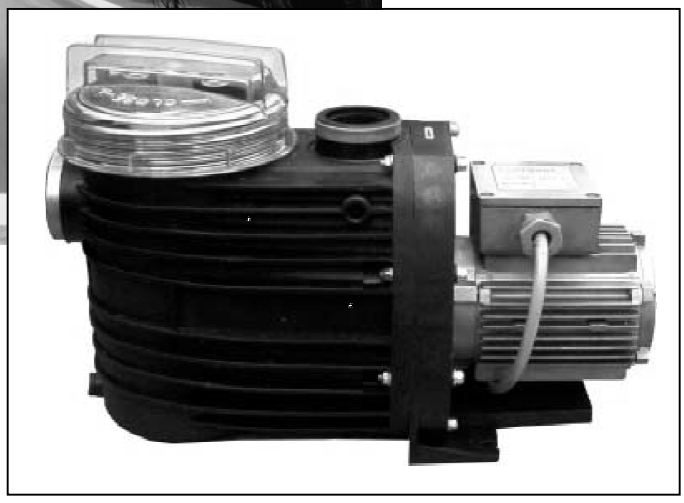
SunCentric™ P

Solar Powered Pump

Instruction Manual



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1 WARNINGS

Failure to follow these instructions will void the warranty.

⚠	REFER TO THE SPECK PUMP OWNER'S MANUAL ENCLOSED, FOR SAFETY WARNINGS AND ADDITIONAL INFORMATION
⚠	The installer is required to reset the "Maximum RPM" setting in the controller to position 2, illustrated in Section 4.6.
⚠	Open circuit (no-load) voltage above 100V will destroy the controller. This may occur if the wrong PV modules (solar panels) are used, or if the solar array is incorrectly wired. Measure the array voltage before connecting to the controller. A "48V" (nominal) array should produce an open circuit voltage around 75-90V under any daylight conditions. (See Solar Array Wiring, Section 4.3)
⚠	Do not attempt to run the ETAPUMP Motor without the ETAPUMP controller. Do not attempt to use ETAPUMP controller for any purpose other than ETAPUMP.
⚠	To be installed, connected and serviced by qualified personnel only. Ensure all power sources are disconnected when making connections to this unit. Follow all appropriate electrical codes. There are no user serviceable parts inside the motor or the controller.
⚠	Install proper system grounding for safety and lightning protection (See Section 4.2)
⚠	Do not touch the controller input or pump wires together to test for a spark.
	Do not run the pump dry. Fill it at least half-way with water for testing.
⚠	Test the direction of motor rotation before installing the pump (clockwise looking at back of motor). If direction is reversed, exchange the connection of any two of the three power wires to the pump. (See Section 4.7)
	When pump is stopped by a shadow or by action of float switch, it will restart after a 30–90 seconds.
	SWIMMING POOL APPLICATIONS normally do not use a low-water probe or float switch. Their terminals must be bypassed in the junction box. (See section 4.5)

Installation should be in accordance with local regulations and accepted codes of good practice.
This manual is the property of the *ETAPUMP* owner.
Please give it to the owner or maintenance personnel when you are finished!
Request copies from your *ETAPUMP* supplier or download from www.dankoffsolar.com

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Version 1.2 August, 2003

2 INTRODUCTION

REFER TO THE SPECK PUMP OWNER'S MANUAL ENCLOSED FOR SAFETY WARNINGS AND ADDITIONAL INFORMATION

Thank you for purchasing the Dankoff *SunCentric P*™ Solar Pool Pumping System. This system is based on time-tested components and 20 years of solar pumping experience. Please follow these instructions carefully. If you have any questions or problems, please call your Dankoff dealer, or call the factory. We try very hard to make our products work in all cases.

Before you begin Check the model numbers of all the components of your system, and verify that they are the items that you ordered. Also check against the *SunCentric P* specifications and performance charts (end of this manual) to be sure the system is appropriate for your application.

Please read the labels on your pump motor and controller and enter the serial numbers here. This will help you to obtain parts or service in the future.

PUMP MOTOR MODEL #_____ SERIAL #_____ ← *Please enter*
CONTROLLER MODEL #_____ SERIAL #_____ ← *Please enter*
SYSTEM # _____

3 INSTALLING THE SOLAR ARRAY

3.1 Location of the Solar Array

Sunlight is the "fuel" that drives a solar pump. Full solar exposure of the solar array is critical for the performance of a solar-direct system.

Choose a location for the solar array that has unrestricted sun exposure through the day and through the year. The array can be placed several hundred feet (100 m) or more from the wellhead. There will be no loss of performance if the electrical wire is sized properly, but naturally, the cost of wire will increase significantly.

WARNING A small shadow on the solar array will cause the pump to slow or stop completely. Each PV module (panel) contains a series of solar cells (typically 36 or 72 cells). Every cell that is shaded acts like a resistor, reducing the output of the entire array. Shading just one corner of the array will reduce the power disproportionately, and may even stop the pump. Consider this when deciding where to install the array.

To determine where shadows may be cast at any time of the year, you can survey the site with a *Solar Pathfinder®.* This device is especially useful in forested areas or wherever there are obstructions nearby. It is available directly from Solar Pathfinder (USA) Tel. & fax (931) 593-3552, www.solarpathfinder.com.

Place the bottom edge of the array at least 2 feet (.6 m) above ground to clear rain spatter, growing vegetation and snow. Keep in mind that trees and perennial plants will grow taller over the years.

3.2 Solar Array Mounting Rack

WARNING All parts of your mounting structure must be engineered for wind resistance, ease of adjustment, and safety.

Follow the rack manufacturer's instructions that are packed with your rack.

WARNING Use extreme caution when assembling the array above your head. You will work with a large and heavy assembly and unpredictable wind. The use of ladders can be dangerous. It is best to assemble a platform using a strong scaffold assembly (the temporary platform system that is used for building construction). A scaffold system can be rented from a local supplier.

Solar Tracking A solar tracker is a special pole-mounted solar array rack that tilts automatically to follow the daily path of the sun. In clear summer weather, it can increase your daily pumping volume by 40-50%. (It is much less effective in winter and in cloudy weather.) A tracker is an option with *SunCentric P* Systems.

PHOTO Typical assembly of a solar array on a passive (non-electric) tracker. The tracker pipe was extended to about 10 feet (3m), by welding it to a larger pipe. The array was assembled and wired on the ground, then lifted and lowered onto the pole with the help of a backhoe and chain. Wire is single-conductor type USE (outdoor rated). See how the wire is looped. This allows it to shed water, and to flex easily as the tracker swings East-West. Wires enter the conduit through a "weather head" fitting (enlarged).

3.3 Solar Array Assembly Methods

WARNING Use extreme caution when assembling the array above your head. You will work with a large and heavy assembly and unpredictable wind. The use of ladders can be dangerous.

There are two ways to install the solar array. See PHOTO GALLERY for examples.

1. Assemble the array on the ground, wiring and all, then lift the entire assembly onto the pole or roof. A system of 300 watts or more may require the assistance of a backhoe, boom truck or crane to lift it over the pole.

Assemble the array piece-by-piece on the pole. If the pole is higher than about 6 feet (2m), it is best to construct a temporary platform, like a scaffold assembly commonly used in building construction). A scaffold system can be rented from a local supplier.

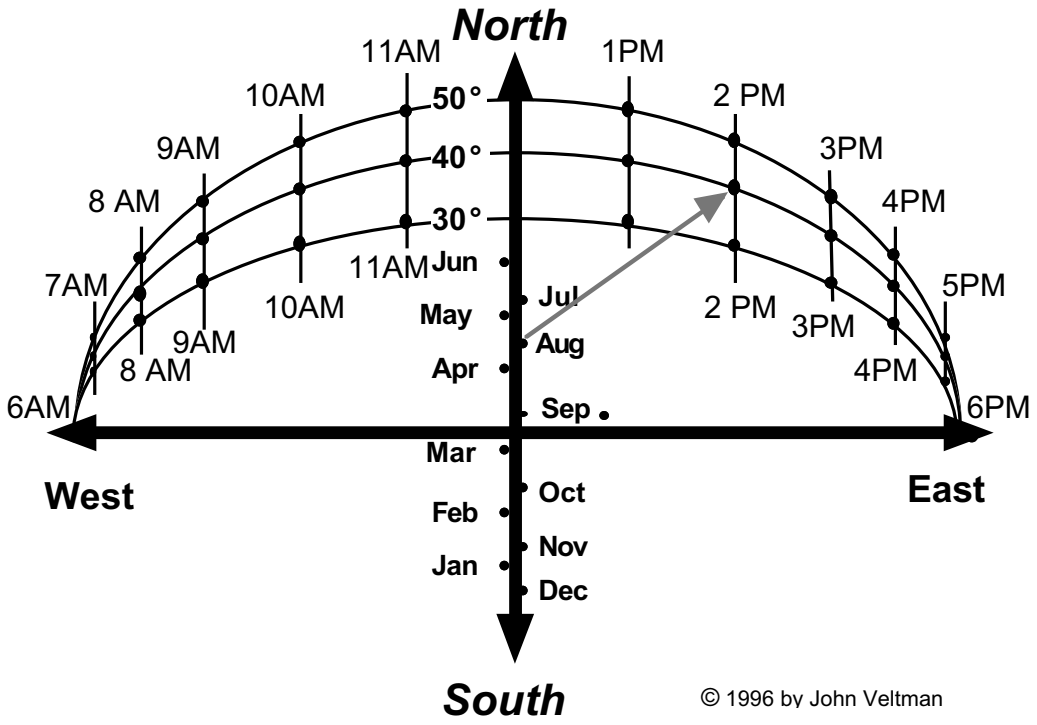
3.4 Orienting the Solar Array to Solar South

For full performance, your solar array must be oriented within 10° of true (solar) south. Depending on your location, a compass reading may show an error of as much as 20°. To correct this discrepancy, apply the magnetic declination for your region. Many regional maps indicate the magnetic declination. If you don't have a compass but can see your shadow and know the time of day, use this ***Sun Compass***.

Sun Compass™

For the USA (lower 48 states) and other 25° to 55° North latitude regions.

Find True South quickly and accurately using only your shadow. No magnetic compass needed!



Sun Compass Instructions

1. Draw an arrow from Month dot to intersection of your Standard Time and Latitude. (The gray line is an example: August, 2 PM at 40° N lat.)
2. Stand and face your shadow.
3. Hold this page horizontally.
4. Point the arrow that you drew to center of your shadow.
5. Sun Compass now indicates the four directions.

Sun Compass™ is available for the following latitudes:

1. U.S.A. (25° to 55°) – shown here
2. Northern (50° N to 70° N)
3. Equatorial (20° N to 20° S)
4. Southern (10° S to 40° S)

3.5 Setting the Solar Array Tilt Angle

Some solar array racks are adjustable to a desired angle, to accommodate both the location and the season. We offer these choices for seasonal management.

1. YEAR-ROUND COMPROMISE (no seasonal adjustment) Set the angle equal to the latitude of the location and "forget it". This is good if the pool is to be used year-round.
2. SEASONALLY ADJUSTED This is good if you want to maximize performance for both the winter and the summer-half of the year. It is sufficient to perform the adjustment only twice per year, at the spring and autumn equinoxes, to the angles indicated below. For central USA, daily water production will be increased by about 8% in summer, 5% in winter compared to option 1. There is less advantage in a cloudier climate. If adjustment is difficult or is likely to be forgotten, this is not a good option.
3. SUMMER USE For use only during summer half of the year, set the array to the seasonal angle shown below, and "forget it". The pump will function in the winter, but at a substantially reduced pumping rate.

Ideal angles (from horizontal) are: Summer optimum = latitude -15° Winter optimum = latitude + 15°

Solar Array Tilt Angles by latitude

Location (examples)	Latitude	Summer Tilt	Winter Tilt	Year-Round Compromise
Southern Canada	50°	35°	65°	50°
Upper Third of USA	45°	30°	60°	45°
Middle Third of USA	40°	25°	55°	40°
Lower Third of USA	35°	20°	50°	35°
Central Mexico	20°	5° *	35°	20°

* 0-25° latitudes Apply a minimum tilt angle of 10°, or dust and debris will accumulate.

4 ELECTRICAL INSTALLATION

4.1 Controller, Junction Box, and Conduit

WARNING To be installed, connected and serviced by qualified personnel only. Ensure all power sources are disconnected when making connections to the controller. Follow all appropriate electrical codes. There are no user serviceable parts inside the motor or the controller.

System Wiring Diagram If your pump was purchased as part of a pre-packaged system, a System Wiring Diagram should be attached at the back of this manual.

Location If the solar array is to be located more than about 100 feet (30m) from the pump, place the controller close to the solar array, not the pump. This will reduce the risk of lightning damage. *Explanation — The controller's input circuitry is more sensitive to surges than its output. It is safest to minimize the length of the input wiring.*

Protection from solar heat Electronic devices are most reliable when they are protected from heat. The ideal location is in the pump room. If there isn't a pump room with adequate space, mount the controller in the shade of the mid-day sun. If the controller is to be mounted at the solar array, an ideal location is directly under the array, on the north side of the mounting pole. If shade is not available, cut a piece of sheet metal and bolt it behind the top of the controller. Bend it over the controller to provide shade. This is especially important in extremely hot locations.

Location of controller Mount the controller vertically to keep out rainwater. It is preferable to mount it ON THE NORTH SIDE of a pole or other structure, to help reduce solar heating. This may also allow easiest access without hitting your head on the lower (south) edge of the array.

Junction Box
A pre-wired junction box is included with your system. The junction box terminals will handle pump wires as large as #6 (13 sq. mm). If large wires cannot be accommodated easily in the box, you can join them to smaller wires in the junction box. #12 (4 sq. mm) or larger is acceptable for this very short length. Do NOT remove terminal screws. If the key to the junction box gets lost, it can be opened with a screwdriver.

Mounting the controller and junction box to a pole See photos on the following page. The controller can be mounted onto the solar array support pole using materials available from your local electric supply store. The best mounting hardware is "slotted strut" (*Unistrut*® or equivalent) with matching conduit clamps to fit around the mounting pole. This makes a very strong assembly that is easy to adjust. In North America, these materials are commonly available from electric suppliers.

Other methods of mounting to a pole:
1. Make "U-bolts" from threaded steel rod. You may need to drill additional holes in the junction box. Seal unused holes with a permanent sealant.
2. Attach a metal plate to the pole and bolt the boxes to the plate.
3. Drill and tap holes in the pole, drill matching holes (centered) in the boxes, and bolt them directly to the pole.

Electrical conduit is recommended We urge you to use electrical conduit (pipe) to protect outdoor wiring from the weather, from human activities, and from chewing animals. If you don't use conduit, use strong, high-quality outdoor cable. Where cables enter the junction box, install sealed strain-relief cable clamps.

Keep the controller and junction box sealed Unused holes must be sealed to keep out animals, insects, water and dirt. Each hole is supplied with a rubber plug that can be kept in place for this purpose.

CAUTION Loose connections are the most common cause of system failures.
Pull on each connection to confirm that it is secure.

ETAPUMP / SunCentric P AC POWER PACK

This allows the use of 115 or 230VAC power to run ETAPUMP for emergency or supplemental backup. Utility power or a portable generator can be used, and interfaced automatically with solar.

If you anticipate use of the AC Power Pack, leave space for it.
Dimensions: 15.7" X 11.8" X 5.5" (400 X 300 X 140mm)

A MODEL INSTALLATION

300-watt solar-direct system
Colorado, USA

This system was installed by students in a solar water pumping class.

The array is set at summer tilt angle.

The controller is mounted on the north side of the pole, directly under the array. This shades it from the hot mid-day sun.

Courtesy of Solar Energy International,
Carbondale, CO, USA

Typical assembly of the controller and junction box on the solar array mounting pole. Boxes are secured using slotted strut and conduit clamps.

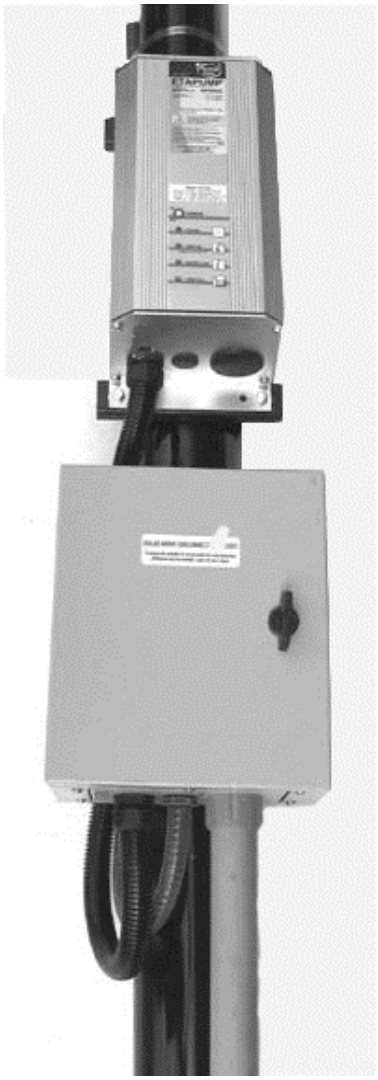
Mount the controller on the north side of the pole to reduce solar heating.

Bare ground wires bond the PV modules to the controller enclosure, and continue down to the ground rod. Flat braid is shown at the array. It is flexible and eliminates need for lugs.

slotted strut (*Unistrut*® or equivalent), cut to the width of the box.

conduit clamp to fit slotted strut

hose clamp



4.2 Grounding and Lightning Protection

WARNING Failure to install and connect an effective grounding system will greatly increase the risk of lightning damage and will void your warranty. We suggest you wire the grounding system FIRST so it is not overlooked. The concrete footer of a ground-mounted array will NOT provide adequate electrical grounding.

Surges induced by lightning are one of the most common causes of electronic controller failures in solar water pumps. Damaging surges can be induced from lightning that strikes a long distance from the system, or even between clouds. The risk of damage is greatly reduced if these instructions are followed.

Construct a discharge path to ground A properly made discharge path to ground (earth) will discharge static electricity that accumulates in the above-ground structure. This helps prevent the attraction of lightning. If a lightning strike occurs at close proximity, a well-grounded conductive structure can divert the surge AROUND the power circuitry, greatly reducing the potential for damage. The *ETAPUMP* controller has built-in surge protectors, but they help ONLY if the system is effectively grounded.

Earth connection – Create an effective discharge path It helps to picture this as a “drain field“ for electrons. Here are suggestions for grounding, in order of their efficacy:

1. The best possible ground rod is a steel well casing located near the array. Drill and tap a hole to make a strong bolted connection to the casing with good metallic contact. Bolt on a brass terminal lug. After the connection is made, seal the connection with silicone sealant or other waterproof compound to prevent corrosion. Protect the ground wire(s) from physical damage so they aren’t stressed by being stepped on, etc.
2. Install a copper plate or other specialized grounding devices designed for the purpose. Some systems use salts to improve the conductivity of the surrounding soil.
3. Install one or more copper-plated ground rods at least 8 feet (2.5m) long, preferably in moist earth. Where the ground gets very dry (poorly conductive), install more than one rod, spaced at least 10 feet (3m) apart.
4. If the soil is rocky and doesn’t allow ground rods to be driven, bury BARE copper wire in a trench at least 100 feet (30m) long. If a trench is to be dug for burial of water pipes, ground wire can be run along the bottom of the trench. The wire size must be minimum #6 (16 sq. mm) or double #8 (10 sq. mm). Connect one end to the array structure and controller. Or, cut the ground wire shorter and spread it in more than one direction.

To achieve good grounding in a dry, rocky location, consult a local contractor who specializes in lightning protection. It is best to plan the procedure in advance, and to coordinate the effort with other earth-excavating procedures that need to be done. Reference: www.lightning.org

Bond (interconnect) all the metal structural components and electrical enclosures Interconnect the PV module (solar panel) frames, the mounting rack, and the ground terminals of the disconnect switch and the controller, using wire of minimum size #8 (6mm2), and run the wire to an earth connection.

Ground connections at the controller The controller and junction box have redundant ground terminals inside. They are all connected in common with the metal enclosures of both the controller and the junction box. Ground connections can be made to any of these points.

Ground connections to aluminum This applies to connections at the solar array framework, and at the controller’s enclosure box. Connections to aluminum must be made using terminal lugs that have an aluminum-to-copper rating (labeled “AL/CU”) and stainless steel fasteners. This will reduce the potential for corrosion.

Grounding the pump *ETAPUMP* requires a ground wire for safety. Connect the ground wire to any ground connection in the junction box or to the controller enclosure.

Float switch cable (This does not apply to swimming pool applications.) A long run of control cable to a float switch can pick up damaging surges from nearby lightning. The best protection is to use shielded, twisted-pair cable (Dankoff Solar Item #10326). Shielded cable has a metallic foil or braid surrounding the two wires. Ground the cable shield as illustrated in Section 5.1.
CAUTION Ground the cable shield at the controller end only, not at the float switch.

Additional lightning protection The *ETAPUMP* controller has built-in surge protection devices. However, additional grounding measures or surge protection devices are recommended under any of the following conditions:

1. Isolated location on high ground in a severe lightning area
2. Dry, rocky, or otherwise poorly conductive soil
3. Long wire run (more than 100 feet / 30m) from the controller to the wellhead, or to the float switch.

Additional lightning protection devices (surge arrestors) can be obtained from your *ETAPUMP* supplier. The device(s) for the controller's PV input, float switch and probe connections, must be rated for DC. The device(s) for the controller's AC output to the motor must be rated for 3-phase AC. In each case, the clamping (bypass) voltage should be 90V or higher, but not much higher.

DO NOT GROUND the positive or the negative of the power circuit. The best lightning protection results from grounding the metallic structure only, and leaving the power system ungrounded. This is called a "floating" system.
Explanation: *With a floating system and a good structural ground, lightning induced surges tend to reach ground through the structure, instead of the power circuit. When high voltage is induced in the power circuit, the voltage in negative and the positive sides tend to be nearly equal, thus the voltage BETWEEN the two is not so high, and not usually destructive. This method has been favored for many decades by most engineers in the remote power and telecommunications fields.*
Exception for battery systems: You can connect the pump to a battery-based home power system that has a negative ground. If the wiring distance to the pump exceeds 100 feet (particularly in a high lightning area), DC-rated surge protection devices are recommended.
Legal exception: If the local electrical authority requires power circuit grounding, ground the PV ARRAY NEGATIVE wire. This may increase the risk of lightning damage.

Solar array wiring Bind the array wires close together, or use multi-wire cable. Avoid forming loops. This helps induced voltages in each side of the circuit to equalize and cancel each other out.

Wire twisting for long runs Twisting wires together tends to equalize the surge-induced voltage so the voltage differential between the wires is small. This reduces the probability of damage. This method is employed in telephone cable, for example. Some power cables are manufactured with twisted conductors. To twist wires yourself, you can alternate the direction of the twist about every 30 feet (10 m). This makes the job much easier.

WARNING Keep solar pump wiring away from electric fence systems. Do not connect the pump system to the same ground rod as an electric fence system. Do not run a float switch cable close to an electric fence.

4.3 Solar Array Wiring

WARNING: Your photovoltaic array generates hazardous voltages. A 48 Volt (nominal) array can generate nearly 100 volts when disconnected from load. A short circuit or loose connection will produce an arc that can cause serious burns. All wiring must be done by qualified personnel, in compliance with local, state, and national electrical codes.

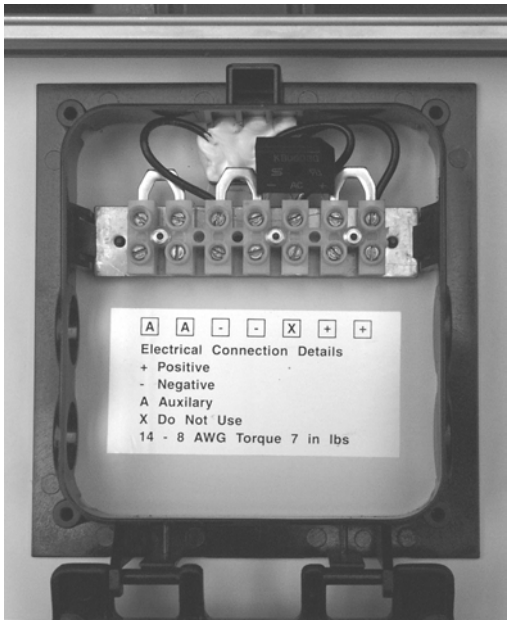
The solar array can produce hazardous voltage even under low light exposure. To prevent shock hazard while wiring the array, leave one or more wires disconnected or cover it with opaque fabric.

SunCentric P solar-direct (non-battery) systems use a variety of array configurations. Some use 12V (nominal) modules, and some use 24V modules. Modules are connected in series for 36 or 48V, and sometimes also in parallel to increase the current. Refer to the System Wiring Diagram for your system, attached at the end of this manual. Be sure the modules (panels) match the description on your System Wiring Diagram.

Solar module connections The terminals in the module junction boxes can be confusing. Refer to the module manufacturer's instructions that are packed with the modules. Make strong connections that will hold for many years. Most array failures are caused by loose, corroded, or shorted connections.

PHOTOS show two types of PV module junction systems.
TOP Quick-connect system using "MC" connectors.
BOTTOM Conventional junction box with conduit holes.

Type of wire Use either electrical conduit or outdoor UV-resistant wire. The solar array has a life expectancy beyond twenty years. Don't degrade it with inferior materials! Use minimum wire size #12 (4 sq. mm) for the connections between modules and for short distances to the controller. Some appropriate types of wire are: USE, UF, SE and SOOW.



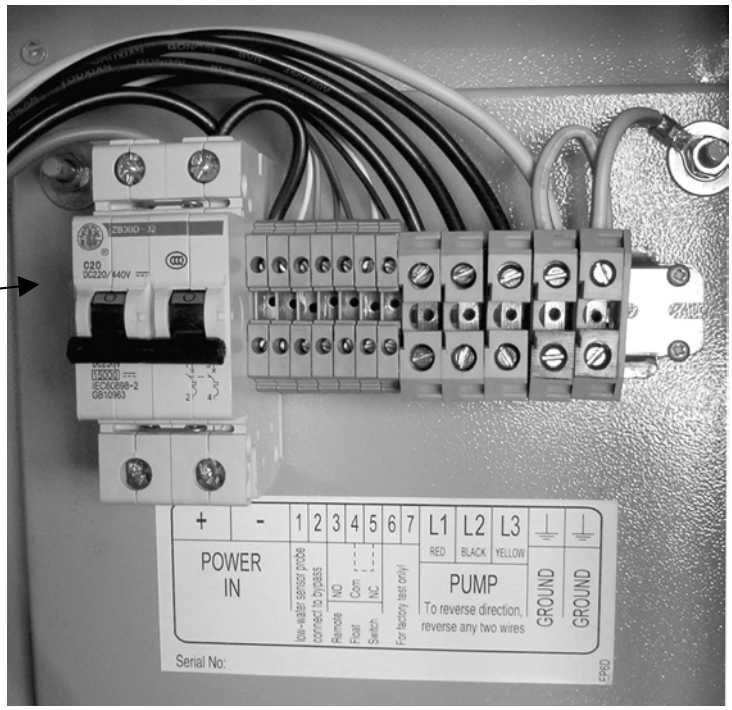
Solar tracker wiring If you are installing a solar tracker, pay careful attention to the wire section that leads from the moving rack down to the stationary mounting pipe. Use materials that are highly flexible. Form a drip loop to shed water and to minimize stress. Secure the assembly mechanically at each end so the insulation and the connections are not stressed by the tracker's motion. Swing the tracker fully in each direction, at various seasonal tilt angles, to verify that the cable does not rub or restrict the tracking motion. See tracker photo.

MC connectors Some PV modules have these quick connectors. If the connector is not appropriate at some junctions, you can cut the wire and make a conventional connection.

CAUTION Loose connections are the most common cause of system failures. Pull on each connection to confirm that it is secure.

4.4 Solar Array Disconnect Switch in the Junction Box

PHOTO Inside of junction box showing the factory-installed wires that lead to the controller.



The disconnect switch prevents the pump from restarting if it has been stopped by the POWER switch on the controller. It also prevents activation by unauthorized personnel.

DISCONNECT SWITCH

The disconnect switch satisfies National Electrical Code requirements for a safety disconnect between the solar array and the controller. During installation and maintenance, switch off the disconnect switch to prevent shock and arc burn hazard.

Note: Overload protection (fuses or circuit breaker) is NOT required in the solar array circuit. *Explanation:*

1. *Short circuit current from the solar array can never reach the ampacity (maximum safe amps capacity) of the recommended wire.*
2. *The ETAPUMP controller has internal overload protection.*

CAUTION Loose connections are a common cause of failure. Pull each connection to confirm.

4.5 Junction Box (Controller Input) Wiring

System Diagram For solar-direct systems, refer to the System Diagram at the end of this manual.

WARNING TEST THE VOLTAGE before connecting power to the controller. Voltage (open circuit) must not exceed 90V. (Even in cloudy weather, the open circuit voltage will be near maximum.)

WARNING Some thin-film modules (panels) may produce excessive voltage, especially when they are new. If the open circuit voltage exceeds 90V, DO NOT connect power to the controller. Contact your supplier. (*SunCentric P* packaged systems do not use this type of module.)

WARNING Do not apply a direct connection or an amp meter between + and – when the controller is connected. A short circuit here will cause a strong discharge.

WARNING SOLAR-DIRECT systems only — Do not connect any electrical load or device to the solar array if it is not part of the *SunCentric P* system. Connection of a battery charger, active tracker controller, electric fence charger, or other load simultaneously with *SunCentric* will "confuse" the controller and prevent proper operation.

Ground connections The two ground terminals in the junction box are bonded together and are also bonded to the metallic enclosures of both the junction box and the controller. See Section 4.2

POWER IN Ensure that the solar array DISCONNECT SWITCH (or battery fuse or circuit breaker) is OFF. Connect the power from the solar array to the input terminals in the junction box. Observe polarity. If your wires are not clearly marked +/–, test them using a DC voltmeter or multitester.

PUMP See Section 4.7 and 4.8.

Low Water Probe See Section 5.4.
Swimming pool systems or other systems not using a low-water probe Connect a small wire between terminals 1 and 2.

Float Switch Connect full-tank float switch wires to terminals. See Section 5.5, Automatic Control for Full-Tank Shutoff.
Swimming pool systems or other systems not using as float switch Connect a small wire between terminals 4 and 5, "common" and "N.C.".

4.6 Maximum RPM Setting

WARNING The installer is required to reset the "Max. RPM setting" to position 2, illustrated below. Failure to perform this adjustment may cause damage and will void the warranty.

The *ETAPUMP* EP-600A controller supplied with *SunCentric P* pumps is manufactured for a variety of solar pumps. *SunCentric P* applications require this change from the standard factory setting.

How to reset the Maximum RPM setting
1. Remove the bottom end of the EP-600A controller enclosure (the end with the conduit openings)
2. Locate the adjustment knob shown in the photo below (circled)
3. In most cases, the knob will be at the standard factory setting full clockwise. Turn it counter-clockwise to the ink mark illustrated as #2 in the illustration below. The exact position may vary from this illustration. Follow the ink marks in the unit.

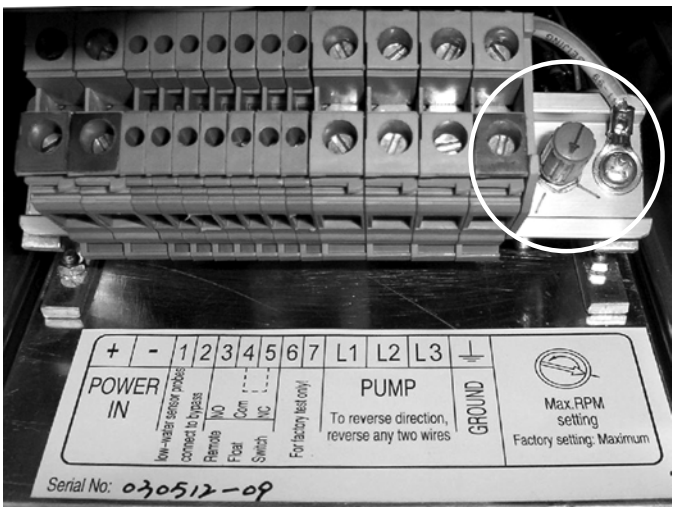
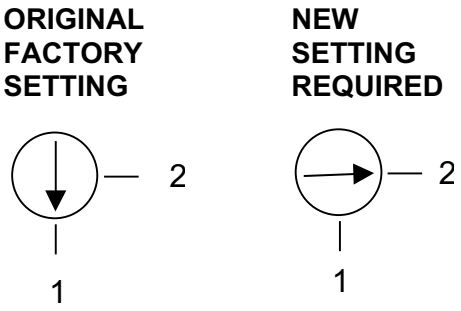


PHOTO Terminals inside the EP-600A controller. "Max. RPM setting" is at right. The two ink marks correspond to positions 1 and 2 illustrated below.

← Maximum RPM setting knob



CHECK HERE TO INDICATE THAT THIS ADJUSTMENT HAS BEEN PERFORMED → _____

You can reduce the maximum RPM further if you desire to limit the peak flow rate to less than this normal setting. This will only reduce the flow in high-sun conditions. It will not influence low-light performance. Turning the control counterclockwise from position 2 allows reduction in pump speed down to about 50%.

4.7 Motor Wiring Order for Correct Rotation

WARNING If the pump wires are in the wrong order, the motor will run in reverse. The proper direction is CLOCKWISE when viewed from the rear of the motor. Remove rubber plug to view shaft at rear of motor.

WARNING Do not run the pump dry. Fill the pump at least half-way with water before testing for direction.

The motor receives 3-phase AC power from the controller. This requires three power wires. If they are not in the proper order, the motor will rotate in reverse direction.

The motor wires inside the motor junction box are labeled L1, L2 and L3. (L1 is closest to the motor.) Connect each one to the corresponding “pump” terminals in the controller.

To make secure connections in the motor junction box, invert one of the two U-brackets on each terminal bolt. The brackets should couple together so they trap the wire securely.

Confirm the direction When first starting the motor, remove the rubber plug from the rear-center of the motor, and observe the shaft rotation. It should turn CLOCKWISE as viewed from the rear of the motor. The motor will start slowly, increasing speed over a 15 second period.

If the direction is reversed, exchange ANY TWO of the power wires, either at the motor or in the controller.

Alternative: Connect the power wires to the controller in ANY random order. Apply power. Observe the pump shaft rotation as the pump starts. If the direction is wrong, stop the pump immediately and exchange ANY TWO of the power wires.

4.8 Pump Motor Bonding and Grounding

WARNING Electrical wiring should be performed by a licensed electrician in accordance with local, state and national codes. Be certain that the motor frame is grounded. Do not connect to electric power supply until unit is permanently grounded to earth and bonded to the pool structure.

Bonding TO REDUCE RISK OF ELECTRICAL SHOCK, a bonding connector is provided for bonding to metal water pipes, metal rails, or other metal within 5 feet of the swimming pool. All local points should be bonded with a #8 AWG wire. As required by National Electrical Code Article 690-22, the pump motor must be electrically bonded to the pool structure (reinforced bars, etc.) by a solid copper conductor not smaller than #8 AWG via an external copper bonding lug on the pump motor.

GROUNDING TO REDUCE RISK OF ELECTRICAL SHOCK, connect ground wires to grounding screw located in the motor. Use no smaller than a #12 AWG wire.

5 INSTALLING THE PUMP

5.1 Pump Location

Locate pump as close to the water source as practical. For swimming pools, consult local codes for minimum distance between pool and pump. Place the pump on a solid foundation to provide a rigid and vibration-free support. Leave access space around it to allow room for service and maintenance.

Whenever possible, the pump should be below the water level in the source, to ensure quick priming via a flooded suction line. This is normal for swimming pool applications. If this is not possible, see Section 5.3 Suction Applications.

Protect the pump against flooding and excess moisture. Prevent foreign materials from blocking air circulation around the motor.

DO NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this pump. DO NOT store pool chemicals near the pump.

5.2 Piping

WARNING The pump has quick-disconnect unions made of ABS plastic. Use only an approved type of solvent cement to connect pipes to these unions.

To connect ABS pipe to the pump unions, use cement that is approved for ABS pipe. To connect PVC pipe to the pump unions, use cement that is approved for connection of BOTH materials. It is called *ABS/PVC crossover cement*.

If the suction pipe is not sealed perfectly, air will be drawn in. The pump will not prime properly and will perform poorly.

The piping should be as direct and free from turns or bends as possible, as elbows and other fittings greatly increase friction losses. Avoid sharp 90° elbows. Use sweep elbows or dual 45° elbows instead.

Pipes should never be smaller than the fittings on the pump. Long distances may require larger pipe. Consult a pipe sizing chart to calculate the equivalent head loss. This is especially critical when using a solar pump, as we are trying to get the most flow for the least amount of power. Reducing the performance of the system by using small-sized pipe is false economy.

Suction and discharge line should be independently supported at a point near the pump to avoid excess strain on the pump.

It is advisable to install gate valves in both the suction and discharge line in the event that the pump must be removed for service.

5.3 Suction Applications

THIS DOES NOT APPLY TO TYPICAL SWIMMING POOL APPLICATIONS

This refers to applications where the pump must be placed HIGHER than the surface of the water source, such as irrigation from a stream or pond.

WARNING Limit of suction height The vertical distance from the surface of the water source to the pump intake must not be more that 8 feet (subtract 1 foot for every 1000 feet elevation above sea level).

Pumps are better at pushing than sucking. In all cases, suction height should be kept to a minimum. If the water is hot or contains a high amount of dissolved gasses, air entrapment may cause loss of prime at less than 8 feet. High altitude location reduces the suction capacity as well.

Special attention must be paid to the suction piping, to minimize its resistance to flow. It should slope upward to the pump without dips or high points, so air pockets do not form. The highest point in the suction piping should be the pump inlet. Follow the same rules as for a drain line, to allow water to flow as quickly and easily as possible — except that the water will be drawn upward.

Foot valve A foot valve must be used at the water intake, to keep the pump primed. Foot valves are available from any local pump supplier. To prevent air from being drawn into suction pipe due to a suction whirlpool, the foot valve may need to be submerged as much as three feet (1 m) below the low water level. This will NOT add to the suction load on the pump. The suction pipe must be tight and free of air leaks or the pump will not operate properly.

Priming the pump Before starting the pump for the first time, remove the lock ring that secures the transparent strainer lid. (Turn the ring counterclockwise.) Fill the strainer tank with water until it is level with the suction inlet. The entire suction pipe and pump body must be full of water. Replace the lid, making sure the O-ring is not damaged. Screw down the lock ring hand-tight only.

Tolerance for running dry If the pump loses its prime or the water source goes dry, or an intake pipe breaks, the pump is in danger of running dry. If the pump is completely dry inside, the shaft seal is deprived of cooling and lubrication provided by water. This causes the seal to overheat, and may cause the surrounding pump material to melt. *SunCentric P* is designed to hold a reservoir of water to prevent this occurrence by splashing water against the seal. It can usually run for a period of a few hours or possibly a day without water intake, before the seal is at risk. However, if dry run is a possibility, the use of a low-water shutoff system is highly recommended. See the next section.

5.4 Low-Water Probe for Dry-Run Protection

THIS DEVICE IS NOT NECESSARY IN NORMAL SWIMMING POOL APPLICATIONS.

WARNING Running completely dry will damage the pump end and void the warranty. The purpose of the probe system is to sense the loss of water in the source, and turn the pump off.

The low-water probe should be used if it is possible for the pump's water source to run low, causing the pump to lose prime or to run dry.

The low-water probe is not included with *SunCentric P*. To obtain this accessory, order *ETAPUMP Low-Water Probe* Item # 11682 from your Dankoff Solar supplier.

Mounting the probe The low-water probe is supplied with a hose clamp, allowing it to be mounted to a water pipe, as shown in the photo. It can be mounted by any practical means, as long as the electrodes are within 30° of vertical position. It can be mounted anywhere in the water source. It does not have to be on the intake pipe.

Wiring the probe Splice the two wires to submersible wires of #18 AWG or larger, using the submersible splice kit supplied with the probe. The splices use heat-shrink tubing, like your main pump splice (see splice kit instructions). In the controller, connect the well probe wires to the low-water probe terminals #1 and 2.

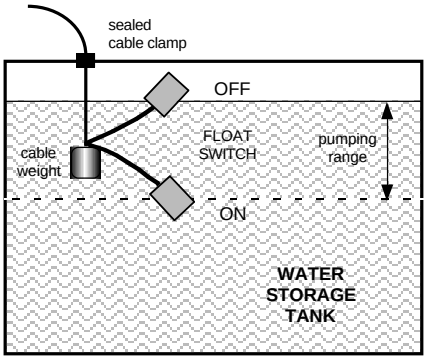
Operation The probe senses electrical conductivity through the water, between two electrodes. If the water level drops below the probe, continuity is lost. The controller will stop the pump and the "Low-Water OFF" light will indicate. When the water level recovers and again contacts the electrodes, the controller will delay the restart for 20 minutes. To force a restart, turn the controller off, then on again.

The Low Water-OFF light stays ON for the remainder of the day, even if the water recovers and the pump restarts automatically. This tells you that the water source ran low at least once since the power was disrupted (or sun went down). To turn the light off, reset the controller by turning it off/on.

If you are not using the well probe, connect a short wire between the probe terminals in the junction box (terminals 1 and 2). Do this only if you feel certain about the reliability of the water source. Dry run damage is not covered by the warranty.

5.5 Automatic Control For Full-Tank Shutoff

THIS DOES NOT APPLY TO SWIMMING POOL APPLICATIONS



This section applies to solar irrigation and other water supply systems that use *SunCentric P* to fill a storage tank.

We recommend the use of a float switch or other means to prevent overflow of the storage tank. This will stop the pump when the tank is full, then reset when the level drops. This conserves ground water, prevents overflow, and eliminates unnecessary pump wear. *ETAPUMP* controllers allow the use of small signal cable to a remote float switch, even if the tank is a long distance away.

Float switch requirements

1. A switch must be used, not wet electrodes.
2. It must not be allowed to switch on/off rapidly.
3. The preferred system requires a float switch to MAKE contact on rise to turn the pump OFF (reverse action).

Float Switch Kit from Dankoff Solar (Item # 10320) meets these requirements. Obtain it from your *ETAPUMP* supplier. The kit includes a sealed float switch (non-mercury type), cable weight and cable clamp as illustrated.

Float switch cable requirements

1. Two wires are needed.
2. Minimum wire size #18 AWG
3. The cable must be suitable for its environment.
4. If it must run a long distance, use twisted-pair shielded cable to reduce the chance of damage from lightning-induced surge. (See Section 4.2, Grounding and Lightning Protection).

Float Switch Cable from Dankoff Solar Products (Item #10326) meets these requirements. It is approved for sun exposure and direct burial, has a twisted pair and a metallic shield for surge resistance.

Wiring to the junction box The controller (and junction box) offers two options for connection of a remote switch. These allow the use of either a “normally open” (N.O.) or a “normally closed” (N.C.) switch. “Normal” refers to the status of the contacts when the switch is DOWN and is calling for water.

When using a NOswitch, the NC terminals (4 and 5) must be wired together. Connection of a standard on/off switch to these terminals will turn the pump on/off in the normal, logical manner.

Wiring the *Dankoff Solar Float Switch Kit* (Item #10320) This is a “normally open switch”. Connect it to terminals 3 and 4 (NO) and common) and connect terminals 4 and 5 together, as illustrated. When the switch floats up, it MAKES contact, and the pump stops. This is called “reverse action”.

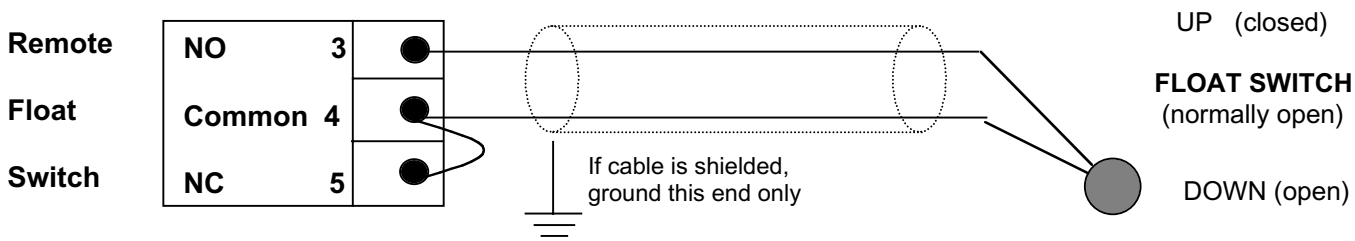


ILLUSTRATION Connection of *Dankoff Float Switch Kit* (NORMALLY OPEN) to junction box terminals

QUESTION Why do we use a reverse-action (N.O.) float switch?
ANSWER If the cable connection is broken, the pump will continue to operate. The water supply will not be disrupted (but of course, the tank will overflow). This is the general preference in the industry. If you prefer the pump to stop if the connection is broken, use a normally closed float switch instead.

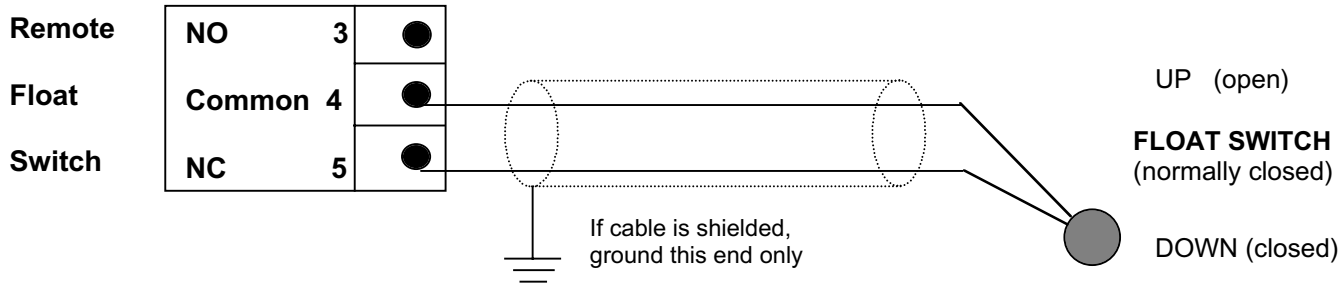


ILLUSTRATION Connection of NORMALLY CLOSED float to junction box terminals

Grounding shielded float switch cable If you use shielded cable (containing a metallic foil or braid around the wires, like Dankoff Solar *Float Switch Cable*), connect the shield to ground AT THE CONTROLLER ONLY. Do NOT ground the shield at the float switch. This will reduce surges induced by nearby lightning.

If you are not using a float switch, terminals 4 and 5 must be connected. Terminal 3 remains disconnected.

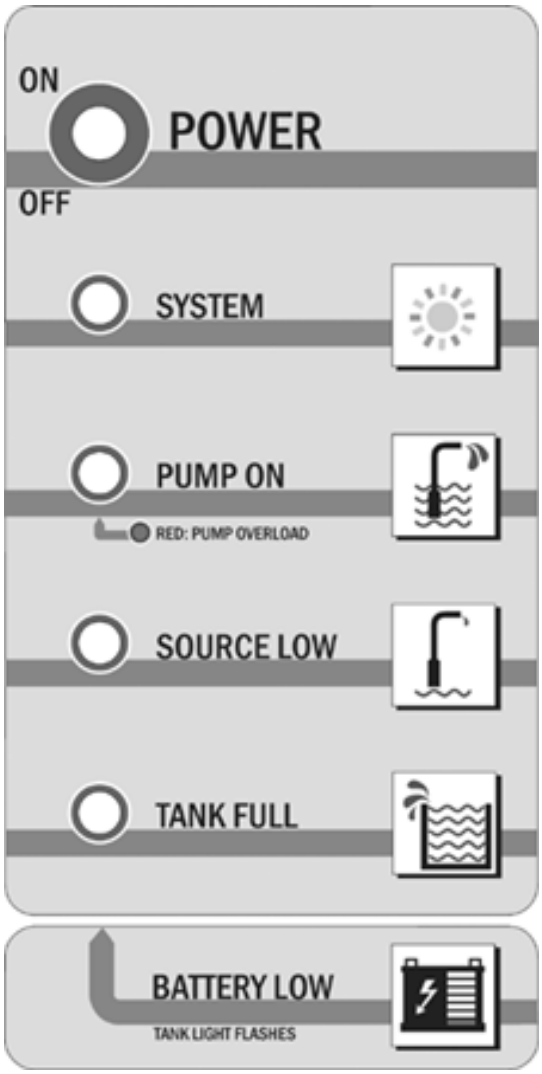
Operation of the float switch system When the water level is high, the float switch will stop the pump. The FULL-TANK OFF indicator on the controller will light up. When the water level drops, the float switch will signal the controller. The indicator light will go out, and the pump will restart if sufficient power is available.

Overriding the float switch You may want to override the float switch to allow overflow for irrigation purposes or to test or observe your system. For a N.O. switch circuit, install a switch to DISCONNECT ONE of the float switch wires. FOR A N.C. switch circuit, install a switch to CONNECT the two float switch wires together.

Manual remote control The float switch circuit can be used with a manual switch to turn the pump on and off from a distance. Use any general-purpose on/off switch available from an electronic supply, electrical supply, or hardware store. Wire it to COMMON and NORMALLY CLOSED (terminals 4 and 5). (See illustration for a normally closed float switch). This way it will work in the normal way (not reverse-action). A pump that is switched off by way of the float switch circuit will stay off, and not restart the next day, until the switch is returned on.

6 OPERATING THE PUMP

This explains the function of the switch and the indicator lights on the pump controller.



SWITCH

← **POWER ON/OFF** (PUSH ON / PUSH OFF)
When switched off/on, it resets all system logic.

INDICATOR LIGHTS

← **SYSTEM (green)**
The controller is switched on and the power source is present. In low-power conditions, the light may show even if there is not enough power to run the pump.

← **PUMP ON (green)**
Motor is turning.

← **PUMP OVERLOAD (red)**
See Troubleshooting section.

← **SOURCE LOW (red)** — ***not used in pool systems***
The water source dropped below the level of the low-water probe (or a probe connection failed). After the water level recovers, the pump will restart, but this light STAYS ON until the sun goes down or until power is interrupted or the POWER button is reset off/on.

← **TANK FULL (red) — not used in pool systems**
Pump is turned off by action of the remote float switch circuit. In case of a pressurizing system, this would indicate that the system has reached the "cut-out" pressure and has stopped.

BATTERY SYSTEMS ONLY:
← **BATTERY LOW (tank light flashes)**
Battery systems only – battery voltage fell to 22V or 44V, and has not yet recovered to 26V or 52V.

IN CASE OF A POOL SYSTEM, the low-water probe and "N.C." float switch connections must be bypassed. The SOURCE LOW and TANK FULL lights should be off. See Section 4.5, Junction Box Wiring.

Starting the pump Be sure there is not a closed valve or other obstruction in the water line. Switch on the array disconnect switch in the junction box, and press the power switch on the controller. Leave the switches on at all times, unless you desire to have the system off.

A solar-direct pump should start under the following conditions
1. clear sunshine at an angle of about 20° or more from the surface of the solar array
2. cloudy conditions, if the sunshine is bright enough to cast a very slight shadow

When sunshine is insufficient In daylight, when sunshine on the array is too weak for the pump to run, it will attempt to start about every 90 seconds. During each attempt, you will hear a slight noise in the controller.

When pump runs slowly under very low sun conditions
In weak sun, the pump may spin slowly without moving much water. This is normal.

When pump stops from a sudden shadow on the solar array
If a shadow suddenly passes over the array, like if you walk in front if it, the controller will lose track of the input voltage. It may make rapid on/off noises and a high-pitched noise, then stop. This does NOT indicate a problem. The pump will attempt to restart after the normal delay.

Time delays
1. After pump stops due to insufficient sunshine or overload fault – 90 SECONDS or less
2. After full-tank float switch resets – 20 SECONDS or less
3. After low-water probe regains contact with water in the source – 20 MINUTES but the indicator light will stay on for the rest of the day, or until power is disrupted.

To force a quick start
To test or observe the system, you can bypass the normal time delays. Switch the on/off switch (or the power source) off for about 2 seconds, then on again. The pump should start immediately if sufficient power is present.

No-load shutoff
If the pump runs out of water, it will run for about 40 seconds, then it will stop. This is the controller's normal response when there is no load on the motor. It will attempt to restart every 30-90 seconds.

7 MAINTENANCE

7.1 Pump Maintenance

The pump requires little or no regular service other than reasonable care and periodic cleaning of the strainer basket.

Strainer basket To remove debris from the strainer basket, unscrew the lock ring and the clear lid and lift out the basket. Never operate the pump without the strainer basket.

If frequent cleaning is a nuisance, add a larger strainer or make some improvement in the system to prevent excessive debris from accumulating.

Keep the motor area clean The motor requires free air circulation to prevent overheating. Keep the area around the motor free of dry leaves or other debris. If debris accumulates naturally, add some shelter around the pump to prevent accumulation.

Shaft seal The shaft seal on the pump shaft is a high quality carbon-ceramic mechanical seal. The seal may wear during the course of, time, particularly if there is abrasive silt in the water. If water continually leaks out, a new mechanical seal should be fitted.

To replace a mechanical seal, remove the eight bolts holding the casing to the seal housing. Slide the motor part including the seal housing out. Remove the impeller by turning it counter-clockwise when facing it, while holding motor shaft at rear end of motor. Slide seal from impeller shaft. To re-assemble, reverse the process. Note: Make sure both parts of the mechanical seal (ceramic and spring portion) are clean. Gently wipe polished faces with soft and dry cotton cloth. Surfaces can easily be damaged by dirt and scratching. Only water should be used as lubricant to mount both parts of the mechanical seal.

7.2 Controller and Junction Box Maintenance

Controller and junction box The controller is electronic with no moving or wearing parts. It requires no maintenance. There are rubber gasket seals at the top and bottom, and rubber plugs to seal unused conduit holes. Inspect them to insure that the controller is sealed from moisture, insects, etc. Check that mounting and conduit hardware is tight.

7.3 Solar Array Maintenance

Solar array mounting bolts Bolts tend to loosen as the array structure flexes in high winds. Check tightness. All bolts should all have lock washers to keep them tight.

Sun exposure Cut away any vegetation that will grow enough to block solar illumination. Shading even a small corner of the solar array may stop the pump, or greatly reduce its flow.

Solar array cleaning If there is dirt, mineral deposits, bird droppings or other debris stuck to the solar array surface, clean it with water, vinegar or glass cleaner.

Solar Array Tilt Inspect the tilt of the array. The optimum tilt angle varies with the season. Some people adjust the tilt twice per year. Other people set it at a single setting as a permanent compromise. Section 3.5 for details.

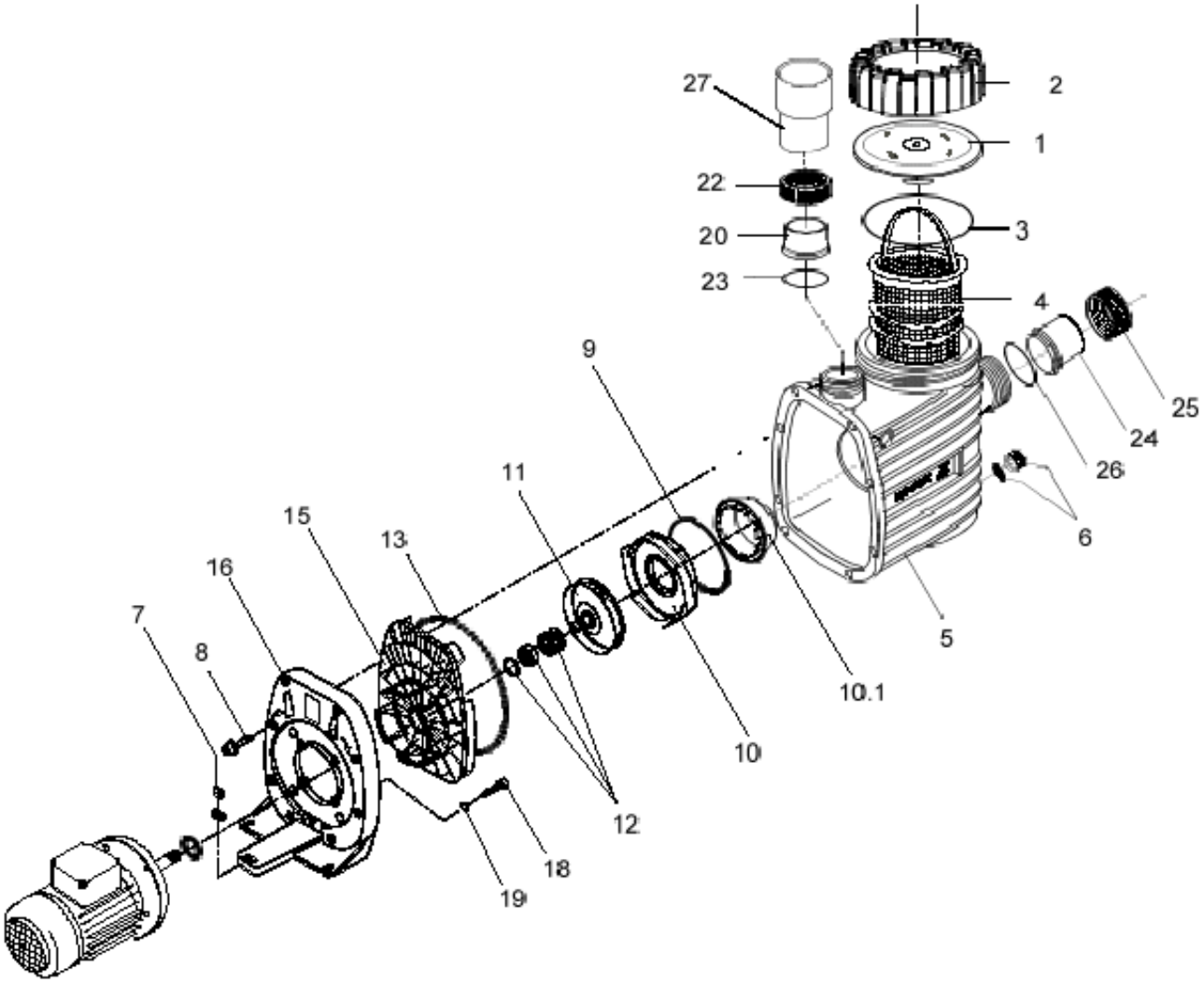
Solar Tracker If the system uses a solar tracker, lubricate the bearings, check mounting bolts and mechanism. Refer to tracker manufacturer's instructions. On a passive tracker, the shock absorber(s) may fail every few years. To test, swing the tracker by hand. It should return slowly due to damping action of the shock absorber. If it returns immediately (and swings in the wind) replace the shock absorber(s).

7.4 Electrical Wiring Maintenance

Power wiring Inspect wires and connections carefully. Any wires that are hanging loose should be secured to prevent them from swinging in the wind. Exposed wiring must be sunlight resistant and in good condition. In the case of a tracking array, look carefully for any wire damage due to rubbing, bending, or pulling as the tracker swings. If wiring was not performed to professional standards, improve it to prevent faults in the future.

Grounding Inspect the grounding system carefully. All connections must be tight and free of corrosion. Poor grounding can lead to damage from lightning-induced surges. See Section 4.2.

7.5 Exploded View of Pump



7.6 Parts List, Pump and Motor

Refer to the illustration in Section 7.5, Exploded View of Pump

FACTORY NUMBER	ILLUSTRATION NUMBER	QUANTITY	DESCRIPTION
2921116010	1	1	LID - CLEAR
2921116020	2	1	LOCK RING FOR LID
2920841210	3	1	O-RING - LID 137 x 5mm
2920314300	4	1	BASKET COMPLETE
2921110108	5	1	CASING
2921658200	6	1	CAP - DRAIN 3/8" WITH GASKET - CASING
2920889410	7	4	LEGO SPACER
2991000088	8	8	BOLT - CASING HEX/SLOT M7 x 48mm SS
2921141255	9	1	O-RING - DIFFUSER 98 x 5mm
2920117420	10	1	DIFFUSER
2921151105	10.1	1	ADAPTOR RING
2921123005	11	1	IMPELLER (12)
2920143310	12	1	MECHANICAL SEAL 14mm
2921141220	13	1	O-RING - CASING 190 x 5.5mm
2921116125	15	1	SEAL HOUSING
2921111300	16	1	F L A N G E
5879120825	18	4	BOLT - FLANGE, M8 x 25mm
2991400035	19	4	WASHER - FLANGE BOLT M8
2500320148	20	1	UNION END 1.5" SLIP (48.5mm)
2500310001	22	1	NUT - SAWTOOTH UNION (1.5")
2920241220	23	1	O-RING - UNION (1.5" SLIP) 50 x 3mm
2921772201	24	1	UNION END 2" SLIP
2921775000	25	1	NUT- SAWTOOTH, UNION (2")
2854000863	26	1	O-RING - UNION(2") 68mm x 3mm
5863727505	27	1	BUSHING - UNION 2" x 1-1/2" SLIP

8 TROUBLE SHOOTING

Please read this section before calling for help.
If you call for help, please refer to the model and serial numbers.

IF THE CONTROLLER MUST BE REMOVED FOR REPAIR OR REPLACEMENT –
Remove the wires and flexible conduit from the controller and remove the CONTROLLER ONLY.
LEAVE THE JUNCTION BOX IN PLACE.

8.1 If The Pump Doesn't Run

Most problems are caused by wrong connections (in a new installation) or failed connections, especially where a wire is not secure and falls out of a terminal. Please follow these instructions before calling for help.

The *System ON* light will indicate that system is switched on and power is available. This indicates that the connection to the power source is probably correct. It indicates that VOLTAGE is present. There may not be sufficient power to start the pump, but it should attempt to start at intervals of about 1 minute.

Pump attempts to start every 60-90 seconds but doesn't run
The controller makes a slight noise as it tries to start the pump. The pump will start to turn or just vibrate a little.

1. There may be insufficient power reaching the controller. A solar-direct (non-battery) system should start if there is enough sun to cast a slight shadow. A battery system should start if the supply voltage is greater than 22V (24V system) or 44V (48V system).
2. If the pump was recently connected (or reconnected) to the controller, it may be running in reverse direction due to wiring error. See Section 4.7. Running in reverse may cause the impeller to unscrew from the shaft.
3. If the motor shaft only vibrates and will not turn, it may be getting power on only two of the three motor wires. This will happen if there is a broken connection or if you accidentally exchanged one of the power wires with the ground wire.
4. The pump or pipe may be packed with sediment or debris.

PUMP OVERLOAD This red light indicates a serious fault. The motor cannot turn freely due to a mechanical cause or a short circuit. To attempt to restart the pump, disconnect the power for at least 8 seconds.

8.2 Inspect The System

Many problems can be located by simple inspection. No electrical experience is required for this.

Inspect the solar array

1. Is it facing the sun? (See solar array orientation, Sections 3.4 and 3.5.
2. Is there a partial shadow on the array? If only 10% of the array is shadowed, it can stop the pump!

Inspect all wires and connections

1. Look carefully for improper wiring (especially in a new installation).
2. Make a visual inspection of the condition of the wires and connections. Wires are often chewed by animals if they are not enclosed in conduit (pipe).
3. Pull wires with your hands to check for failed connections.

Inspect the controller and junction box

1. Remove the screws from the bottom plate of the controller. Move the plate downward (or the controller upward) to reveal the terminal block where the wires connect. (See Section 4.5.)
2. First, check for a burnt smell. This will indicate a failure of the electronics. Look for burnt wires, bits of black debris, and any other signs of lightning damage.
3. Open the junction box. Is the Power IN switch turned ON? Pull on the wires to see if any of them have come loose.
4. Inspect the grounding wires and connections. Most controller failures are caused by an induced surge from nearby lightning where the system is NOT effectively grounded. Ground connections must be properly made, tight, and free of corrosion. (See Section 4.2)

Check the low-water probe (See Section 5.4)

In most swimming pool installations, a low-water probe is not used. It's connections must be bypassed in the junction box.

Check the full-tank float switch (See Section 5.5)

In most swimming pool installations, a float switch is not used. It's connections must be bypassed in the junction box.

Force a quick start

If you restore a connection or bypass the probe or float switch, there is no need to wait for the normal time delay. Switch the on/off switch (or the power source) off then on again. The pump should start immediately if sufficient power is present.

8.3 Test The System

Test the solar array circuit

1. OPEN-CIRCUIT VOLTAGE You can do this easily by opening and switching off the array disconnect switch. The reading should be 72-96V (with a 48V nominal array) or 55-72V (with 36V nominal solar array). This should vary only slightly with solar intensity. This is merely "idle" voltage. It is high because no current is being drawn (it sees no load).
2. VOLTAGE UNDER LOAD (with pump running) This should be 60-73V (with a 48V nominal array) or 45-55V (with 36V nominal solar array). This should vary only slightly with solar intensity.
3. CURRENT UNDER LOAD Measuring current is the way to determine if the solar array's output is equal to its full potential. This requires either a DC clamp-on amp meter or a conventional meter wired in series with the array circuit (by breaking either + or – connection and running the circuit through the meter). The current is determined by both the array AND the load in the circuit (the pump system). If the pump is not drawing full power, it will not draw full current.
4. SHORT CIRCUIT CURRENT and SPARK TEST This will give you an indication of the array output independent of the pump system. This is helpful if the pump is trying to start or does not seem to be getting full power. CAUTION DISCONNECT THE ARRAY from the controller before making this test. Short-circuiting the array will not cause damage if it is done for a minute or less. You can do this easily by switching off the array disconnect switch. You should see a blue spark when short-circuiting the solar array exposed to sunshine. (Unlike other power generators, a short circuit at the array will only cause current slightly higher than normal.) If you don't have a DC amp meter, a spark that can jump 1/4" (6 mm) indicates a good probability that the array is working properly.

If power was connected to the controller with reverse polarity

Reverse polarity (+/–) at the controller's POWER IN terminals will be blocked. No lights will show on the controller. This will not cause damage.

Test the controller power output (measure AC voltage to pump)

1. Make these tests with the pump connected and the power turned on. Observe caution!

2. Use an AC voltmeter or a multimeter set to AC volts. (Any AC meter should be sufficient. It does not need to be a “true RMS” meter.)
3. Measure between each combination of two pump wires (L1–L2 / L1–L3 / L2–L3).
4. Voltage should be 20-60VAC, depending on the power available and the load. Each reading should be equal.

Test the motor circuit (resistance test with power off)

This resistance test will confirm the condition of the entire motor circuit, including the motor, pump cable and splice. Make this test if there is proper voltage at the controller input but the motor does not run.

1. Disconnect power from the controller.
2. Disconnect at least two of the three pump power wires from the junction box terminals.
3. Use a multimeter set on resistance (RX1 or Ω).
4. Measure between each combination of two pump wires (L1–L2 / L1–L3 / L2–L3).
5. The resistance should be .1 to 1 ohm (Ω), depending on the length and size of the pump cable. EACH READING MUST BE EQUAL.
6. NOTE — Resistance between meter probes and wires can produce an erroneous reading. Hold the probes tightly to the wire and scratch them to ensure good contact. Hold them still until the meter display shows the LOWEST reading that you can get. Holding the probes with your fingers will not alter the reading.
7. Measure resistance between the ground wire and the motor wires. Your meter should show either no reading, or more than 100 MW (that means 100 million Ω or 100 megohms). A lower reading indicates an insulation fault in a power wire to the pump.

8.4 If The Pump Runs But Flow Is Less Than Normal

1. Is the solar array receiving shadow-free light? (It only takes a small shadow to stop it.) Is it oriented properly toward the south, and tilted at the proper angle? See Section 3.
2. For water-lifting applications, be sure you have the right pump for the total lift that is required, out of the source + vertical height up the hill.
3. Be sure all wire and pipe runs are sized adequately for the distance. Refer to an appropriate wire sizing table, and to a pipe sizing chart.
4. Inspect and test the solar array circuit and the controller output, as above. Write down your measurements.
5. There is a “max. RPM” adjustment in the controller. It may have been set to reduce the flow to less than the normal setting “position 2” shown in Section 4.6.

Has the flow decreased over time?

1. The pump end (pump mechanism attached to motor) may be worn from abrasive material (sand, silt, clay) in the water. Is sediment accumulating in the water tank or pipes?
2. Inspect the pump’s intake screen or foot valve. It may be clogged with debris, especially in a surface water source.
3. If there is a check valve at the pump’s outlet, inspect it to see if sand or silt is blocking the flow.

The pump may be running in reverse

The pump may produce partial pressure and a slight flow if it is run in reverse. Motor reversal only happens if the pump is wired to the controller improperly. See Section 4.8 “Wiring Order for Correct Rotation”.

9 WARRANTY

SunCentric P pumps and their associated controllers and AC-DC converters are warranted by the manufacturer to be free from defects in materials and workmanship for two years from the date of purchase.

Failure to provide correct installation, operation, or care for the product, in accordance with the instruction manual, will void the warranty.

Warranty does not cover damage from running the pump dry, water temperature greater than 170°F, abrasive solids, mishandling, unauthorized modification, or other abuse, weather exposure, overheating due to sun exposure, or lightning, flood or other acts of nature.

Shaft seals are considered to be normally wearing parts and are not covered under warranty.

Product liability, except where mandated by law, is limited to repair or replacement, at the discretion of the manufacturer. Manufacturer is not responsible for incidental or consequential damages or the labor or other charges necessitated by the removal, transportation, or reinstallation of any defective product.

No specific claim of merchantability shall be assumed or implied beyond what is printed on the manufacturer's printed literature. No liability shall exist from circumstances arising from the inability to use the product, or its inappropriateness for any specific purpose. It is the user's responsibility to determine the suitability of the product for any particular use.

In all cases, it shall be the responsibility of the customer to insure a safe installation in compliance with local, state and national electrical codes and safety regulations.