



## **Solar Pumps & Monitor Instruction Manual**

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## INTRODUCTION

SAMKING solar motor powers the new system for the supply of clean water based on the most widely available renewable energy, the sun.

By means of the electric power supplied by a series of photovoltaic panels and taking advantage of the combination of a series 4" & 5" & 6" submersible pump with a built-in inverter type controller, 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.

To extend the flexibility of the system, each package is supplied with:

- Water Pump to suit Head and Flow requirements
- SAMKING 4" Solar Motor AC/DC 2.2kW
- SAMKING Monitor (optional)
- Float Switch (optional)
- Flow Switch & Pressure Switch (optional)

The SAMKING Monitor allows for the seamless integration of input signals such as level control, pressure switch or flow meter.

The Monitor will manage additional energy inputs such as grid supplied AC power, generator AC power and activate the starting of the generator when required.

*Note: For a screw pump, monitor must be configured to prevent dry run.*

## CONSTRUCTION FEATURES OF THE SP PUMP

Multistage centrifugal type with radial or semi-axial impellers. Pump and motor directly coupled with rigid coupling.

Stainless steel impellers fitted on floating clearance rings made of synthetic low abrasion material, and technopolymer diffusers that impart significant wear resistance to the pump.

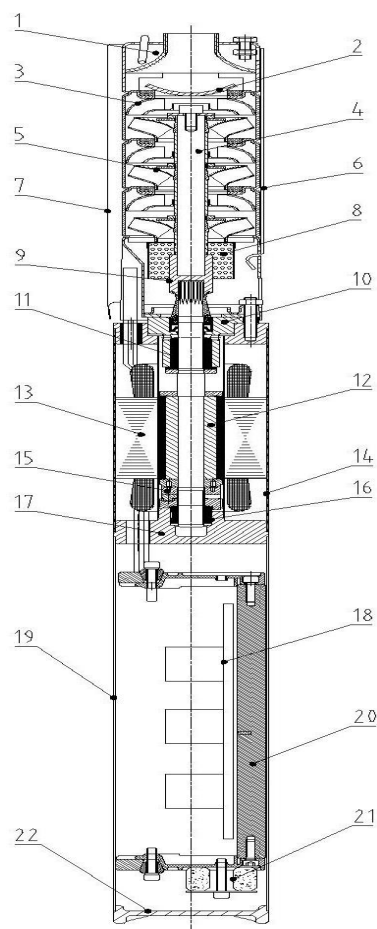
Pump liner, shaft and coupling, strainer and cable sheath in stainless steel. Base support and upper head in microcast AISI 304 stainless steel; check valve incorporated in the head.

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

Maximum permitted amount of sand: 120 g/m<sup>3</sup>.

## MATERIALS

NO	PART*	MATERIALS
1	Discharge chamber	Stainless steel
2	Non-return valve	Stainless steel
3	Guide vanes	PC/Stainless steel
4	Pump Shaft	Stainless steel
5	Impeller	POM/Stainless steel
6	Impeller fastener	Stainless steel
7	cable cover	Stainless steel
8	Inlet part	Stainless steel
9	Shaft coupling	Stainless steel
10	Upper Bearing Housing	Stainless steel
11	Upper Bearing	Silicon Carbide
12	PM Rotor	--
13	Stator	--
14	Pump Housing	Stainless steel
15	Thrust bearing	Graphite
16	Lower Bearing	Silicon Carbide
17	Lower Bearing Housing	Stainless steel
18	PABA	--
19	Controller Housing	Stainless steel
20	Radiator	Aluminium
21	Inductor	--
22	Base	Stainless steel



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## CONSTRUCTION FEATURES OF SAMKING SOLAR MOTOR

Innovative design allows the motor to be powered by both AC and DC power sources.

The motor is one size for all models with a maximum power output (P2) of 2200 W and is suitable for selected PENGYANG pumps only. The speed range of the motor is 0 rpm to 3600 rpm depending on the power input and load.

*Note: Use other pump body with the SAMKING Solar Motors, please consult PENGYANG.*

The motor uses rare earth permanent magnets, and has a built-in electronic unit comprising a frequency converter and motor controller. Vector control and MPPT are used to select the best operating point for the pump, based on the energy available from the input source.

The motor can be supplied with either AC or DC voltage.

*Note: Maximum axial thrust 3000N. Maximum Pump P2 load 2.2 kW (3hp).*

The motor is welded and sealed, maximum diving depth 150m.

**The SAMKING Solar Motor is capable of the following functions:**

1. Powered by AC/DC
2. MPPT Efficiency high
3. Dry protection
4. Reverse protection
5. Over-head protection
6. Over-load protection
7. Over-current protection
8. Over-voltage protection
9. Losting-Phase protection
10. Missing-voltage protection
11. Lightning & surge protection
12. Over power protection

**Note:**

*1、 SP series solar pump with SP series monitor will be more versatile.*

*2、 The screw pump must be well coordinated with the bottom float to have Dry protection.*

### MOTOR ENERGY INPUT CAPABILITIES

Voltage	Current	Energy
60 – 380V DC	12A DC (ISC)	Direct Current eg Solar
1X90 – 240V AC	10A AC	Alternating Current eg Generator or Mains Supply

*Note: Panel Volts Max:380VMP / 440VOC*

# SP MONITOR

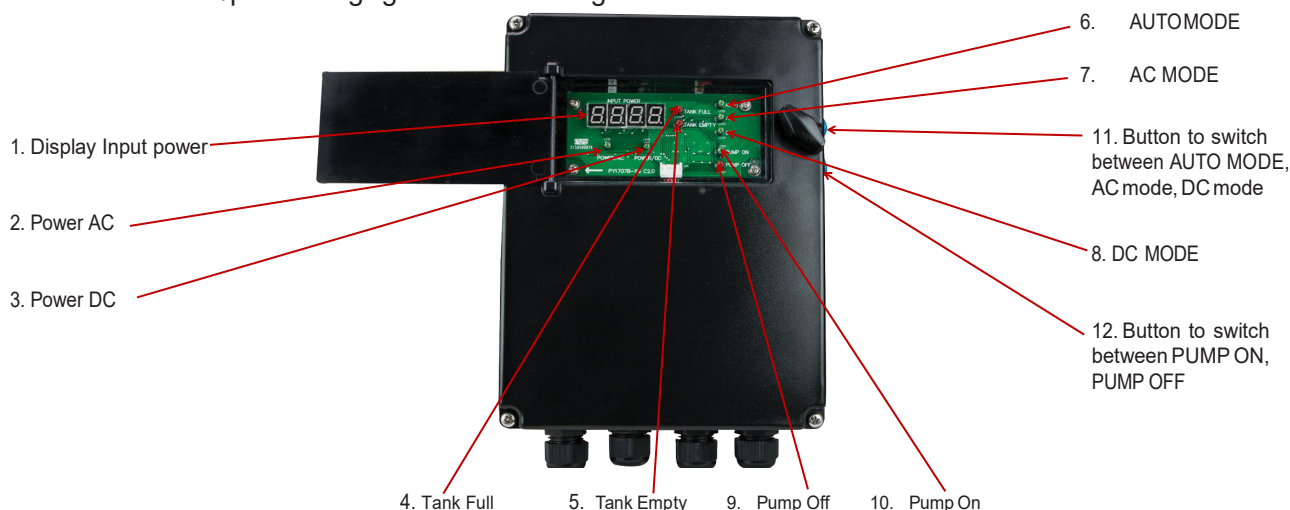
## Operation and features

The SP Monitor is capable of the following functions:

1. Display input power
2. Display of mode of AC
3. Display of mode of DC
4. Display of tank full
5. Display of tank empty
6. AUTOMODE
7. Ability to select the incoming power source. In AC MODE, the incoming power source can be from Mains power supply or a generator.
8. Ability to select the incoming power source. In DC MODE, the power supply can be from either Solar Panels or Battery. However, DC will be the favoured power supply.
9. Pump ON
10. Pump OFF
11. Button to switch between AUTO MODE, AC MODE, DC MODE
12. Button to switch between Pump ON, Pump OFF
13. Deadhead/no flow conditions protection (with Flow Switch)
14. Lightning and surge protection
15. Over-voltage protection
16. GPRS/RMS

The SP Monitor is capable of the following features:

- The SP monitor can take signals from two float switches placed in a tank or similar.
- The high level float switch signal indicates on SP Monitor that the reservoir/tank is full and at this point the controller stops the pump. When the water level of the storage tank drops, the float drops closed and the pump returns to operation after 10 minutes. Within 10min, the "TANK FULL" signal light remains on and the display starts counting down from "600" to "0." The countdown ends and the "TANK FULL" indicator goes off and the pump system restarts.
- The low level float switch signal indicates on SP Monitor that the reservoir/tank is empty and at this point the controller starts the pump. When the water wells or pools without water, the water under the float drop and closed, PV monitor "TANK EMPTY" signal indicator light, direct the pump system immediately shut down. When the water level rises, the float rises and falls, and the pump returns to operation after 10 minutes. Within 10 minutes, the "TANK EMPTY" signal light remains on and the display starts counting down from "600" to "0." The countdown is over and the "tank full" indicator goes off and the pump system restarts. On power up, if tank is not full, then the SP monitor powers the pump to fill the tank.
- The SP monitor is suitable for outdoor installation and is weather-proof, however, its location/positioning against direct sun light should be avoided.



# THE SP MONITOR INSTALLATION OPTIONS

## WARNING

- The power supply from any DC or AC supply can cause serious harm or death from electrocution.
- Apply appropriate safety procedures when working on or with any system component.
- Only suitably qualified personal should be involved in the electrical connection / disconnection and handling of the equipment. Off-grid electrical equipment is subject to applicable state, national and country electrical standards.
- The SAMKING Solar Motor contains capacitors that must be allowed to discharge before handling
- Allow a minimum of 1 MINUTE for stored energy to dissipate before handling the motor.
- The Solar panels will create electrical energy when exposed to light. Assume all panel cables are “live” at all times and handle with appropriate safety equipment and procedures.

## Caution

Isolate all electrical sources before commencing any installation, servicing or repair on any component in the installation.

The SP monitor is used to switch AC and DC power supplies and can automatically start a connected generator or switch between DC (Solar) or AC (Generator / Mains) power sources at ANY time.

Ensure all energy sources and generator starting circuit is properly locked-out before working on the system.

## Electrical Component Selection

When using DC power such as supply from Solar Panels, any switches, contactors, sensors, meters, recorders used in the electrical connection and monitoring of the installation MUST BE selected according to the Input power available and rated for DC POWER supply.

## Control Panel Mounting

The SP monitor is IP65 Rated however it is recommended that the panel is not mounted in direct sunlight.

Mounting the controller behind the Solar Panel array is often a good way to protect the panel.

Consideration should be given to mounting the control panel inside a steel cabinet (not included) to allow for easy access to isolation switches and termination of supply feeds and input control feeds.

## Earthing

As most Solar installations are –off-grid, particular attention must be paid to earthing of the controller and pump motor. Follow the instructions in the controller manual and legislated electrical requirements for your area.

## Switching between DC and AC supplies

The SP monitor can be manually switched between a DC power supply and AC supply or the controller will perform the change when in AUTO mode.

During the switch over the controller in the Solar motor runs through an automatic discharge process to dissipate the electrical charge contained in the capacitors fitted to the electrical motor. This process cannot be sped up.

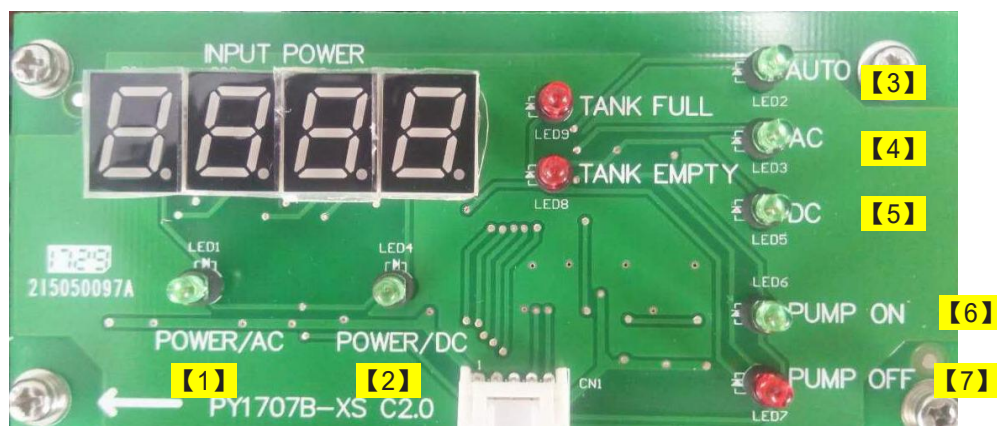
If the pump is not running when there is a suitable input power supply, firstly check the display panel to see if the changeover is taking place before further investigation.

The controller is biased to DC supply when in Automatic mode.

## MONITOR Operating Instruction

1. Before operating any components in the system preform a visual inspection of the installation for damage cause by weather events, stock, pests or human interference. Solar panels should be clean and not in shade. All wiring terminated, no bare wires exposed.
2. Check pump is completely immersed when in a surface water source.
3. Turn any isolator switches to ON position. Open any valves.
4. Mains AC Supply present (if connected) – Indicated by LED light on controller **【1】**
5. DC Supply present (Solar / Battery) - Indicated by LED light on controller **【2】**
6. Generator (if connected) is topped up with fuel, generator starts and runs on demand and is connected to SP monitor via “GEN Signal” wire.
7. Select **MODE** the Controller is required to operate in using the TOP BUTTON on the right hand side of the controller. Each time the button is pushed, the controller cycles through one of the operating modes indicated by the LED light on the display panel.
  - i. **AUTOMATIC MODE 【3】** – Controller selects the power source and uses this to run the pump depending on input signals. Bias is always DC power source. When the system is using AC power, the AC led light pulses in 30 sec intervals ,the system is using DC power, the DC led light pulses in 30 sec intervals.
  - ii. **AC MODE 【4】** - Controller only uses AC power source and uses this to run the pump depending on input signals and available power from grid supply or generator.  
Note, only one AC power supply can be used, either Grid Supplied AC 240V power or Generator supplied AC 240V power.
  - iii. **DC MODE 【5】** - Controller only uses DC power source and uses this to run the pump depending on input signals and available power from Solar Panels or Batteries.

**CAUTION** – When switching between modes, the motor needs to dissipate the energy stored within the internal capacitors. This process takes 1 minute. Repeated switching between modes will restart the dissipation cycle, causing extended delays before the pump will run.
8. Push **PUMP ON** button on the left hand side of the controller which is the **BOTTOM BUTTON**. LED **【6】** light indicates pump on. Controller will start pump using selected power supply provided,
  - i. The input energy is sufficient to run the motor
  - ii. Motor has finished power dissipation cycle if required
  - iii. The input signal devises indicate the unit should run. This would include,
    - a. WWL – Well water level is “open” indicating sufficient water around pump(when fitted)
    - b. TWL – Tank water level indicates tank requires filling (when fitted)
    - c. TWL – Pressure switch indicates system pressure is low (when fitted)
    - d. TWL is bridged meaning pump runs when input energy sufficient.
9. To stop pump, push **PUMP OFF** button on the right hand side of the controller which is the **BOTTOM BUTTON**. LED **【7】** light indicates pump off.
10. When finished with the system, turn any electrical isolating switches and valves to the off position. Lock Out equipment from use as per your site specific procedures.





## Technical specification

- The SP Monitor is a microcontroller, designed, developed and manufactured for the Samking SOLAR pump.
- It is suitable for simultaneous AC and DC incoming power supplies.
- Manually or automatically switchable between two power supplies depending on solar irradiation.
- IP65 weatherproof enclosure.
- Suitable for up to 2.2 kW (3 hp) pumps.
- AC voltage input range 1X90 – 240 VAC. **Terminals L N & GND**
- DC voltage input range 60 – 380 VDC. **Terminals + - & GND**
- Input connections for 1 or 2 float switches. **TWL & WWL**
- Input connection for pressure switch. **TWL**
- Input connection for matching flow meter. **FLOW SIGNAL -> REF. Setting flow meter function (on this page)**
- Indication for power on, input power, pump on, pump off, water tank full or tank empty.
- Auto operation via 1 or 2 float switches.
- Auto operation via pressure switch.
- Auto off via flow meter.
- Auto starting of generator via volt free contacts. **GEN SIGNAL**
- Manual operation.
- Auto switching from AC to DC supply with DC bias. DC switching point is 40V.



*Note: Faulty wiring can cause serious damage or death. Please refer to page 10 for wiring.*

## SETTING FLOW METER FUNCTION



**Flow Meter**

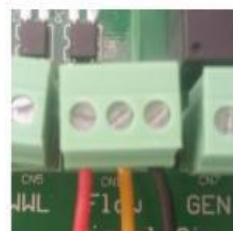


**Switch**

- Without flow meter connected set switch 1 to "off" condition.
- With flow meter connected set switch 1 to "on" condition

*Note:*

1. The wiring sequence of the flow-meter is red, yellow and black. Incorrect wiring may cause system abnormal work.
2. Don't change the state of set switch 2.



**Terminal terminal**

## GPRS/RMS

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

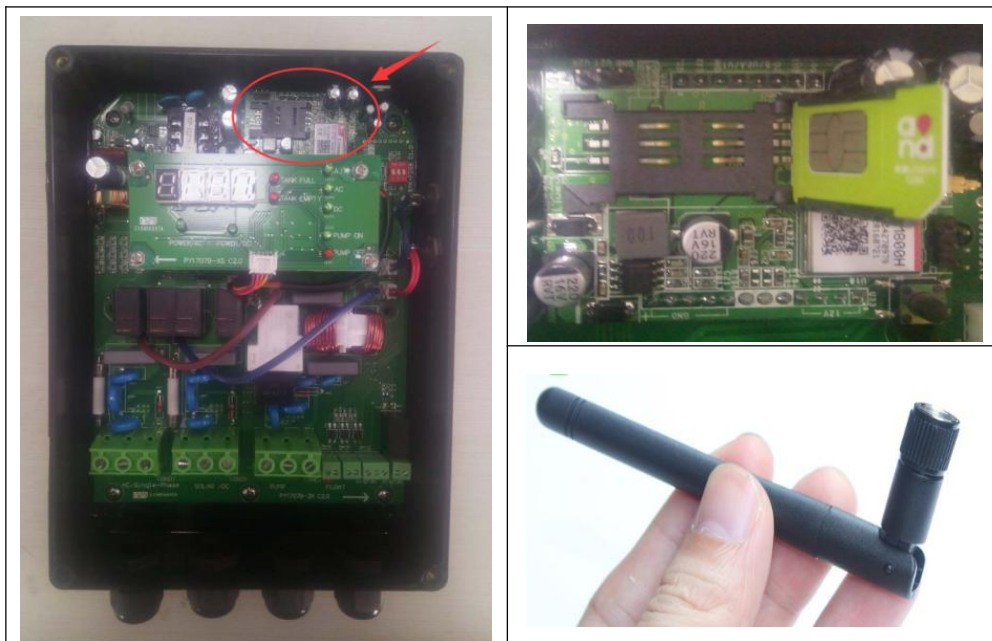
Function:

- 1, check the device operation parameters, such as: voltage, current, instantaneous power, PV power and pump flow
- 2, abnormal indication, when the equipment running voltage, current and so on abnormal.
- 3, web and APP end start and stop equipment
4. Historical data view and download

Operation

- 1、 Open up Monitor install SIM card and antenna
- 2、 Enter the ID and password on the logon site( <http://118.190.33.7:8083/>)
- 3、 Set the pump model and head correctly

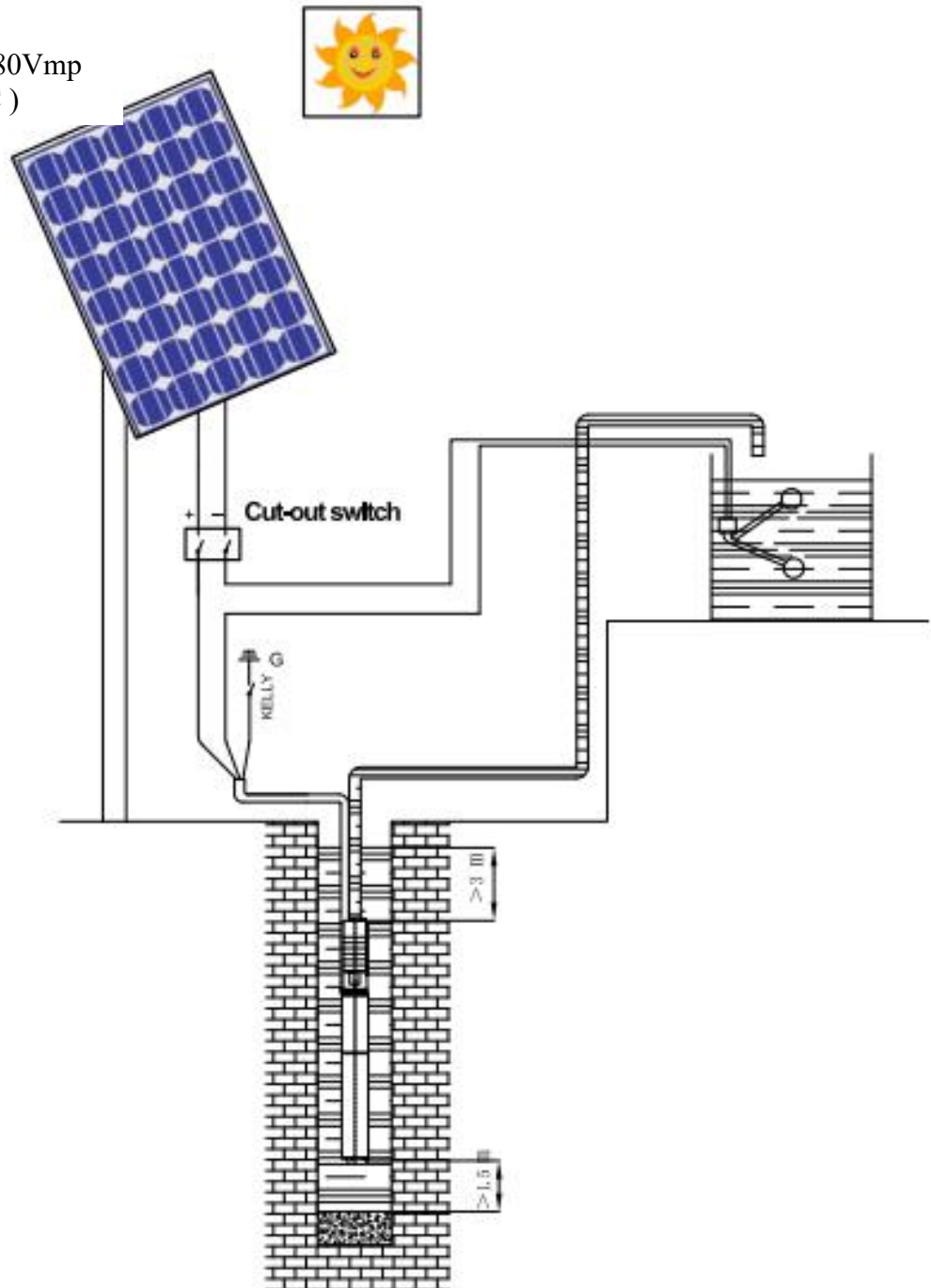
*Note: The specific operation can be referred to the GPRS instruction manual*



# INSTALLATION OPTIONS

## 1. Without Monitor

Panel  
(Series/60~380Vmp  
/60~440VOC )



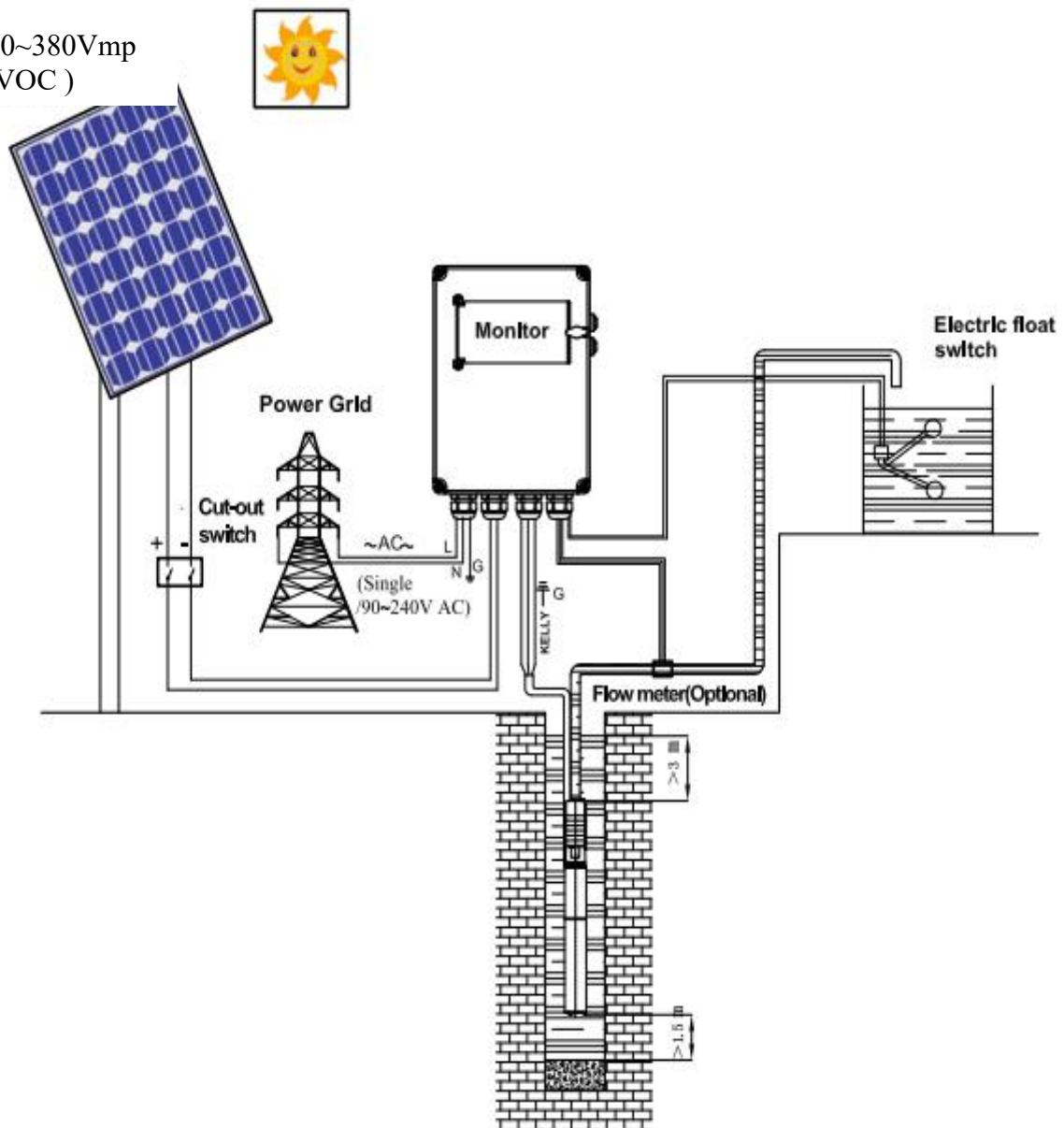
### Note:

- 1、 The above Solar panel power supply can be directly replaced by battery or AC power. When AC power is selected, the input power can be a utility power grid or a generator.
- 2、 Green and blue cable for ground, other two cable connect anyway for pumps
- 3、 Volts: Panel Max :380Vmp/440VOC  
DC:60-380VDC  
AC:1X90-240VAC

## INSTALLATION OPTIONS

## 2 Monitor with Electric Float Switch (One Or Two)

Panel  
(Series/60~380Vmp  
/60~440VOC )



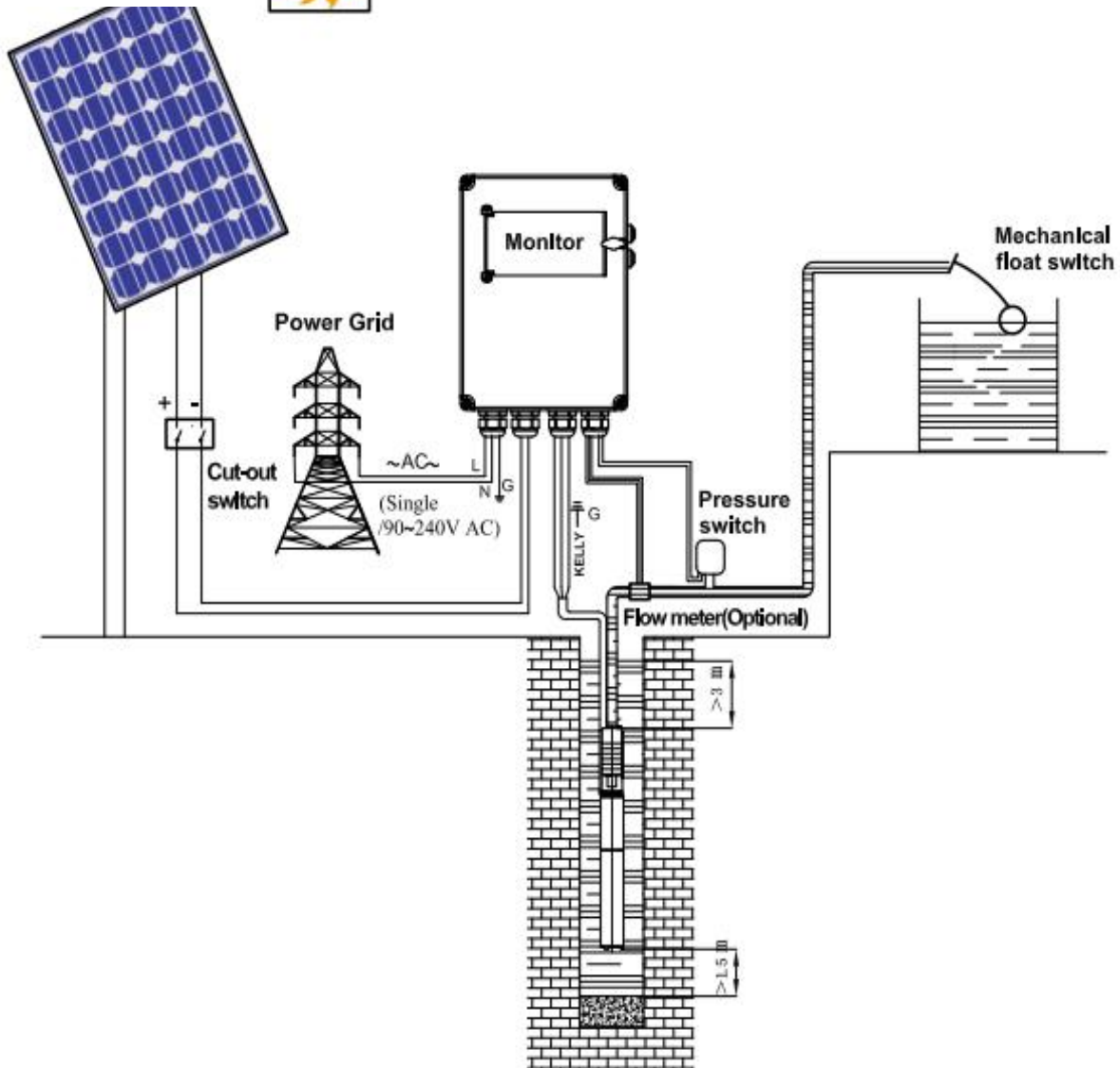
*Note:*

The centrifugal pump usually requires only one float in the tank. But for a screw pump, a floating ball in a well is necessary

# INSTALLATION OPTIONS

## 3 Mechanical Float Switch

Panel  
(series/60~380Vmp  
/60~380VOC)



### Note:

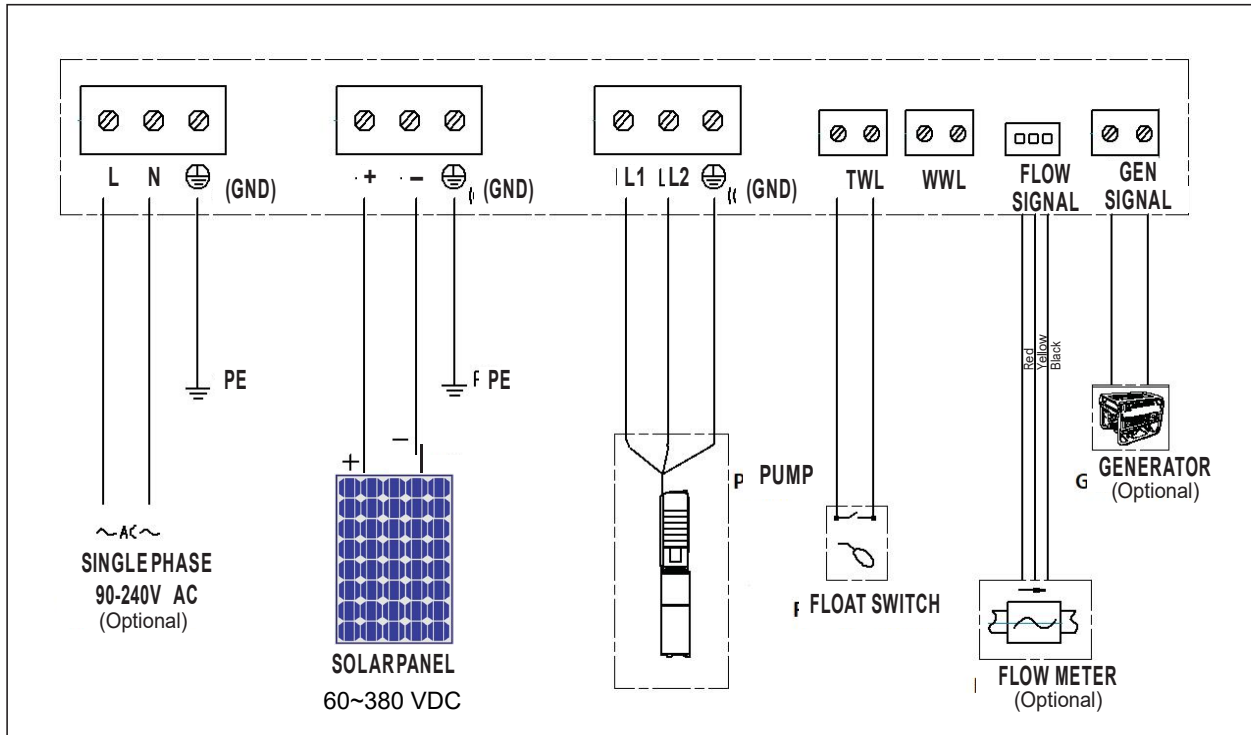
The mechanical float must be used in the system with the pressure switch, and the pressure switch needs to be adjusted to the appropriate pressure range. Otherwise, it may cause the pump to stop abnormal and even cause the pipeline to burst.



# SP MONITOR

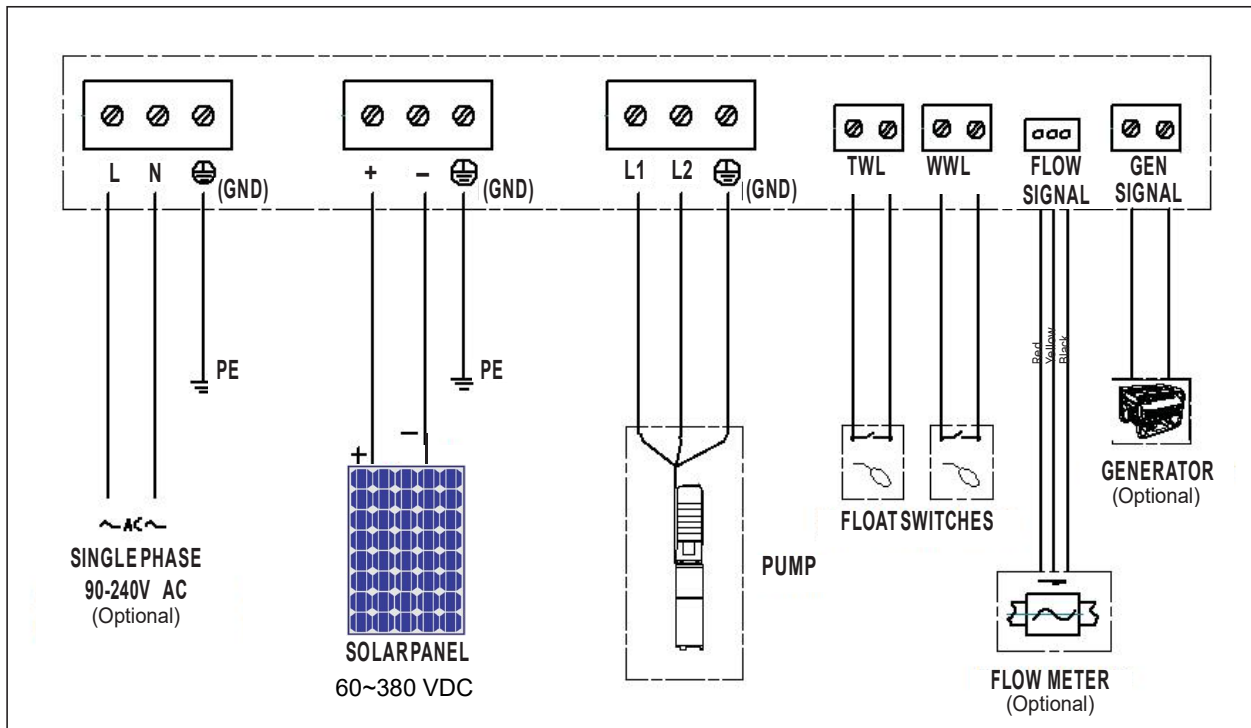
## Electrical Connections

### 1. With One Float Switch.



TWL = TARGET TANK WATER LEVEL      WWL = WELL WATER LEVEL  
 USE 3 WIRE FLOAT SWITCHES WIRED FOR TANK FILL (OPEN ON RISE - BLACK AND BLUE WIRES)  
 Kelly cable for ground, other two cable connect anyway for pumps

### 2. With Two Float Switches



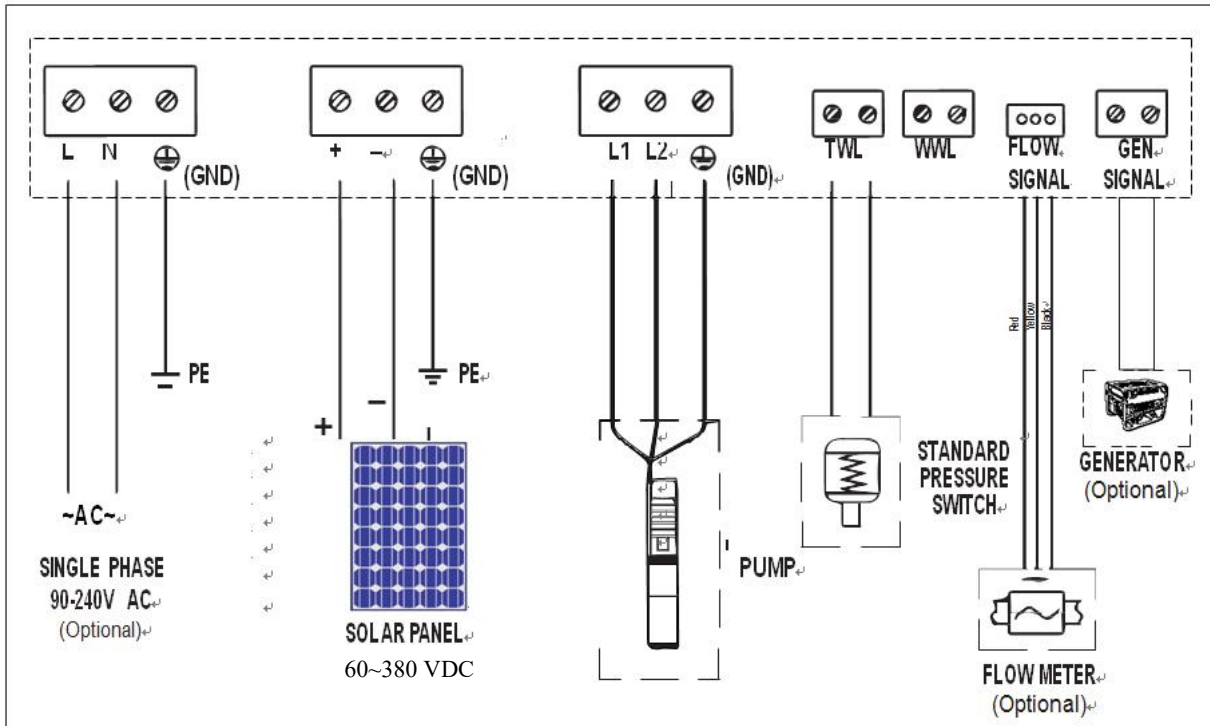
TWL = TARGET TANK WATER LEVEL      WWL = WELL WATER LEVEL  
 BOTH FLOAT SWITCHES NEED TO BE 3 WIRE TANK FILL (OPEN ON RISE, BLACK AND BLUE WIRES)  
 GENERATOR CONTACT WILL CLOSE IF NO AC AND DC DROPS BELOW 90V.

**FOR ALL WIRING OPTIONS ONLY ONE AC INPUT SOURCE CAN BE USED BY THE CONTROLLER – USE 240V AC MAINS SUPPLY or GENERATOR unless the Generator has an Auto Transfer System (ATS) to manage the switch over. Consult your Generator manual.**

# SP MONITOR

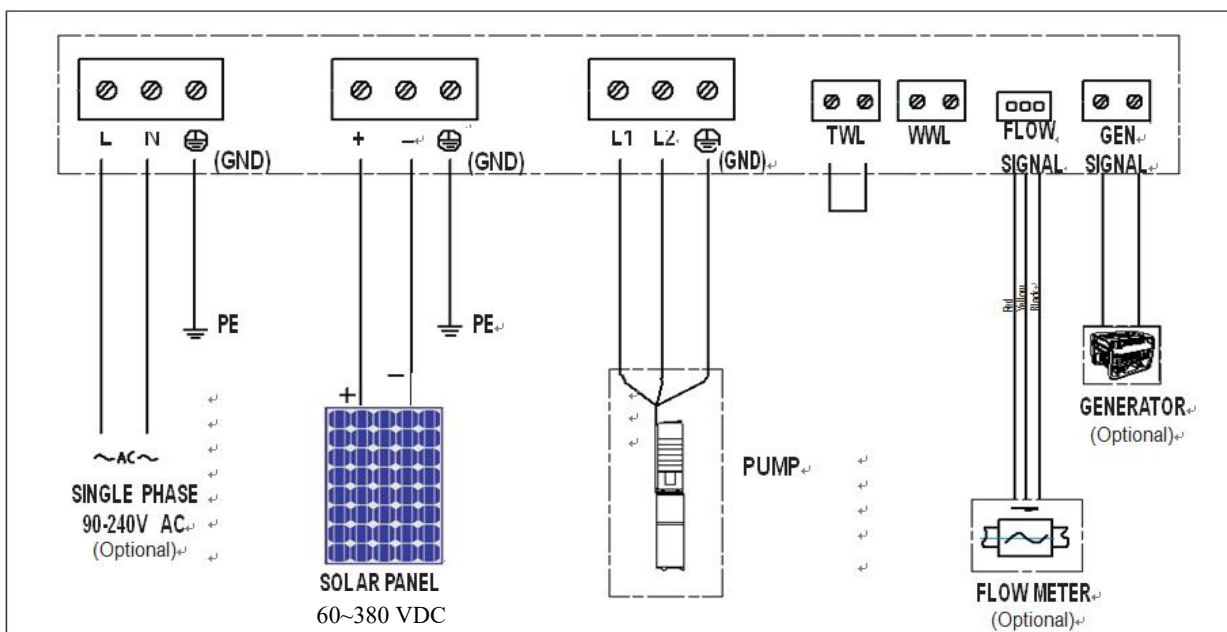
## Electrical Connections

### 3. Pressure Switch



FOR PRESSURE SWITCH CONTROL, USE A NORMAL PRESSURE SWITCH OF SUITABLE RANGE – SWITCH OPENS ON PRESSURE RISE  
Kelly cable for ground, other two cable connect anyway for pumps

### 4. No Switches



#### GENERAL NOTES FOR ALL SET UP CONFIGURATIONS

NORMAL PRESSURE SWITCH ON TWL

REVERSE ACTING PRESSURE SWITCH ON WWL WITH JUMPER ON TWL

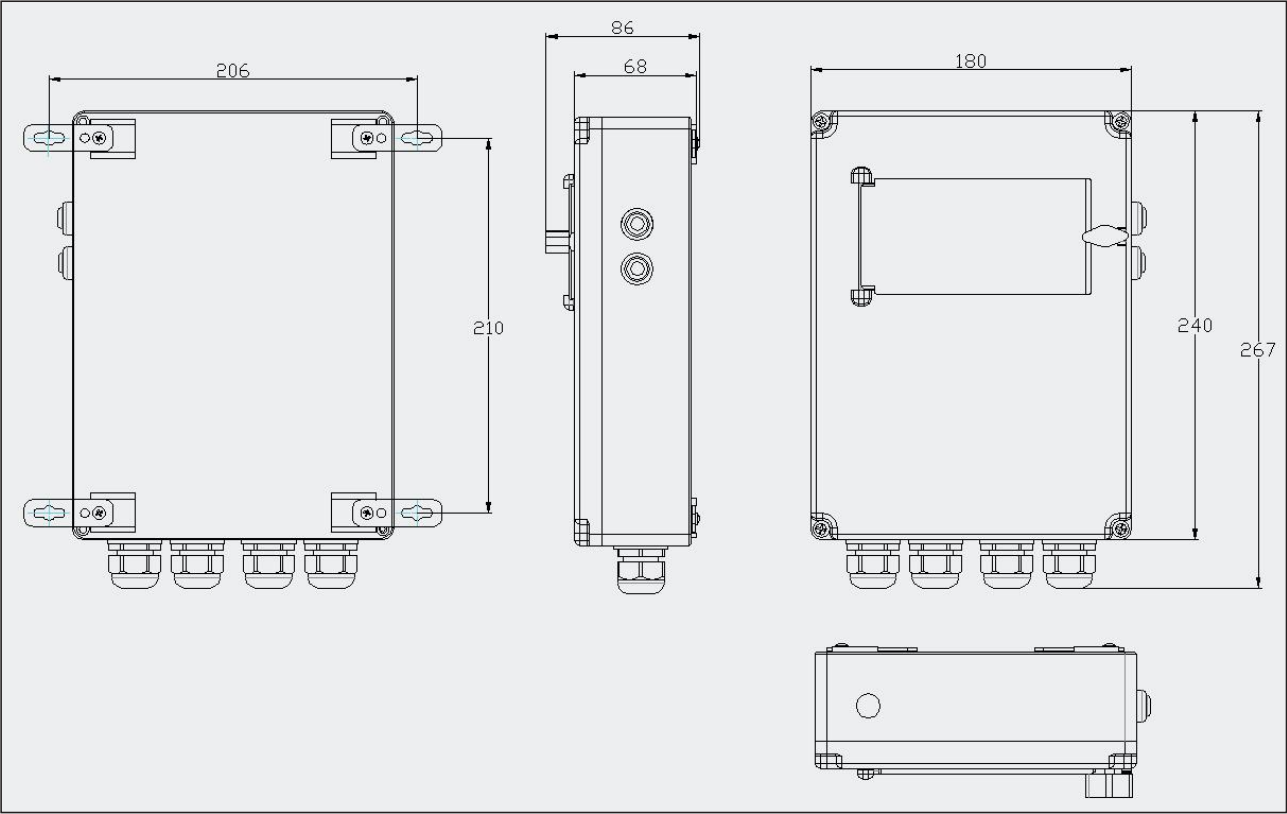
GENERATOR CONTACT WILL CLOSE IF NO AC AND DC DROPS BELOW 90V.

Kelly cable for ground, other two cable connect anyway for pumps

**FOR ALL WIRING OPTIONS ONLY ONE AC INPUT SOURCE CAN BE USED BY THE CONTROLLER – USE 240V AC MAINS SUPPLY or GENERATOR unless the Generator has an Auto Transfer System (ATS) to manage the switch over. Consult your Generator manual.**

# SP MONITOR

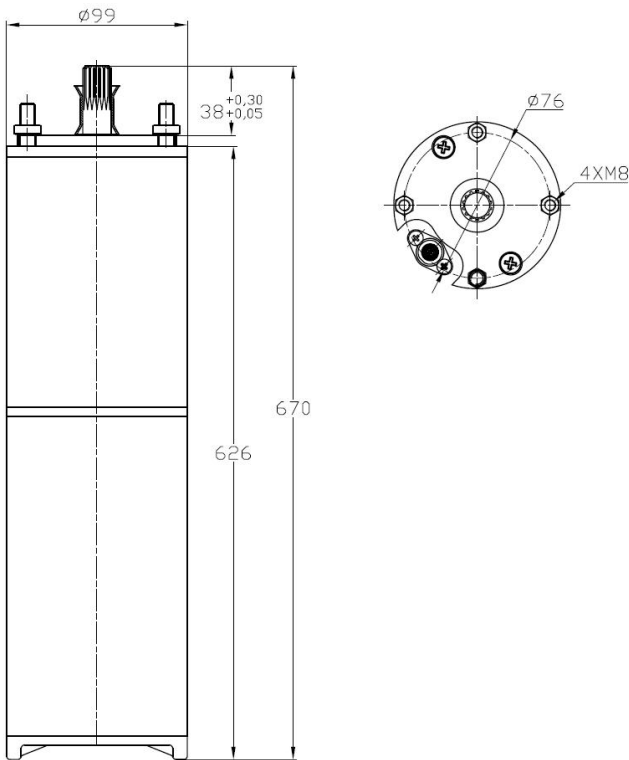
## Dimensions



Dimensions: 267mm (H) x 180mm (W) x 86mm (D); Weight 1.4 kg

# SOLAR MOTOR

Dimensions:  
670mm (H) x 99mm (Dia)  
Weight 12 kg





## **SMAKING SOLAR PUMP GENERAL INSTALATION NOTES**

### **Water Source and Pump Installations Options**

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 SP Solar Pump can be installed,

- Vertically in a bore or well
- Horizontally in a stream or open body of water

In all installation positions the SP 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

### **WARNING**

- **The power supply from any DC or AC supply can cause serious harm or death from electrocution. Apply appropriate safety procedures when working on or with any system component.**
- **Only suitably qualified personal should be involved in the electrical connection disconnection and handling of the equipment. Off-grid electrical equipment is subject to applicable state, national and country electrical standards.**
- **The SAMKING Solar Motor contains capacitors that must be allowed to discharge before handling. Allow a minimum of 1 MINUTE for stored energy to dissipate before handling the motor.**
- **The Solar panels will create electrical energy when exposed to light. Assume all panel cables are “live” at all times and handle with appropriate safety equipment and procedures.**

### **Caution**

Isolate all electrical sources before commencing any installation, servicing or repair on any component in the installation.

The SP Monitor module is used to switch AC and DC power supplies and can automatically start a connected generator or switch between DC (Solar) or AC (Generator / Mains) power sources at ANY time.

Ensure all energy sources and generator starting circuit is properly locked-out before working on the system.

## SOLAR PANELS

For DC operation, power supplied by solar panels is required:

Motor is rated: 60 – 380V DC, 12A.

### WARNING:

Panel combinations must NOT exceed the Samking Solar Motor input limits

DC Volts Max: 380Vmp/ 440VOC

DC Amps Max:12AISC

AC Volts Max: 240V

AC Amps Max:12A

Exceeding limits may cause serious harm or irreparable damage to the motor and VFD as well voiding the motor warranty.

Recommended solar panel power for SP Series Solar Pump:

Motor Power(kW)	Motor Power(kW)	Recommend Photovoltaic Power(kW)	Connection
0.37	0.5	0.6	In Series
0.55	0.75	0.75	In Series
0.75	1	1	In Series
1.1	1.5	1.5	In Series
1.5	2	2	In Series
1.8	2.5	2.5	In Series
2.2	3	3	In Series

*For example:*

*Below is a selection table based on 300W solar panels.*

*The panels would be wired in series connected in parallel.*

All Electrical Data @ STC				
P <sub>max</sub>	VOC (V)	VMP (V)	ISC (A)	IMPP (A)
300W	45.5	37	8.64	8.11

#### VOLTS, AMPS and WATTS

- VOC (V) Volts open circuit, nothing connected
- VMP (V) Volts maximum power point, under load
- ISC (A) Amps short circuit
- IMPP (A) Amps maximum power point
- $DCPowerinW = VMP * IMPP$

*SAMKING SOLAR PUMP model: 4SP8-8 3HP*

*In this case:*

*Recommended : 9 solar panels in series.*

*Output voltage multiplies by the number of panels.*

*eg: 9 x 45.5 VOC = 409.5 Voc*

*Output voltage multiplies by the number of panels.*

*eg: 9 x 37 VMP = 333 Voc*

*Output watts multiplies by the number of panels.*

*eg: 9 x 300 W = 2700W*

*Output amps remains the same as a single panel.*

*eg: 8.64 ISC (A)*

All equipment mentioned in this manual must be installed by skilled and qualified people. A licensed electrician must make all electrical connections.

# **SOLAR PANEL INSTALLATION**

Power Connection for SOLAR PANELS

## **WARNING**

- The power supply from a DC supply such as Solar Panels can cause SERIOUS HARM or DEATH from electrocution.**
- Apply appropriate safety procedures when working on or with any system component.**
- Only suitably qualified personal should be involved in the electrical connection / disconnection and handling of the equipment.**
- Off-grid electrical equipment is subject to applicable state, national and country electrical standards.**
- The Solar panels will create electrical energy when exposed to light. Assume all panel cables are “live” at all times and handle with appropriate safety equipment and procedures.**
- Use only electrical cable and connectors supplied with the Solar Panels. Avoid cutting or joining cables by ordering correct lengths of cable and connectors at time of purchase.**

Follow the instructions provided with the Solar Panels and mounting system to complete the framing support for the panels.

## **General Notes:**

Mounting Frame must always face NORTH for panels fitted in the Southern Hemisphere. The orientation of the PANEL to the SUN is determined by the LATITUDE co-ordinate for the site location.

Use a GPS or other mapping app such as “Google Maps” to determine the latitude co-ordinate of the panel installation site. This becomes the angle the panels are orientated from the horizontal to face the sun directly.

## **SOLAR AVAILABILITY**

As a general rule-of-thumb panels will receive 3.5hr or more of solar irradiation during winter months. Actual average sun hours for each geographic region are available from NASA or your countries weather statistics recorder

Possible pump flow capabilities should be based on minimum WINTER energy availability.

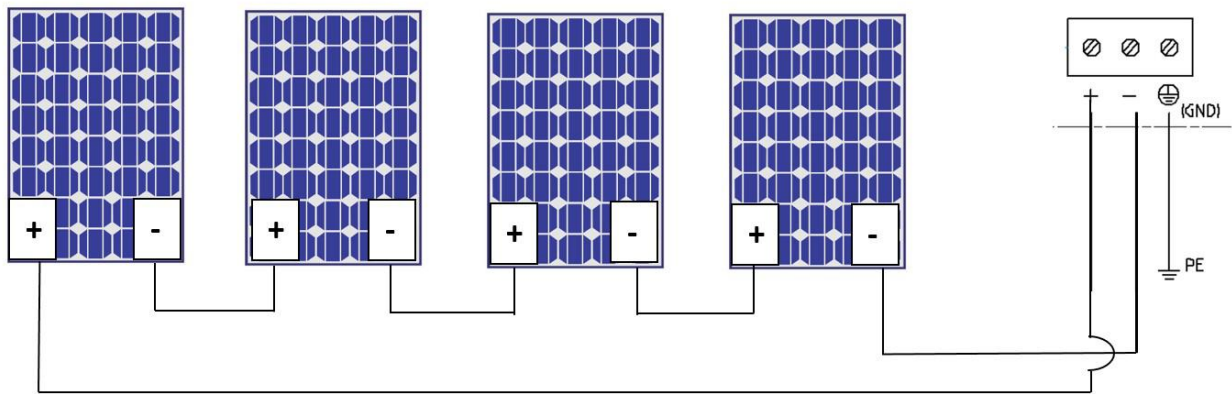
# SOLAR PANELS WIRING

## Series (Recommended for SP series Solar PUMP)

To wire solar panels in series, positive of one solar panel is wired to the negative of the next solar panel.

**In this case:**

- Output voltage multiplies by the number of panels. eg:  $4 \times 45 \text{ VOC} = 180 \text{ Voc}$
- Output voltage multiplies by the number of panels. eg:  $4 \times 37 \text{ Vmp} = 148 \text{ Vmp}$
- Output watts multiplies by the number of panels. eg:  $4 \times 300 \text{ W} = 1200 \text{ W}$
- Output amps remains the same as a single panel. eg:  $8.64 \text{ ISC (A)}$



A group of panels wired in series as above is called a string.

*Note: in any combination, output Volts or Amps must not exceed stated limits.*

# **SAMKING SOLAR SUBMERSIBLE PUMP INSTALLATION AND OPERATING INSTRUCTIONS**

These instructions supply the necessary information for the installation and operation of SP series submersible pumps, and should be thoroughly read and understood before installation is attempted.

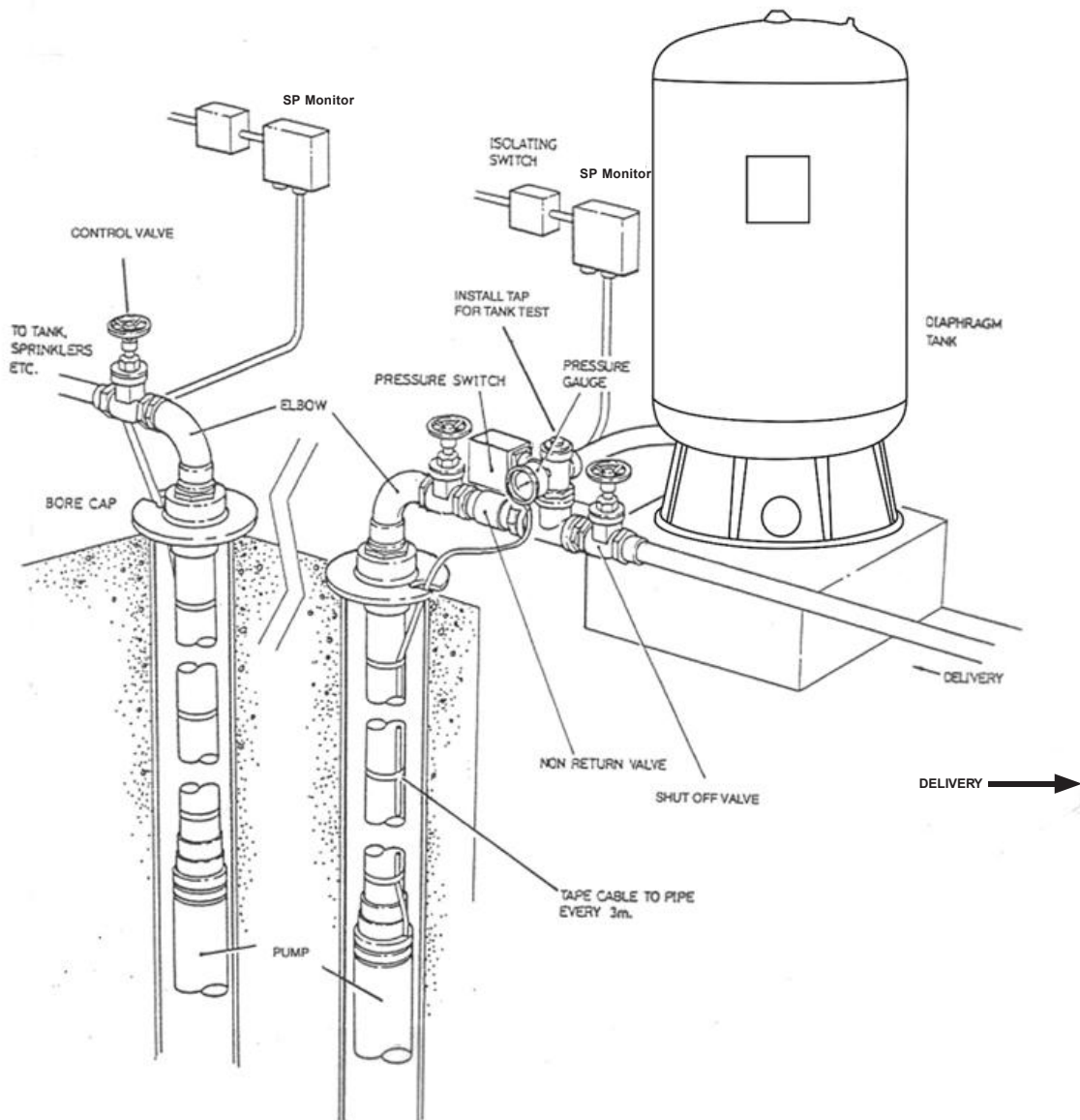
## **WARRANTY**

The following Warranty conditions shall apply to SP series submersible pump installation. PENG YANG shall not be held responsible for damage caused by improper installation, use of cable and SP Monitor or level controls which are not approved by White International, negligent or careless handling, lightning, improper voltage supply, corrosion due to impure water, wear caused by sand, gravel or other abrasives in the water being pumped.

## **IMPORTANT PRECAUTIONS**

1. Damage to pump or motor caused by abrasive or corrosive water is not covered by the Warranty; however, to guard against installing a pump in aggressive water, it is suggested that an analysis of the bore water be carried out prior to installation to ensure pump suitability.
2. The bore should be clean before installation. The submersible pump must not be used to bail a new bore. Guarantee does not cover failure or wear due to abrasives in the water.
3. Be sure voltage and frequency as shown on the nameplate of the Monitor and motor the same as the voltage and frequency on the line to which the motor is to be connected. Voltage at the motor must be 60 to 380 VDC / 240V AC.
4. Do not allow Screw pump to run dry unless it is properly connected to the SP Monitor.
5. In addition to the check valve built into the pump, it may be necessary to install an additional check valve. This is mandatory for heads greater than 80 metres, or on pressure systems. This will reduce water hammer shocks to the pump.
6. Know the total depth of the bore and ensure that the pump does not rest on the bottom or in sand. Ensure 1.5 metres (5 feet) clear below the pump to the bottom of the bore.
7. Know the pumping level of the bore and ensure that the pump remains submerged at all times. Use of level controller is recommended. If probe type is used, the probe should be located to switch the pump off when the bore water level drops within 1 metre of the pump suction.
8. A Flow Inducer Sleeve or shroud which ensures that the water is drawn into the pump from below the motor is required when the pump is in open water (i.e. water tank, river or dam), is in a rock well, below casing or set in screens, or well diameter is too large.  
  
Do not install borehole submersibles in a crooked bore without gauging first. Lower a gauge which is the same diameter and length as the pump to be used into the bore. If the gauge does not bind, it is safe to install the pump.
9. Never support the weight of the pump by the drop (power) cable or by the safety rope

# TYPICAL SUBMERSIBLE INSTALLATION



## DEPTH OF INSTALLATION

Make sure that the unit is at least one metre above any gravel layer and one metre below the minimum draw down level. If during the initial operation, the pump lowers the well water level until suction is discontinued, then lower the pump where feasible, or install a protection device, or reduce the flow rate of the pump to prevent over-pumping.

It may be necessary, as a safety precaution to install a non-return valve at the top of the bore. This is in addition to the non-return valve fitted in the pump. This will assure a break down of the water hammer and consequently a reduction of shocks on the hydraulic components (which occurs in any pump system) immediately after each shutdown.

This non-return valve is mandatory where the pump heads (pressure at the top of the bore plus pump depth) exceed 80 m (785 kPa or 262 ft) or where the pump is part of an automatic pressure system.

## WIRING

Wiring should conform to the requirements of local and national electrical codes. If in any doubt, contact your Electricity Supply Authority.

### CAUTION

The use of smaller cable than specified below may cause premature motor failure and will void the warranty. Larger sized cables may be used.

The table indicates the correct size electrical drop cable and maximum lengths to be used.

### SINGLE PHASE 240 VOLT CABLE SELECTION

MOTOR kW (HP)		0.37 (0.5)	0.55 (0.75)	0.75 (1.0)	1.1 (1.5)	1.5 (2.0)	2.2 (3.0)
Metric Cable Stranding	Area mm <sup>2</sup>	metres	metres	metres	metres	metres	metres
7/0.50	1.5	94	67	49	36	29	19
7/0.67	2.5	174	123	91	67	53	36
7/0.85	4.0	279	197	146	106	85	58
7/1.04	6.0	417	296	218	159	126	87
7/1.35	10	701	496	366	268	213	147
7/1.70	16	1117	791	585	426	339	235

### EARTHING PUMPS

The Pump motor is equipped with an earth lead which must be connected to the earth of the control module. If testing or used outside a well, the motor must be connected to the power supply earth lead to prevent a lethal shock hazard.

### ELECTRICAL CHECK LIST2

It is recommended that where possible, all electrical connections be carried out before delivery to site.

Always check that the motor gland is tight.

Check Monitors, motors and pumps are as ordered and correctly matched. If possible, it is good to practice run the pump briefly in a container of water (water must be over the suction inlet) to check on operation before installation in the bore.

Drop cable should be affixed at three metre intervals by a suitable underwater tape with the cable having some slackness between each interval to compensate for the expansion of the polythene pipe when under load.



## **DELIVERY PIPING**

Large diameter pipe should be used for long runs to compensate for pressure losses due to friction.

Long pipe runs can cause water hammer and damage to pumping systems. Consult your local borehole specialist as additional check valve and water hammer arrestor (pressure tank) may need to be fitted.

## **PUMP SWITCHING**

By Float Switches, Pressure Switches, Timers etc. (See also section headed "Pressure System Installation")

Use the supplied SP Monitor module to manage input and output signals and voltage.

NOTE: Any automatic switching of the pump greater than 20 starts per hour will shorten the motor life and may void warranty.

## **INITIAL STARTING**

Before connecting the pump outlet pipe from the bore, bend and gate valve should be screwed into the top of the bore cap as a pump valve.

With the gate valve just slightly open, start the pump.

## **NEVER START THE PUMP AT FULL FLOW FOR THE FIRST TIME**

Immediately the pump has been started, catch some of the discharge water in a large container and allow the solids to settle out. If little or no sand appears, open the gate valve to 1/3 and pump until the water is clean.

For the first 10 to 20 minutes of operation, it is suggested to keep the gate valve only partially open, to maintain a low flow which will prevent turbulence in the well near the pump and possible seizing of the pump due to excessive sand in the water.

If excessive amounts of sand or other solids are being pumped, shut the pump down, and have the bore attended to before restarting the pump.

Submersible pumps are not guaranteed against failure due to pumping sand. Pumping of sand of even very fine small quantities will shorten the effective life of any pump

## **NEVER OPEN THE GATE VALVE ABRUPTLY**

as this may raise sand and deposits.

The pump should be run for a period of 30 minutes to check that it does not pump the bore dry. This would be obvious by large fluctuations on the pressure gauge and the ammeter as the pump flow surges. Continuing operation in this manner could cause serious damage to the pump and motor due to shock pressures as the pump alternately takes up and loses the hydraulic load. This effect is generally referred to as “snoring”.

If in doubt about the draw down level of the bore, the use of level controller is recommended. If probe type is used, the probe should be located to switch the pump off when the bore water level drops within 1 metre of the pump suction. The use of a high level probe to automatically turn the pump on is not desired, as a rapid cycling of the pump could occur causing severe damage to the unit. Time clock or manual restart is recommended.

# PRESSURE SYSTEM INSTALLATION

When a submersible pump is to be used as a pressure system, the following items are required. A pressure tank of at least 30 litres draw off. A non-return valve at the top of the bore in addition to the pump's in-built non-return valve is required for pressure system application. It is recommended to install an additional gate valve (isolating valve) to allow blow down of the pressure tank to facilitate pressure pre-charge checking.

The pressure tank connected must be large enough to provide the storage capacity and draw off to limit pump starts to 5 per hour. Use more than one tank if necessary. Do not use "air volume control" tanks from old model pressure systems or primitive non-diaphragm type tanks.

*CAUTION: If the available pump pressure at the bore head can exceed the pressure tank's maximum working pressure should there be a pressure switch failure, then a pressure relief valve should be fitted in the delivery line to prevent the tank being over pressurised. Use only nominal 30 litre draw off tanks or larger. Do not at any time use smaller tanks. If cut out pressures exceed 5 bar (500 kPa, 73 psi) fit a 12 bar switch. Pressure switches operated outside their design working range can fatigue and cause pump and fittings failures and void warranty.*

## Troubleshooting

THE TROUBLE IS?	WHAT TO LOOK FOR
Pump doesn't start	Faulty pressure switch Control box in sun or near heat source Wrong control box being used Defective control box Hydraulic overload Water logged pressure tank Low voltage supply to motor (low solar irradiation) ISOLAR controller switching between energy sources
No water delivered	Low solar irradiation Broken pump shaft or coupling Check valve installed backwards Check valve stuck closed Inlet screen clogged Water level too low in well Hole in delivery pipe below top of bore
Low water delivery	Fittings stopping check valve opening fully Water level too low in well Discharge pipe clogged, corroded or ruptured Pump installed too low in well and covered with sand or other solids Inlet screen partial clogged Worn pump Leak in outlet pipe below top of bore Check valve stuck partially closed
Pump doesn't shut off	Pipe ruptured Defective or improperly adjusted pressure switch Water level too deep for pump. Check selection Pump is air or gas bound Worn pump Pipe obstruction Pump needs adjusting
Pump starts and stops too often (i.e. more than 5 per hour)	Incorrect pressure switch, see pressure system installation Defective air valve or tank diaphragm Pressure switch differential adjustment failure Pressure tank is too small
Electric shock from water pipe Note: A motor down to earth or defective cable will not cause a shock.	Defective (grounded) incoming power leads Defective control box Earth wire connected to wrong control box terminal
Pressure gauge oscillates, flow surges (snoring)	Water level too low in the well. (Flow through pump greater than flow into well)
Electrolysis on motor and pump	Insufficient earth / earth leakage Broken earth wire

*NOTE: Always install borehole submersibles with ON/OFF switches and approved circuit breaker to protect against motor damage and electrocution*

## Notes

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## Contact us:

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