



# **Solar Pumps Instruction Manual**

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# Introduction

MAXIMA solar motor powers the new system for the supply of clean water based on the most widely available renewable energy, the sun. When sunlight is insufficient, AC power can be input, such as power grid or generator.

By means of the electric power supplied by a series of photovoltaic panels and taking advantage of the combination of a series submersible pump Or helical pump, the system is able to ensure a continuous drawing of water from a suitable source while the solar irradiation conditions may vary.

The permanent-magnet motor technology assures high efficiency of the system that, consequently, can require a smaller number of photovoltaic panels in order to work.

It is designed for easy use and requires no maintenance. It is the ideal solution for supplying water in remote areas, where the normal power supply of electricity from the power grid is inconsistent or completely unavailable.

## Features and Protections

- High efficiency BLDC motor;
- Accepts AC (50Hz&60Hz) and DC power ;
- High efficiency MPPT and Vector control;
- External controller;
- Display of voltage, current, power, etc;
- Water filled motor(No leakage pollution);
- Thrust Bearing system;
- Dry protection;
- Over-load protection;
- Over-voltage protection;
- Low-voltage protection;
- Lost Phase protection;
- Stall protection;
- Fault code display.



## Pump End

Multistage centrifugal type with radial or semi-axial impellers. Pump and motor directly coupled with rigid coupling. Standard 4-inch NEMA connection installation.

Impellers fitted on floating clearance rings made of synthetic low abrasion material, and techno polymer diffusers that impart significant wear resistance to the pump. Stainless steel and plastic impellers or SUS304 or SUS316 available.

Pump liner, shaft and coupling, strainer and cable sheath in stainless steel. Base support and upper head in microcast AISI 304 stainless steel; check valve incorporated in the head.

The innovative wet end design gives the pump superior sand handling capabilities and provides maintenance free operation.

Stainless steel pump end or plastic impeller pump end is available.

## Motor

This series of motors are high efficiency BLDC motors specially designed for solar pump system. Adopt shielding structure, all stainless steel material, welding process, ensure long-term high reliability of the motor, free from maintenance. Thrust bearing system, water filled structure, ensuring more stable operation and longer service life. No oil, cleaner and No pollution.

All different types of motors are different. When using, pay attention to the matching of Voltage and power requirements. The centrifugal pump motor is 1000 rpm to 4000 rpm depending on the power input and load.

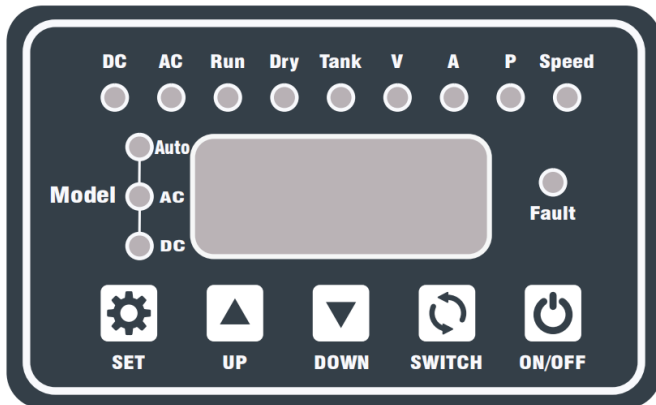
Here are some of the installation parameters used:

- ◆ The maximum submergence depth is 150m;
- ◆ The sediment content of water source shall not exceed 120g/m<sup>3</sup> ;
- ◆ Recommended water temperature of 0 to 40°C;
- ◆ Maximum axial thrust 3000N.

# Controller

## LED Lamp Instructions In Panel

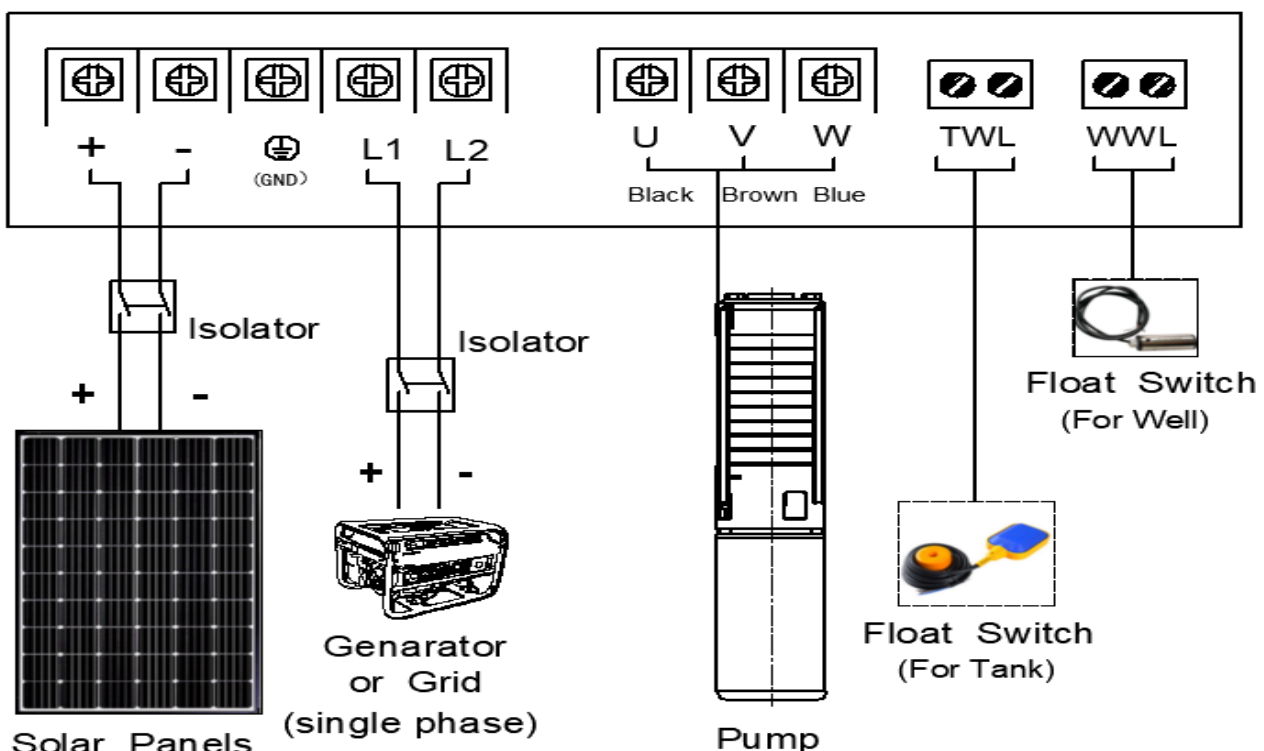
- ◆ LED **【 DC 】** : DC power supply, the indicator is on;
- ◆ LED **【 AC 】** : AC power supply, the indicator is on;
- ◆ LED **【 Run 】** : Controller is turned on, the indicator lights up, Associated with **【 ON/OFF 】**
- ◆ LED **【 Dry 】** : Alarm for pump dry protection, Associated with **WWL** terminals Or **low power** ;



- ◆ LED **【 Tank 】** : Alarm for Water tank full protection , Associated with **TWL** terminals;
- ◆ LED **【 V 】** : When this indicator light is on, Voltage is displayed;
- ◆ LED **【 A 】** : When this indicator light is on, Current is displayed;
- ◆ LED **【 P 】** : When this indicator light is on, Power value is displayed;
- ◆ LED **【 Speed 】** : When this indicator light is on, Speed is displayed;

- ◆ LED **【 Fault 】** : Alarm for Various fault;
- ◆ LED **【 Model--Auto 】** : **AUTO MODE**: Intelligent selection of DC or AC power, DC first.  
In **AUTO Model**, AC power is being used, and Led **【 Model--AC 】** flashes once every 3S;  
In **AUTO Model**, DC power is being used, and Led **【 Model--DC 】** flashes once every 3S;
- ◆ LED **【 Model--AC 】** : **AC MODE**: power supplied from a Generator or Mains power;
- ◆ LED **【 Model--DC 】** : **DC MODE**: power supplied from a Solar Array or Battery storage;
- ◆ Press **【 SET 】** , Select power supply mode, **AUTO**、 **AC** or **DC MODE**.
- ◆ Press **【 SWITCH 】** , check the **【 V 】** , **【 A 】** , **【 P 】** , **【 Speed 】** cycle.

## Electrical Connections



## Parameter Setting

### Step 1: Enter the setting interface.

- Press and hold **【 SET 】** and **【 SWITCH 】** at the same time for 3 seconds. After 5 seconds countdown, H00 will be displayed

### Step 2: Enter parameter change password (Default password H00-12)

*Note: please enter correct password before any parameter change process ,or change will useless .*

- Press **【 SET 】** to enter H00, and adjust H00 value to 12 through **【 UP 】** and **【 DOWN 】**
- Press and hold **【 SET 】** for 3 seconds to save the parameters and return to H00

*Note: Short press 【 SET 】 to return to H00 directly, but the parameter is not saved and does not work.*

### Step 3: Set various parameters, such as speed, power, etc

*Note: Various parameter codes H00 ~ H09, refer to table 1.*

- After set H00 value to 12 and save it. Adjust parameter H01-H09 through up and down.
- Press **【 SET 】** to enter Hxx, and adjust Hxx value through **【 UP 】** and **【 DOWN 】**
- Press and hold **【 SET 】** for 3 seconds to save the parameters and return to Hxx

*Note: Short press 【 SET 】 to return to Hxx directly, but the parameter is not saved and does not work.*

### Step 4: Exit the parameter setting interface

- Short Press the **【 SWITCH 】** Exit the setting interface

*Note: No operation in the setting interface for 2min, it will exit automatically*

### Step 5: Restore factory parameters (Default H00-10)

- Set H00 to 10 and save, For specific operation, refer to step 2.

## Parameter Code And Default Value

Table 1

Code	Interpretation	Adjustable range		Default value
H00	10: Restore the factory settings or 12: Change the parameter password	0-12		0
H01	High voltage protection value	450		450V
H02	Low voltage protection value	50		50V
H03	Maximum speed	2500-4200RPM		4000RPM
H04	Tank full recovery time(TWL)	30-1800S		600S
H05	Recovery time of dry protection(WWL)	30-1800S		600S
H06	Recovery time of dry protection(Low power)	300-1800S		1800S
H07	Maximum DC input power	0.5HP	300-750	750W
		0.75HP	300-1000	1000W
		1HP	500-1200	1200W
		1.5HP	500-1800	1800W
		2HP	500-2200	2200W
		3HP	500-3000	3000W

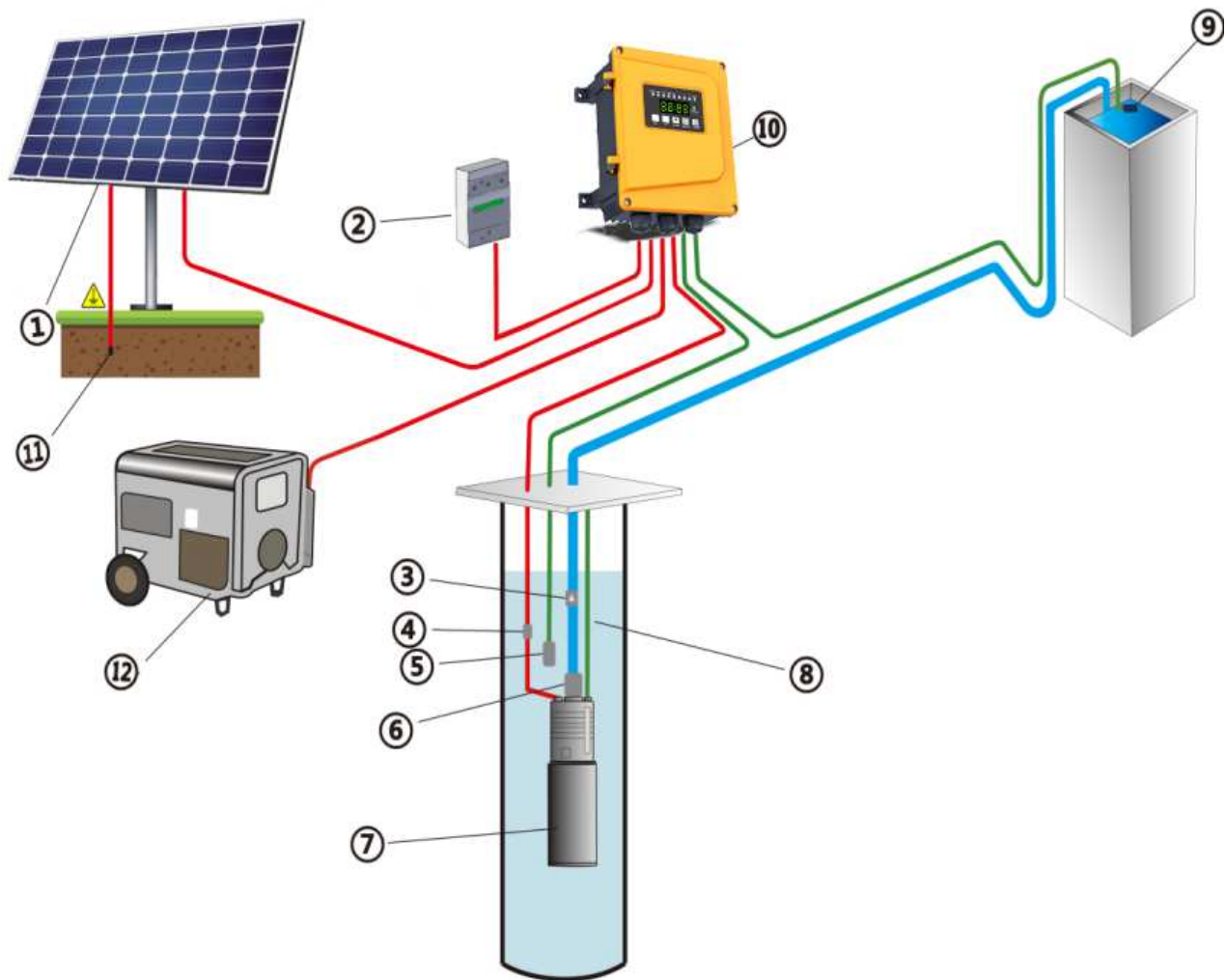
## Alarm and Fault code

Table 2

Code	Interpretation	Causes and Solutions
<b>P50</b>	Low voltage protection	◆The Voltage below the requirement
<b>P51</b>	High voltage protection	◆The voltage exceeds the requirement
<b>P48</b>	Dry protection	◆Water shortage in well, low power ◆ <b>WWL</b> “closed” .
<b>P45</b>	Tank Full	◆Water tank full , <b>TWL</b> “Open” .
<b>P02</b>	PFC protection	◆PCB fault, need to return to factory for inspection
<b>P09</b>	U phase over current	◆Controller U phase output over current
<b>P10</b>	V phase over current	◆Controller V phase output over current
<b>P11</b>	W phase over current	◆Controller W phase output over current
<b>P43</b>	Phase Missing Protection	◆Phase loss of controller output; ◆ The wiring between the motor and the controller is loose. ◆The cable is damaged and needs to be replaced. ◆The motor may be damaged. Please check the motor resistance between every 2 items of UVW,exceed 15% is not allowed
<b>P44</b>	Short circuit protection	◆ Short circuit of cable or terminal between motor and controller; ◆ the motor or cable is damaged;
<b>P46</b>	Stall Protection	◆The pump is blocked or jammed; remove the jam ◆ check whether the connection between the pump body and the motor is smooth; ◆ motor bearing damage, need to replace the bearing
<b>P60</b>	Controller High Temperature	◆ Keep good ventilation and heat dissipation near the controller
<b>P20</b>	Abnormal fan	◆ The fan is damaged or jammed; remove the jam or replace the fan
<b>E10</b>	PCB component failure	◆PCB damaged, need to return to factory for inspection
<b>E00</b>	Power mode error	◆ Power mode error,please chose <b>Atuo</b> mode ◆ AC/DC wrongly connected.The <b>L1 / L2</b> terminals of the controller correspond to AC power, <b>+/-</b> correspond to DC power



## System Installation Diagram



- 1、Solar Panel Array
- 2、SPD(DC-600V), Surge Protection Device (Optional)
- SPD(AC-275V), Surge Protection Device (Optional)
- 3、Check valve (Optional)
- 4、Wiring waterproof assembly
- 5、The Low-Level Float (For Well ,Optional)
- 6、Sacrificial Anode (Optional)
- 7、Water Pump End and BLDC Motor
- 8、Safety rope
- 9、The High-Level Float (For Tank ,Optional)
- 10、External controller
- 11、Grounding pile (Optional)
- 12、Generator (Single phase 220V)



*SAMKING solar pump operation is very simple, please read the manual carefully before use.*



# System Installation

## Water Source

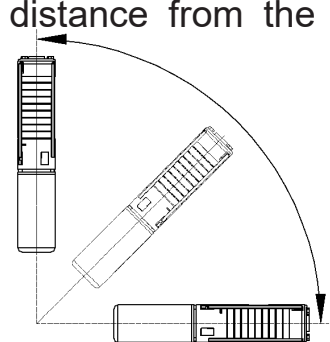
The water source must be “clean water” , free from contaminates such as, dirt, dust, loose rocks, decaying organic matter and other foreign bodies that could block the intake screen or fowl the impeller stack. Sand content not to exceed 120g/m<sup>3</sup> of water pumped.



*The new bore must be clean before installation. A helical pump must **NEVER** be used to bail a new bore. Warranty does not cover failure or wear due to abrasives in the water.*

## Pump Installed

- ◆ Before the pump is put into the well, test run in the tank to ensure that the pump works normally;
- ◆ Make sure the pump is completely submerged in water;
- ◆ When the pump is installed, it must keep a certain distance from the bottom. Prevent sand from burying and damaging the pump.
  - In well, the pump and the bottom keep 1.5m;
  - In open water, such as river, keep 0.3m.
- ◆ Allowable installation angle of pump 0-90°.
- ◆ Allowable operating temperature 0-40°C.

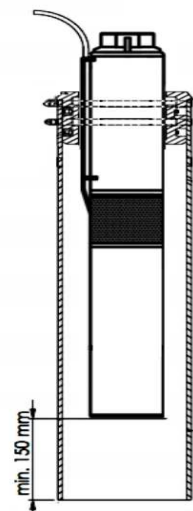


## Heat Dissipation Requirements For Pump Installation

In all installation positions, the Solar motor must be fully submerged and a minimum water flow across the motor during operation of 8cm / sec before entering the pump intake.

To induce the correct water flow across the motor use of a flow inducing sleeve should be used when:

- ◆ Well diameter too large relative to motor diameter to induce correct flow.
- ◆ Motor and Pump are in open water.
- ◆ Motor and Pump are in a rock well or below casing.
- ◆ The Bore is top feeding (water enters intake without passing over motor).
- ◆ Motor and Pump are set in screens.



## Installation Of The Float

### **The Low Level Float**

- ◆ The low-level float fitted into the **WWL** terminal to prevent dry running.



*It is an option for centrifugal pump, but it **must** be installed for Helical pump to prevent dry running.*

- ◆ The low-level float must be Vertical installed of 150mm above the pump outlet.

- ◆ When the water level rises the pump will restart after a 10-minute delay, The display shows the countdown of delay time.



### **The High Level Float**

- ◆ The High-Level float fitted into the **TWL** terminal to prevent the tank is full.
- ◆ To prevent the pump from starting and stopping frequently, adjust the float to a suitable swing range.
- ◆ When the float “closed”, the pump will restart after a 10-minute delay, The display shows the countdown of delay time.



## SPD( Surge Protection Device )

The Surge Protection Devices protect the system from lightning. Where lightning damage is likely to occur, SPD must be effectively installed and the system must be effectively grounded.



*Please select suitable SPD, AC and DC mode, and the voltage specification should not be lower than the maximum voltage of the system.*

- ◆ DC SPD rated Voltage 600V;
- ◆ AC SPD rated Voltage 275V.

### **Installation Of Controller**

The SAMKING Controller Panel is IP65 Rated however it is recommended that the panel is not mounted in direct sunlight. It is recommended to install on the back of solar panels or in a room or control cabinet with good heat dissipation.

### **Distance Between Controller And Pump**

The farthest installation distance between SAMKING controller and motor is 400m. The further installation distance may lead to control failure. In addition, the cable between the motor and the controller will cause power loss. For long distance installation, please thicken the cable specifications as required.

### **Check Valves**

Check valve can effectively prevent the impact damage caused by water hammer on the pump. It is recommended to install a check valve every 70m of the vertical height of the pipeline.

Areas where water freezes in winter, When installing check valve, it is necessary to consider pipeline drainage or pipeline protection.



## Extension Cable Specifications

Locate the solar array and the controller as close to your water source as possible. It is important that energy losses are minimised to ensure performance expectations are met.

The following parameters are calculated based on power loss not exceeding 8% and voltage drop not exceeding 5%.

Table 3

Input Power	Cable specification (mm <sup>2</sup> )				
	2.5	4	6	10	16
	Maximum allowable length of cable (m)				
0.5HP	44	70	104	135	200
0.75HP	50	76	120	187	230
1HP	60	87	132	193	280
1.5HP	75	105	150	217	348
2HP	82	122	183	304	400
2.5HP	95	139	209	348	400
3HP	109	174	261	400	

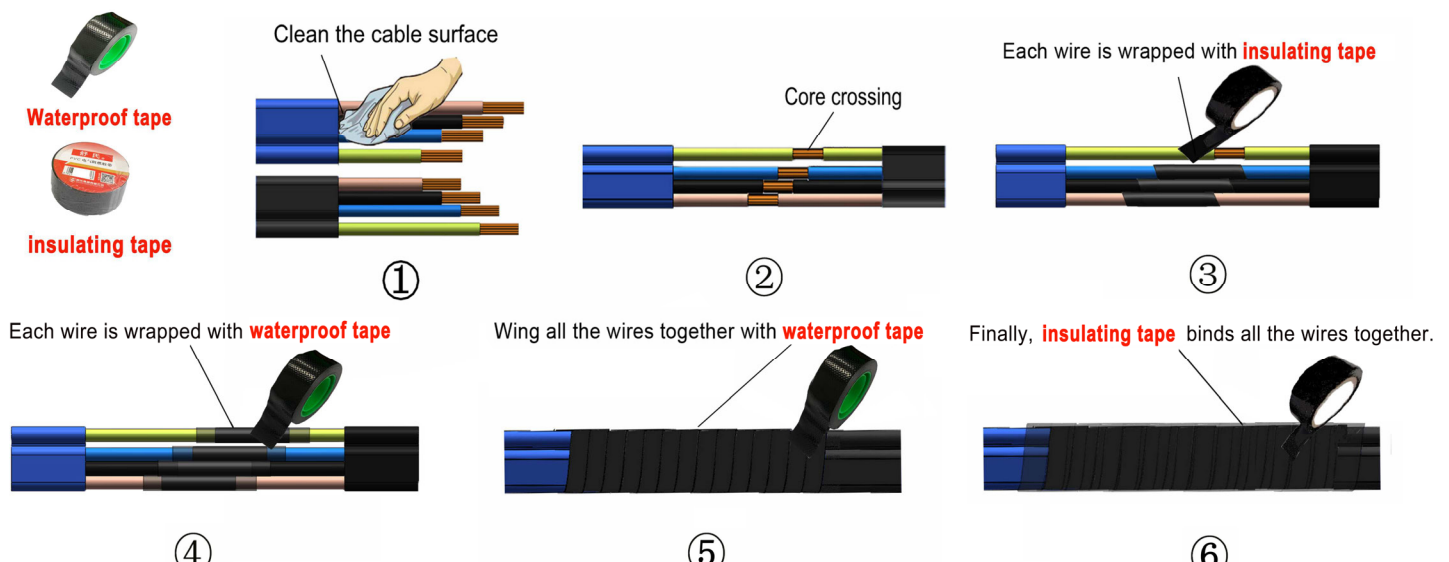


- ◆ Total cable length measured from the solar array to the pump motor.
- ◆ The distance between the motor and the controller should not exceed **400m**.
- ◆ Do not use the cable to carry the weight of the pump or make the cable bear any tension. The cable should be kept in a relaxed state.
- ◆ Drop cable should be affixed at three metre intervals by a suitable underwater tape with the cable having some slackness between each interval.

## Extension cable Jointing

The effective contact and waterproof of the joint of the cable extension line are the necessary conditions for the pump system to work for a long time. The wrong method may lead to electric leakage, and cause the pump system can not work or corrosion, and even cause personal injury.

The factory provides an effective wiring method and material, please follow the steps in the picture.



# Solar Array Installation



## Warning

- The power supply from a DC power source such as solar panels can cause **SERIOUS HARM** or **DEATH** from electrocution
- Use appropriate safety procedures when working on any system component
- Only suitable qualified personnel should carry out electrical connection /disconnection
- Off-grid electrical equipment is subject to applicable regional and national electrical standards
- Always treat solar panels as **LIVE** and handle with care
- Use correctly rated electrical cable and connectors

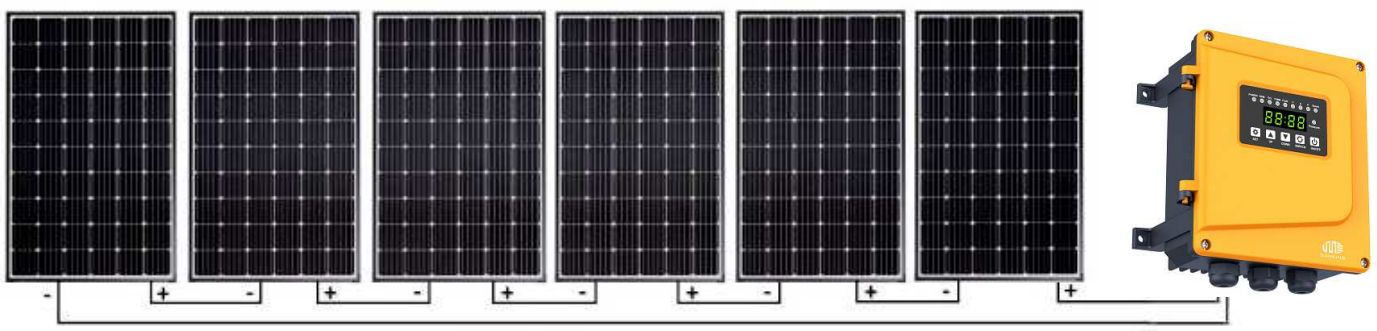
## Solar Panel Glossary of Electrical Terms

Table 4

Term	Definition
VOC(V)	Volts open circuit,nothing connected
Vmp(V)	Volts maximum power point,under load
Isc(A)	Amps short circuit
Imp or Impp(A)	Amps maximum power point

## Solar Panel Connection(Recommended in series for the Pumps )

In order to make the system more safe and effective, the maximum DC input current of this series of pumps is limited to 10A. Therefore, Solar panel parallel system can not play the maximum efficiency. In General, solar panels in series are recommended.



**In series solar panel system, VOC,Vmp and Power are calculated as follows:**

- $VOC \text{ of System} = VOC \text{ of each solar panel} \times \text{Number of solar panels};$
- $Vmp \text{ of System} = Vmp \text{ of each solar panel} \times \text{Number of solar panels};$
- $\text{Power of System} = \text{Power of each solar panel} \times \text{Number of solar panels}$
- $\text{Current of System} = \text{Current of each solar panel}$

## Motor and Controller Input Energy Limitations:

Table 5

Motor& Controller	AC		SOLAR / DC			Solar panels (340W)	
	Voltage	Max. Current	Vmp	Max. VOC	Max. Current	Accept	best
0.5HP	150-240	10A	60-380	450	10A	( 2-10 ) Pcs	( 2-3 ) Pcs
0.75HP	150-240	10A	60-380	450	10A	( 2-10 ) Pcs	( 3-4 ) Pcs
1HP	150-240	10A	60-380	450	10A	( 2-10 ) Pcs	( 3-5 ) Pcs
1.5HP	150-240	12A	60-380	450	10A	( 2-10 ) Pcs	( 4-6 ) Pcs
2HP	150-240	12A	60-380	450	10A	( 2-10 ) Pcs	( 5-7 ) Pcs
2.5HP	150-240	12A	60-380	450	10A	( 2-10 ) Pcs	( 7-10 ) Pcs
3HP	150-240	12A	60-380	450	10A	( 2-10 ) Pcs	( 7-10 ) Pcs



*The pump system must not exceed the allowable VOC voltage , otherwise, it will cause pump damage and even personal damage. Damage caused by incorrect voltage is not Warranty.*

## Solar Array Installation Considerations:

- The installation direction of solar panels must be determined according to the installation position. Generally, in the southern hemisphere, the solar panels should face north. In the northern hemisphere, it should face south.
- The solar panel angle should correspond to the latitude of the site. Consult the instructions supplied with the solar array to assist your decision regarding the best angle for your situation.
- Any shading whatsoever will reduce the solar panel(s) performance so locate the panels with this in mind. Panel shadowing is like “open circuiting” a panel.
- Dust or bird droppings will impair the array energy output. Keep panels clean.
- Ensure the array is earthed to ground in the event of lightning strike.



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