

OPERATION AND INSTALLATION MANUAL

For systems built after 4-1-2016



For SPV Series Pump
Controllers Models

SPV 2-240-IT
SPV 3-240-IT
SPV 5-240-IT
SPV 7.5-240-IT

SPV 7.5-460-IT
SPV 10-460-IT
SPV 15-460-IT

SPV 3.7-380-IT
SPV 5.5-380-IT
SPV 7.5-380-IT
SPV 11.380-IT



**SPV SERIES
SOLAR ELECTRIC
PUMP SYSTEMS
2 HP to 15 HP
1.5 KW to 11 KW**

Manufactured & Serviced By:

**SunPumps, Inc.
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Made in America



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1.0 Introduction

Thank you for selecting a Sun Pumps SPV series pump controller. It is a key component to a high quality solar powered pumping system. High quality stand-alone operation makes them an ideal solution for any remote solar pumping system using almost any 230, 380, 415 or 460 VAC, 50 HZ or 60 HZ, three phase inverter grade motor up to 150 HP.

The SPV-series controllers are micro-processor-based, solid-state DC-AC power inverters designed as the interface between a solar module array and a three phase motor. This manual will cover the 2 HP to 15 HP three phase SPV pump controllers. The purpose of the controller is to maximize the total daily water output while providing protection for the pump, as well as providing an interface with other related pumping system equipment.

Caution: Sun Pumps SPV series pump controllers have a variable frequency, three phase output and require either an inverter grade motor or an output filter. A dv/dt output filter has been included with this specific controller series and it has been installed internally between the controller and the motor. Output filters are used to protect the motor from high voltage spikes generated by variable frequency drives.

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

PRECAUTIONS

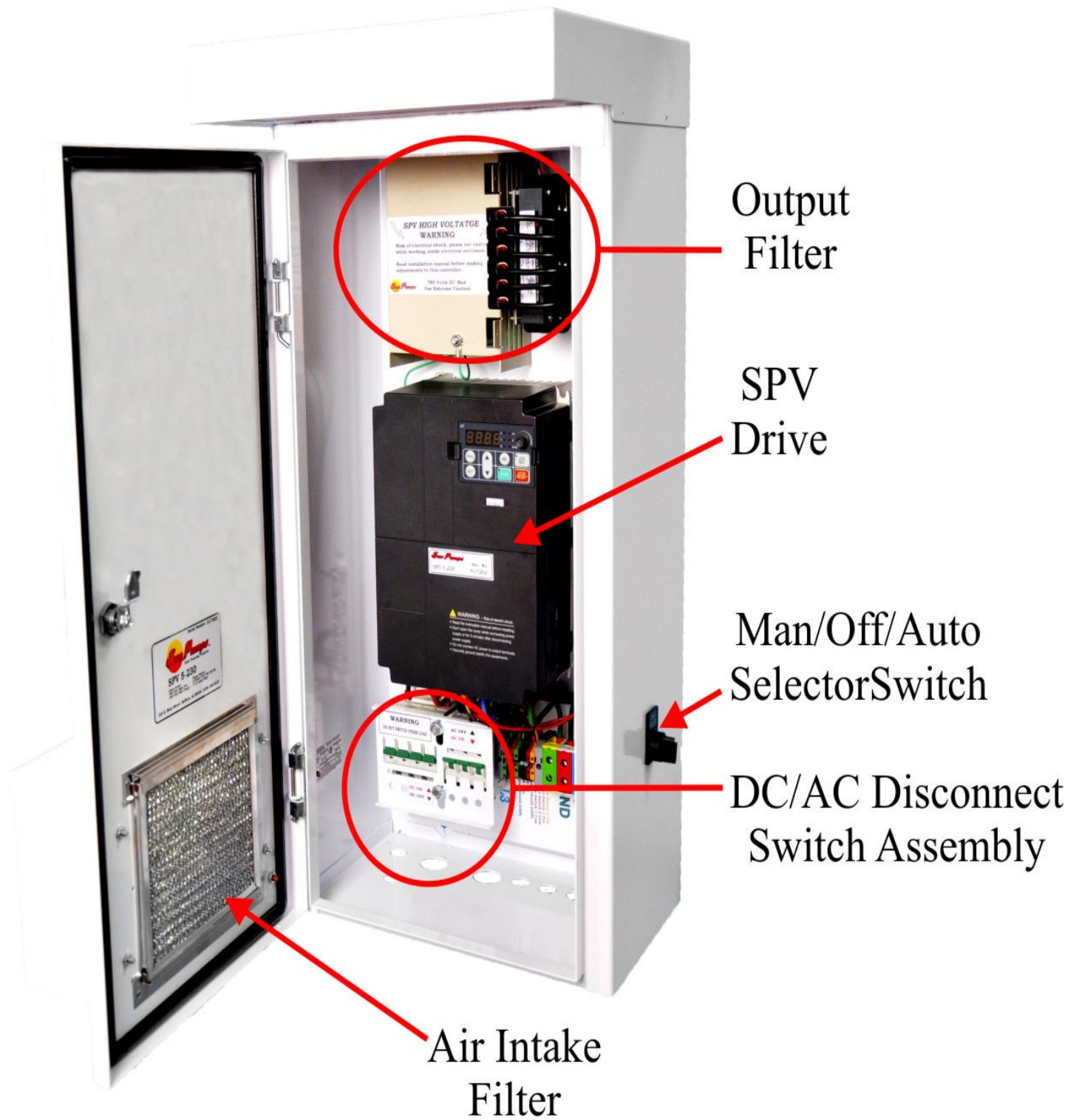
- **Safety First – Always understand what you are doing when working with any form of electricity. Guessing at something is not worth the potential of product damage and/or severe personal injury.**
- **Shut down all power when working on the system.**
- **Do not attempt to feed live wires into the SPV-series controller or product damage and/or personal injury may result.**
- **Do not exceed the voltage rating of the controller. Keep in mind the module Voc (Open Circuit Voltage) will be higher in colder weather.**
- **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 Electrical or Pump Contractor only.**

2.0 Product Overview

This Sun Pumps SPV-series controller was designed specifically to run 230, 380, 415 and 460 volts, three phase, 50 or 60 HZ AC induction motors directly from a solar array without the use of batteries. 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.

The SPV series controller uses Maximum Power Point Tracking (MPPT) algorithms and Variable Frequency Drive (VFD) algorithms to operate any 230-460 volt, 3 phase AC motor. The SPV controller changes the frequency, and thus the speed of the motor, in proportion to the available sunlight. As the pump speed drops, so does the power requirements. This allows the pump to continue operating under varying sunlight and thus varying power conditions. An added benefit to this technology is the soft start feature that is used as the controller finds the maximum power point of the system. This greatly reduces the number of panels needed to start the pump motor.

SPV Controller Basic Components



2.1 Controller Features

1. Voltage regulation of the solar electric array at its maximum power point. (MPPT)
2. Over-current protection via integrated electronic circuit breaker.
3. Voltage and current limiting to pump motor.
4. Digital display indicating status, power, voltage, current and more.
5. System Manual/Off/Auto selector switch.
6. Operates on DC or AC power.
7. Includes a manual DC/AC disconnect switch.
8. Includes an internal dv/dt output filter for motor protection.
9. Weather resistant NEMA 3R, powder coated, steel enclosure with a hinged door.
10. Rising clamp screw terminal blocks – no fork terminals required.
11. Remote switch interface – float switch or remote shutdown – Normally Open only.
12. Low Power Shut Down circuit.

2.2 Application

The only application this SPV series controller is designed for is the interface between a solar array and a 230-460 volt, three phase, 50 or 60 Hz AC induction motor.

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

3.0 Installation

The following sections are outlined in a step-by-step format to guide you through the installation and configuration of the SPV series controller. The procedure for installing the pump is the same as any standard three phase, AC 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 Electrician or 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

Connecting the solar array to the controller in reverse polarity will not allow the controller to function properly and could damage the control board. Please check polarity before connecting the DC power to the controller.

This controller was designed for either 230, 380/415 or 460 volt, three phase AC Induction Motors only. Check the model number for the correct voltage. Do not use this controller on Brush-Type motors or Brushless DC motors. Damage to the controller will result.

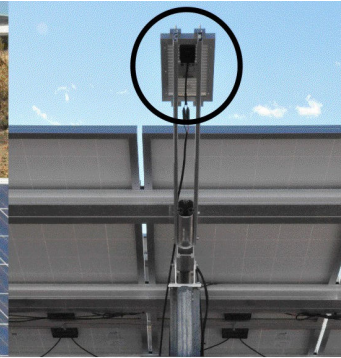
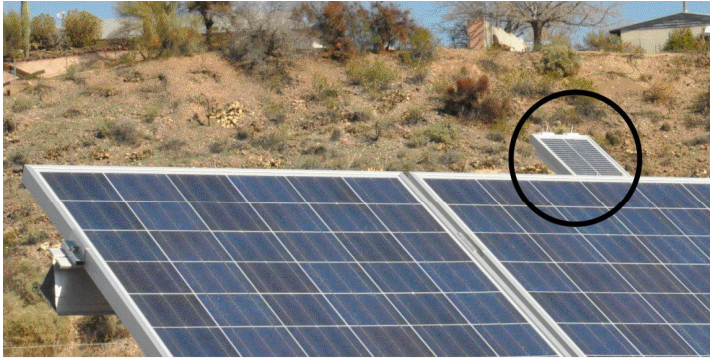
3.1 Location

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 and storage tank location. 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!

The SPV-series controller can either be mounted indoors or outdoors. **Do not mount this controller in direct sunlight.** Locate all system equipment as close as possible to each other. This general physical layout is conducive to clean installation both aesthetically and electrically.

3.2 Controller & Solar Sensor Module Installation

Install the SPV controller using the four mounting holes in the back of the enclosure. There are 2 on the top and 2 at the bottom. Mounting it to a back plane or wall is recommended. The method of securing the enclosure to the wall is at the discretion of the installer. Sun Pumps will not warranty damage caused by failure to properly mount the SPV enclosure to the wall or back plane. Do not mount in direct sunlight.



Solar Sensor Module Installation



Slide clamps under frame angle and tighten bolts.

The sunlight sensor module (referred to as the SunSwitch module) which is included with your SPV controller should be mounted on the same plane as the solar array that powers the SPV controller. The same orientation should be used for all panels. A convenient place to mount the module is to the top of any solar module in the solar array.

The included wire should be run from the sensor module to the SunSwitch using red for PV+ and black for PV-. Do not connect the SunSwitch output to the SPV unit until all other components are installed and wired. Without this module installed, the SPV will not turn on. If installation is to be done in an area where bird spikes are to be used, consideration should be given to mounting the SunSwitch module to the bottom of the array, away from any potential shading issues.

Enclosure Installation

The mounting bracket that comes with the sensor module kit does not require drilling any holes. Slide the two clamps under the solar module aluminum frame angle and tighten the four bolts. Note: The bracket on the left side, clamps on both the top and the side of the aluminum frame angles. The sensor module can be installed on either side or at the bottom of any of the larger solar modules in the array.

3.3 Wiring Practices

Prior to connecting any wires to the controller, be sure you have a system wiring diagram to use as a reference (see figure 1). 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 or AC voltage loss table or call your Sun Pumps 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.

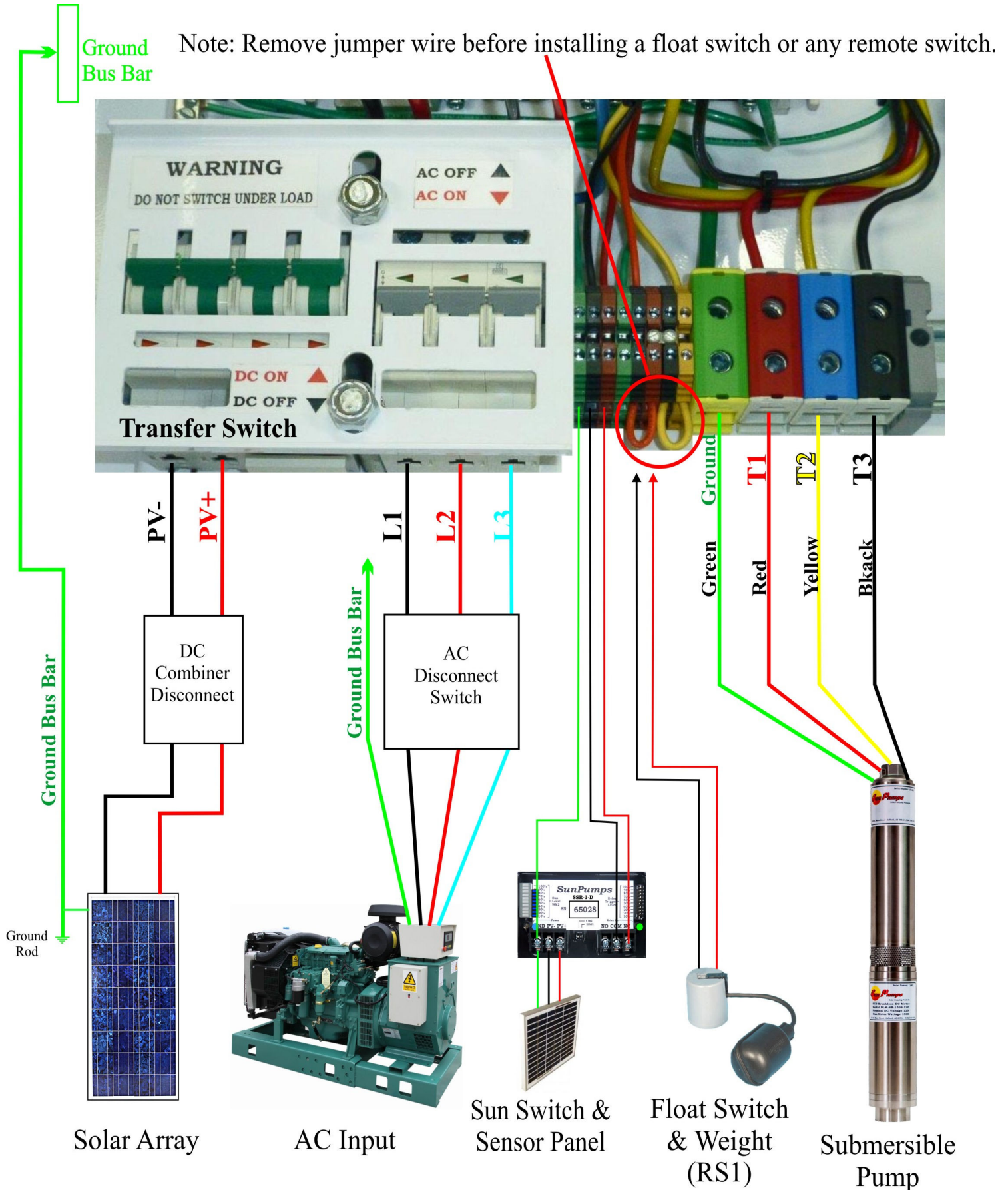
When wiring the controller, use a proper size screw driver for each connection. This will help ensure that the connections are tight and that you will be able to disconnect and reconnect wires as needed in the future. All other system equipment should be installed before proceeding to wire the controller. This manual assumes you are familiar with the common installation, layout, and wiring practices for all other components of the system your Sun Pumps dealer can help if you are not. Double check polarity and wire termination tightness before powering up the system.

CAUTION: Photovoltaic panels produce DC electricity when exposed to sunlight. Be extremely cautious when connecting the solar array or working inside the electrical enclosure. Land the input wires in the DC disconnect before connecting the solar panels to the wire.

CAUTION: The array voltage connected to the main disconnect can be up to 1000 DC volts and 480 volts AC on the output of the controller. Use extreme caution when working inside the open enclosure. These procedures should only be done by a licensed Electrical Contractor.

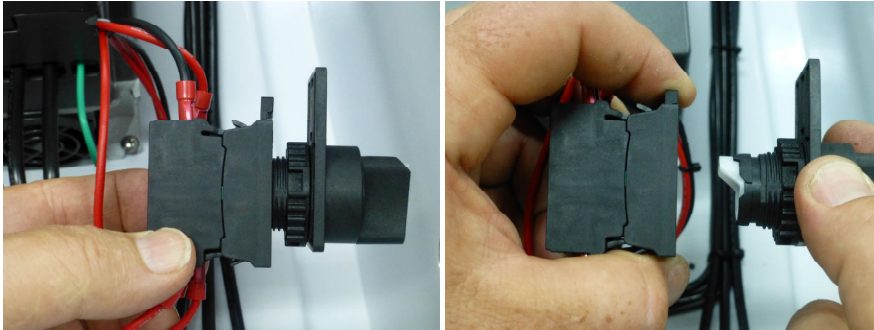
Controller Wiring Diagram

Figure1



3.4 Controller Wiring Procedures

The SPV drive was shipped with the MAN/OFF/AUTO selector switch removed from the enclosure to prevent shipping damage. This switch must be installed before proceeding.



To remove the Man/Off/Auto selector switch from the switch plate shaft, squeeze the top of the switch as shown and remove switch plate.

Remove the nut from the switch plate shaft and install the threaded shaft through the side of the enclosure.

Install the plastic nut on the threaded shaft located on the inside of the enclosure, align the switch plate and hand-tighten only.



Install the switch on the shaft by squeezing the top part of the switch and then releasing when in position. Be sure put the switch in the center position and then align the knob to the Off position before you tighten the nut.



Wiring The Pump To The Controller

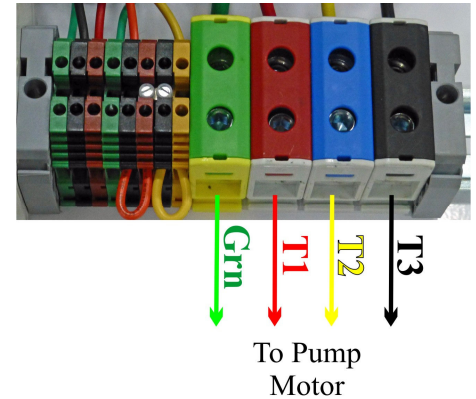
1. After mounting the SPV Drive, SunSwitch (SSR-1-D) and the solar sensor module, make sure the fuses in the combiner box are not installed and that the DC disconnect and the Man / Off/ Auto selector switch on the side of the controller are in the OFF position.

CAUTION: Never try to connect or disconnect the solar array input or pump output without disconnecting the power going into the enclosure. The voltages in this enclosure are deadly. Never turn the pump off, using the disconnect switch. Always use the Man/Off/Auto selector switch before turning the disconnect switch off or you may damage the SPV drive. This is not covered under warranty.

2. Ground the solar module frame ground conductor to the ground rod.



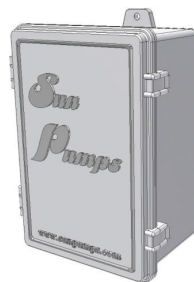
3. Ground the controller enclosure to the ground rod.
4. Connect the green pump ground conductor to controller bus bar grounding block.
5. Connect pump motor leads to the corresponding “Pump Motor” terminals on the controller. Red to “T1”, Yellow to “T2” and Black to “T3”. If the pump wires are connected wrong, it will not damage the controller but the pump will run backwards and will not pump correctly. **(NOTE: Some motors may have a different wiring that may affect the direction of rotation. If you think the pump output is lower than expected you can reverse any two of the pump wires and see if the output increases.)**



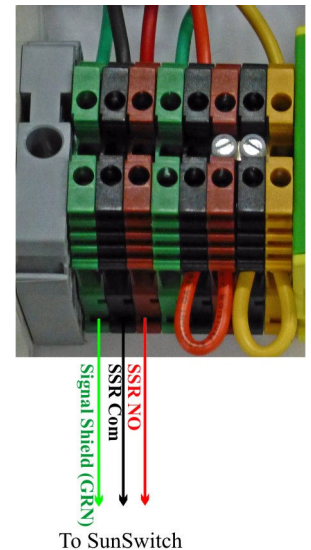
Wiring The SunSwitch To The Controller

6. Run the solar sensor module wire from the solar sensor panel to the SSR-1-D SunSwitch . Connect the negative (black wire) from the sensor module to PV-, the positive (red wire) to PV+, and the shield ground to the ground terminal (GND). The SunSwitch should now be reading the amount of sun insolation on the bar graph.
7. Run the control wire from the SunSwitch controller to the SPV enclosure but do not connect the SunSwitch to the SPV drive at this time. **The controller will not turn on without this sensor connected unless the selector switch is in the Man position.** This bypasses the SunSwitch. (Refer to Figure 5 for detailed wiring information.)

**Sensor
Module**



SunSwitch

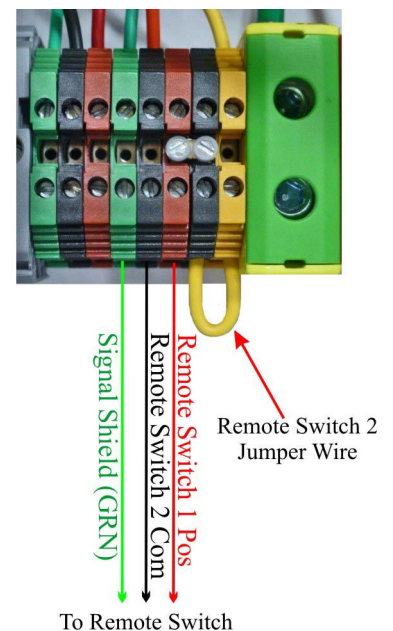


Wiring The Remote Switches To The Controller

8. If you are using a float switch and/or a pressure switch, connect each remote switch ground to Signal Shield (GRN) terminal, the positive to one of the Remote Switch positive terminals and the negative to one of the Remote Switch Com terminals. There are two remote switch terminals that can be used for various applications.

Note: The remote switch must break a connection to turn the pump off so the controller is shipped with two jumper wires in place. If you are not using one or both of the remote switch terminals, a jumper wire must be in place for the pump to run. You must remove the jumper wire to use either one or both of the remote switch circuits.

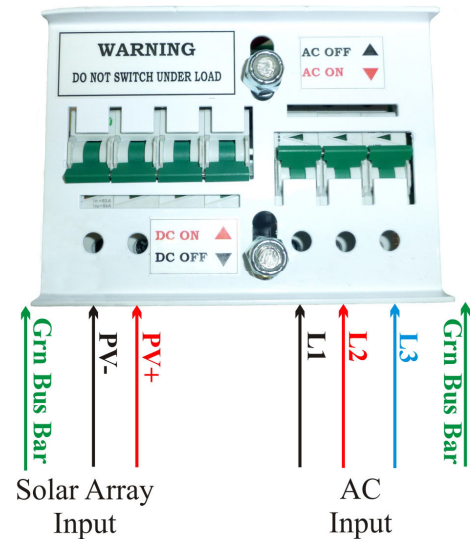
This is a make or break switch only. No voltage should be applied to the remote switch terminal blocks. Voltage applied to these circuits will damage the controller and this is not covered under warranty.



Wiring The DC/AC Disconnect Switch Assembly

Note: When loosening the screws on the disconnect switches, **do not** back the screws all the way out, loosen only enough to get the wire inserted. If they come out it is difficult to get them started again without removing the switch plate.

1. Before wiring, make sure that both disconnect switches are in the off position.
2. Connect the DC & AC ground wires, green conductor, to the ground bus bar terminal.
3. Connect the solar array negative (-), the black conductor, to the controller terminal labeled "PV-".
4. Connect the solar array positive (+), the red conductor, to the controller terminal labeled "PV+".
5. Connect the AC wires from a generator or from the grid to L1, L2 & L3 as shown.



CAUTION: Photovoltaic panels produce DC electricity when exposed to sunlight. Be extremely cautious when connecting the solar array. Land the input wires in the DC disconnect before connecting the solar panels to the wire.

6. Now connect the SSR-1-D SunSwitch output wires to the SPV drive terminals SSR NO (Red), SSR Com (Black) and Ground (Green). Read the bar graph on the SunSwitch to see if there is enough sun for the SunSwitch to turn on, if so the green LED on the right side of the SunSwitch will be on and the relay will be activated. The factory default for the sun switch is 30% but it can be adjusted by following the procedures outlined later in the manual if you feel it is necessary.

Note: The controller will not activate the pump without the solar sensor properly connected or if there is insufficient light. However the SunSwitch can be bypassed by turning the selector switch to the Manual (MAN) position. Placing the switch in the MAN position bypasses the SunSwitch when operating the drive with AC power.

Checking Open Circuit Voltage (Voc) & Polarity

7. All system components should now be installed and wired. Double check wire polarities and wire termination tightness.
8. Verify the DC and the AC disconnect switches in your SPV controller are both in the off position. Install the fuses in the combiner or disconnect needed to provide power to the SPV controller. Using a DC volt meter, measure the array open circuit voltage (Voc) at the PV array disconnect switch or combiner box terminals and check the module polarity at the same place. Record the Voc for future reference. You may do this on the "Solar Pump System Information Sheet" near the end of this manual. Check this voltage reading against the Voc range for your specific solar array and against the maximum voltage on your SPV drive label. This reading should be + 3% - 10% of your array Voc, depending on the solar module type and cell temperature.



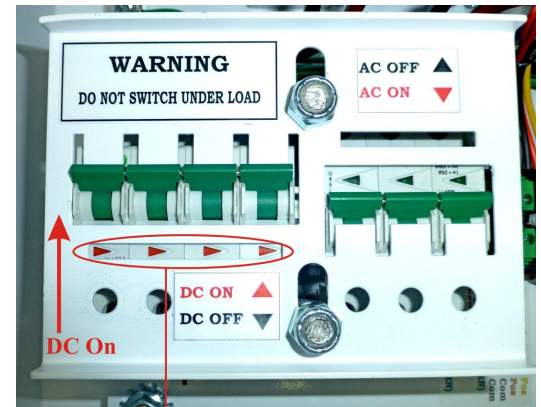
For example: If you are wiring a 240 VAC pump system and you are using 250 watt solar modules that have a Voc of 36.3 volts and you have 14 modules wired in series then you would multiply $36.3 \times 14 = 508$ volts. The voltage range should be between 523 and 457 volts, a +3 to -10% of the nominal Voc voltage, depending on the cell temperature.

3.5 System Start-Up On DC Power

Figure 2 Turn the DC disconnect switch on:

- Once you have verified the connections and voltages and with the enclosure door still open, switch DC side of the disconnect switch on. **Always make sure to have both the AC and DC switches turned off before switching either one on. Do not rely on the switch plate to turn either disconnect switch off.**

Use caution with placing your hands inside the enclosure, there could be up to **1000** volts connected to various terminal blocks including the transfer switch.



Note: Red arrows indicate the DC power is on.

- After all the voltages have been verified and the DC disconnect is on and the SunSwitch indicates there is enough power to operate the pump then your pump system is ready to turn on.

Display With Disconnect Switch On & Selector Switch Off

Figure 3 Display Before Start-Up

- As soon as the disconnect switch is turned on, the drive display will count down for about 15 seconds and stop at the programmed minimum start frequency, typically 30 HZ.

“Auto” Is For DC Power

“Man” Is For AC Power



Display With Selector Switch On Auto (For DC Power) & Operating At 60 HZ

Display After Start-Up

- Switch the Selector switch to the Auto position. (For DC Power)
- If properly installed, set up and sufficient sunlight is available, as soon as the selector switch is turned to Auto, the drive will start the pump and slowly ramp up to as high of frequency as it has power to do so.



Note: Not all systems will operate at the full 50 or 60 HZ frequency. The frequency will depend on the system design and the solar module arrangement for your specific flow rate requirements. Some systems will never reach full frequency but will still produce the full designed flow rate at a lower frequency design point.

Display Parameter Chart

	Indicator	State	4 Digit Display Value
Unit Indicator	Hz	Flashing	Given Frequency
	Hz	On	Output Frequency
	A	On	Output Current
	V	On	Input Power
	V	Flashing	Input Voltage
	Hz and A	On	RPM
	A and V	Flashing	PID Value
	A and V	On	PID Feedback

Light indicates which parameter is being displayed.



Use SET button to toggle through parameters.

Drive Display Parameters

The SPV drive will display input voltage, input power, output current, output frequency, programmed frequency and RPM's. Use the SET button to toggle through any parameter you want to view. The drive default is set on frequency. Please note, if you leave it on another parameter, it will automatically return to frequency after a few minutes.

3.6 Operating The SPV Drive On AC Power

The SPV drive can be operated from solar modules or from AC grid power or from an AC generator. While three phase AC power is highly recommended, in some cases single phase power can be used. However with single phase, the drive may not be able to get to the full frequency so it will not produce the full rated output of the pump.

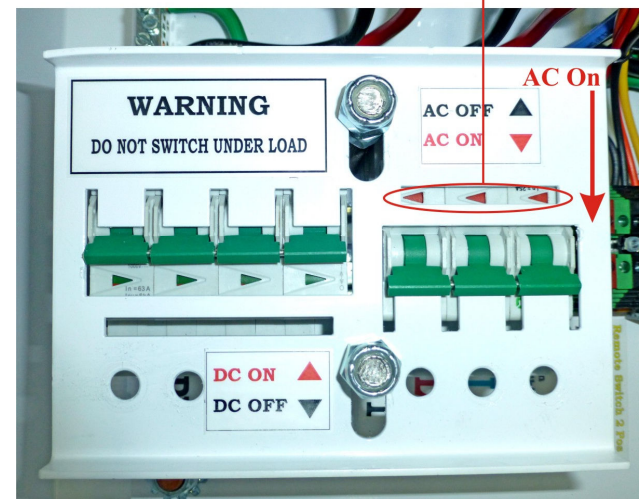
When switching to AC power you will notice the switch plate will not allow both DC and AC power to be on at the same time. Before you switch to AC power you must turn the Man/Off/Auto selector switch to the "Off" position. **Never switch the power from either disconnect switch under a load, this may damage the drive. Always make sure both disconnect switches off before turning one on.**

To change power sources follow these procedures:

1. Turn the selector switch to the "Off" position.
2. Turn the DC disconnect switch off and the AC transfer switch on. When the switch is on you will see the arrows turn red. When they are green, it means the switch is off.
3. With the AC power turned on, turn the selector switch to the "MAN" (AC) position. This bypasses the SunSwitch so you can operate the pump at night or in low sunlight conditions.

NOTE: It is not intended to use the switch plate to turn the disconnect switches on and off. Make sure both disconnect switches are in the off position before turning either one on.

Note: Red arrows indicate the AC power is on.



3.7 SSR Series SunSwitch Controller

The SunSwitch is a sun insolation meter as well as a programmable sunlight switch. The bar graph indicates the intensity of sunlight measured in percent of full sunlight, 1000 watts/meter² (watts per square meter) is considered full sunlight. The control circuit allows the pump to turn on only when there is enough sunlight, or power, to pump water. This saves a lot of unnecessary wear on the pump. In low sunlight conditions, when the pump could be running but there is not enough power to produce water, the SunSwitch can be adjusted to wait until there is sufficient sunlight to actually pump water.

The SunSwitch is pre-set to 30% sun insolation or, 300 watts/m², and is usually a good start point for a most pump systems. However the SunSwitch can be calibrated to fit your specific application. (See “SunSwitch Start-Up Adjustment”.)

Figure 4

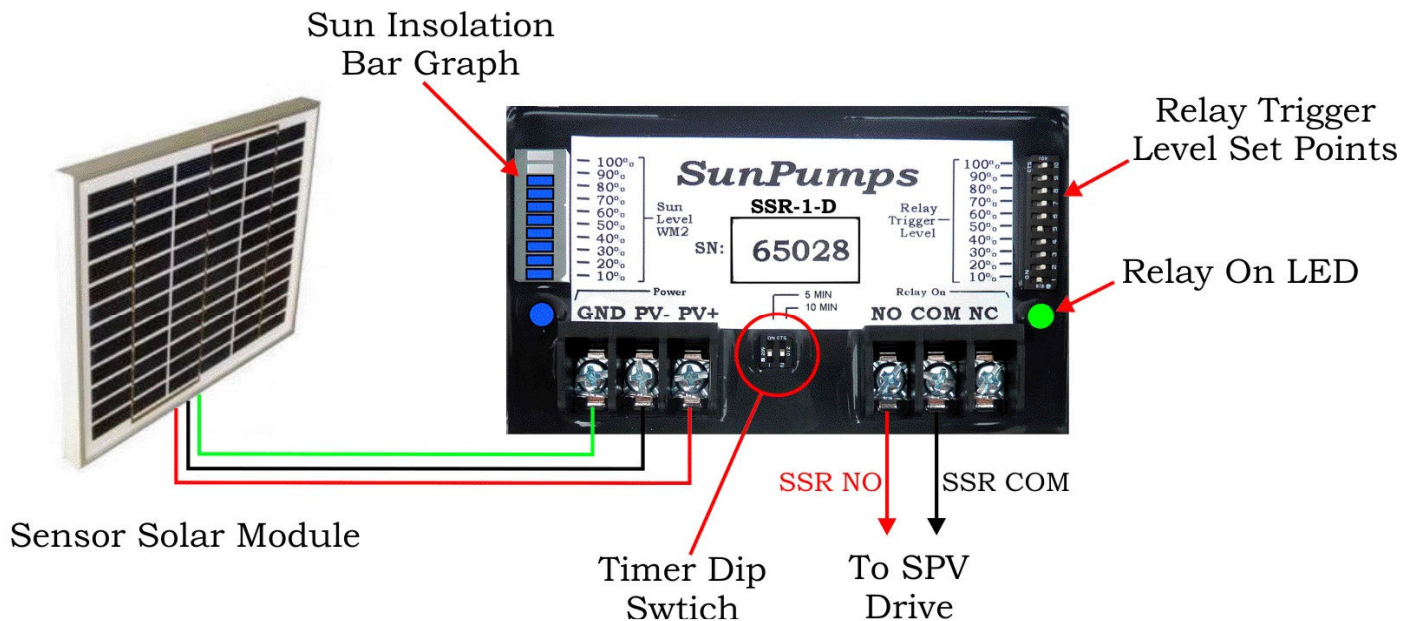
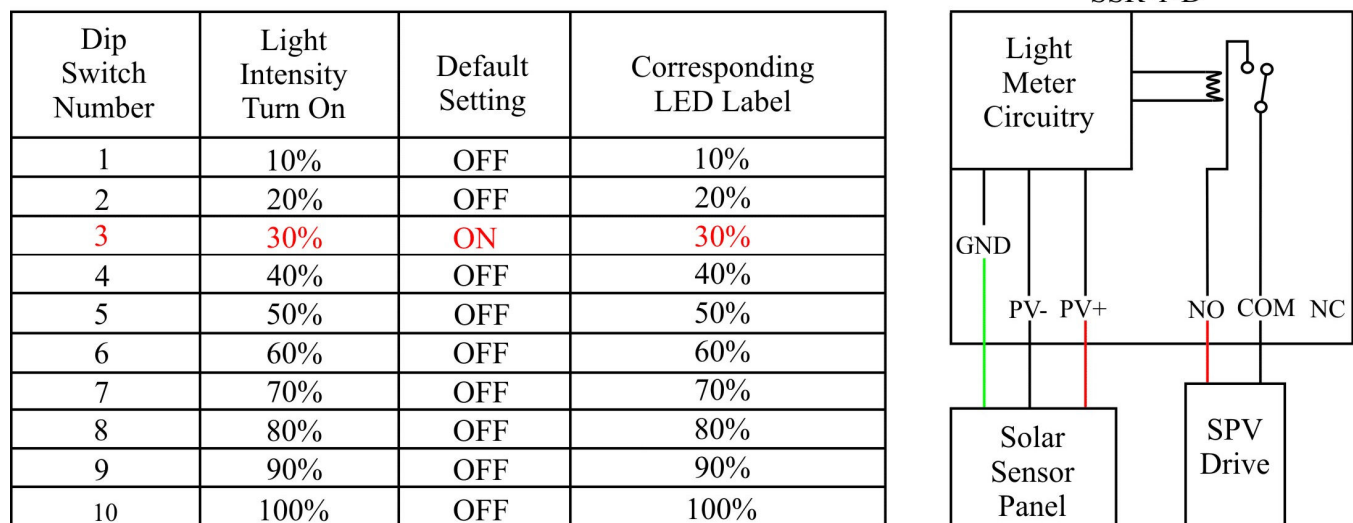


Figure 5



Relay Trigger Level:

The operation of the SSR SunSwitch is very simple. The setup consists of turning on one of the dip switches on the right side of the unit. This dip switch causes the relay to activate at the specified sunlight intensity and disengage at 5% less than that set point. If a different dropout level is desired then a second dip switch may be turned on and then the relay will activate at

the upper setting and deactivate at the lower setting. This allows a great amount of flexibility. (See Figure 5 above for dip switch settings.)

The LED array (bar graph) on the left side of the controller indicates the amount of available sunlight. When the sunlight reaches the set point, the relay will automatically activate and it will stay activated until the sunlight level drops below the set point. When the relay is activated the green LED labeled “Relay On” will be on. To deactivate the controller, simply turn all of the dip switches to the “OFF” position. The light meter (bar graph) will still show sun insolation values but the relay will be deactivated.

Note: There is a minimum hysteresis built into the unit. This means that if the unit is set at 40% it will turn on at 40% but will not turn off until the light fades to about 35% or to the second setting if more than one dip switch is set. This is to prevent frequent switching in borderline conditions.

Example:

1. If only one dip switch is on then the activation point corresponds to that setting. If dip switch 3 is on then the turn on point would be at 30% sunlight. The turn off point will be 5% less than 30% or 25%.
2. If two dip switches are on then there will be corresponding turn on and off points. If dip switch 4 is on and dip switch 3 is on then the turn on will be 40% while the turn off will be 30%.
3. If more than two dip switches are on then the top two on settings will be the turn on and turn off points.
4. If no dip switches are on then the relay will not activate.

SunSwitch Timer Dip Switches:

In between the two terminal blocks is a second set of dip switches. Their function is to change the relay turn on delay if so desired. The timer is not typically used but if you want to delay the SPV from turning on then you can use this feature. The default is with dip switch 1 and 2 off, no time delay.

It works as follows:

Timer Dip switch 1 off and 2 off = No relay turn on delay.
Timer Dip switch 1 on and 2 off = 5 minute relay turn on delay.
Timer Dip switch 1 off and 2 on = 10 minute relay turn on delay.
Timer Dip switch 1 on and 2 on = 15 minute relay turn on delay.

SunSwitch Start-Up Adjustment

If you would like to optimize your early morning start-up and late evening shut-down, then the easiest way is to observe the pump in the evening as it shuts down. First set your SunSwitch to 10% so it does not shut down too early. Now watch the flow rate of the pump as it slowly tapers off. When it almost stops pumping then check the SunSwitch bar graph so see how much sunlight you have at this flow rate. This is the amount of sunlight it takes for your pump system to start producing water. If it is at 20% then adjust the SunSwitch to 20%. If it is at 30% or 40% then set it for that specific set point.

3.8 Remote Switch Circuits

Your SPV has an On/Off switch, 1 input for the Sun Pumps SSR sunlight controller and 2 inputs for remote switch applications. The On/Off switch is prewired to the switch on the right side of the drive enclosure. The SSR sunlight controller must be wired in by connecting the COM and NO (normally open) connections from the SSR sunlight controller to the SSR COM and SSR NO connections on the din rail connectors in the SPV drive. (See section 3.4 for wiring details.)

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 micro-switch type float switch. This type of switch does not interrupt the main power like most switches do. It is a low amperage micro-switch, and it must break contact in order to turn the pump off.

There is an optional down well “Low Water Cut-Off” float switch that incorporates a programmable time delay relay available from SunPumps. The kit is Sun Pumps Low Water Micro Float Switch and Timer assembly, part number **19216**.

Low Water Float Switch



NOTE: Use only “Shielded Wire” to connect any control device to the controller. The ground wire must be grounded to the controller side only. Induced voltages from lightning storms or close radio transmissions could damage the controller and the shielded cable will protect the controller from these stray voltages.

3.9 Auxiliary Control Circuits and Other Features

Over-Current Shut Down

The over-current shut down feature will turn the controller off any time the current exceeds the current limit of the controller. If you have a locked rotor or frozen pump or any over current condition it will display “o.L.1” indicating a motor overload condition.

Under Voltage Shut Down

Normally the SunSwitch will only let the pump run when there is sufficient sunlight to operate the pump. However there are conditions that you will see an under voltage condition. The under voltage shut down feature will turn the controller off any time the voltage is not within the inverter’s specified range.

If you see the drive turning off without the SunSwitch turning it off, then it could be caused by too low of a setting on the SunSwitch or can be caused by a cloud shading part of the solar array and not the sensor module. This is a frequent occurrence especially if the sensor module is mounted far away from the solar array or if it is a large system and the solar array is very long. A cloud could shade the part of the solar array without shading the sensor module. This will drop the array power enough to go into a low voltage situation while the sensor module is indicating a higher sun insolation.

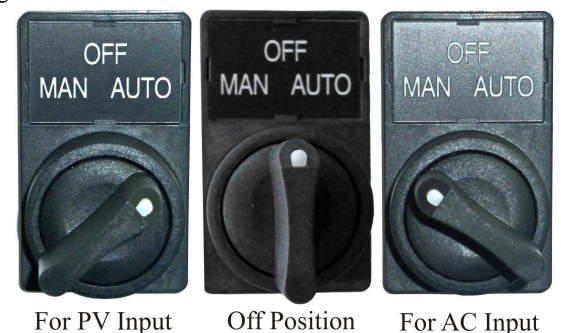
When the controller turns off because of an under-voltage condition, it will remain off for a preprogrammed amount of time and then turn on again. When it turns off it may display a “L.u.1.” or a “o.L.1” message for four seconds then it starts the delay timer. When it turns on again, if it continues to be in a low voltage condition, it will continue to shut down for a slightly longer time and try to restart. It will continue this throughout the day or until there is sufficient power to run. Once the drive has succeeded in starting and running at the minimum frequency (30 Hz) for 2 seconds, the timer will reset to the minimum time delay. The minimum time between starts for this condition is 15 seconds and the maximum time between start attempts is 3 minutes.

An under-voltage error will occur with fast moving clouds. A fast moving cloud can drop the array current faster than the controller can respond. This will trigger an under-voltage condition. However the controller will just turn off and continue to restart until it can or until the SunSwitch turns the drive off.

If the SPV is turned off at the Man/Off/Auto switch or if the SunSwitch turns the pump off at any time during the low power time delay cycle it will reset the timer to zero and the SPV will start the timer again from zero.

Manual/Off/Auto Selector Switch

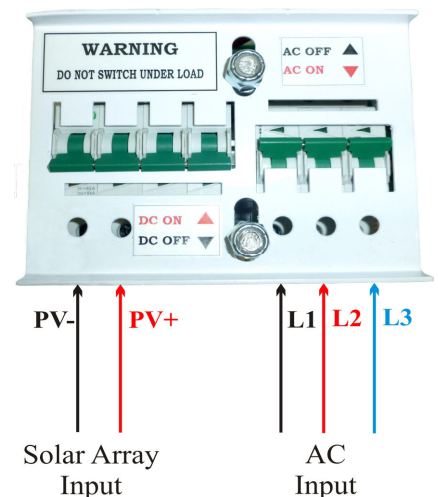
The manual/off/auto selector switch is located on the right side of the box while you are facing the enclosure. This switch is used as a manual switch to turn the drive on or off for maintenance or during programming or to bypass the SunSwitch for AC operation. It may be beneficial to think of this as a run, don’t run switch for DC or run, don’t run for AC. This switch does not prevent the drive from receiving power but should prevent the drive from outputting power to the pump. Use this switch or a remote switch to turn the pump on and off. Never use the disconnect switch or transfer switch to turn the pump off. Always turn the selector switch to the off position before switching either one of the disconnect switches.



DC/AC Disconnect Switch Assembly

The DC/AC Disconnect Switch Assembly is built into the controller and is for disconnecting power to the SPV drive, connecting DC power to the drive or connecting AC power to the drive. This is sometimes referred to as a “Transfer Switch” but it is not a true transfer switch, it is two disconnects with a switch plate that makes sure only one disconnect can be on at any one time. Do not use the switch plate to turn the disconnect switches on and off. Manually turn off each disconnect switch before turning the other one on.

The drive will not receive power if both the DC and the AC circuit breakers are in the off position but there is still high voltage on the terminals PV- and PV+ and the L1, L2 & L3 terminals. When both switches are turned off, it does not disconnect the input power to the enclosure, only to the SPV drive unit.



CAUTION: Never wire the disconnect switch assembly without first disconnecting the power from the source. Never use the DC/AC disconnect switch to turn the drive off. Interrupting power under a load will damage the drive and this is not covered under warranty. “Always use the selector switch or remote switch to turn the pump on and off.”

Never use the switch plate to turn the disconnect switches on and off. Make sure both disconnect switches are in the off position before turning either one on.

4.0 Maintenance

The only regular maintenance required by your SPV pump drive is to regularly clean the air filters on the front of the enclosure door and to verify the drive fans are still running when the drive starts. This inspection and maintenance should be done at least once about every 2 months. If you are in a very dusty environment or there are many bugs which get trapped in the air vents, it should be done more frequently to allow proper ventilation of the system. It is recommended that the drive vent fans should be replaced every two to three years as preventive maintenance.

5.0 Troubleshooting

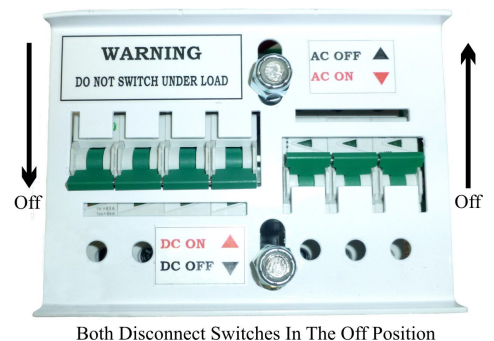
Sun Pumps, Inc. is dedicated to its customers and will gladly help you trouble shoot any problems with your system. However, especially during the busy summer pumping season, we may not be able to help you right away. Using this trouble shooting guide as your first resource when your system is not working properly can save you valuable time in getting your system fully functional. If at any time 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 “Solar Pump System Information Sheet” and complete the form as much as possible. We cannot help you without this information.

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 solar pump system, make sure you have good sunlight and have a multi-meter and a screwdriver and a possibly a few wrenches with you.

Use caution with placing your hands inside the enclosure, there could be up to 1000 volts connected to various terminal blocks including the disconnect switches.

CONTROLLER DOES NOT POWER ON (With a DC input)

1. With the enclosure door open, verify that the disconnect switch assembly is in the appropriate position for your source power. Both disconnect switches should be up for operation from the solar array, and both disconnect switches should be down for operation from the AC input. When the left disconnect switch is down and the right disconnect switch is up as seen to the right, both disconnect switches assembly are in the off position.
2. Check the open circuit voltage including polarity. It should be above 440 volts DC for a 240 VAC output or 800 volts DC for a 460 V AC output. If the voltage is below this, you will need to troubleshoot the solar array.
3. If the open circuit voltage is still low, check the Voc on each individual solar module and count the number of solar modules you have connected in series to see if you have the correct number connected in series. If the voltage is above 600 VDC for 240 volt AC system or 900 VDC for a 460 AC, you probably have too many modules connected in series. If you need help you can call Sun Pumps for technical support.



CAUTION: These are high voltage terminals and care should be taken when working inside the pump enclosure. This procedure should be done by a licensed Electrical Contractor.

CONTROLLER DOES NOT POWER ON (With an AC input)

1. With the enclosure door open, verify that the disconnect switch assembly is in the appropriate position for your source power. Both disconnect switches should be up for operation from the solar array, and both disconnect switches should be down for operation from the AC input. When the left disconnect switch is down and the right disconnect switch is up as seen above, the switch assembly is in the off position.



2. Check the AC voltage at the closest connection to the drive. Do not put voltmeter probes through the disconnect switch plate. This may create an arc and short the solar array to ground. The voltage should be at least 240 volts AC in order to power on. Use of 208 volt power is not supported by this drive. If the correct voltage is present but the drive does not turn on, contact Sun Pumps for technical support.

CAUTION: These are high voltage terminals and care should be taken when working inside the pump enclosure. This procedure should be done by a licensed Electrical Contractor.

CONTROLLER POWERS ON BUT DOES NOT TURN ON PUMP

1. Look at the display on the drive to see if it is powered. It should be reading “30.00” or “0.0”.
2. Check the FWD button on the keypad. It should have a green light in the top left hand corner. If it is off, skip to step 3. If it is on, the drive may be in a solar timeout. Wait a few minutes for the timer to cycle.
3. Check the installed remote switches. To verify a problem with the remote switch circuit, disconnect both remote switch wires, if used, and install the original jumper wires that came with the drive across Pos and Com on both RS1 and RS2. With one of each of the remote switches shorted, the remote switch circuit will not prevent the drive from running.
4. Turn the MAN/OFF/AUTO selector switch off, then back to MAN. If the drive runs, troubleshoot the remote switches. If it does not, it is in a solar timeout and should be left with the switch in the auto position and the drive will eventually start. You can also call Sun Pumps for further assistance.
5. If the light is not on, verify that the MAN/OFF/AUTO selector switch is in the MAN or AUTO position. If it is set in the AUTO position check the activation led on the SSR unit. It is the green LED on the right hand side of the SSR controller. If it is not on make sure you have the correct dip switch on, that there is sufficient sunlight and that the SSR unit is connected to the appropriate terminals in the SPV controller.
6. If you have verified the SSR is activated and the drive is not running, change the switch to MAN. It may take up to 10 seconds for the light to turn on after turning on the switch. This will check the drive AUTO switch and the SSR relay.
7. If the FWD led still does not light, call Sun Pumps for further assistance.



CONTROLLER TURNS ON BUT PUMP DOES NOT PUMP

1. If the controller is on and the pump motor is running but not pumping water there could be many down hole causes. There could be a hole in the drop pipe, a cracked pipe coupling, a bad check valve or a broken motor or pump shaft. For any of these problems the pump will have to be pulled.
2. If the controller is on, check the display frequency to make sure the frequency is above the minimum pumping frequency. This information comes from section 3.7 under “SunSwitch Start-Up Adjustment.” The pump could be running, but not fast enough to pump water to the surface.
3. If the controller is on and the motor is not running there could also be many causes. You could have a broken pump wire, a shorted motor wire, a shorted pump winding or a locked motor rotor. If the motor does not run, the display should list a fault. See the Drive Error Codes found later in this manual for more information. For example, an open motor wire, or open phase, an “Err2” will be displayed.
4. You can verify this by testing between the motor leads with an ohm meter. If the motor winding is shorted or an output phase is grounded an S.C will be displayed. If you have a locked rotor or frozen pump it will display “o.L.1” indicating a motor overload.

CONTROLLER TURNS ON, PUMP STARTS AND BEGINS TO RAMP UP BUT SHUTS OFF

1. Make sure the solar array is not shaded anywhere. Shade on any module may send conflicting signals to the controller and it can cause it to shut down.
2. In this instance, the drive will almost always display an error on the led display. Check the error in the Drive Error Codes found later in this manual, and follow suggestions for your specific error.

PUMP IS RUNNING BUT THE OUTPUT IS LOW OR ZERO

1. Make sure you have full sun light at midday, that there are no clouds blocking the sun and no shadows on any part of the array or sensor module. Then verify power coming out of the controller and the running frequency of the drive. Look at the LCD screen and read the voltage, current and power and check the frequency on the screen of the drive. Check this against the pump chart for your specific application. If the drive is outputting 60 Hz but is not producing enough power to match the expected load, the pump may be spinning backwards or if it is a centrifugal type pump, may be trying to pump against more pressure than it is rated for. Both of these conditions may cause low or no output from the pump.
2. If the wires are correct and connected, 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.
3. Check each array for appropriate power. Use a DC current meter or you can alternatively start and stop the pump with half of the array strings connected. Do the same with the other half. The voltage, current and frequency of each of these tests should be essentially equal.

EXCESSIVE CURRENT DRAW (More than the rating of the pump, but less than the rating of the controller)

1. Check wiring diagram for proper connection. If the pump is spinning backwards it may need excessive current and produce less water than expected.
2. Check for skinned wires or faulty underwater splice.
3. Check for locked motor armature.
4. If you have not been able to determine the reason your SPV drive will not run the pump, please contact Sun Pumps for further assistance, and we will be glad to help.

Figure 6 Drive Error Codes

Fault Code	Type of Fault	Possible Reason	Troubleshooting
S.C	System Fault	Frequency inverter output phase or grounding short circuit;	Check the pump motor, the grounding line, all motor shield line grounding condition and distance, and the condition of terminals and connections.
o.C.1	Acc over current	Accelerating too fast	Restart drive
o.C.2	Dec over current	Potential load or inertia is too large;	Call Sun Pumps for technical support.
o.C.3	Over current at constant speed	1. Sudden load change; 2. Input voltage too low for stability;	1. Check for broken pipes, change valves slowly while pump is running. 2. Check supply voltage, fuses and breakers
o.U.1	Acc over voltage	Input voltage spike	Check input voltage, troubleshoot and restart drive
o.U.2	Dec over voltage	Input voltage spike	Check input voltage, troubleshoot and restart drive
o.U.3	Over voltage at constant speed	Abnormal input voltage	Check input voltage, troubleshoot and restart drive
o.U.4	Close down over voltage	Supply voltage overrun	Check input voltage, troubleshoot and restart drive
o.L.1	Machine overload	1. Low input voltage vs load 2. Pump is in a locked rotor condition or is under a heavy load.	1. Check input voltage, troubleshoot and restart drive 2. Check pump
o.L.2	Frequency inverter over load	Pump is in a locked rotor condition or is under a heavy load.	Check pump
o.H.	Internal overheating	1. Ambient temperature too high or drive mounted in the sun; 2. Damaged fan; 3. Blocked air duct;	1. Check installation and ambient air temperature; 2. Replace fan; 3. Clear air duct, improve air circulation around drive;
LU1	Under-voltage of supply power	1. Inadequate supply power (solar) 2. Inadequate supply voltage(generator)	1. Check sun insolation and array sizing. 2. Verify generator/AC supply sizing.
SEn	Feedback sensor fault	Not used	Call Sun Pumps for technical support.
Err1	Open-phase at input side	Open-phase in frequency inverter three phase input power Phase.	Check three phase input power and three phase input power wiring. For single phase input systems, call Sun Pumps for technical support.

Err2	Open-phase at output side	Open-phase in frequency inverter three phase output power Phase.	Check motor wire and three phase output power wiring
Err3	Current detecting fault	Internal fault	Call Sun Pumps for technical support.
Err4	Frequency inverter exterior fault	Not used	Call Sun Pumps for technical support.
Err5	Swing frequency running parameters setting error	Not used	Call Sun Pumps for technical support.
Err6	Keyboard communication fault	Error in the keyboard	Call Sun Pumps for technical support.
93SE	Memory fault	Internal memory fault	Turn off all power to system for 10 minutes and turn back on.
LIFE	Reserved	--	Call Sun Pumps for technical support.

Solar Pump System Information Sheet

The form below is a list of the information required to set the parameters on your controller. This form lists the detailed information you need and is also the same information Sun Pumps requires for the warranty card and for technical support.

If you call for technical support please have this information available. 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

Well Specifications:

Well Depth _____

Well Diameter _____

Static Water Level _____

Pumping Level _____

Pump Setting _____

Warranty Statement

6.0

SPV Series Pump Controllers Limited Warranty – Twenty Four Months

Sun Pumps 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 four (24) months after the original date of purchase, but not to exceed thirty (30) months from the date of manufacture.

At its option, Sun Pumps will repair or replace any Sun Pumps product, which has failed due to a defect in material or workmanship during this warranty period. An SPV series controller must be installed in conjunction with a pump which is rated no greater than the controller to validate the warranty. This limited warranty shall not apply if the Sun Pumps 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 Sun Pumps factory.***

There are no express warranties except as listed above. Sun Pumps shall have no responsibility for damage to property, persons, animals, or other loss or injury resulting from the use of a Sun Pumps 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 SUN PUMPS 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. SUN PUMPS MAXIMUM LIABILITY SHALL NOT IN ANY CASE EXCEED THE PURCHASE PRICE FOR THE GOODS CLAIMED TO BE DEFECTIVE OR UNSUITABLE.

Sun Pumps 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. Sun Pumps is not responsible for loss or damage to products, owned by customer and located on SunPumps premises, caused by fire or other casualties beyond Sun Pumps 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 _____	Static Water Level _____
Pump Model _____	Pumping Level _____
Pump Serial No. _____	Additional Vertical Lift _____
Manufacturer _____	
Controller Model _____	Pump Depth _____
Controller Serial No. _____	Total Dynamic Head _____
Manufacturer _____	
Warranty Card No. _____	Well Depth _____

Appendix A

Sun Pumps SPV Solar Drive Specifications

U.S. Models 60 HZ 240 VAC

Sun Pumps Model Number	SP Part Number	Max Voltage (Voc)	Drive Current (Amps)	Drive kW's	240 VAC Submersible Motor HP	Frequency HZ	Drive Dimensions WxHxD (Inches)	Enclosure Size WxHxD (Inches)
SPV 2-240-IT	15650	780	8.5	3.7	2	0-50/60	6.3 x 9.7 x 6.2	15 x 33.5 x 10
SPV 3-240-IT	15651	780	13	5.5	3	0-50/60	6.3 x 9.7 x 6.2	15 x 33.5 x 10
SPV 5-240-IT	15652	780	17	7.5	5	0-50/60	7.7 x 11.5 x 6.6	15 x 33.5 x 10
SPV 7.5-240-IT	15623	780	25	11	7.5	0-50/60	7.7 x 11.5 x 6.6	15 x 33.5 x 10

Note: The drive must be derated 1.8% for each 1000 feet above 3300 feet of elevation.

U.S. Models 60 HZ 460 VAC

Sun Pumps Model Number	SP Part Number	Max Voltage (Voc)	Drive Current (Amps)	Drive kW's	460 VAC Submersible Motor HP	Frequency HZ	Drive Dimensions WxHxD (Inches)	Enclosure Size WxHxD (Inches)
SPV 7.5-460-IT	15660	1000	13	5.5	7.5	0-50/60	6.3 x 9.7 x 6.2	15 x 33.5 x 10
SPV 10-460-IT	15661	1000	17	7.5	10	0-50/60	7.7 x 11.5 x 6.6	15 x 33.5 x 10
SPV 15-460-IT	15662	1000	25	11	15	0-50/60	7.7 x 11.5 x 6.6	15 x 33.5 x 10

Note: The drive must be derated 1.8% for each 1000 feet above 3300 feet of elevation.

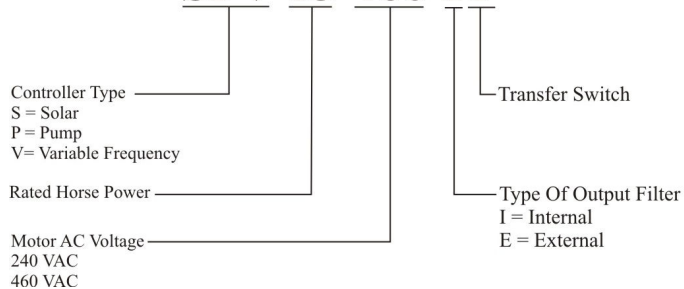
European Models 50 HZ 380/415 VAC

Sun Pumps Model Number	SP Part Number	Max Voltage (Voc)	Drive Current (Amps)	Drive kW's	380 VAC Submersible Motor (HP)	Frequency HZ	Drive Dimensions WxHxD (mm)	Enclosure Size WxHxD (mm)
SPV 3.7-380-IT	15880	1000	8.5	3.7	5	0-50/60	159 x 246 x 157	381 x 851 x 254
SPV 5.5-380-IT	15681	1000	13	5.5	7.5	0-50/60	159 x 246 x 157	381 x 851 x 254
SPV 7.5-380-IT	15682	1000	17	7.5	10	0-50/60	195 x 291 x 167	381 x 851 x 254
SPV 11-380-IT	15683	1000	25	11	15	0-50/60	195 x 291 x 167	381 x 851 x 254

Note: The drive must be derated 1.8% for each 300 meters above 1000 meters of elevation.

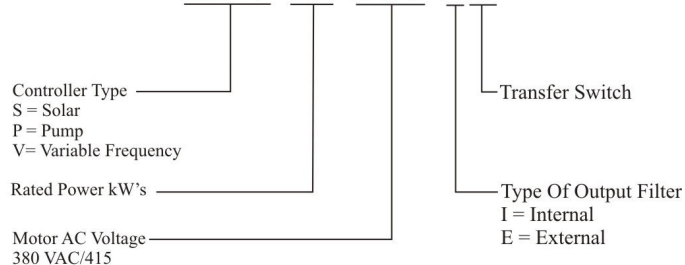
SunPumps SPV Drive U.S. Model Numbers

SPV 15-460-IT



SunPumps SPV Drive European Model Numbers

SPV 11-380-IT



Appendix B

Solar Tec S60PC-250 Solar Modules
Each Module Rated 250 Watts
Typical of 1 Module
Voc=36.3, Vmp=30.6 Imp=8.17
Isc=8.71

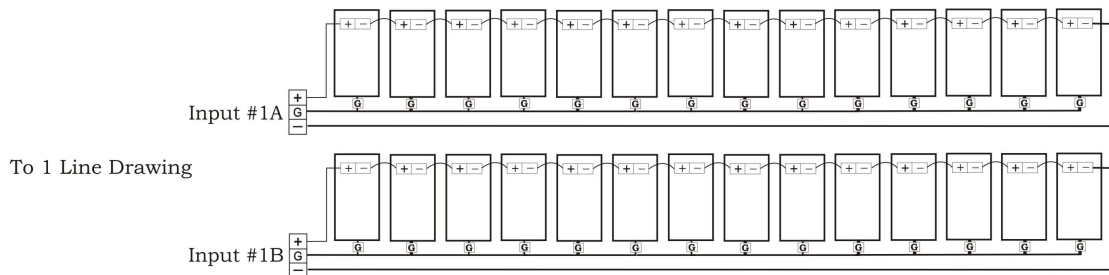
Wired 14 Series X 1 Parallel Each
Series String. Rated 3,500 Watts

Typical for Each 14 Module String:
Voc=508.2, Vmp=428.4, Imp=8.17
Isc=8.71

Wired 14 Series X 2 Parallel Each
Inverter. Each Array Rated 14,000 W

Typical for Each 56 Module Array:
Voc=508.2, Vmp=428.4, Imp=16.34
Isc=17.42

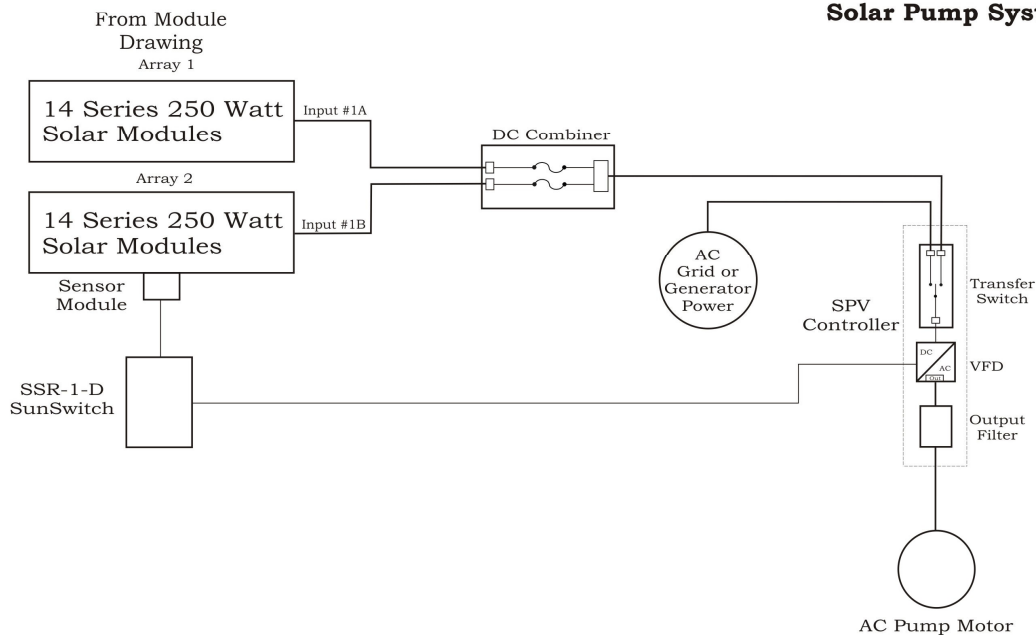
Sample Wiring Diagram For A Typical 5 HP, 240 VAC SPV Series Solar Pump System.



NOTES:

1. Equipment shall be installed in accordance with NEC and all applicable requirements of the local authority having jurisdiction..
2. Ground wire must be continuous and installed to allow for panel removal without disturbing continuity. All module grounding connections shall be in accordance with NEC 690-4 (C).
3. Follow manufacturers suggested installation practices and wiring specifications.

325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	4-20-15	7,000 Watt Photovoltaic Array Wiring Diagram	
CUSTOMER	SunPumps, Inc.	Revision	SHEET
		1	1 of 3
		DRAWING NO. 042015-001	



Sample Wiring Diagram For A Typical 5 HP, 240 VAC SPV Series Solar Pump System.

NOTES:

1. Label switch as "Photovoltaic System Disconnect Switch".
2. Ground wires should not be cut at each terminal. Use one length for each main ground wire and lay-in lugs for each terminal.

325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	4-20-15	One Line Electrical Diag. 7 KW PHOTOVOLTAIC SPV Pump SYSTEM	
CUSTOMER	SunPumps, Inc.	Revision	SHEET
		1	2 of 3
		DRAWING NO. 042015-002	

Solar Tec S60PC-250 Solar Modules
Each Module Rated 250 Watts
Typical of 1 Module
Voc=36.3, Vmp=30.6 Imp=8.17
Isc=8.71

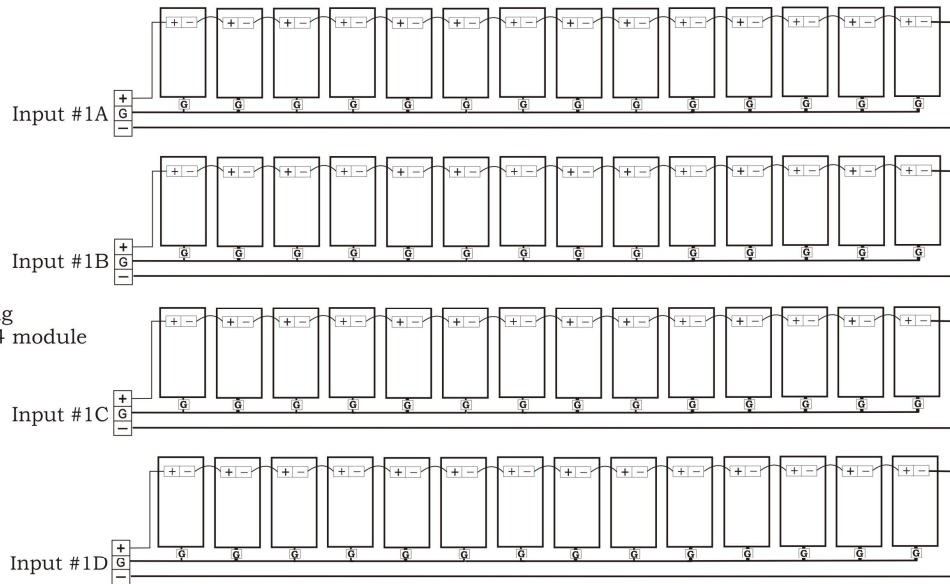
Wired 14 Series X 1 Parallel Each
Series String. Rated 3,500 Watts

Typical for Each 14 Module String:
Voc=508.2, Vmp=428.4, Imp=8.17
Isc=8.71

Wired 14 Series X 4 Parallel Each
Inverter. Each Array Rated 14,000 W

Typical for Each 56 Module Array:
Voc=508.2, Vmp=428.4, Imp=32.68
Isc=34.84

Sample Wiring Diagram For A Typical 10 HP, 240 VAC SPV Series Solar Pump System.

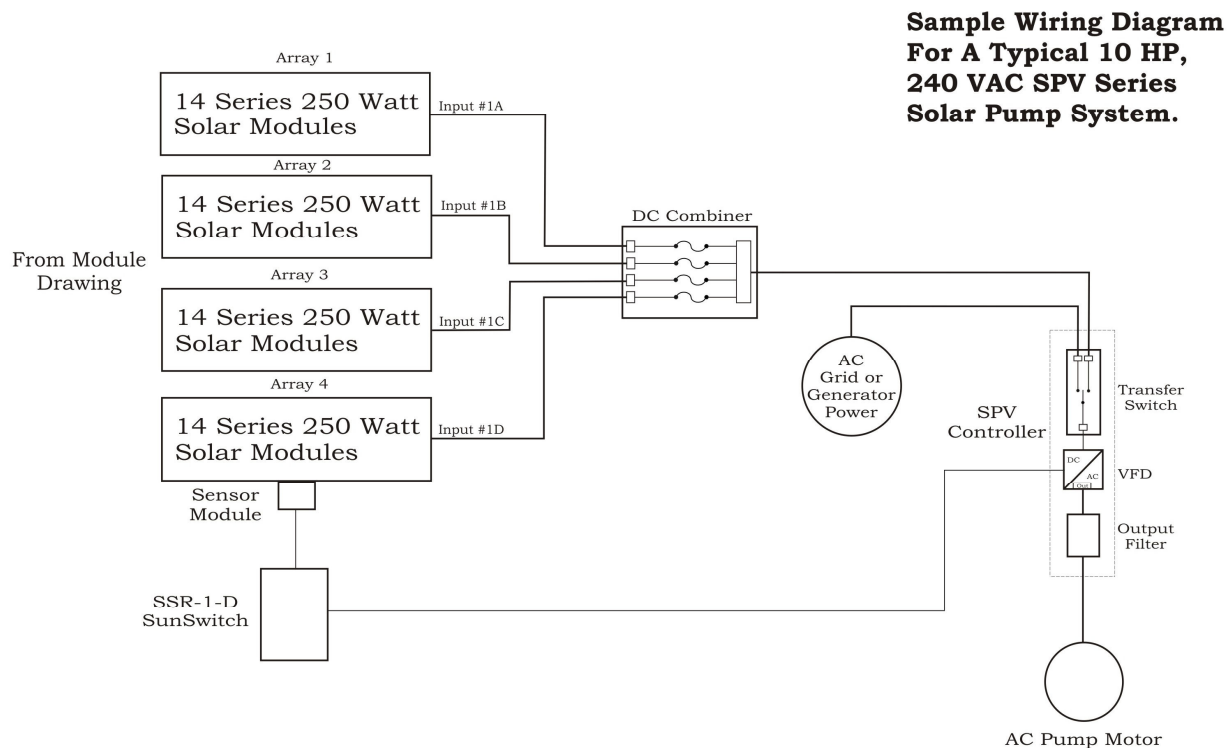


To 1 Line Drawing
typical of each 14 module
string.

NOTES:

1. Equipment shall be installed in accordance with NEC and all applicable requirements of the local authority having jurisdiction..
2. Ground wire must be continuous and installed to allow for panel removal without disturbing continuity. All module grounding connections shall be in accordance with NEC 690-4 (C).
3. Follow manufacturers suggested installation practices and wiring specifications.

325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	4-20-15	14,000 Watt Photovoltaic Array	
CUSTOMER	SunPumps, Inc.	Wiring Diagram	
Revision	1	SHEET	1 of 3
		DRAWING NO.	042015-001



Sample Wiring Diagram For A Typical 10 HP, 240 VAC SPV Series Solar Pump System.

NOTES:

1. Label switch as "Photovoltaic System Disconnect Switch".
2. Ground wires should not be cut at each terminal. Use one length for each main ground wire and lay-in lugs for each terminal.

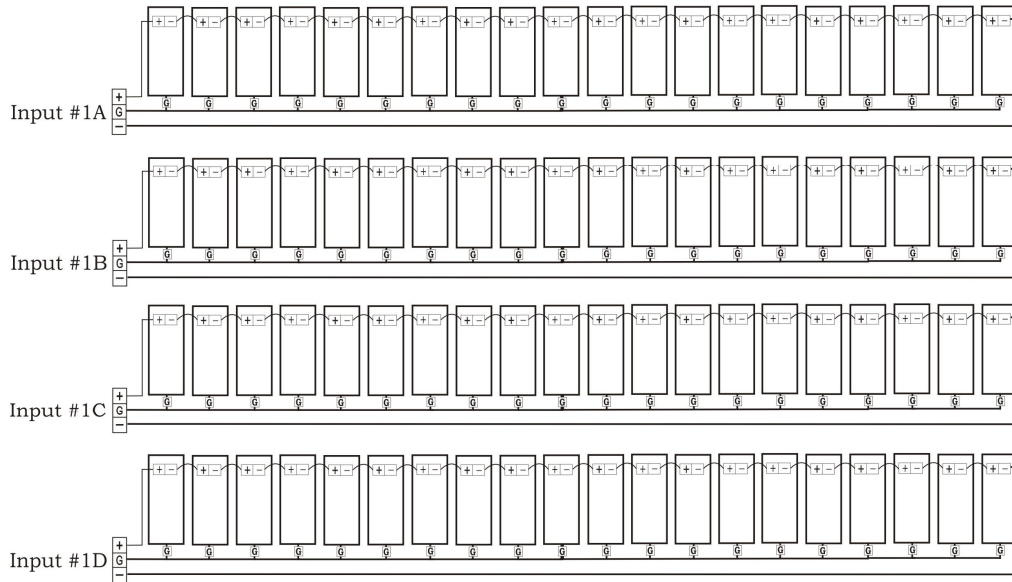
325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	4-20-15	One Line Electrical Diag.	
CUSTOMER	SunPumps, Inc.	14 KW PHOTOVOLTAIC SPV Pump SYSTEM	
Revision	1	SHEET	2 of 3
		DRAWING NO.	042015-002

Solarland SW-280 Solar Modules
Each Module Rated 280 Watts
Typical of 1 Module
Voc=39.5, Vmp=32.0 Imp=9.07
Isc=9.71

Wired 20 Series X 1 Parallel Each
Series String. Rated 5600 Watts
Typical for Each 20 Module String:
Voc=790, Vmp=640, Imp=9.07
Isc=9.41

Wired 20 Series X 4 Parallel.
Total Solar Array Rated 26,500 Watts
Typical for Each 80 Module Array:
Voc=790, Vmp=640, Imp=36.28
Isc=38.84

Sample Wiring Diagram For A Typical 15 HP, 380/415 VAC SPV Series Solar Pump System.

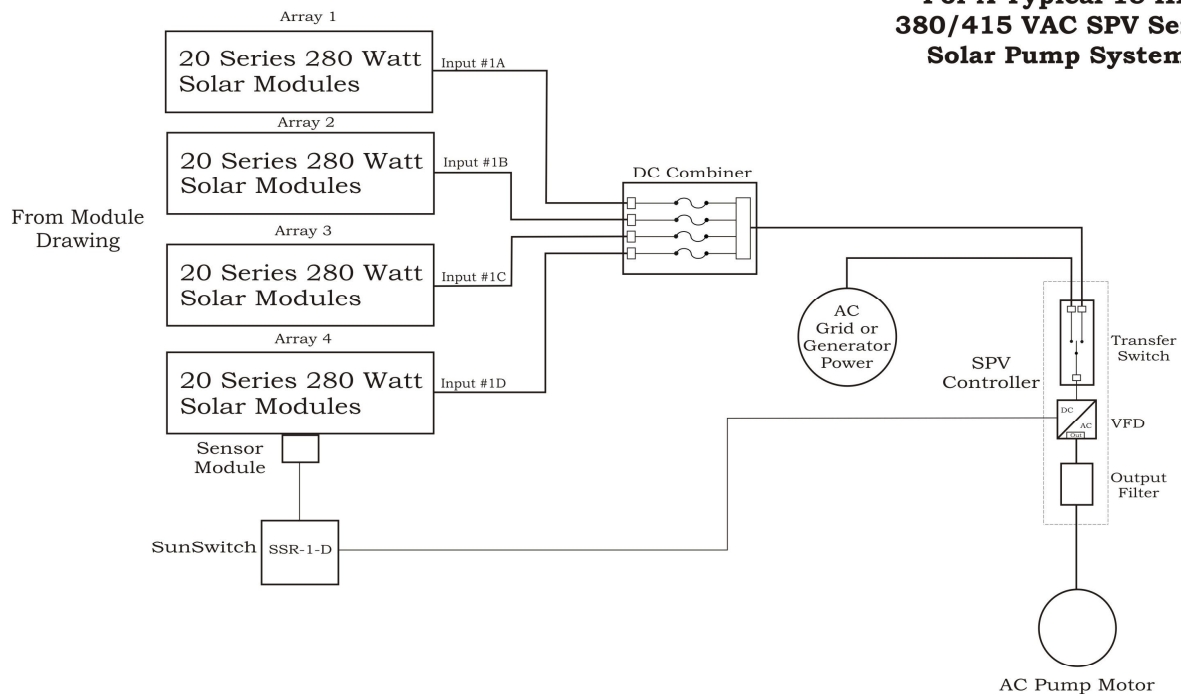


NOTES:

1. Equipment shall be installed in accordance with NEC and all applicable requirements of the local authority having jurisdiction..
2. Ground wire must be continuous and installed to allow for panel removal without disturbing continuity. All module grounding connections shall be in accordance with NEC 690-4 (C).
3. Follow manufacturers suggested installation practices and wiring specifications.

DATE	4-20-15	22,400 Watt Photovoltaic Array Wiring Diagram	
CUSTOMER	SunPumps, Inc.		
Revision	1	SHEET	1 of 3
		DRAWING NO.	042015-001

Sample Wiring Diagram For A Typical 15 HP, 380/415 VAC SPV Series Solar Pump System.



NOTES:

1. Label switch as "Photovoltaic System Disconnect Switch".
2. Ground wires should not be cut at each terminal. Use one length for each main ground wire and lay-in lugs for each terminal.

325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	4-20-15	One Line Electrical Diag.	
CUSTOMER	SunPumps, Inc.	22.4 KW PHOTOVOLTAIC SPV Pump SYSTEM	
Revision	1	SHEET	2 of 3
		DRAWING NO.	042015-002

Solartec S-60PC-235 Solar Modules
Each Module Rated 235 Watts
Typical of 1 Module
Voc=36.9, Vmp=29.8 Imp=7.9
Isc=8.46

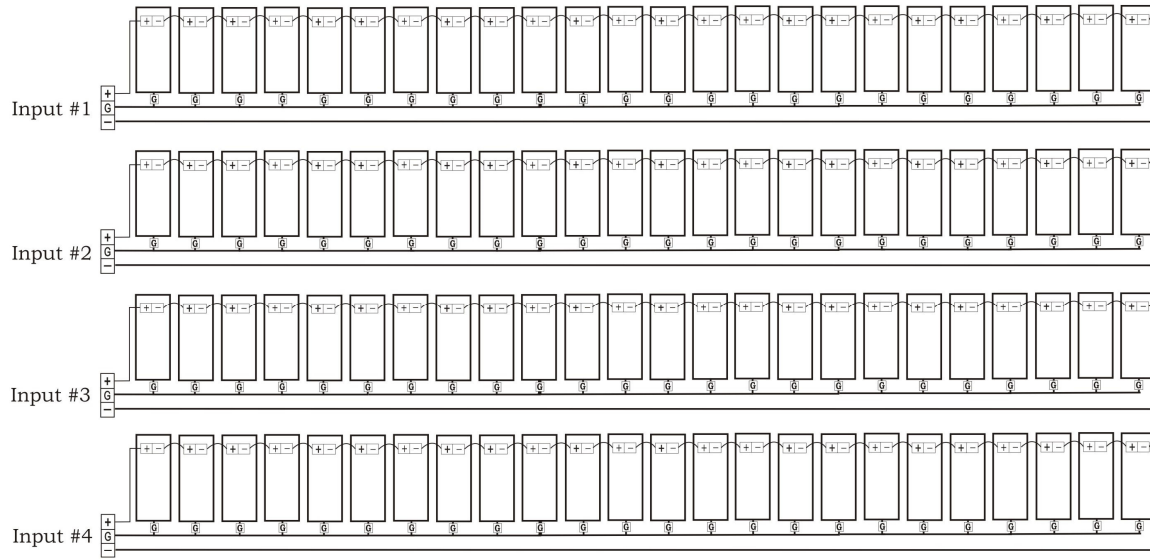
Wired 24 Series X 1 Parallel Each
Series String. Rated 5616 Watts

Typical for Each 24 Module String:
Voc=885.6, Vmp=715.2, Imp=7.9
Isc=8.46

Wired 24 Series X 4 Parallel.
Total Solar Array Rated 22,560 Watts

Typical for Each 96 Module Array:
Voc=885.6, Vmp=715.2, Imp=31.6
Isc=33.84

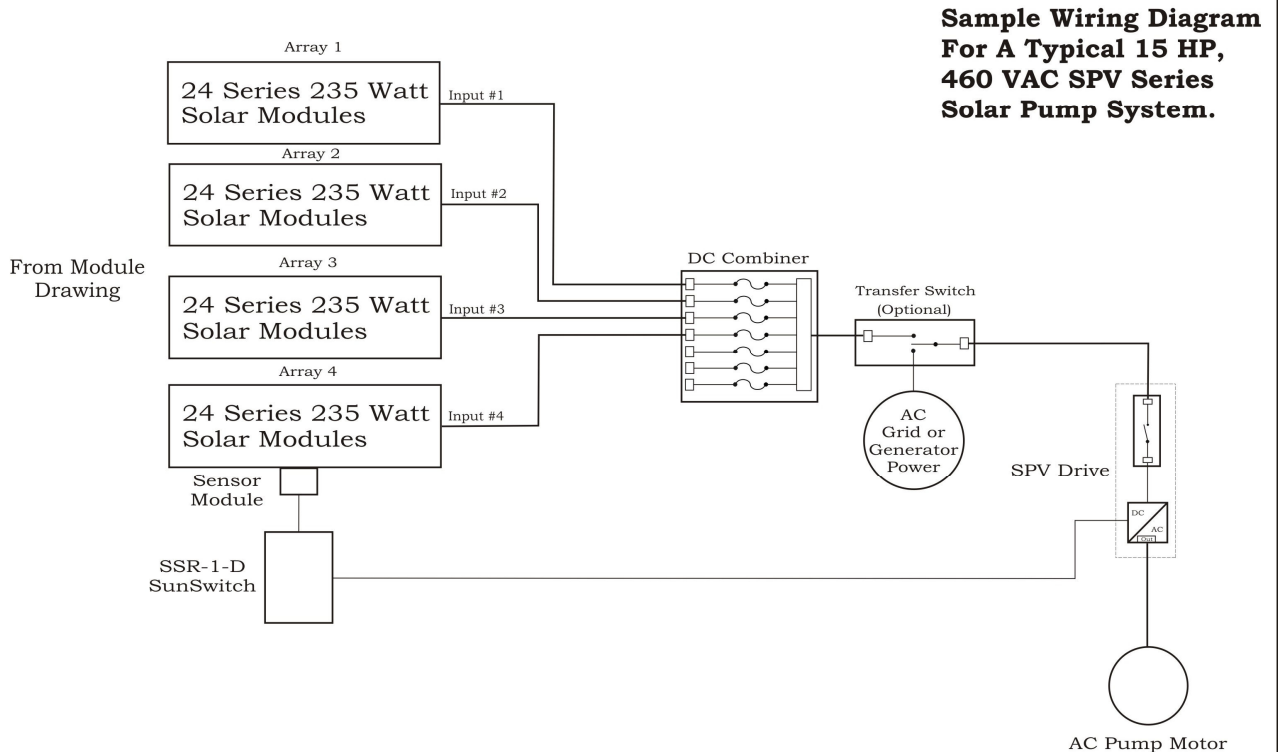
Sample Wiring Diagram For A Typical 15 HP, 460 VAC SPV Series Solar Pump System.



NOTES:

- Equipment shall be installed in accordance with NEC and all applicable requirements of the local authority having jurisdiction..
- Ground wire must be continuous and installed to allow for panel removal without disturbing continuity. All module grounding connections shall be in accordance with NEC 690-4 (C).
- Follow manufacturers suggested installation practices and wiring specifications.

325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	6-16-15	22,560 Watt Photovoltaic Array	
CUSTOMER	SunPumps, Inc.	Wiring Diagram	
Revision	1	SHEET	1 of 2
		DRAWING NO.	061615-001



Sample Wiring Diagram For A Typical 15 HP, 460 VAC SPV Series Solar Pump System.

From Module
Drawing

NOTES:

- Ground wires should not be cut at each terminal. Use one length for each main ground wire and lay-in lugs for each terminal.

325 E. Main St. Safford, AZ 85546		SunPumps, Inc.	
DATE	6-16-15	One Line Electrical Diag.	
CUSTOMER	SunPumps, Inc.	22.56 KW PHOTOVOLTAIC SPV Pump SYSTEM	
Revision	1	SHEET	2 of 2
		DRAWING NO.	061615-002