lot of energy so caution must also be exercised here as well. A dark cloth to shade the panels is a good precaution to reduce the power output.



internal wiring diagram

Tips1：Do not reverse the positive and negative of power, otherwise it will not work.

Tips2：Before you start wiring the controller box switch must be in the off ppsition.

Wire the pump, panels to the control box as per the wiring diagram below. Please connect the pump to the controller making sure they do not touch each other. Later when we test the system if the wiring is incorrect the pump will run backwards and you will only have to swap over two wires to get it running correctly.

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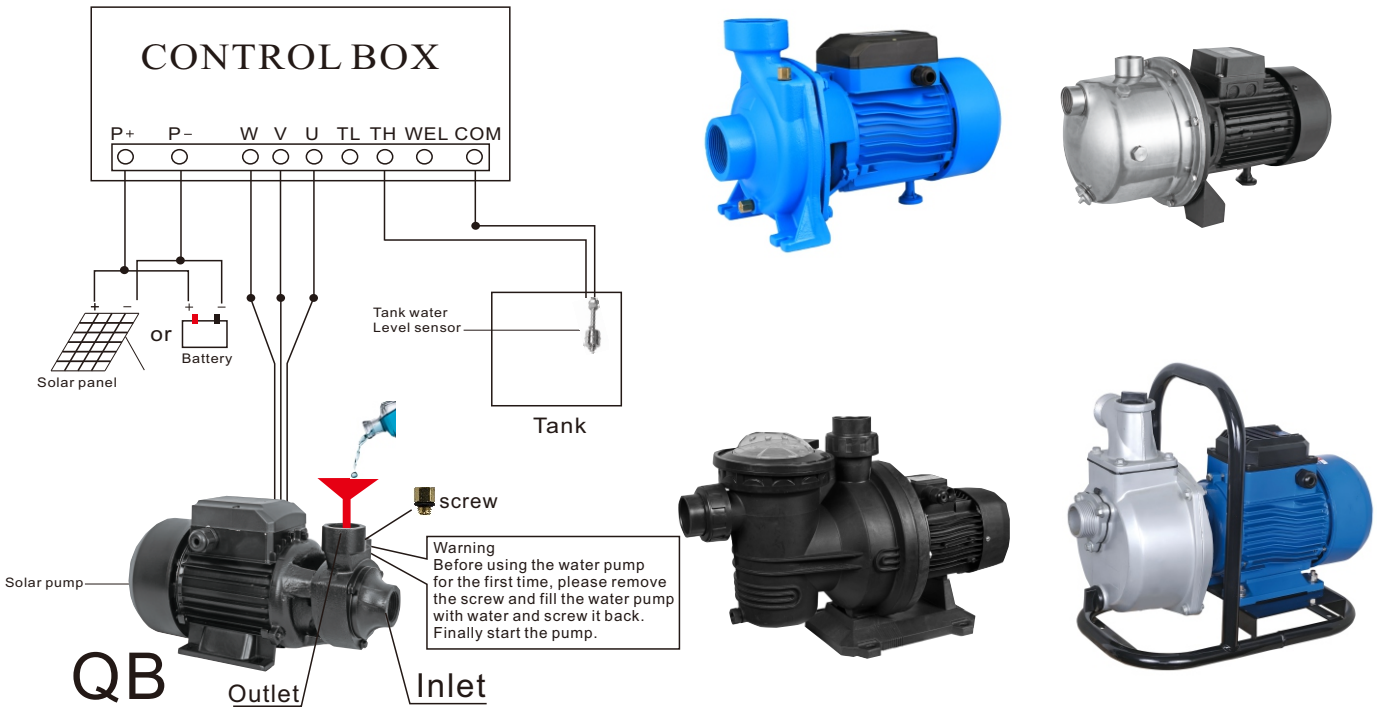

internal wiring diagram

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Tips2：Before you start wiring the controller box switch must be in the off ppsition.

Working Environment and Electrical Property

Controller and Pump Matching Method					
Controller Model	Adaptable Pump	Max. Input Current (A)	Max. Open Voltage (V)	MPPT Voltage Range (V)	Working Temperature (℃)
HD-24	Rated24V Pump	18	<60	30-48	-15-60
HD-36	Rated36V Pump	18	<60	30-48	-15-60
HD-48	Rated48V Pump	18	<110	60-90	-15-60
HD-72	Rated72V Pump	18	<170	90-120	-15-60
HD-110	Rated110V Pump	18	<220	110-150	-15-60

The controller will be burned out when the open circuit voltage higher than our setting.

ตัวควบคุมจะถูกเผาไหม้ออกเมื่อแรงดันไฟฟ้าวงจรเปิดสูงกว่าการตั้งค่าของเรา

El controlador se quemará cuando el voltaje del circuito abierto sea mayor que nuestro ajuste.

سيتم حرق وحدة التحكم عندما يكون الجهد الكهربي المفتوح أعلى من إعدادنا.

WARNING

The controller must match with the recommended solar pumps. Please do not use the controller for other pumps. If cause any problems because of this reason. We do not bare any responsibility. For the perfect performance and long-life working, the controller should be kept away from strike, shake, sunshine, salt mist, oil mist and etc. Because of the power loss from cable, please try to use the shortest cable. While use longer cable, the cable connecting controller and solar panels should be over 4mm^2 (Do not use single wire kind). While the cable between controller and pump within 30m,the cable should be at least 2mm^2 . While over 30m, the cable should be at least 4mm^2 .

CABLE			
POWER (W)	2	2.5	4
300W-24V, 210W-36V, 120W-24V	30	50	100
400W-48V, 600W-48V, 750W-48V	30	50	100
750W-72V	70	100	150
1100W-72V		100	150
750W-96V,1100W-110V		150	200
1300W-110V,1500W-110V		150	200
750W-96V, 1100W-150V,1500W-180V,2200W-280V, 3000W-300V		150	200

Operation Panel

1. LED Indicator Light

- Voltage(V): Voltage indicator lights.
- Speed(RPM): Speed indicator light.
- Current(A):Current indicator light.
- Power(W): Power indicatorlight.
- Tank: Light when tank is filled with water.
- Well: Light indicates no water in well.
- MPPT: Solar energy running lights (twinkling).
- Power： light twinkles at downtime, light is constent in running.

2. Key Operation

Key Type	Function
 Set Key	Manufacturer parameter setting, not opened.
 Enter	Manufacturer parameter setting, not opened.
 Up	RPM setting key， Each time you press, the RPM will increase for one grade. In fault state, turn off / on the fault display.
 Dowm	RPM setting key， Each time you press, the RPM will decrease for one grade.
 Switch	In the operation status, you can circularly switch the display mode in voltage (V) - > speed (RPM) - > current (A) - > power (W).
 On/Off	In the running state, you can turn it off. In the stop state, you can turn it on.

Test Running

Before you testing the pump, the controller box switch must be in the off position. The pump must be under water at all times and should have been pre-conditioned forat least 15 minutes. Water is the lubrication for the pump and if it is not"preconditioned" properly the bearings will not be adequately lubricated. Do not attempt to test the pump if even for a moment without it being submerged, or permanent damage will occur. You will need a large container so the pump does not pump it dry in seconds. is used to raise and lower the pump. Never use the power cable to do this.

1.Attach a durable rope or stainless steel cable to the top of the pump using the mounting hole. Make sure the rope or cable is longer than the depth at which you want to install the pump. This is used to raise and lower the pump. Never use the power cable to do this.

2.Attention

Do keep the pump under water at all times when operating Do be careful with wiring Do remove the pump if not used for a long time and wipe the screw and body. Wipe with vegetable oil. Do make sure the pump has adequate water around it during pumping. don't run without water. Do put your solar PV panels in a sunny position facing true north(southern hemisphere)or true south (northern hemisphere). If the panel angle is fixed then an angle equal to your latitude will be a good compromise. Dont run the pump out of the water, even momentarily. It will void the warranty Dont use the pump in dirty water Premature wear will not be covered by warranty. Don't disassemble the pump and control box.

Operation Mode

1. Pump Start

1) Power on to start

Every time it connect with electricity, the system default boot, and pump start immediately without testing water tank (without any Shutdown conditions).

2) Button to start

In shutdown state, press the button 

to turn on the pump, without testing water tank (without any Shutdown conditions).

3) Water Shortage to Start

If the system boot but the pump stop and water shortage switch is closed, the pump immediately starts. (TL signal terminal of the main control board is shorted to the COM terminal).

2. Pump Stop

1) Float Switch Mode

In running state, when the water full switch is closed, the pump immediately stops. (TH signal terminal of the main control board is shorted to the COM terminal, and the Tank light is on)

In running state, when the water shortage switch is closed, the pump immediately stops. (WEL signal terminal of the main control board is shorted to the COM terminal, and the Tank light is on)

2) Dry Pumping Shut Down

If the water pump continuous work for a period of time, and the power is less than the set power at the current speed and continues for 20s, the pump will stop immediately and report P48 fault. After 30 minutes, the fault is cleared.

3) Button to Stop，

In running state, press the button 

to turn off the pump.

3. Pump Operation

Every time the pump starts, it will recognize the DC (battery) and PV (solar) power supply mode for 10 second, and then switch to the corresponding mode to run. The setting speed is invalid during the identification process.

1) DC mode (battery)

In DC (battery) mode, the pump speed is adjustable, range of 1000-4000RPM. The default setting speed is 4000RPM. The speed can be set by the 

or 

keys, and the speed can be increased (or decreased) by pressing the increment

(or decrement) button.

With the pump running, DC (battery) supply voltage will continue to decline to prevent excessive discharge, when the voltage is lower than the corresponding electrical protection voltage, the pump stops working.

Model	Protection Voltage(V)
HD 24	20
HD 36	20
HD 48	40
HD 72	60
HD 110	80

2) PV Mode

In PV mode, the pump setting speed is similar to DC mode, and the maximum speed (4000 RPM), limit is effective. Pump running speed is also determined by the current solar power. Maximum power point tracking. When the solar light enhances, the output power of solar panel increases, the pump speed increases, and vice versa.

In PV mode, the MPPT indicator flashes. If it flashes faster, it indicates that the current working point is closer to the maximum working point. If the flashing frequency is slower or not, it indicates that the maximum power point is being tracked.

Solar power is insufficient, the pump speed will continue to fall, when the speed drop to 600 RPM, pump stops, and report P46 faults after 3 second.

When solar power is too insufficient to maintain the current system of starting or running, the output voltage of solar panels will drop rapidly.

When the minimum voltage drops to the lowest voltage of system and lasts for 10s, it will report "PL" fault. Try consecutively 5 times to restart, if it still appears "PL" fault, hold this state for 30 min, then try to start again.

4. **Reverse connection protect**

If the positive and negative of power supply is reversed, the controller will continue to alarm.

5. **Dry-run protection**

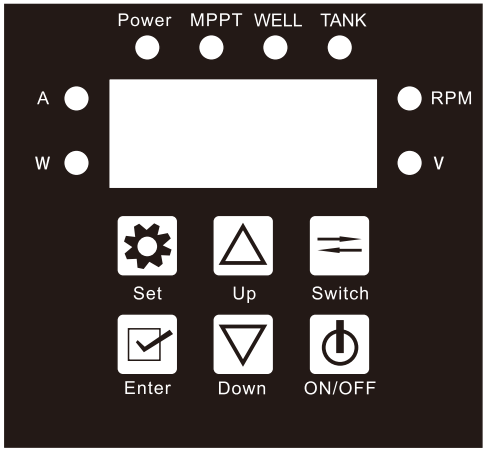
This function refers to the pump pumps out water on well, the system can automatically detect the anhydrous state, pump will stop working automatically by set program. Dry-run protection is effective all working modes, in manual mode, float switch model and solar mode. Pump will Standby for 30 minutes torestart the work (meet the start condition). Start to detect again whether there is water or not, if no water, stop working automatically; there is water, keep working, that cycle repeats.

Servicing and Maintenance

1. After working 3000 hours, the easily damaged parts should be replaced (such as bearing, sealing ring, mechanical seal), or it may cause much more serious damage.
2. If the pump didn’t use for long time, please scrub it, place at dry and ventilated place and keeping properly.

Fault Information and Troubleshooting Method

Fault Type			
Fault Code	**Fault Description**	**Causes and Solutions of Fault**	**Recovery Procedure**
P0	Hardware Overcurrent	◴ Motor model is mismatch, please choose matching pumps ◴ UVW three-phase short-circuit connection, please rewiring to ensure the normal installation of UVW	Automatically remove after 30s
P43	Phase Protection	UVW three-phase open circuit, please rewiring to ensure it reliable contact.	Automatically remove after 30s
P46	Stall Protection	◴ Motor model is mismatch, please choose matching pumps ◴ Pump extension cord is too long, please reduce the extension cord ◴ Power is too low, increase the power supply ◴ Pump bearing is stuck, please clean pump bearings	Automatically remove after 30s
P49	Software Overcurrent	◴ Water pump bearing stuck, clean pump bearings ◴ UVW three-phase short-circuit connection, please rewiring to ensure the normal installation of UVW	Automatically remove after 30s
P50	Low Voltage Protection	The input voltage is too low, please distribute power refer to the electrical characteristics.	Voltage return to normal, remove the fault immediately
P51	High Voltage Protection	The input voltage is too high, please distribute power refer to the electrical characteristics.	Voltage return to normal, remove the fault immediately
P48	Dry-run Protection	◴ Not all of air in the pump is exhausted, cut off the power, re-power and start the pump drainage after 30 seconds ◴ There is no water in the water tank waiting for water, it will restart	Automatically clear after 30 minutes or re-power to clear
P60	High Temperature Protection	The temperature of controller MCU is more than 90° C	Automatically clear after the temperature is normal
E8	Current Sampling Failure	Cut off the power and restart after 30 seconds	Restart the power
PL	Power Shortage	◴ No sunlight, waiting for the sunlight to restart ◴ Solar panel matching error, refer to the recommendation to match correctly	At the first 5 times, it will removal after 30 seconds, and then 30 minutes to removal



LV controller system setting

long press for 3 s,
enter the settings menu

Set → SHOW P0.0 → Enter → SHOW 0 → Up / Down → TO password 12 → Enter

long press for 3 s,
exit the preservation

Set

	INITIAL VALUE	RANGE VALUE			
P0. 0:Password	0	12 : Get modification permission		21 : Restore factory setting	
P0. 1:Type of Water Pump	1	1: OPEN	0 :COLSE	(without dry-running protection)	
P0. 2:Power Supply Mode	0	0 : Automatic Recognition		1 : DC Mode	2 : Solar Mode
P0. 3:Return Value of Voltage Protection		24V=2	48V=4	72V=6	96/110V=8
P0. 4:Protection Value of Under-voltage		24V=20	48V=40	72V=60	96/110V=80
P0. 5:Power point of Dry-running 1 , Corresponding Speed 2000 rpm		24V=35	48V=70	72V=80	96/110V=80
P0. 6:Power point of Dry-running 2 , Corresponding Speed 3000 rpm		24V=60	48V=120	72V=155	96/110V=180
P0. 7:Power point of Dry-running 3 , Corresponding Speed 4000 rpm		24V=95	48V=200	72V=280	96/110V=360
P0. 8:Power point of Dry-running 4 , Corresponding Speed 5000 rpm		24V=140	48V=300	72V=400	96/110V=500
P0. 9:Setting of Default running speed	4000	1000~5000			
P1. 0:Memory Function of ON-OFF State	1	0: Default off	1:Start by default	2:Use the last command	
P1. 1:DC Power limit		24V: 500W	48V: 1000W	72V: 1200W	110V: 1550W
P1. 2:Motor direction switching	0	0:Corotation		1:Rollback	
P1. 3:Motor model setting	decided by the pump model	24V: 2C24 & 3C24 48V: 2C48 & 4C48		This function is only for 24V/48 control box	