



# SMPT Solar Pump Controller

## User Manual



# Preface

Thank you for using SMPT series products, this manual provides you with relevant operation instructions and detailed description of parameters. Please read this manual carefully before installation, running, maintenance or inspection.

Please make sure the wiring and the pump's rotation direction is correct before use.

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## Notes for Safe Operation

### ■ Before Installation




- Cannot install or operate the controller while it's damaged or has missing parts. Otherwise, it may result in equipment damage or personal injury.

### ■ Installation



- Hold the bottom of the controller when installing or moving the controller, please do not just hold the shell.
- When the controller is mounted in a protective cabinet which needed to set vents to ensure ambient temperature is below 40°C, otherwise the controller may be damaged because of high temperature.
- The controller can be installed under the PV array and should avoid direct sunlight.



- Ensure only qualified person to install. Otherwise it can cause an electrical shock or the damage of the controller.
- Make sure the controller is isolated from power supply by the circuit breaker. Otherwise it may cause a fire or electrical shock.
- Make sure that the ground terminal  is grounded correctly.

**■ Run**

- Do not open or remove the front cover when system running. Otherwise it may cause an electrical shock.
- Can not make the pump dry-run for a long time before testing the pump. The maximum dry-run time cannot be more than 15 seconds.
- It will impact the draw water ability, if the pump turning is reversed. Please connect the pump lines according to the installation manual.
- Due to the light exposure, it will restart the operation after 120s (default).

**■ Maintenance and check**

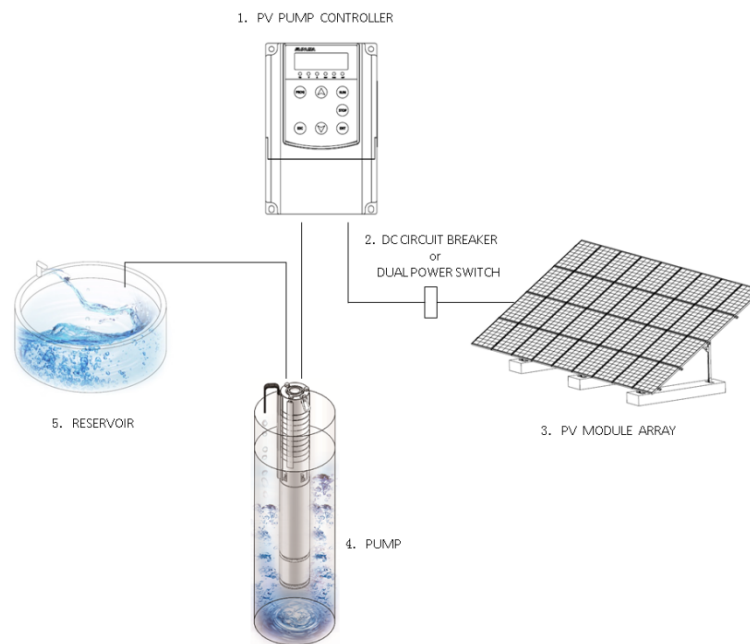
- Only qualified or authorized professional personnel can maintain, replace and inspect the controller. Otherwise it may cause damage and injury.
- Wait at least 20 seconds after power off, or make sure there's no residual voltage before maintenance and inspection, otherwise it may cause damage.

**■ Others**

- If failing to follow these instructions, and resulting in the damage to the equipment, will void the warranty service.

# 1 How It Works

The ePump system serves to apply a clean water solution where electrical grid power is either unreliable or unavailable. The controller can convert DC from the PV array to AC, and drive the pump. In sunny days, the ePump system can continuously pump water. Recommended to take water pumped to a reservoir for later use and water sources are those natural or special such as river, lake, well or waterway, etc. if the system without batteries and other energy storage devices. A float switch can be installed in the water tower or in the well to control the pump operation and detect the well water. When the water shortage, pump will stop. Figure 1 shows a typical diagram of a ePump system. The major parts and components of the system are listed in the following diagram.



**Figure 1: ePump system operation diagram**

The ePump system is designed which consists of:

- 1、 PV module array
- 2、 DC Breaker
- 3、 SMPT series solar pump controller
- 4、 pump and motor
- 5、 reservoir
- 6、 water tower

The SMPT solar pump controller runs at variable speed while match the changing power provided by the PV module array. Variable speed operation means there is no surge of energy during the motor start-up, helping to eliminate the abrasion on the motor and

pumping system.

## 1.1 Features

### System Diagnosis

The SMPT solar pump controller continuously monitors system performance and detects a variety of abnormal conditions. In many cases, the controller will compensate as needed to maintain continuous system operation; however, if there is high risk of equipment damage, the controller will protect the system and display the fault condition. If possible, the controller will try to restart itself when the fault condition subsides. See Fault Diagnosis and Elimination section for a list of Fault Codes and corrective action.

### Motor Soft-Start

Normally, when there is demand for water and power is available, the SMPT solar pump controller will run. Whenever the SMPT solar pump controller detects the requirement for water, the controller always increase the motor speed while gradually increasing motor voltage, resulting in a cooler motor and lower start-up current compared to conventional water systems. Due to the controller's soft-start feature this will not harm the motor.

### Over Temperature Monitor

The SMPT solar pump controller is designed for full power operation from a PV module array in ambient temperature up to 45°C. In excess of 45°C temperature conditions, the controller will reduce output power in an attempt to avoid shutdown. Full pump output is restored when the controller temperature cools to a safe level.

### Float Switch

The SMPT solar pump controller can access two float switches which detect and remotely control the pump automatically. The float switch in the tank (or tower) is optional, not mandatory.

## 2 General Information

The SMPT solar pump controller is a variable speed motor drive designed to run the IEC standard three-phase asynchronous motor. The SMPT solar pumping system provides water to remote locations by converting high voltage, direct current from a PV module array into alternating current to run a standard three-phase asynchronous motor. The controller provides fault detection, motor soft start, and speed control. The SMPT solar pump controller is designed to provide these features with the plug and play ease of installation.

The SMPT solar pump controller is designed with the high standard of reliability expected products. The controller attempts to drive the pump and motor to deliver water even under tough conditions, reducing output as necessary to protect the system components from damage, and only shutting down in extreme cases. Full operation is restored automatically whenever abnormal conditions subside.



## 2.1 Inspection

Before using the SMPT solar pump controller unit, verify that the part number is correct and that no damage has occurred during transport.

Notice: the SMPT solar pump controller is one component of ePump system which has other two components, PV module array and AC pump with motor.

## 2.2 Descriptions and Features

The SMPT solar pump controller continuously monitors system performance and incorporates a number of features for pumping system protection. In the event of a fault, the SMPT solar pump controller will indicate the type of fault through the LED display mounted on the front cover of controller.

The ePump system is optimized for pumping under tough input power conditions to PV module arrays:

A: Internal diagnosis is ok for a lower input voltage.

B: Whenever possible, the controller will maximize use the power output from the PV module array to drive the pump.

C: An easy to use interface is provided to enhance configurability and enable remote system monitoring.

## 2.3 Protection Features

Electronic monitoring offers the controller the capability to monitor the system and automatically shut down in the event of:

- Dry well conditions – with float switch
- Bound pump – with auto-reversing torque
- High voltage surge
- Low input voltage
- Open phase circuit
- Short circuit
- Over heat
- Over load

## 2.4 Solar Pump Controller Model Description

### 2.4.1 Model Description

**SM P T – R75**  
 ①      ②      ③      ④

Segment	Description	Options
①	SM	Company code
②	ePump series	Product code
③	with boost or not	B:with boost circuit T:no boost circuit
④	Motor Power Rating	R75:0.75kW; R:decimal point

**Table 1: Model Description**

### 2.4.2 SMPT Solar pump controller General parameters

SMPT Solar pump controller General parameters			
<b>Protection</b>			
Surge Protection	Integrated	Overvoltage Protection	Integrated
Undervoltage Protection	Integrated	Locked pump Protection	Integrated
Open circuit Protection	Integrated	Short circuit Protection	Integrated
Overheated Protection	Integrated	Dry-run Protection	with float switch
<b>Communication</b>			
with RS-485 Isolated,Support Modbus protocol			
<b>Other</b>			
Ambient Temperature Range	-20°C ~ 60°C ; > 45°C ; lower power		
Cooling Method	Fan Cooling		
Ambient Humidity	≤95%RH		
Standard Warranty(month)	18		
Certificates	EN 62109-1:2010, EN 61000-6-2:2005,EN 61000-6-4:2007+A1:2011		

**Table2: General parameters**

## 2.4.3 SMPT Solar Controller Input and Output Data

SMPT Solar pump Controller Input and Output Data				
Controller Model	SMPT-R38	SMPT-R55	SMPT-R75	SMPT-1R5
<b>Input Data</b>				
Max Input Voltage(Voc)	DC 250V			DC 400V
Min Input Voltage, at MPP	DC 180V			DC 375V
Recommended Voltage, at MPP	DC 180 - 230V			DC 375 - 400V
Recommended PV Array Power[kW]	0.68	0.99	1.35	2.6
<b>Output Data</b>				
Output Voltage, Rated	110V 3~			220V 3~
Max Amps(RMS)[A]	5	6.5	8	8
Output Power Rated[kW]	0.375	0.55	0.75	1.5
Output Frequency	0 ~ 60Hz			

Table3: Input and Output parameters

## 2.5 Outline & Installation Dimensions

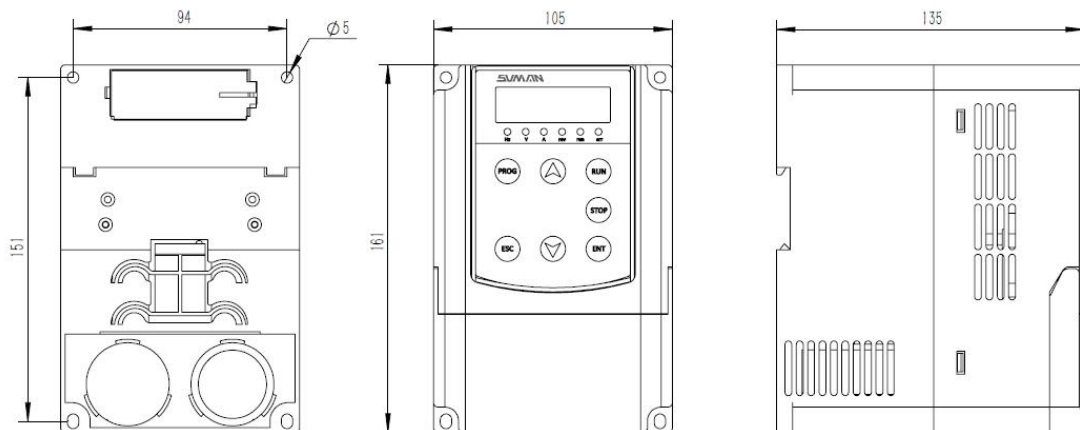


Figure 2: Dimensions of Controller

# 3 Mechanical and Electrical Installation

## 3.1 Mechanical Installation

### 3.1.1 Overheat protection

Install the SMPT solar pump controller in a control box with control terminals and power wiring. Install the control box out of direct sunlight to prevent overheating and bad performance. The optimum location is on the mounting pole for the PV module array

underneath the array for protection from the sun, heat, and weather elements. Placing the control box in direct sunlight or high ambient

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temperatures will result in reduced performance due to temperature protection of SMPT solar pump controller. For optimum performance, maximize the shading of the control box.

It is recommended that use a wire tube to protect the electric wire from the destruction of wildlife and natural weathering, and bury the wire tube into the ground to strengthen protection. If you do not use a wire tube, you can use a higher quality outdoor cable.

### 3.1.2 Location Selection

The SMPT solar pump controller is intended for operation in ambient temperatures up to 60°C, but in order to avoid overheating caused by the failure, it is recommended to install the controller in the shadow position.

## 3.2 Electrical Installation

### 3.2.1 Terminals

The following are typical figures of terminal blocks.

NOTE: Terminals are different in shapes and combinations, depending on different sizes of SMPT solar pump controller.

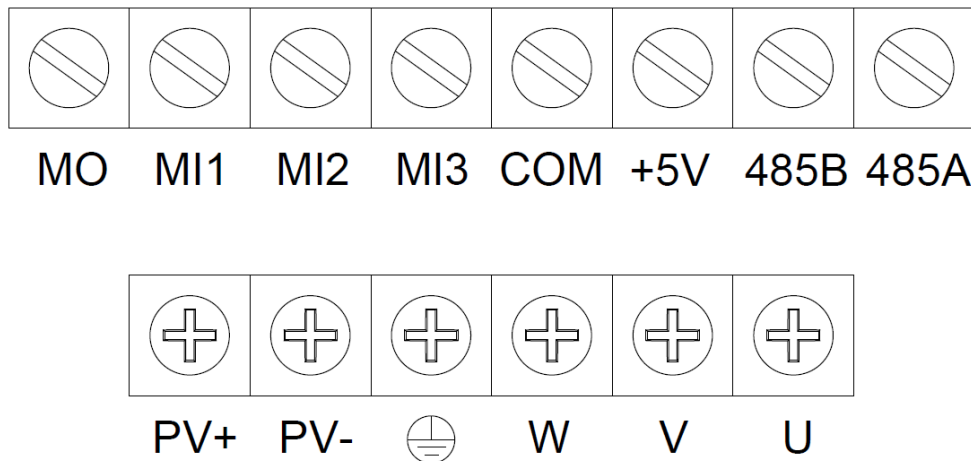


Figure 3: Terminal of Controller

### 3.2.2 Power in DC Wiring

For ePump System, a two-pole DC disconnect switch must be installed between the PV module array and the SMPT solar pump controller.

Connect the cable which comes from the two-pole DC disconnect Switch downstream terminals marked with “+” and “-”(positive and negative poles of solar panel output), to SMPT solar pump controller’s terminals block labeled as “PV+”, “PV-”.



Before connect DC wiring, following the steps below to prevent hazardous electric shock resulting in serious injury or device burning.

- Make sure that the external DC disconnect switch is off.
- To ensure that the polarity of the PV module array cable must be properly connected to the controller's +, - pole, otherwise possible damage the controller.

### 3.2.3 Ground Wiring



Ground terminal (GND) is labeled as this icon . Please refer to the instruction to this icon, or other equivalent icon or sign by local electrical codes or international standard. Correct grounding helps to prevent shock hazard if there is a fault in the motor.

### 3.2.4 Motor wiring

Connect the cable with four wires from the Motor to the controller terminal block to terminals U, V, W and GND. Check motor lead color to ensure correct installation.

Note: To reverse direction of motor rotation, reverse any two wires.

	GND	W	V	U
PUMP	Ground(GND)	Yellow(YEL)	Red(RED)	Black(BLK)

**Table4: Wiring of Pump and Controller**

### 3.2.5 Float water switch

Float switch lines offered in the accessories can be extended if customers have that requirements ( 21 AWG or equivalent specifications ) . Sunman recommend to connect by welding, and insure the waterproof and insulating performance of lines by using waterproof tape and insulating tape.

### 3.2.6 System Wiring Diagram

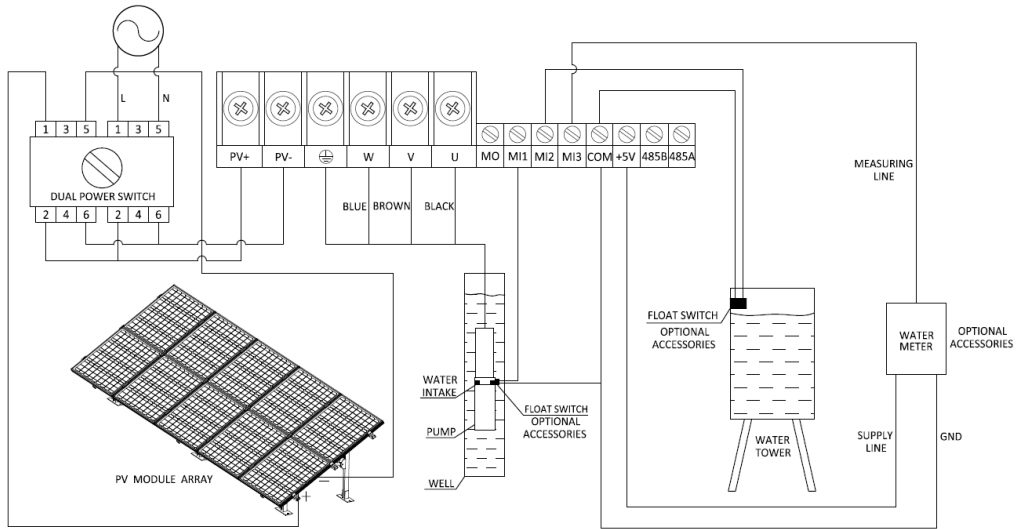


Figure 4: ePump System with dual power

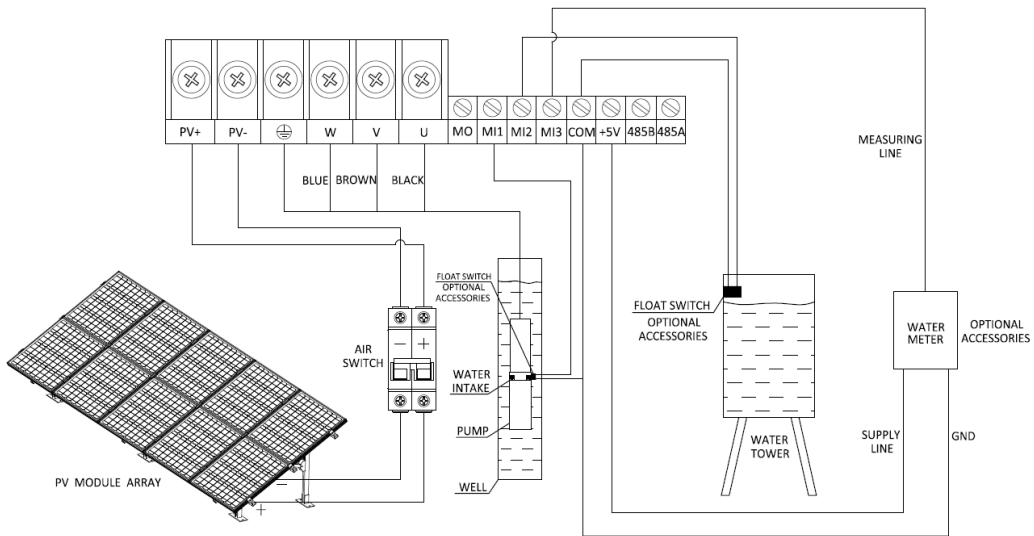


Figure 5: ePump System with PV power only

## 4 Start-up and Operation

### 4.1 Keypad Description

The key pad is as following figure, 7 buttons.



Figure 6: Display Panel and HMI






## 4.2 Keypad Operation Process

### 4.2.1 Parameter setting

Two levels of menu are as following:

- Function code group and function code (first-class)
- Setting parameter of function code (second-class)

In order to set up the electric automatic start function FD.04 = 1 as an example, the modified parameter flow chart is as follows:

1. Press  button, the menu adjust from standby status to parameter status (the controller must be stop), until display FD.
2. Press  button, adjust to FD.04.
3. Press  button, adjust into the setting menu.
4. Press  button, adjust the number to 1.
5. Press  button to confirm.

### 4.3 Trial operation

- Check and make sure wiring is correct. If needed, take a megger to test the insulation of motor, cable, etc.;
- Use a multimeter to test the PV output voltage at the DC switch.
- Power on the controller by the DC switch.
- If necessary, modify and set the parameters of motor to the controller

For Example, if the motor which rated frequency is 60Hz, these parameters need modification:

High limit of running frequency F0.04 = 60.00;

Other related parameters are motor rated Power F2.00, motor rated Frequency F2.01=60, motor rated voltage F2.02, motor rated current F2.03.

Note: default motor rated frequency setting is 50Hz.

Slowly start to check the direction, Press the RUN key to start the motor shortly and slowly, and check the direction of the pump. If the pump is in dry-run state, the maximum operating time can't exceed 15s, otherwise it may cause damage to the pump. When the pump wrong operation, please close the DC switch according to the pump/motor wiring to change the wiring of the motor section of the two leads.

When the light is insufficient, the solar power module output power will be reduced, and the pump operation speed will be very slow until stop. The controller will attempt to start every 120s, and during the trial run, the running indicator is always on.

When a shadow suddenly passes through the PV array, the controller will lose track of the input voltage, and the pump will stop working. But the controller does not show the fault, the controller will try to restart the pump.

### 4.4 Panel parameters

Display code	Name	Description	Unit
U	Input voltage	DC Input voltage	V
C	Output current	Total output current	A
H	Circuit current	circuit current of PV array	A
F	Operating Frequency	The operating frequency	Hz
t	IPM temperature	IPM Module temperature	°C

**Table5: Display Parameters**

Note: Press  key to switch.



## 4.5 User-defined Parameters

Function Code	Function	Descriptions	Unit	explain	Factory Setting
<b>F0 Basic Functions</b>					
F0.00	single of run/stop	0/1	/	keyboard/terminal	0
F0.01	frequency source	0/1	/	digital/sunlight	1
F0.02	direct	0/1	/	forward/reversal	0
F0.04	High limit of running frequency	30.00 ~ 60.00	Hz	use when F0.01 = 0	50.00
F0.05	low limit of running frequency	0.00 ~ F0.04	Hz	use when F0.01 = 0	10.00
F0.07	Acceleration time	0.1 ~ 500.0	Hz/s	use when MPPT	0.2
F0.08	Deceleration time	0.1 ~ 500.0	Hz/s	use when stop	4.0
<b>F2 Motor Functions</b>					
F2.00	Motor rated power	380~1500	W		according to model
F2.01	Motor rated frequency	50~60	Hz		50.00
F2.02	Motor rated voltage	110~380	V		according to model
F2.03	Motor rated current	0.5~30	A		according to model
<b>F5 Input/Output Functions</b>					
F5.00	Mo	0/1	/		0
F5.01	M1	0/1	/		0
F5.02	M2	0/1	/		0
F5.03	M3	0/1	/		0
F5.04	Single selection	0~15	/	significance bit	15
<b>FD PV Functions</b>					
FD.00	time of lowest running frequency	1~100	min		2
FD.01	Restart time	1~600	min		10
FD.04	Auto start when power on	0/1 dis/en	/		1
FD.05	Auto start delay	0~900	s		60
FD.06	Water shortage detection time	0~250	s		10
FD.07	Lowest running frequency when yielding water	0~50.00	Hz		20.00
FD.09	time step of out water	1~900	min		10

**Table6: User-define Parameters**

## 5 Fault Diagnosis and Elimination

The SMPT solar pump controller will attempt to drive the pump to deliver water even under tough conditions. To ensure years of

reliable service, it must also protect the system components from conditions that might result in equipment damage. When tough conditions arise, the controller will continue to deliver as much water as possible at reduced output if necessary, and will shut down only in extreme cases. Full operation will resume automatically whenever abnormal conditions subside.

If the controller has stopped to indicate a fault code on the display, the associated time-over delay will vary depending on the nature of the fault. The number following the “E” symbol corresponds to the error code for the unhappy condition.

## 5.1 Fault Codes

Fault code	Fault description	Possible causes	Remedy
E001	Communication fault	Long-time communication interruption	Check communication devices and cables
E002	Under-voltage fault	Too-low input voltage	Check Solar array voltage
E003	Over-voltage fault	Too-high input voltage	Check Solar array voltage
E004	Over-current fault	Too-heavy load	Replace with higher-rating controller
		Motor open phase	check motor and wiring
		dry run	water level is too low, or float water switch installed failed
		Damaged IPM Module	change the controller
E005	Over heating fault	Short-circuit	check the wiring
		Abnormal wires	check the wiring
		Cooling fans of controller stopped or damaged	Replace cooling fan
		Too-high ambient temperature	Decrease the ambient temperature if possible
		Abnormal PCB board	Ask for support
		Heat sink damaged	
E006	Well level fault	Dry well or slow water recovery	Wait for water to recover or reinstall the pump
		float switch incorrect installation	Ask for support
E007	Tank level fault	High-level in the tank	wait for water to used
		float switch incorrect installation	Ask for support

**Table7: Fault Codes**

## 5.2 Common Faults and Trouble shoot

The SMPT solar pump controller may have following fault or malfunctions during operation, please refer to the following solutions.

### 5.2.1 Pump run failurely

If the controller has the below fault during operation, please refer to the following solution:

Fault Reason	Fault judgement	Solution
Insufficient illumination	check short-circuit current or based on the local illumination conditions	Wait for the sufficient illumination
Pump wiring error	Pump running, achieving the rating output frequency, the pipe has no water leakage phenomenon	Any two phases reversed connect
Pump connector loose	Pump has vibration phenomenon	Check the pump wiring
Pump or pipe blocked	Pump vibrating, has some water out, but water's muddy	Re-check pump and pipe

**Table 8: Judgement and Solution of the Pump cannot run Re-check Pump and Pipe**

## 5.2.2 Controller overcurrent, overload fault

Some reasons cause the controller overflow and overload as below:

Fault Reason	Fault judgement	Solution
Pump or pipe blocked	Pump vibrating, has some water out, but water's muddy	Re-check pump and pipe
Pump wiring overlong	Pump current too big, especially when start-up	convert the controller into the higher level to use

**Table 9: Judgement and Solution of the Controller Overload**

## 5.2.3 The keyboard without display after power on

Fault Reason	Fault judgement	Solution
Input voltage too low or too high	Use multimeter to check the controller input voltage	Re-check series-parallel connection of the modules
Internal components damaged	Has burning smell when the controller box powered on	contact the supplier and replace the controller

**Table 10: Judgement and Solution of the Keyboard no Display after Power On**

# 6 Regular maintenance

## 6.1 Controller and pump

- Controller

The controller box should periodically check whether reliable grounding, and clean the inner dust and possible animal, have to insure the safety measures during the cleaning process.

- Pump

The motor is permanently sealed, no need to maintain. The pump head is a mechanical device, sand and other impurities in the water will cause abrasion for a period of time, needs regular testing of the pump performance. If the pump flow is less than the normal

value, may need to be replaced.

## 6.2 PV module array

Need to regularly check whether PV bracket bolts are loose and regularly clean the surface of photovoltaic modules.

## 6.3 Cable

Need to regularly check the power line and the ground line, to ensure that all wires are reliable connections and no corrosion.