

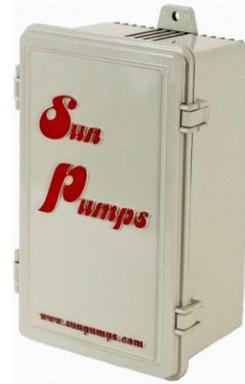
# OPERATION AND INSTALLATION MANUAL

## SJT SERIES SOLAR ELECTRIC SHALLOW WELL JET PUMP



**SJT10-120 BL**

***Quality First!***



## Sensorless Brushless DC Motor



**Manufactured & Serviced By:**

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**Made In America  
ARRA Compliant**

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## 1.0 Introduction

Thank you for selecting a SunPumps SJT series solar jet pump system. The SJT series pump and PCA series Sensorless Brushless DC pump controller are the key components to high quality solar powered pumping systems. Their stand-alone, pollution free and low noise operation makes them an ideal solution for remote homes, irrigation projects, and wildlife and stock watering without violating the environment.

SunPumps SJT series systems are solar powered, shallow well jet pumps, utilizing a sensorless brushless DC motor. The brushless DC motors constructed of high quality, anodized, die-cast aluminum and the controller is mounted in a powder coated, die cast, NEMA 3R enclosure. These pumps were designed specifically for water delivery in remote locations.

The PCA-BLS series controllers are microprocessor based solid state DC power converters designed as the interface between a solar module array and a three phase sensorless brushless DC pump motor. The purpose of the controller is to operate the high efficiency, high reliability DC motor and maximize the total daily water output while providing protection for the pump as well as providing an interface with other related pumping system equipment.

**Although these SJT series pump systems are easy to install, please read this manual to become familiar with the pump and controller features, functions, connection points and various configurations. For future reference, keep this manual and other relevant product information in a safe place.**

### PRECAUTIONS

- **Safety First – Always understand what you are doing when working with any form of electricity. Guessing at something is not worth the potential of product damage and/or severe personal injury.**
- **Shut down all power when working on the system.**
- **Do not feed live wires into the PCA-BLS-M2. Personal injury or other damage may result.**
- **Do not exceed the voltage rating of the controller.**
- **Do not start or run the pump dry.**
- **Do not splash water on the controller when the cover is open.**
- **Mount the controller in a shaded, well vented, vertical position.**
- **Installation of this system should be done by a licensed Pump Contractor.**
- **Verify wiring connections between the controller and the motor before starting the pump.**

## 2.0 Product Overview

The SunPumps PCA-BLS-M2 series controllers were designed specifically for SunPumps sensorless brushless three phase DC pumps. When properly installed and configured, the unique features incorporated into this stand-alone system will automatically control and protect your pump system permitting many years of dependable, trouble free service. SunPumps has produced two versions of this controller. The notable differences between the two are certain set points and electrical characteristics which are detailed in the table below.

**Table 1**

Controller Model	Min Voltage <sup>1</sup>	Max Voltage	Min Power	Max Power	Low Water Cutoff Min	Low Water Cutoff Max	Nominal Voltage
PCA-60BLS-M2 <sup>2</sup>	30 V	100V	Set by LWC	840 W	50 W	300 W	60 V
PCA-120BLS-M2 <sup>2</sup>	90 V	200 V	Set by LWC	1000 W	50 W	500 W	120 V

<sup>1</sup>Min Voltage is the minimum voltage which the unit must see in order to start the pump. If this voltage is not obtained, the unit will not attempt to start the pump. Voltages lower than this will not hurt the unit.

<sup>2</sup>Both controller models have the same operating features, functionality and setup. Voltage and power tolerances are the only differences of concern to the end user. This manual will only differentiate when necessary for clarity.

## 2.1 Controller Features

1. Current boosting for matching the load requirements of the pump.
2. Voltage regulation of the solar electric array at its maximum power point. (MPPT)
3. Over-current protection via integrated electronic circuit breaker.
4. Reverse polarity protection (10 amperes maximum) on the input terminals.
5. Voltage and current limiting to pump motor.
6. Transient protection and surge suppression.
7. Adjustable output motor power control for precision output flow.
8. System ON/OFF switch.
9. LED indicators; 1. Power In, 2. Motor Run, 3. MPPT, 4. RS Stop, 5. Low Power, 6. Over-Current, 7. Fault Condition.
10. Weather resistant powder coated, die cast aluminum enclosure with a hinged door.
11. Rising clamp screw terminal blocks – no fork terminals required.
12. Remote switch interface – float switch or remote shutdown –Normally Open or Normally Closed, user selectable.
13. Sensor and sensorless “Low Water” circuit
14. Low Power Shut Down circuit

## 2.2 Application

The only application the PCA-BLS series controllers are designed for is the interface between a solar module array and SunPumps Sensorless Brushless DC motors.

*No other applications or DC power sources are recommended or warranted unless written approval is provided by the SunPumps factory.*

## 3.0 Installation and Operation

The following sections are outlined in a step-by-step format to guide you through the installation and configuration of an SJT series pump and PCA series controller. The procedure for installing the SJT shallow well jet pump is the same as any standard AC jet pump. Any licensed pump contractor will be familiar with the proper installation procedures. The installation and operation should be in accordance with local regulations, accepted codes of good practice and common sense. This pump should be installed by a licensed professional pump installer.

**Before installing any pump system read all product manuals then review all system components to become familiar with the physical and electrical layout.** Check all equipment for any product damage. Refer to applicable figure(s) as a guide during the installation. Controller door must be closed during normal operation.

### **Warning**

*Reverse polarity on a panel system capable of producing over 10 amps will result in non-warranted product damage. Please check polarity before connecting power to the controller.*

*This controller is for SunPumps Sensorless Brushless DC Motors only. Do not use this controller on AC, Brush-Type or Sensor Type Brushless DC motors. Damage to the controller and/or motor will result.*

## 3.1 Location

As the majority of system installations vary greatly, only general comments can be made as to location. Prior to installing the system, it is suggested to make a system layout plan. During the system layout, take into consideration any potential shading of the solar electric modules, wire runs, wire size, conduit runs, trenching, controller accessibility, tank location, pump head etc. Shading even a small portion of the array can reduce the output of the entire array and thus reduce or completely stop the output of the pump. There is no substitute for a good plan! Always follow State and Local Building Codes.

The PCA-series controller can either be mounted indoors or outdoors. Locate all system equipment as close as possible to each other. For top of pole mount racks, the controller is usually mounted on the north side (shaded side) of the mounting pole. The controller must be mounted in a vertical position for proper cooling and to keep the electronics dry. The pole should be located close to the well (bore hole). This general physical layout is conducive to clean installation both aesthetically and electrically.

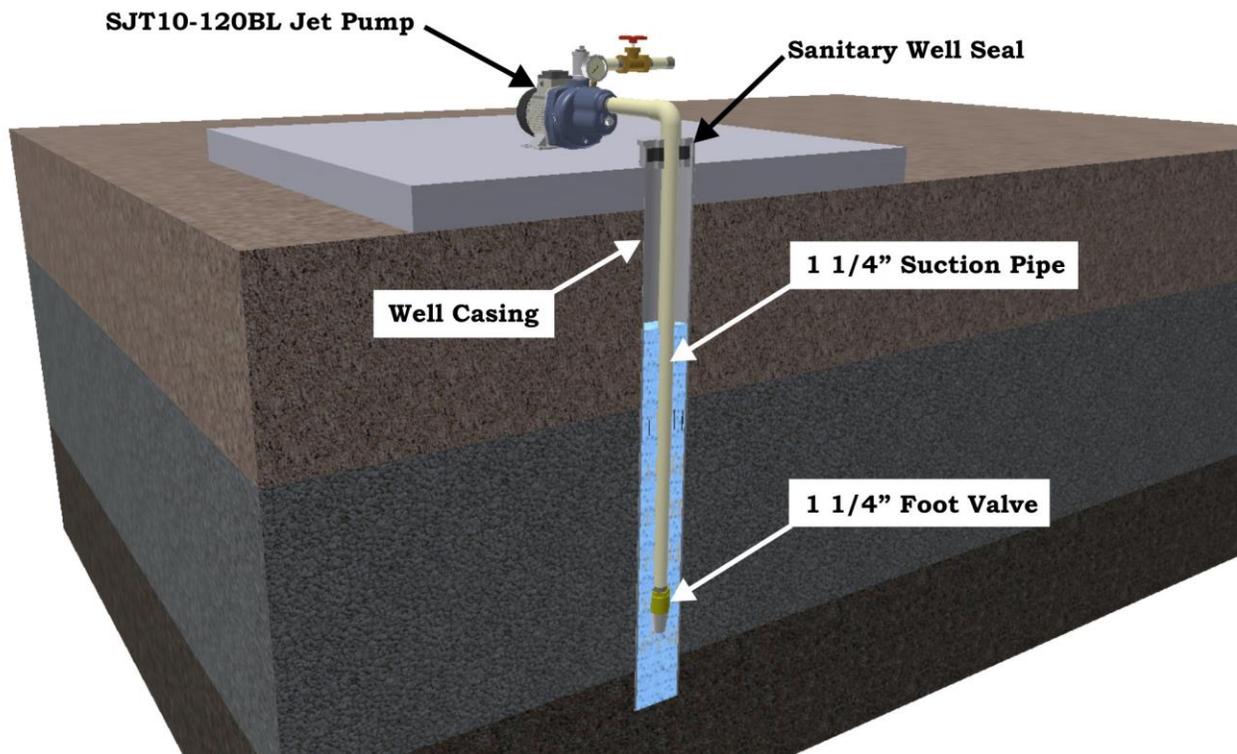
### **3.2 System Design Basics (Read carefully before installation)**

1. The pump discharge piping should be sized for efficient pump operation. We suggest using the Friction Loss Tables to calculate the Total Dynamic Head using different pipe sizes. Use no less than a 1 1/4" suction pipe and increase the pipe size if the run is over 50 feet.
2. For optimum pump performance make sure that the wire is sized properly for the length of run between the pump and the solar modules. Wire sized too small will cause a decreased output from the pump. Keep the distance from the solar modules to the pump as short as possible. Refer to a DC wire loss chart for proper sizing. It is recommended to keep the voltage drop under 3%.
3. The SJT series shallow well jet pumps have a maximum suction lift capability of 25 feet at sea level. For every 1000 feet above sea level the suction lift will be decreased by 1 foot.
4. Always use a foot valve on the suction pipe with a negative suction lift. Keep the suction pipe in a straight sloping line without any loops where air could be trapped. Keep the suction pipe as short as possible. To avoid air pockets, slope the horizontal pipes continuously upward from the water source by at least 1 inch for every 30 inches of horizontal pipe.
5. Always fill the suction pipe and the pump with water before you turn the pump on. If the pump is operated dry, damage to the impellers will occur and dry running is not covered under warranty.
6. If pumping from a tank or any source that could run low on water, install a low water float switch to protect the pump from running dry.
7. If a pressure switch is used in the system, choose one with a Low Pressure Cut-Off. If the pump runs dry the pressure will drop and the low pressure switch will turn the pump off.
8. Never install the controller in direct sunlight. Direct sunlight on the controller may cause over-heating of the controller.
9. Never lay the controller on the ground or mount the controller in a horizontal position. **The controller should be mounted in a vertical position only.** A convenient place to mount the controller is on the north side (shaded side) of the solar module array.
10. The controller should be grounded to the pump motor housing, the frame of the solar modules and to an 8-foot ground rod. If the well casing is steel it may be used as the ground rod. Drill and tap a hole in the casing or weld a bolt to the casing for the ground lug. Use only a copper lug to attach the ground wire. The cemented support structure pole will not provide an adequate ground. Do not ground the positive or negative electrical wires. Always use a DC surge/lightning arrestor on the panel side of the controller. (Midnight Solar MN-SPD surge arrestor is recommended)
11. Do not ground the array positive or negative electrical wires.

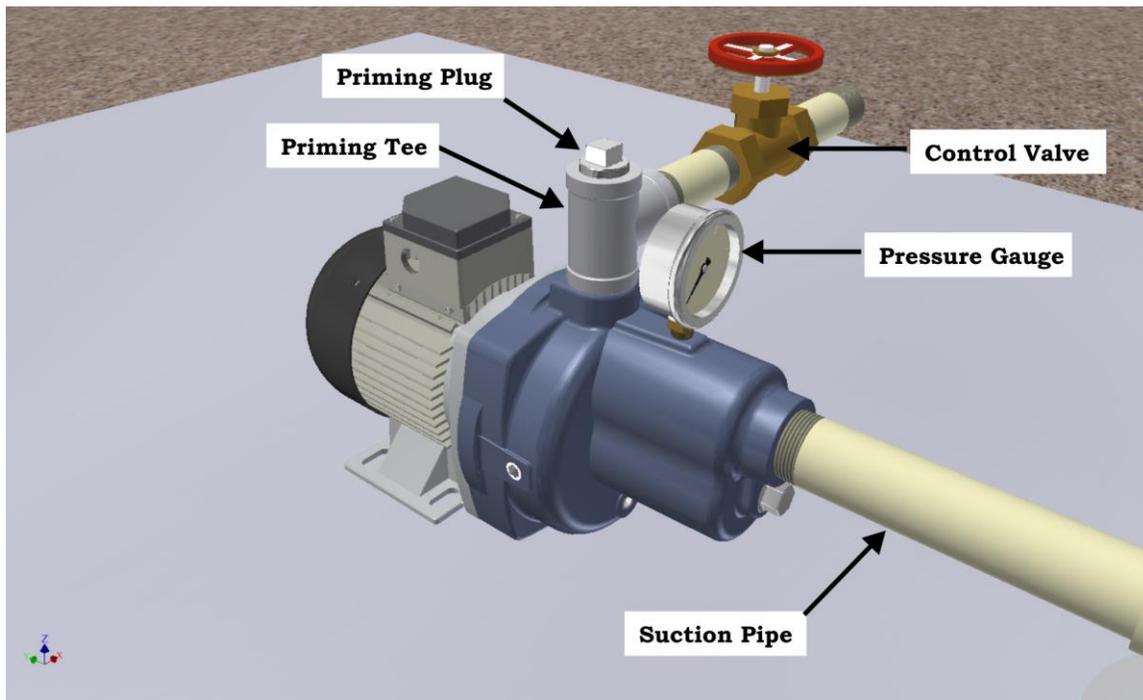
### **3.3 Shallow Well Pump Installation**

1. Write the pump, motor and controller model number and serial number in the space provided on the last page in this Instruction Manual. This information will be needed when filling out the Warranty Card. And will aide in any troubleshooting if necessary.
2. Inspect all components for shipping damage and insure that you have all the components that are required for a complete installation.
3. Locate the pump on a flat surface close to the water source but do not mount in direct sunlight. The motor requires free circulation of air so always install in a well-ventilated and dry area.
4. Keep the suction line as short and as direct as possible. This reduces the friction losses through the pipe and fittings. The suction line should have continuous slope from the lowest point in the line to the inlet of the pump. Make sure there are no loops or high spots in the suction line that could trap air. To avoid air pockets, slope the horizontal pipe continuously upward from the water source to the pump by at least 1" for every 30" of horizontal run.
5. Make sure the suction joints are tight. The suction line should be the same size or larger than the suction port, 1 1/4". Increase the pipe size if the pipe run is over 50 feet.
6. Install a foot valve at the end of the drop pipe, if the well is 2" or larger. Lower the drop pipe with the foot valve into the well. Keep the foot valve off the bottom of the well at least 5 feet if possible. This will lower the chance of debris being pulled into the suction screen or the pump. Barbed type connectors should always be double clamped. For poly pipe, compression fittings are recommended.
7. Connect the suction pipe to the suction end of the pump as shown in Figure 1.
8. Install a 1" priming tee to the discharge port of the pump as shown with the pipe plug at the top. The pipe plug can be removed to fill the suction pipe and the pump housing with water before start-up. After priming the pump, reinstall the pipe plug and tighten. Always use a pipe thread sealant.
9. For an open discharge system, install a control valve on the discharge line as shown in Figure 2. The valve is used to regulate the internal pressure of the pump for proper jet performance. Connect the pipeline from the valve to the place of use.

**Figure 1**                      **Typical Shallow Well Suction Pipe Installation**



## Figure 2 Typical Shallow Well Pump Installation



### 3.4 Adjusting The Pressure On The Jet Pump (For Open Discharge)

If the system is used with an open discharge, pumping into a non-pressurized tank, there must be internal pressure in the pump housing for the jet to operate properly. This is provided by adjusting the control valve on the discharge pipe as shown in Figure 2. (Not included with the pump.)

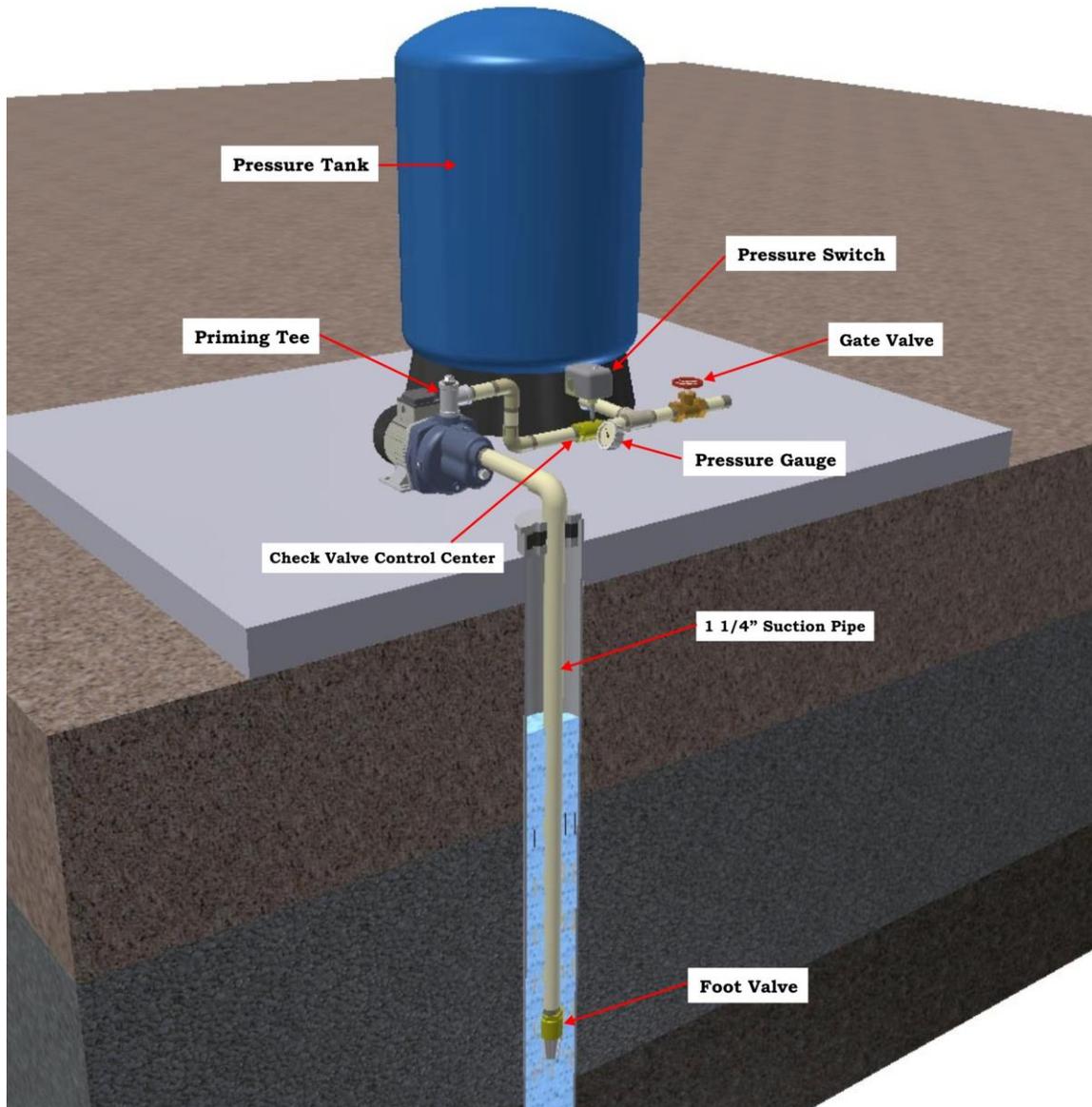
The required minimum pressure varies with pump speed, elevation and suction lift so there is no easy way of predetermining the minimum internal operating pressure. With solar power and changing sunlight conditions there will be varying motor speeds so the best time to make the adjustment is at mid-day in with clear skies with full sunlight.

The easiest way to adjust the control valve is by sound. If the internal pump pressure for your specific pumping application is too low the pump will cavitate and cavitation makes an audible sound. Cavitation occurs when the local static pressure is below the vapor pressure. To stop the pump from cavitating, the internal pump pressure must be increased above the vapor point. To do this the control valve on the discharge pipe is slowly adjusted toward the closed position until you hear the cavitation stop. You can watch the pressure gauge to see what this minimum internal pressure is for your application.

### 3.5 Typical Pressure System Installation

1. Follow the same installation procedures in Section 3.3 for the “Shallow Well Pump Installation” with the exception of the location of the pressure gauge and the control or gate valve.
2. Install a check valve control center, a pressure gauge and a pressure switch between pump and the pressure tank. Make sure both the pressure gauge and the pressure switch are on the tank side of the check valve in the 1/4” NPT tapped holes.
3. Install a gate valve on the discharge pipe as shown in Figure 3.
4. When choosing a pressure switch make sure the “minimum pressure” required by the jet is at or above the cut-in pressure on the pressure switch. Usually a 30-50 pressure switch is a safe choice if you do not know what it is. Keep in mind the cut-in pressure can be adjusted up or down to fit your specific application.

### Figure 3 Pressure Tank Installation



### 3.6 Wiring

Prior to connecting any wires to the controller, be sure you have a system wiring diagram to use as a reference (see figure 3). Guessing at polarity and connection points is not worth the risk of potential product damage and/or personal injury.

Ensure the wire sizes are of adequate diameter (gauge) to minimize voltage drop. Please refer to a DC voltage loss table or call your SunPumps dealer for assistance. Wire gauge being too small will cause excessive voltage losses to the motor and will reduce the flow rate of the pump.

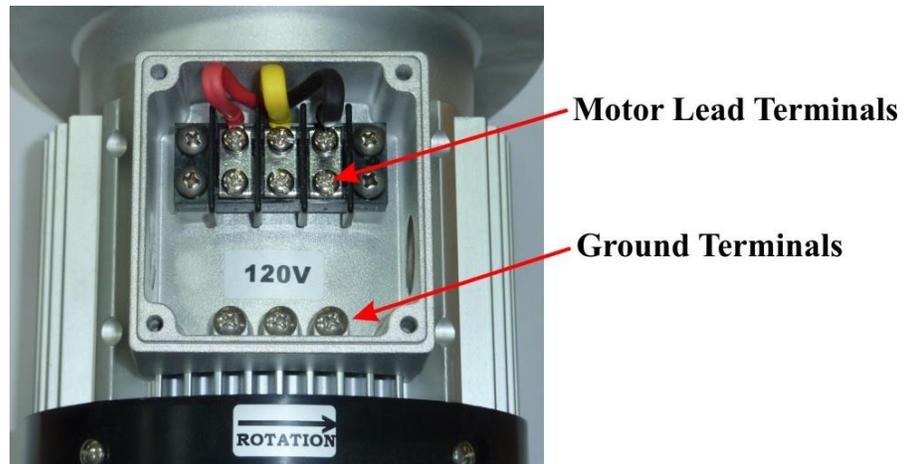
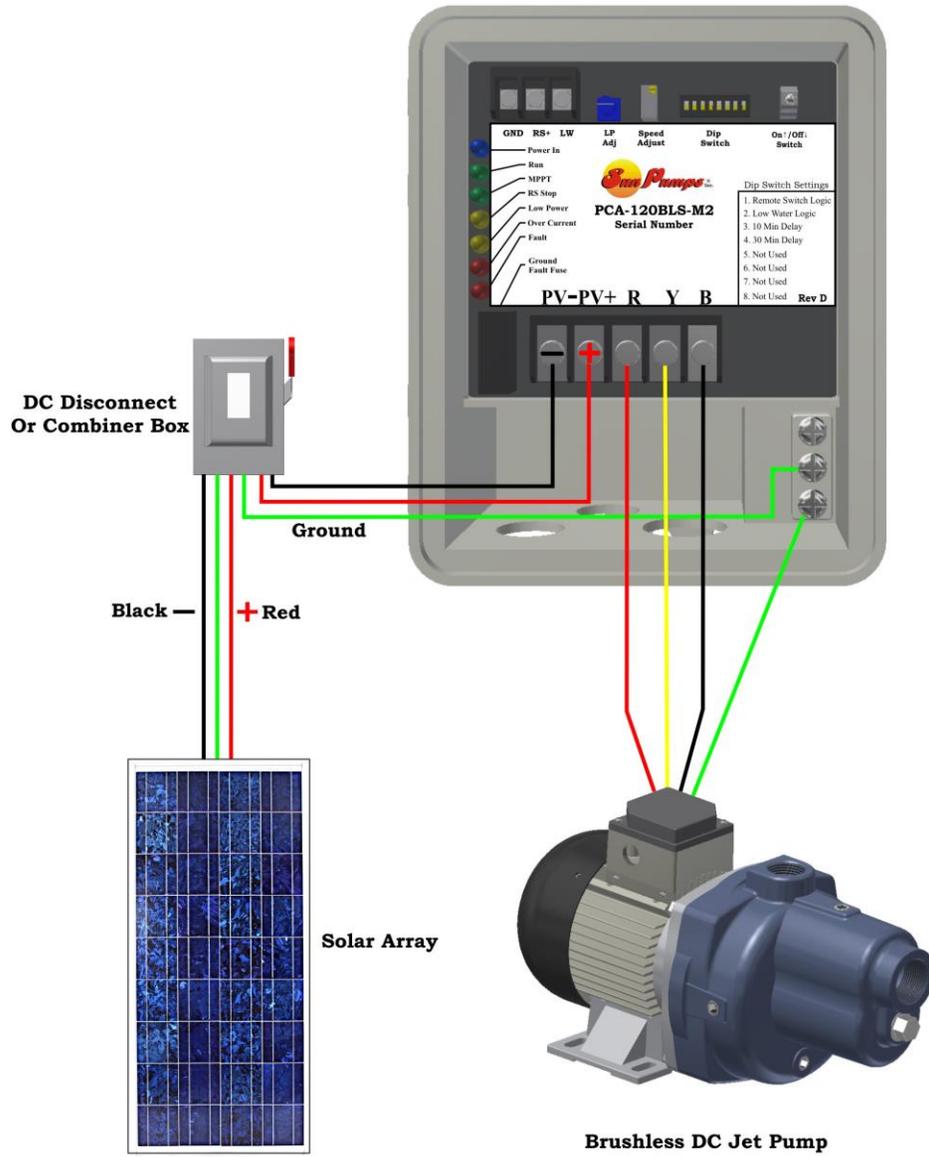
All other system equipment should be installed before proceeding with wiring the controller. Double check polarity and wire termination tightness before powering up the system.

**CAUTION: Photovoltaic panels produce DC electricity when exposed to sunlight. Cover the panels with a blanket or with a non-opaque material before wiring. Install a disconnect switch between the solar modules and the controller.**

**Follow the proper color code between the controller and the motor terminals. If the motor turns in the reverse direction the impeller and diffuser will be damaged and this is not covered under warranty.**

1. After mounting the controller, turn the on/off switch to the OFF position.
2. If you are using a remote switch, like a float switch, set dip switch 1 to the correct position for the type of switch being used. (“Normally Open” or “Normally Closed”.) If you are not using a remote switch leave switch 1 off.
3. Verify all remaining dip switches are off at this time.
4. Connect ground rod conductor to the controller chassis ground block.
5. Connect solar module frame ground conductor to controller chassis ground block.
6. Connect the green pump ground conductor to controller chassis ground block.
7. Connect pump motor leads to the corresponding “Pump Motor” terminals on the controller. Red to “Red”, yellow to “Yellow” and black to “Black”. **(CAUTION) If the wire connections are not correct the motor will turn in a reverse direction and the impeller will unscrew from the shaft and damage the impeller and the diffuser. This will not be covered under warranty.**
8. Verify the disconnect switch is in the off position. Connect the DC source supply negative (-), the black conductor, to one of the controller terminals labeled “Negative” on the “Solar Array Input”. (NOTE: The power should be connected to a disconnect switch and it should be in the OFF position before connecting power to the controller).
9. Connect the DC source supply positive (+), the red conductor, to one of the controller terminals labeled “Positive” on the “Solar Array Input”. (NOTE: The power should be connected to a disconnect switch and it should be in the OFF position before connecting power to the controller).
10. Refer to the next section for “Remote Switch” connections and “Adjustment Procedures” for configuration, if applicable. Sensor type low water cutoff is supported by the controller but not for booster pumps at this time. If you would like to use one contact SunPumps for assistance.
11. At this point, all system components are installed and wired, double check conductor polarities, wire termination tightness and controller configuration. With a DC volt meter check the array open circuit voltage (Voc) on the array side of the disconnect switch and the module polarity. Record the Voc for future reference. You may do this on the Before Calling Sun Pumps Worksheet near the end of this manual. Check this voltage reading against the “Voc” range for your specific system in the chart below. (Figure 3)
12. After you have verified the voltage and polarity, switch the disconnect switch on - if the polarity is correct the first LED light will be on.
13. Turn the “On/Off” switch to the ON position. The system should be operational. If the system does not start and turns on any error lights or gives you an error message, proceed to the troubleshooting guide.

**Figure 4** Controller Wiring Diagrams



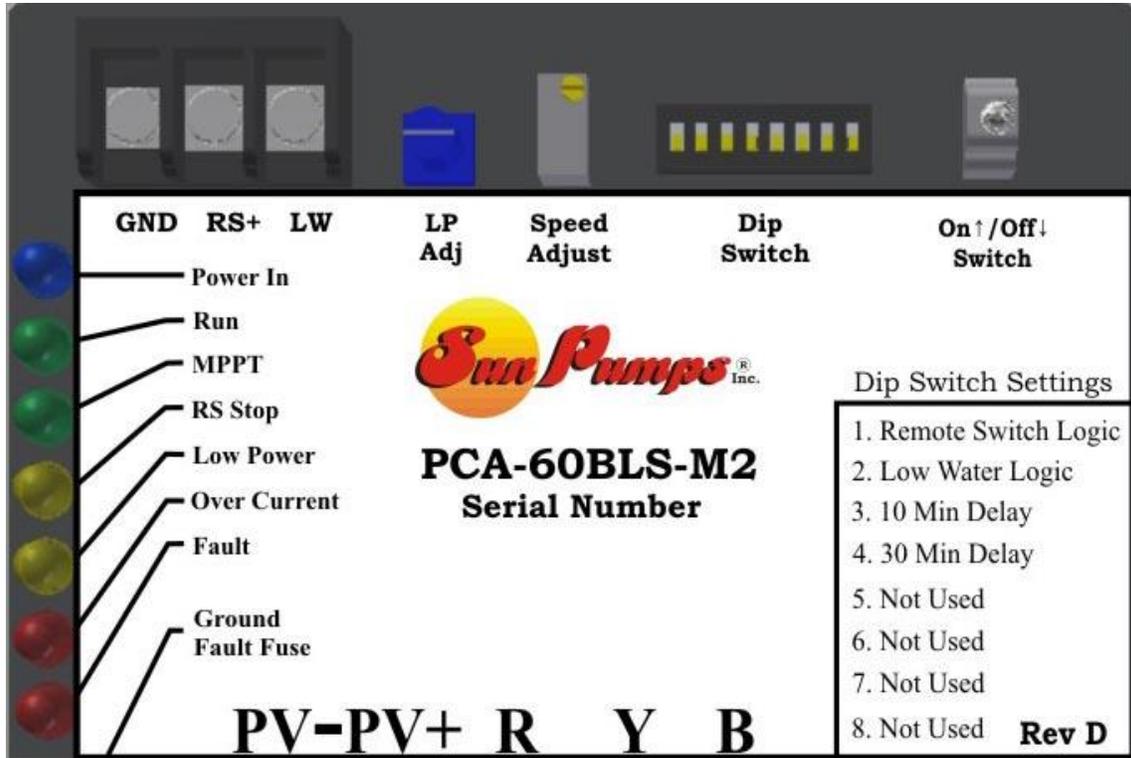
**Motor Electrical Junction Box**

**Figure 5 Controller Wiring Diagram**  
**(Auxiliary)**



Figure 6

Dip Switch Settings



Switch Number	Switch Position	Description	Function	Default Setting
1	OFF	Remote Switch Logic	Turns pump off when terminals connect.	OFF
1	ON	Remote Switch Logic	Turns Pump on when terminals connect.	OFF
2		Low Water Logic		OFF
3		Low Water 10 Minute Time Delay		OFF
4		Low Water 10 Minute Time Delay		OFF
5		Not used at this time	Should be in the off position for proper operation	OFF
6		Not used at this time	Should be in the off position for proper operation	OFF
7		Not used at this time	Should be in the off position for proper operation	OFF
8		Not used at this time	Should be in the off position for proper operation	OFF

## **3.7 Controller Settings**

The PCA series controllers have several settings (see figure 3). Most features include system configuration adjustments, some of which are user selectable by an eight position DIP-switch located on the face of the controller.

Switch 1 is the Remote Switch Logic. With this switch off (down), terminals “RS+” and “GND” must be connected to turn the controller off. With this switch on (up), terminals “RS+” and “GND” must be connected to turn the controller on.

Switch 2 is the Low Water Cutoff Logic. With this switch off (down), terminals “RS+” and “GND” must be connected to turn the controller off. With this switch on (up), terminals “RS+” and “GND” must be connected to turn the controller on. If you want to use this feature with the booster pump system, contact SunPumps for further assistance.

Switches 3 and 4 are delay timer adjustments. The delay timer is used for the remote switch and the low water cutoff. This timer by default is set for a 3 minutes. Switch 3 will increase the timer to 10 minutes; Switch 4 will increase it to 30 minutes. See Remote Switch and Low Water Cutoff for more information.

Switches 5, 6, 7 and 8 are not used at this time and should remain down.

## **3.8 Auxiliary Control Circuits**

The auxiliary control circuits are configured and controlled with the “Dip Switches”, “LP Adj.”, “Speed Control” and the “RS”, “LW” and “GND” terminals. (See Figure 4)

These circuits offer expanded capability and are described here. The remote switch control is for float switches (storage tank level), pressure switches or a remote system “ON/OFF” toggle switch. The motor speed control is for adjusting the flow rate of the pump. There is also the low water cutoff, low power shut down and over current protection circuits. See each corresponding detailed description below.

**NOTE: Use only “Shielded Wire” to run from the remote switch to the controller and the ground wire must be grounded to the controller side only.** Induced voltages from lightning storms or two-way radio transmissions could damage the controller.

### **Over-Current Shut Down Circuit**

The over-current shut down circuit will turn the controller off any time the current exceeds the current limit of the controller. When it turns the controller off it will remain off for 3 minutes and then turn on again. When it turns off an error light will light and the display will say Over-Current. When it turns on again, if it is still pulling excessive current it will continue to shut down for 3 minutes and try to restart.

### **Sensor Low Water Cutoff Circuit**

The sensor type low water cutoff circuit is designed as a safety feature to protect your pump from running dry or your tank from over flowing. This feature is designed for use in the submersible SCS systems with the ground wire installed. For use with the SCB or SCP systems contact SunPumps for assistance. The “LW” terminal of the controller should be attached to a low water sensor electrode which is mounted in your tank or well. The system can be used to detect low water or to detect high water depending on the position of switch 2 on the dip switch. When dip switch 2 is in the off position, the low water cutoff circuit expects not to touch water. If water comes into contact with it, and completes the circuit to ground, the pump will shut off until the water is removed and the delay timer times out. A three minute timeout is default for this feature but is modifiable by switches 3 and 4 to 10 or 30 minutes respectively. This timeout applies to remote switch and low water cutoff.

### **Remote Switch**

The Remote Switch interface can serve as an automatic system shutdown when used with a water storage tank mounted float switch, a pressure switch or it can also serve as a manual system shutdown with a remote system ON/OFF toggle switch. The remote logic circuit allows the use of standard “Pump-Up or Pump Down” float switches. Please refer to the following operation scenarios for configuration options.

With switch number 1 in the *OFF* position, the controller is configured to accommodate a Normally Open (N.O.) float switch or remote toggle switch. In this configuration the controller will operate as follows:

### PUMP ON

float switch open = water tank low = pump ON

### PUMP OFF

float switch closed = water tank high = pump OFF

With switch number 1 in the *ON* position, the controller is configured to accommodate a Normally Closed (N.C.) float switch, pressure switch or remote toggle switch. In this configuration the controller will operate as follows:

### PUMP ON

switch closed = water tank low = pump ON

### PUMP OFF

switch open = water tank high = pump OFF

A three minute timeout is default for this feature but is modifiable by switches 3 and 4 to 10 or 30 minutes respectively. This timeout applies to remote switch and low water cutoff.

## Low-Power Shut-Down/Sensorless Low Water Cut-Off Circuit (LPLW)

The Low-Power Shut-Down/ Low Water Cut-Off Circuit (LPLW) turns the pump off any time the controller output power drops below a functional level. This may be caused by lack of power from the solar panels or from running out of water. This protects the pump in stall conditions and saves wear on the system when no or very little water is being pumped. This feature must be adjusted for your specific application.

This feature is always monitoring the output of the motor. If you are not interested in using this feature turn the “LP Adjust” trim pot fully counter-clockwise. This will give the pump the minimum low power set point possible.

### **LPLW Adjustment**

The Low Water Cut-Off Circuit and the Low Power Shut-Down circuit are adjusted using the same trim pot labeled “LP Adj.” on the controller. The default is the arrow pointing straight up. This is sufficient for most systems but adjustment will maximize the life and output of your system. Follow the steps below to adjust this feature.

1. Turn the “LP Adj.” trim pot fully counter clockwise.
2. Turn the “Speed Control” trim pot counter clockwise until the pump is pumping the desired minimum flow. This may be down to 0 gal/min but is not recommended for proper pump cooling.
3. Turn the “LP Adj.” trim pot clockwise until the pump shuts off.
4. Reset the “Speed Control” trim pot back to the desired position.

## Output Power Limit Circuit (Motor Speed Control)

The Output Power Limit Control circuit is used to control the speed of the pump motor and thus the flow rate of the pump. It is primarily used for low producing wells where the pump output is matched to the production rate of the well. However it can also be used any time specific flow rates are required.

### **Output Power Limit Adjustment**

The purpose of this procedure is to adjust the output power of the controller and thus reduce the water flow of the pump. If tests have shown the pump will out produce the well capacity, then the controller “Speed Control” feature can be used to match the flow rate of the pump to the production of the well.

1. With the system installed and controller properly configured, allow the pump to run at full power at mid-day until the pump starts surging.
2. Slowly turn the “Speed Control” trim pot located on the face of the controller counter clockwise until the pump stops surging. This is the point where the pump flow rate equals the well production. This process will probably take a few attempts to “balance” the system for optimum water production. If maximum water is not a critical issue you may want to reduce the pumps flow rate an additional 5% to 10% to insure the pump will not run dry.

(NOTE: The trim pot has a 15- turn range. It usually takes many complete turns in a counter-clockwise direction before you will notice any change in water output or output power on the display).

## 4.0 Troubleshooting

Sun Pumps, Inc. is dedicated to its customers and will gladly help you trouble shoot any problems with your system. However, especially during the busy summer pumping season, we may not be able to help you right away. Using this trouble shooting guide as your first resource when your system is not working properly can save you valuable time in getting your system fully functional. If at any time however, you are not comfortable performing any of these tasks, or do not fully understand the system, it is better to call than to guess. **Before calling please go through the section below labeled “Before Calling Sun Pumps” and complete the steps there.**

### ***CONTROLLER DOES NOT TURN ON***

1. Check the LED's on the face of the controller. The top LED, labeled “Power In”, should be on. This indicates power is connected to the controller and the polarity is correct. If it is not on, verify that the controller is properly wired, including polarity, and that the input terminals have at least 30 volts. Less than 30 volts at the input terminals and the unit may show no signs of operation. If you do have at least 30 volts in the right polarity, contact Sun Pumps for further assistance.
2. If the expected voltage is not present, disconnect the panels from the controller using the disconnect switch, and check any fuses and breakers in the system. Replace blown fuses and reset tripped breakers.
3. If there are no blown fuses and no tripped breakers, check the open circuit voltage of your array. If the open circuit voltage is not correct trouble shoot the array to find the problem. If the open circuit voltage is correct, call Sun Pumps for further assistance.

### ***CONTROLLER TURNS ON BUT PUMP DOES NOT RUN***

1. Make sure the On/Off switch is in the up position. (On)
2. The second LED is labeled “Run”. This indicates the pump is running. If it is on, go to the bore hole and listen for the sound of the motor. Check for breaks in the pipe. If you cannot find a problem call Sun Pumps for further assistance.
3. Check the fourth LED, labeled “RS Stop”; this is the remote switch shutdown indicator. If it is on, the remote circuit or low water cutoff circuit is preventing the controller from running the pump. Set the #1 and #2 dip switches to off and disconnect the remote switch and low water cutoff. Turn the switch off then back on. If the light goes out and the pump starts, troubleshoot the remote switch and low water cutoff individually. If the pump does not start and the LED is still lit, call Sun Pumps for further assistance.
4. Check the fifth LED, labeled “Low Power”; this is the low power shutdown indicator. If it is on, the controller detected a low power or low water condition. The low power shut down is a common occurrence on days which have clouds which block the sun momentarily. First check the input voltage to the controller. Verify that this exceeds the minimum voltage in Table 1. If it does not meet or exceed the minimum voltage, you do not have enough power to start your pump. **Note:** To accurately trouble shoot this feature there should be absolutely no clouds blocking the sun at any time during the following tests. If you have enough input voltage, turn the controller off then on again to reset this fault. If the low power or low water condition still exists then the controller will start but shut down again. Turn the blue pot labeled “LP Adj” all the way counter-clockwise. Cycle the pump off then on. If the pump does not shut down, the low water cutoff was causing the error. If you want to use this feature, readjust the low water cutoff as seen earlier in this manual. If it does not run properly, skip to step 7. Check to verify the pump is not running out of water. If your pump is not running out of water, call Sun Pumps for further assistance.
5. If the sixth LED, labeled “Over Current” is on, the controller has exceeded its current limit and shut down. Turning the controller off then on again will reset this fault. If the controller continues to need high current, it will turn itself off again. Verify the nominal voltage of your array. If the calculated  $V_{mp}$  for your array is higher than 200 V, the controller may go into over current. Remove one series panel from each string and try again. Check the pump for a short to ground using an ohm meter and call Sun Pumps for further assistance.
6. Check motor wiring and connections. Also check the ground fault fuse, it may have been blown.
7. Check your system for ground loops and replace the fuse with a 500 VDC 1A rated fuse. If this does not solve the issue, contact Sun Pumps for further assistance.
8. Check for proper dip switch settings on your controller. Switches 5, 6, 7, and 8 must be in the off position for proper operation.

9. Check for proper controller input voltage. If the pump is not running, the input voltage should be the array open circuit voltage, (Voc). Verify that this voltage is below the maximum input voltage allowed for your controller (model dependent see Table 1). Check the Voc on the label on the back of the solar modules and multiply this figure times the number of modules that are connected in series. This number should be + - 10% of the measured reading. If it is not then confirm all electrical terminations are tight and secure. Use a DC volt meter to check each solar module for proper open circuit voltage (Voc). One bad module will drop the voltage on the complete series string.

### ***PUMP IS RUNNING BUT THE OUTPUT IS LOW***

1. Make sure you have full sun light at midday, that there are no clouds and no shadows on any part of the array. Then verify power going into the controller by measuring the voltage and current. Check this against the pump chart for your specific application.
2. If the power is correct for your pump model and array size then make sure the pump wires are connected to the proper terminals. If two wires are reversed the motor will be running in reverse. It may still pump but not at the full rated output.
3. If the wires are correct verify that your system does not have any leaks where water can be lost. If you cannot determine the problem, contact Sun Pumps for further assistance.
4. Make sure the water in the well is not drawing down past the suction capability lift of the pump.
5. Check the suction screen on the foot valve to see if it is plugged.
6. Make sure the hole in jet nozzle is not plugged. (Part No. 41459)

### ***PUMP DRAWS EXCESSIVE CURRENT (More than the rating of the pump, but less than the rating of the controller)***

1. Check wiring diagram for proper connection.
2. Check for skinned wires or faulty underwater splice.
3. Check for locked motor armature. With the pump out of the well, remove the pump end from the motor (if this is not feasible skip this step and contact Sun Pumps). Allow the controller to attempt to start the motor. If the motor still does not run, contact Sun Pumps for further assistance.

**BEFORE CALLING SUNPUMPS**

If at all possible when calling Sun Pumps for technical support there are a few things which will help to speed up the process and help us determine the cause of and solution to the system failure. The best way to get help is to call while you are physically at the location of your pump, have good sunlight, and have a multimeter and a screwdriver with you.

Furthermore, please fill out the form below before calling. This information will provide us with most of the preliminary information we need to help you. If you cannot physically be at the site, filling out the worksheet is a must.

Pump Model Number: \_\_\_\_\_  
Pump Serial Number: \_\_\_\_\_  
Motor Serial Number: \_\_\_\_\_

Controller Model Number: \_\_\_\_\_  
Software Version \_\_\_\_\_

Date Purchased: \_\_\_\_\_

Solar Module Specifications:  
Model Number \_\_\_\_\_  
Rated Watts \_\_\_\_\_  
Voc \_\_\_\_\_  
Vmp \_\_\_\_\_  
Isc \_\_\_\_\_  
Imp \_\_\_\_\_

Solar Modules Connected in Series \_\_\_\_\_ X Voc \_\_\_\_\_ = \_\_\_\_\_ Array Voc

Solar Modules Connected in Series \_\_\_\_\_ X Vmp \_\_\_\_\_ = \_\_\_\_\_ Array Vmp

Series Strings Connected in Parallel \_\_\_\_\_ X Isc \_\_\_\_\_ = \_\_\_\_\_ Array Isc

Series Strings Connected in Parallel \_\_\_\_\_ X Imp \_\_\_\_\_ = \_\_\_\_\_ Array Imp

# Warranty Statement

*SJT Series Brushless DC Jet Pumps*  
*PCA Series Pump Controllers*  
Limited Warranty – Twenty Four Months

SunPumps warrants to the original consumer that its products shall be free from defects in material and workmanship under normal applications and service conditions for a period of twenty (24) months after the original date of purchase, but not to exceed eighteen (30) months from the date of manufacture.

At its option, SunPumps will repair or replace any SunPumps product, which has failed due to a defect in material or workmanship during this warranty period, no other brand controller is authorized for use with this pump. A PCA series controller must be installed in conjunction with the pump to validate the warranty. This limited warranty shall not apply if the SunPumps product has been damaged by unreasonable use, accident, negligence, mishandling, misapplication, alteration, modification, abrasion (sand damage to pump), shipping, service or modification by anyone (other than by SunPumps), or failure which are caused by products not manufactured by SunPumps, or should the products serial number being altered, or by damage that is attributable to an act of God, or by any other causes unrelated to defective materials or workmanship. Any disassembly whatsoever of the product voids all warranty.

The original purchaser MUST complete and send in the warranty registration card, with the pump serial number and the controller serial number for warranty validation. ***No warranty performance will be rendered without a valid warranty card on file at the SunPumps factory.***

There are no express warranties except as listed above. SunPumps shall have no responsibility for damage to property, persons, animals, or other loss or injury resulting from the use of a SunPumps product. The purchaser's exclusive remedy shall be only as stated herein. This warranty is in lieu of all other warranties expressed or implied.

Except for the warranty that the products are made in accordance with the specifications therefore supplied or agreed to by customer, SunPumps makes no warranty expressed or implied, and any implied warranty of merchantability or fitness for a particular purpose which exceeds the forging warranty is hereby disclaimed by SunPumps and excluded from any agreement made by acceptance of any order pursuant to this quotation.

***UNDER NO CIRCUMSTANCES WILL SUNPUMPS BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, LOSS OR EXPENSE ARISING IN CONNECTION WITH THE USE OF OR THE INABILITY TO USE ITS GOODS FOR ANY PURPOSE WHATSOEVER. ALL PRODUCTS ARE SOLD AS IS WITH ALL FAULTS. SUNPUMPS MAXIMUM LIABILITY SHALL NOT IN ANY CASE EXCEED THE PURCHASE PRICE FOR THE GOODS CLAIMED TO BE DEFECTIVE OR UNSUITABLE.***

SunPumps is not responsible for labor, transportation, and related costs incurred by the customer to make allegedly defective equipment available to the factory for inspection re-installation, lost profits or costs caused by interruption of service. SunPumps is not responsible for loss or damage to products, owned by customer and located on SunPumps premises, caused by fire or other casualties beyond SunPumps control.

This equipment is not to be used for anything other than its intended purpose as stated in this manual.

**For future reference, please list your system data before installing the pump.**

Installation Date \_\_\_\_\_  
Pump Model \_\_\_\_\_  
Pump Serial No. \_\_\_\_\_  
Controller Model \_\_\_\_\_  
Controller Serial No. \_\_\_\_\_  
Warranty Card No. \_\_\_\_\_