SOLAR WATER PUMP DC CONTROLLER

User Manual

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WARNING

1. The DC controller will be burned out when the open-circuit voltage is higher than setting value.
2. The DC controller must match with the recommended solar pumps.
3. Do not use the DC controller for other pumps. If cause any problems because of this reason. We do not bare any responsibility.
4. For the perfect performance and long-life working, the DC controller should be kept away from strike, shake, sunshine, salt mist, oil mist and etc.
5. Because of the power loss from cable, try to use the shortest cable.
6. While use longer cable, the cable connecting DC controller and solar panels should be over 4mm^2 (Do not use single wire type). While the cable between DC controller and pump within 30m, the cable should be at least 2mm^2. While over 30m, the cable should be at least 4mm^2.

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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 (℃)**
DF-12	Rated 12V Pump	15	＜48	30-48	-15~+60
DF-24	Rated 24V Pump	15	＜48	30-48	-15~+60
DF-36	Rated 36V Pump	15	＜48	30-48	-15~+60
DF-48	Rated 48V Pump	15	＜100	60-90	-15~+60
DF-72	Rated 72V Pump	15	＜150	90-120	-15~+60
DF-110	Rated 110V Pump	15	＜200	110-150	-15~+60

3. Installation and Wiring

3.1 Solar Panel Selection

Before installing the solar water pump and DC controller, we should know how to select the solar panel for the solar water pumping system.

3.1.1 Select the type

Solar panel can be divided into thin-film photocell, polycrystalline silicon solar cell and mono-crystalline silicon solar cell. The prices are different for the three kinds of solar panel. Mono-crystalline type has the highest price but the efficient is the best. The thin-film photocell is the cheapest one.

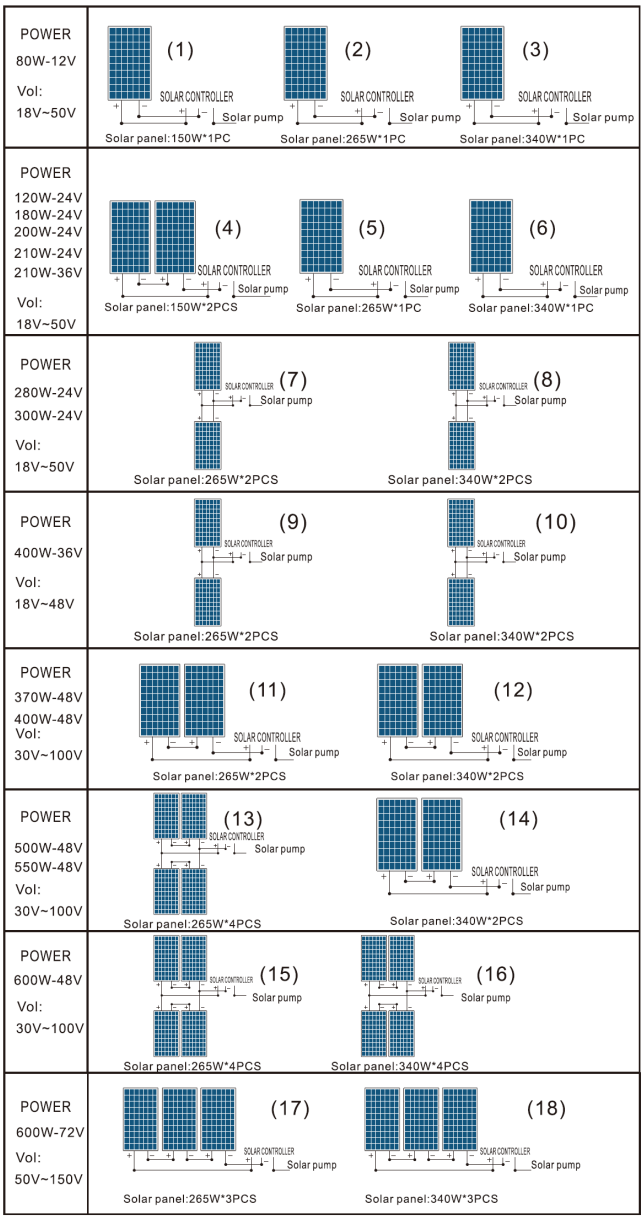
3.1.2 Select the rated power and Voc

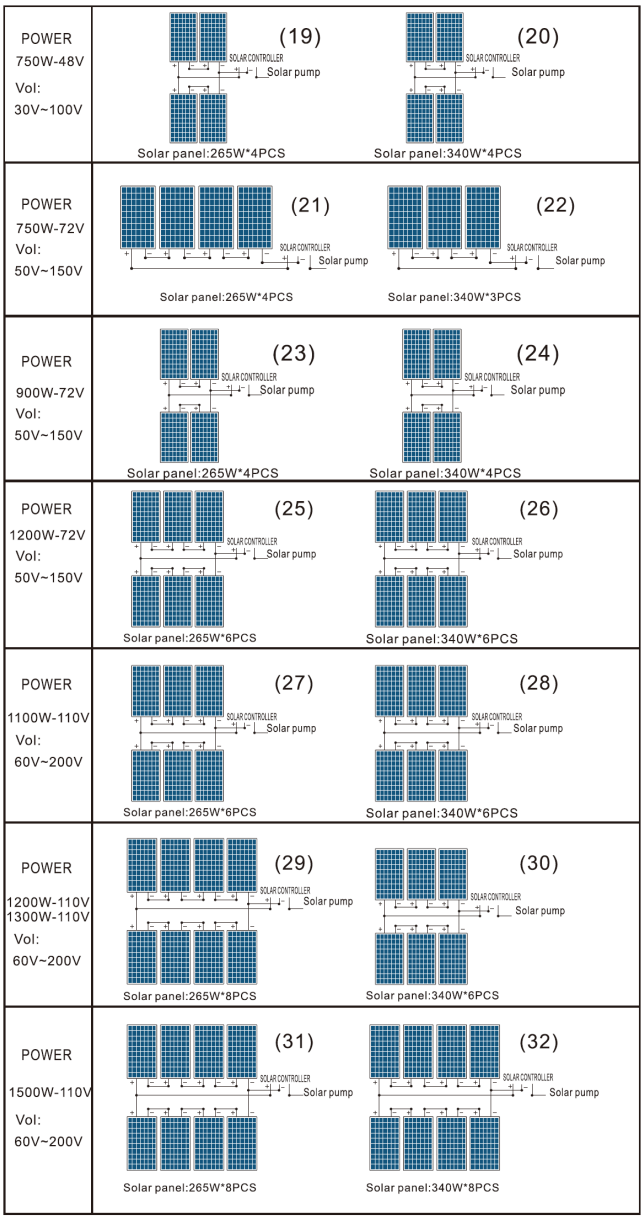
- Rated power: The power is proportional to the panel area. Normally, the rated power of solar cell is 150W per square meter.
- Voc: The open-circuit voltage (Voc) means the max electromotive force before solar panel working. The common open-circuit voltage (Voc) is DC 21V, 36V, 44V, etc. The lower the temperature, the higher the Voc. Because the open-circuit voltage changes along with the change of area and temperature. If the Voc is not high enough, connect more solar cells in series. The total voltage value equals the sum of each panel's Voc.
- How to select Voc and rated power?
  When solar panel working, its voltage will decrease, this voltage is called working voltage (Vmp). The Vmp of solar cell needs to be selected according to the solar pump controller's working voltage, and then to confirm the open-circuit voltage (Voc) of solar panel.
  After that, according to the solar pump power to select the solar panel power. The generating efficiency of solar panel is under 70% usually. In order to ensure the rated working time (for example 4 hours a day), the solar panel power equals to 1.5 times of solar pump power. It is the minimum power for choose. That means, if the solar panel power is smaller than the minimum power, the solar pump can work normally but can't reach its rated flow and head. The best solution is to use more solar panels if condition permits, and it is also ensure more working time for the solar water pump.

3.1.3 Solar panel recommendation for 12V-110V DC solar water pump

When the solar panels are in series connection, the voltage is added, but the current isn't changed.
When the solar panels are in 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.





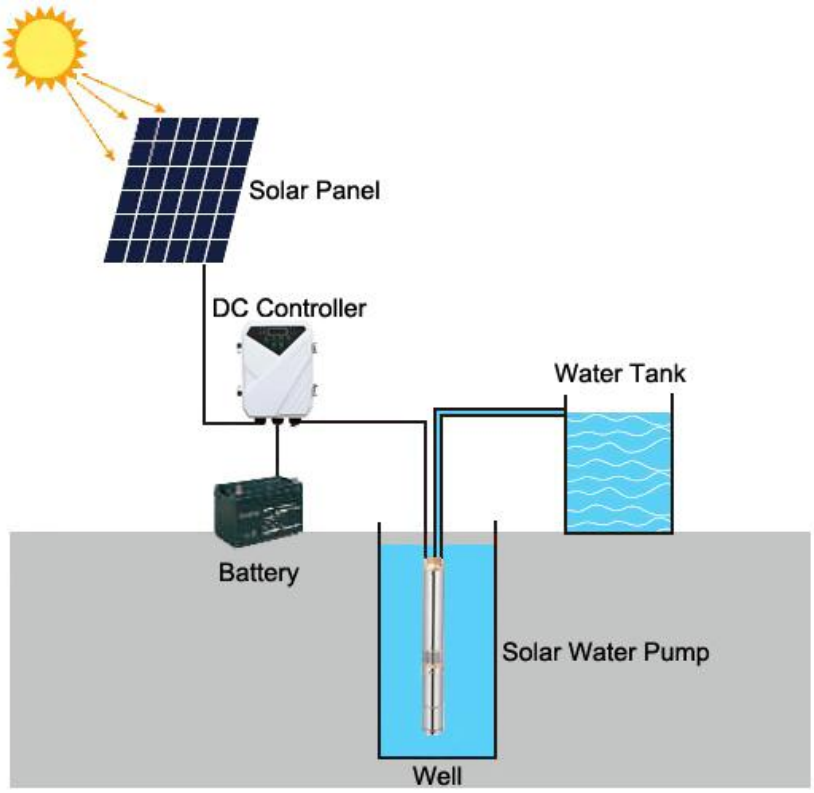
Solar Panel Specification:

150W
Max power: 150W
Short Circuit Current: 9A
Open Circuit Voltage: 22V
Max Power Current: 8.4A
Max Power Voltage: 18V

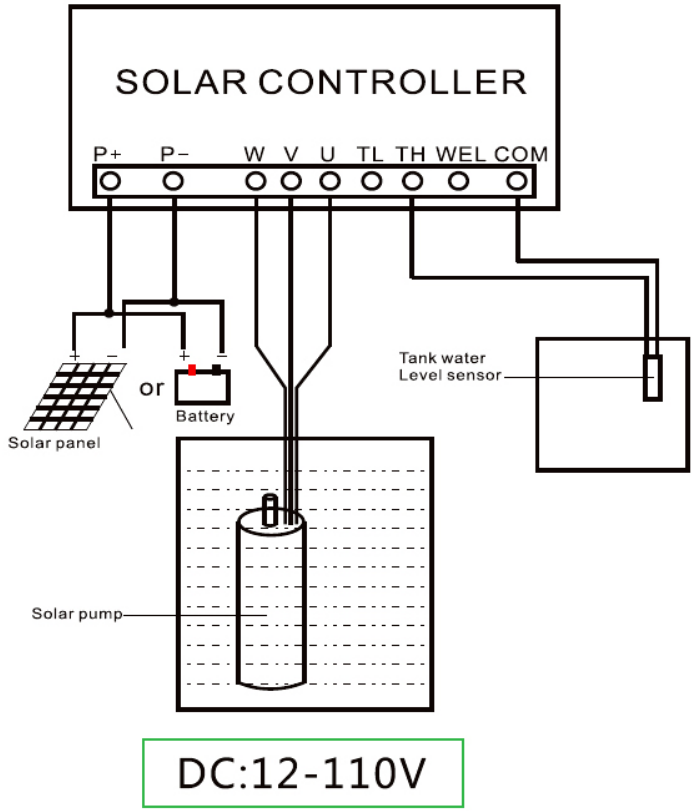
265W
Max power: 265W
Short Circuit Current: 8.7A
Open Circuit Voltage: 36.6V
Max Power Current: 7.68A
Max Power Voltage: 30.6V

340W
Max power: 340W
Short Circuit Current: 9.5A
Open Circuit Voltage: 46.2V
Max Power Current: 8.9A
Max Power Voltage: 38.2V

3.2 Solar Water Pumping System Installation Diagram



3.3 Solar DC Controller Wiring Diagram



3.4 Wiring Instructions

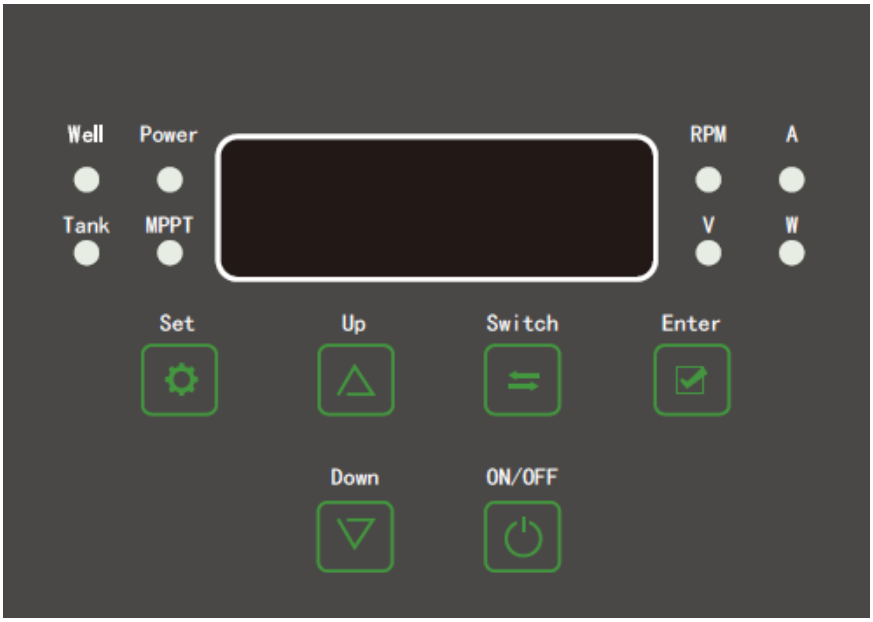
Before you star wiring the controller box switch MUST be in the OFF position. Wire the solar pump and solar panels to the DC controller as per the wiring diagram. Make sure the pump and controller are not touching each other. If the wiring is incorrect, the pump will run backwards. Then exchange two wires of solar panel to the correct wiring. When connecting with the battery, make sure the polarity is correct, "+" to "+", "-" to "-".

Caution:

1. When wiring a battery. Be careful not to reverse or short the terminals. We advise you remove all metal wrist bands or watches before you start.
2. Solar PV panels connecting together can also produce a lot of energy. So operators are more careful about wiring.
3. A dark cloth to shade the panels is good precaution to reduce the power output.

4. Operation

4.1 Operation Panel



- Voltage (V): Voltage indicator lights.
- Speed (RPM): Speed indicator light.
- Current (A): Current indicator light.
- Power (W): Power indicator light.
- 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 constant in running.

4.2 Key Instructions

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.
 Down	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.

4.3 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 for at least 15minutes. 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 pump if even for a moment without if being submerged or permanent damage will occur. You will need a large container so the pump does not pump it dry in seconds. It 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. Don't run the pump out of the water, even momentarily. It will void the warranty. Don't use the pump in dirty water. Premature wear will not be covered by warranty. Don't disassemble the pump and controller.

4.4 Operation Mode

4.4.1 Pump Start

1. Power on to start
   Every time it connects with electricity, the system default boot, and pump start immediately without testing water tank (without any shutdown conditions).
2. Key to start
   In shutdown state, press the ON/OFF key 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).

4.4.2 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 ON/OFF key to turn off the pump.

4.4.3 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 UP or DOWN 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)
DF-12	20
DF-24	20
DF-36	20
DF-48	40
DF-72	60
DF-110	80

2. PV Mode (solar panel)

   In PV mode, the pump setting speed is similar to DC mode, and the maximum speed (4000RPM), limit is effective. Pump running speed is also determined by the current solar power. 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 600RPM, 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.

4.4.4 Reverse connection protect

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

4.4.5 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 tore start 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.

5. 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.

6. Fault Analysis and Corresponding Solutions

Fault Type			
Fault Code	**Fault Description**	**Causes and Solutions of Fault**	**Recovery Procedure**
P0	Hardware Overcurrent	1. Motor model is mismatch, please choose matching pumps 2. 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	1. Motor model is mismatch, please choose matching pumps 2. Pump extension cord is too long, please reduce the extension cord 3. Power is too low, increase the power supply 4. Pump bearing is stuck, please clean pump bearings	Automatically remove after 30s
P49	Software Overcurrent	1. Water pump bearing stuck, clean pump bearings 2. 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	1. Not all of air in the pump is exhausted, cut off the power, re-power and start the pump drainage after 30 seconds 2. 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℃	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	1. No sunlight waiting for the sunlight to restart 2. 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
ALARM	Reverse Connection protect	Exchange the positive and negative wire	Restart the power