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.The system can be also supplied by AC 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:

- Accepts AC (50Hz&60Hz） or DC power ;
- High efficiency BLDC motor;
- High efficiency MPPT and Vector control;
- External controller;
- Display of voltage, current, power, etc;
- Water filled motor(No leakage pollution);
- Thrust Bearing system;
- GPRS (Remote monitoring，optional);
- Dry protection;
- Over-load protection;
- Over-voltage protection;
- Low-voltage protection;
- Lost Phase protection;
- Stall protection;
- “Dead Head” protection;
- Error 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 、 plastic impeller pump or helical 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 pollution。

All different types of pumps are same motor and controller. The centrifugal pump motor is 1000 rpm to 4000 rpm depending on the power input and load.

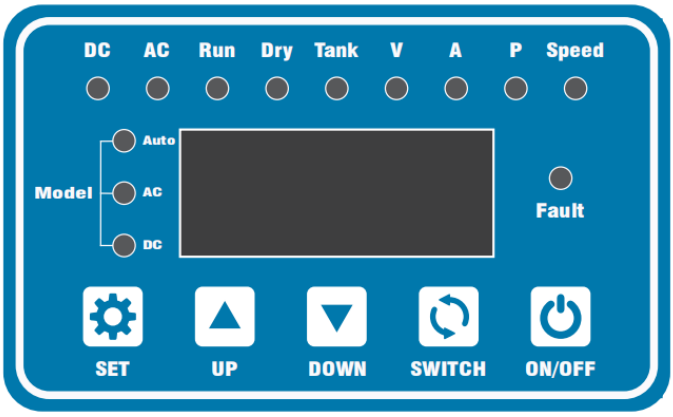
Here are some of the installation parameters used:

- ◆ The maximum submergence depth is 150m;
- ◆The sediment content of water source shall not exceed 120g/m^3；
- ◆ Recommended water temperature of 0 to 40℃;
- ◆ Maximum axial thrust 3000N.
- ◆ Standard 4-inch NEMA connection .
- ◆ Max.Input Power AC 2200W ， DC 3000W.

Controller

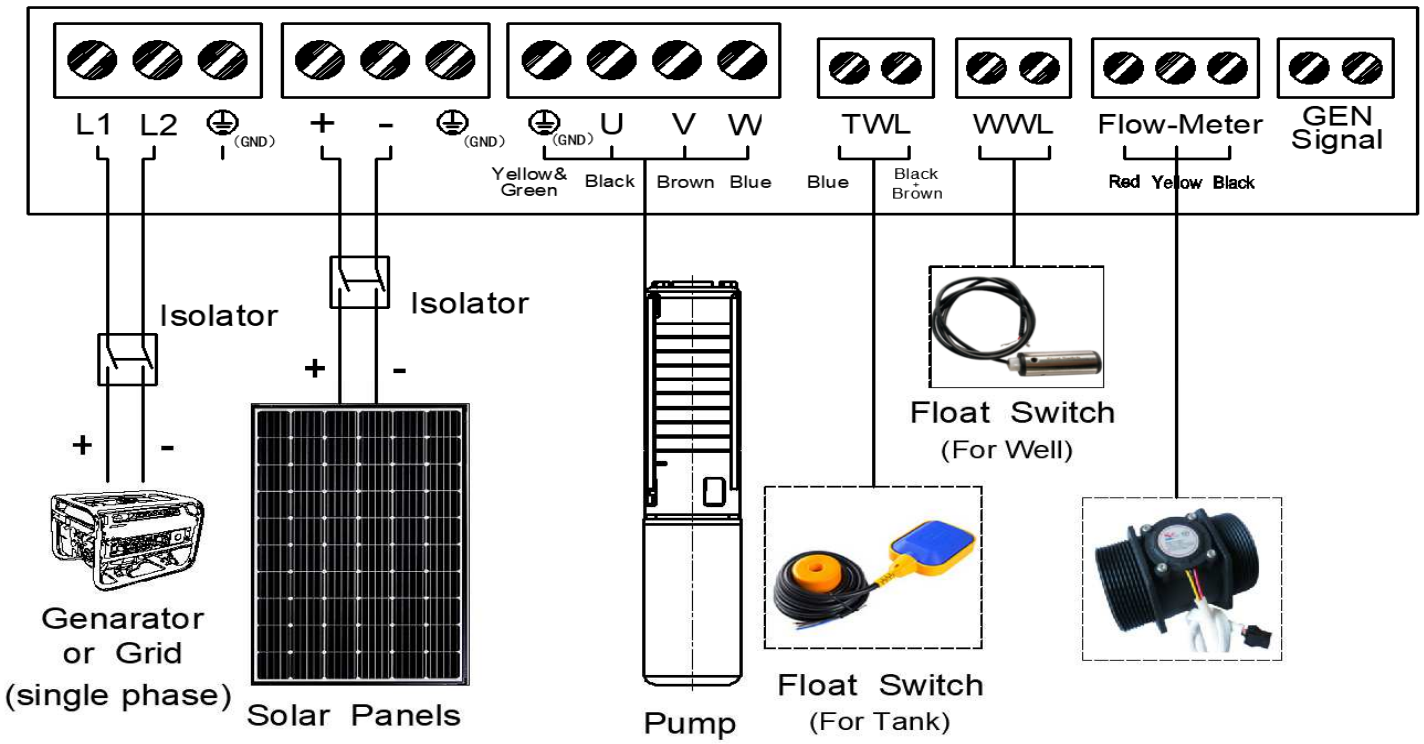
LED Lamp Instructions In Panel

- 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



If the maximum voltage is exceeded, the controller will be damaged irreparably.Maximum voltage see page 15（table5）.

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：If there is 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 12: Change the parameter password	0-12	0
H01	High voltage protection value	480V	480V
H02	Low voltage protection value	40-150V	40V
H03	Maximum speed	2500-4000RPM	3900RPM
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	500-3000W	3000W
H08	Minimum DC operating power	0-1200W	0(Function Off)
H09	Recovery time of over temperature protection	30-1800S	30S
H12	Each time AC power is used, the minimum continuous working time of AC power	60-1800S	600S
H13	GEN MODE	/	0
H14	Flow-Meter protection	0---Function off 1---Function on	0
H15	Recovery time for Flow-Meter protection	180-3600S	1800S

Alarm and Fault code

Table 2

Code	Interpretation	Causes and Solutions
P50	Low voltage protection	◆The Voltage below the requirement
P51	High voltage protection	◆The voltage exceeds the requirement
P48	Dry protection	◆Water shortage in well, low power ◆**WWL** "closed".
P45	Tank Full	◆Water tank full ,**TWL** "Open".
P02	PFC protection	◆PCB fault, need to return to factory for inspection
P09-P11	U phase over current	◆Controller output over current
P43	Phase Missing Protection	◆Phase loss of controller output; ◆The wiring between the motor and 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.
P44	Short circuit protection	◆Short circuit of cable between motor and controller; ◆ the motor or cable is damaged;
P46	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
P60	Controller High Temperature	◆Keep good ventilation and heat dissipation near the controller
P20	Abnormal fan	◆The fan is damaged or jammed; remove the jam or replace the fan
P80	Flow-Meter protection	◆The flow protection function is on, no water passes through or the flow-meter is not installed correctly.
E10	PCB component failure	◆PCB damaged, need to return to factory for inspection
E00	power is lost	◆ The input voltage is unstable ◆Input power supply does not match 【**Mode**】.**For example,**Select **Mode-DC** ,just AC power input.

Intelligent switching between AC and DC

The controller provides three working modes： AUTO, AC and DC；

When **AC MODE** is selected，The pump system can only work witch AC power;

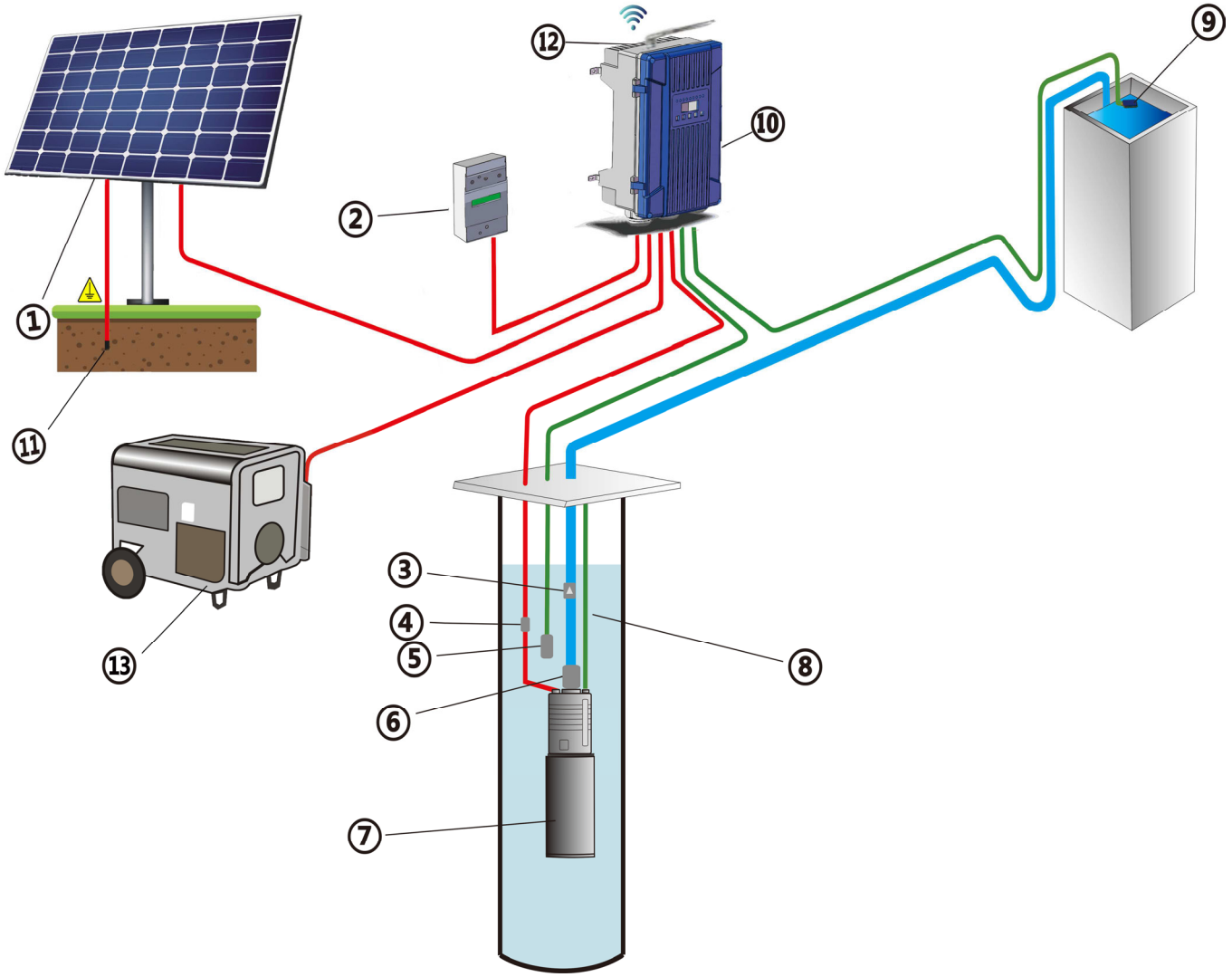
When **DC MODE** is selected，The pump system can only work witch DC power;

When **AUTO MODE** is selected，The pump system can work witch DC or AC power,DC first.When the system is short of DC power, it will switch to AC power automatically.When DC power supply is restored, the system switches back to DC power.

In order to avoid frequent switching between AC and DC power when the sun is weak.In **AUTO MODE**, once AC power is used, it will be kept running for at least a period of time (Default 3min) before switching back to DC power.The minimum operation time of AC can be adjusted by parameter **H12**

Under normal conditions, when the DC voltage is lower than 40V, it will switch to AC automatically. However, in order to ensure sufficient continuous working time of the pump, you can adjust the parameter **H08**. When the DC input power is lower than a certain value, the AC power will be automatically switched to use, and it will be switched back to DC after 10min Or adjust the time by **H12**.

System Installation Diagram



- 1、Solar Panel Array
- 2、SPD(DC), 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、GPRS (Optional)
- 13、Generator（Single-phase,Optional）

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/m3 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

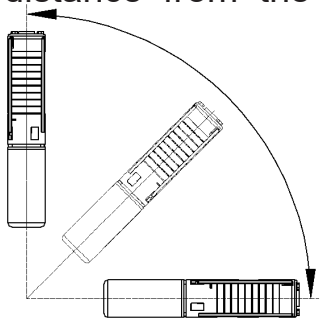
◆ Before the pump is put into the well, test run in the tank to ensure that the pump works normally;

◆ 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℃.

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:

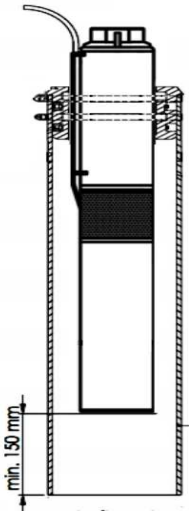
◆ Well diameter too large relative to motor diameter to induce correct flow.

◆ 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.

Pressure Switch And Mechanical Float

When the pipeline is very long, it is not convenient to install the long-way floating ball cable. Pressure switch and mechanical floating ball is a kind of alternative to the High-Level float.

The mechanical float is installed at the outlet of the pipeline. When the water tank is full, the floating ball is closed and the pipeline pressure is increased. When the pressure switch changes state,and stop the pump by changing the **TWL** or **WWL** status. When the water level of the water tank drops, the pump returns to work.

◆ Normally closed pressure switch connected to **TWL** terminal

◆Normally Open pressure switch connected to **WWL** terminal

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.

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.The distance between the motor and the controller should not exceed 250m.Longer line, easy to cause the motor to run in the state of losing control.

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.

GPRS/RMS

The GPRS/RMS integrated module is a micro monitoring and remote operation system specially designed for solar pump system. The GPRS module is integrated in the controller. Customers can check the pump's running state and control start and stop by web or mobile phone APP terminal.

Function:

◆ check the device operation parameters, such as: voltage, current, instantaneous power, PV power and pump flow

◆abnormal indication, when the equipment running voltage, current and so on abnormal.

◆ web and APP end start and stop equipment.

◆ Historical data view and download.

Operation:

◆ Open Controller install SIM card and antenna;

◆ Enter the ID and password on the logon site;

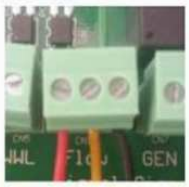
◆ Set the pump model and head correctly.

Note: The specific operation can be referred to the GPRS instruction manual.

Flow-Meter

The head and flow of solar pump will change with the change of sunlight.When the sunlight is weak and the power is insufficient, it may appear that the pump is working.But the water can't be sent to the pipe outlet. At this time, the water temperature in the pump and pipeline will rise, and it will reducing the service life of the system. We call him “dead head”. The installation of flow meters provides a protection method . When there is no water pass through the flow meter, pump will stop for protection. Resume automatic operation after Specified time(Default 30min).

- When parameter **H14** is set to 1, the function is effective
- The installation sequence of flow-meter cable is red, yellow and black



Flow Meter Terminal

Generator

The single-phase generator can be directly used to supply power to the pump system, and the voltage should not exceed 240V.Some” Poor quality” generators will produce instantaneous high-voltage in the starting process. This can cause damage to the controller.Therefore, it is suggested to install a air switch between generator and controller. Keep switch “off” when starting the generator. After the generator operates normally, close it.

- Single-phase
- Voltage ⩽ 240V
- Recommended power ⩾ 3 kW

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

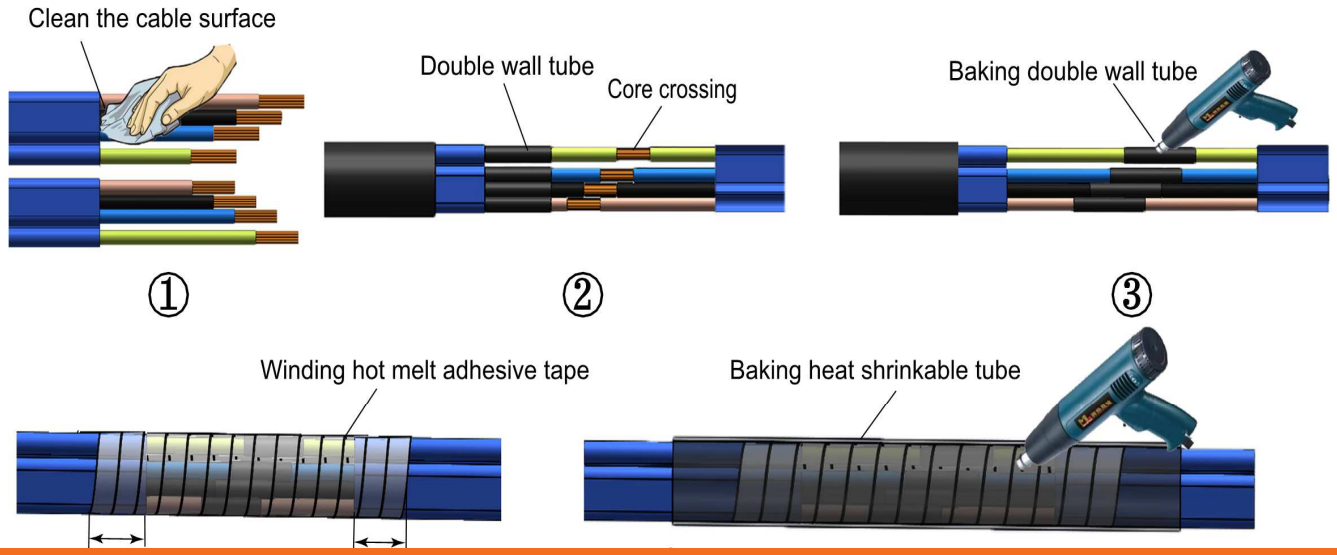
Motor	Input Power (w)	Cable specification （mm^2）					
		2.5	4	6	10	16	25
		Maximum allowable length of cable (m）					
0.5HP	600	22	35	52	87	139	217
1HP	1200	43	70	104	174	278	435
1.5HP	1500	54	87	130	217	348	543
2HP	2100	76	122	183	304	487	761
2.5HP	2400	87	139	209	348	557	870
3HP	3000	109	174	261	435	696	1087

◆ Total cable length measured from the solar array to the pump motor.
◆ In order to reduce the power loss caused by long cables, more solar panels can be selected. When more solar panels are used, a thinner cable can be selected,However, the maximum allowable voltage should not be exceeded.
*◆The distance between the motor and the controller should not exceed **250m.**Longer line, easy to cause the motor to run in the state of losing control.*
◆ 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

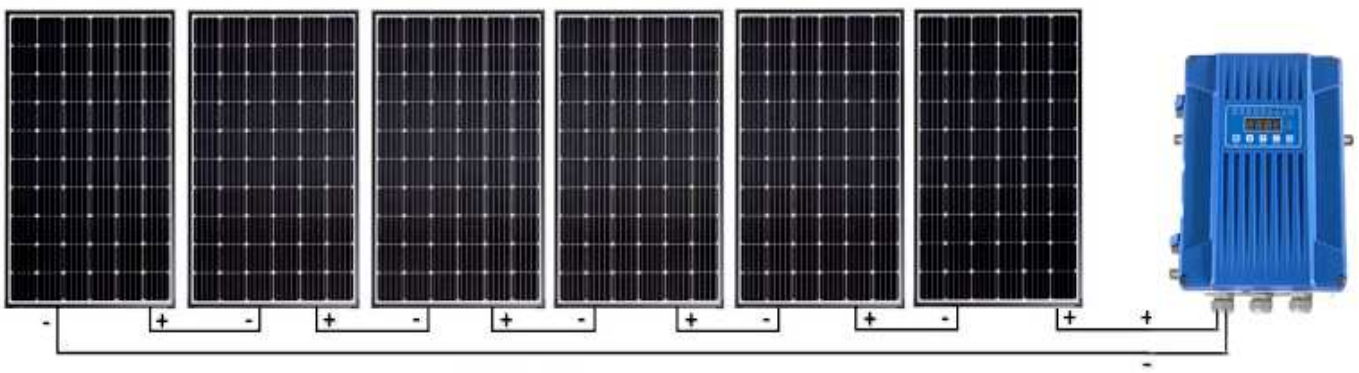
Solar Panel Glossary of Electrical Terms

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 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 of System = VOC of each solar panel × Number of solar panels;
- Vmp of System = Vmp of each solar panel ;
- Power of System = Power of each solar pane ×Number of solar panels

Motor and Controller Input Energy Limitations:

1、 DC Power

Table 5

Power Supply	Vmp	Max. VOC	Max. Current	Max.Input Power
DC	60-380	440	10A	3000W

Recommended for solar panels 300W*(2~10)

2、 AC Power

Power Supply	Voltage	Max. Current	Max.Input Power
AC	1X90-240V	10A	2200W

The pump system must not exceed the allowable VOC voltage or AC 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.