

PCA 10-30A SDS SUBMERISIBLE PUMP CONTROLLER



USER'S MANUAL



OPERATION AND INSTALLATION MANUAL FOR THE PCA10-30A SOLAR ELECTRIC PUMP CONTROLLER

MANUFACTURED BY:

GOLDEN GENESIS CO
SOLARJACK
7812 E. Acoma Dr.
SCOTTSDALE, ARIZONA 85260
UNITED STATES OF AMERICA

PHONE # (800) 223-9580
FAX # (480) 483-6431

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For controllers with serial numbers 18057 and above

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1.0 Introduction

Thank you for selecting the PCA10-30 pump controller. The PCA series of pump controllers are a high quality, solid state DC power converters designed as the interface between a Solarjack SDS series pump and a DC power source. The purpose of the controller is to maximize the total daily water output while providing protection for the pump and the DC power source as well as providing interface with other related pumping system equipment. Although the PCA series pump controllers are easy to use, 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 PCA or product damage and/or personnel injury may result.
- Do not exceed the power rating of the controller.
- Do not splash water on the controller when the cover is open.
- When working with batteries, be careful not to short the battery terminals, as thousands of amperes can flow. Remove all jewelry, use insulated tools and secure all conductors.
- Batteries can produce explosive hydrogen gas. Be sure battery housing is well ventilated.

2.0 Product Overview

The PCA series of controllers are designed to operate with a variety of DC power sources. Typically these include solar electric modules, wind generators and batteries, or any combination of the three. When properly installed and configured, the unique features incorporated into this line of controllers will automatically control and protect your pump system permitting several years of dependable, trouble free service.

When used in a solar electric panel direct system or a wind generator direct system, the PCA series of controllers will provide pump protection from over-voltage and over-current conditions as well as current boosting in low sunlight conditions or low wind conditions respectively.

In a battery powered system, the PCA series controllers are not to be used as a solar electric charge regulator between the solar electric panel and the battery bank. However, the PCA controllers feature a Low Voltage Cut-off function when used on battery-sourced systems. This feature will prevent excessive battery discharge conditions thereby helping to extend the battery bank life. In addition, the PCA controllers will provide a degree of protection for your charge regulator by attenuating inductive voltage spikes generated when pump motors switch on or off.

2.1 Features

1. Current boosting for matching the load requirements of the pump motor.
2. Voltage regulation of the solar electric array at its maximum power point.
3. Low Voltage Cut-off function for battery-sourced installations.
4. Over-current protection via integrated automatic resetting electronic circuit breaker.
5. Reverse polarity protection (10 amperes maximum).
6. Voltage and current limiting to pump motor.
7. Transient protection and surge suppression.
8. Adjustable pump motor voltage setting for precision system tuning.
9. Adjustable input voltage (solar and wind) for system optimization.
10. System ON/OFF switch.
11. LED indicators - Red = power in, Green = power out, Yellow = over current shutdown.
12. Weather resistant cast aluminum enclosure with hinged door and strain relief connectors.
13. Rising clamp screw terminal blocks - no fork terminals required.
14. User selectable pre-adjusted input voltage configuration and power source selection.
15. Remote switch interface - float switch or remote shutdown - N.O. or N.C. user selectable.
16. Water level electrode interface - user selectable high or low water level cut-off.
17. 2 year limited warranty

2.2 Application

The only application the PCA series of standard controllers are designed to operate on is the interface between the Solarjack SDS series of pumps and the DC power source as well as peripheral pump system signal devices. The PCA series controllers are capable of operating with a variety of DC inputs, including solar electric modules, wind generators and batteries or any combination of the three. Of these, solar electric modules are the most common.

No other applications or DC power sources are recommended or warranted unless written approval is provided by Solarjack management.

3.0 Installation and Operation

The following sections are outlined in a step by step format to guide you through the installation, configuration and system power-up of the PCA series controllers. Read all product manuals and review all system components to gain physical and electrical familiarity before undertaking the installation effort. Check all equipment for any product damage. Refer to applicable figure(s) as a guide during the installation.

The PCA series controllers are limited to a maximum power output of 300 watts, which is 30 volts at 10 amps. Providing more power to the input of the controller will not increase pump flow rate.

WARNING

Reverse polarity on a battery sourced system or a panel system capable of producing over 10 amps will result in non-warranted product damage.

NEC compliance and local electrical inspectors

3.1 Location

As the majority of system installations vary greatly, only general comments can be made as to location. Prior to installing the system, it is suggested to make a system layout plan. During the system layout, take into consideration any potential shading of the solar electric modules, wire runs, wire size, conduit runs, trenching, controller accessibility, tank location, pump head and etc.. There is no substitute for a good plan!

The PCA series controllers can either be mounted indoors or outdoors. Locate all system equipment as close as possible to each other. Generally the controller is mounted to the side of a pole which has solar electric modules or wind generator mounted atop of it. The pole is located a few feet from the well head. This general physical layout is conducive to clean installation, not only aesthetically, but also electrically.

3.2 Wiring

Prior to connecting any wires to the controller be sure you have a system wiring diagram to use as a reference. Generic system wiring diagrams are included in this manual for your convenience. Guessing at polarity and connection points is not worth the risk of potential product damage and/or personal injury. Furthermore, ensure the wire sizes are of adequate diameter (gauge) to minimize voltage drop.

All other system equipment should be installed before proceeding with wiring the controller. Pre-configure the controller switches prior to wiring. Refer to "Adjustment Procedures" for details. double check polarity and wire termination tightness before powering up the system.

1. Turn "ON/OFF" switch to the OFF position.
2. Connect ground rod conductor to controller chassis ground block.
3. Connect frame ground conductor to controller chassis ground block.
4. Connect pump ground conductor to controller chassis ground block.
5. Connect pump motor negative (-) conductor to controller terminal labeled "L-".
6. Connect pump motor positive (+) conductor to controller terminal labeled "L+".
7. Connect DC source supply negative (-) conductor to controller terminal labeled "PV -".
8. Connect DC source supply positive (+) conductor to controller terminal labeled "PV +".
9. Refer to the next section for "Water Sensors and Remote Control" connections and "Adjustment Procedures" for configuration (if applicable) and then return to this point.
10. At this point, all system components are installed and wired, double check conductor polarities, wire termination tightness and controller configuration.
11. Turn "ON/OFF" switch to the ON position. The system should be operational. If the system is not working refer to the "Troubleshooting" section.

3.3 Water Sensors and Remote Control

The PCA series controllers feature remote peripheral interface functions with easy programming. These include two independent ports. First is a remote switch interface which supports float switches (storage tank level) or a remote system "ON/OFF" toggle switch. The second peripheral is a water level electrode interface that requires three E-1s brass electrodes. Refer to sample system wiring diagrams as a guide during hook-up.

Remote Switch

The Remote Switch interface can serve as an automatic system shutdown when used with a water storage tank mounted float switch. It can also serve as a manual system shutdown with a remote system ON/OFF toggle switch. The majority of installations will use this port for float switch interface. Both applications are configured and operate the same way. Please refer to the following operational scenarios for configuration options.

With switch number 5 in the OFF position, the controller is configured to accommodate a Normally Open (N.O.) float switch or remote toggle switch. In this configuration the controller will operate as follows:

PUMP ON

float switch open = water tank low = pump ON

PUMP OFF

float switch closed = water tank high = pump OFF

With switch number 5 in the ON position, the controller is configured to accommodate a Normally Closed (N.C.) float switch or remote toggle switch. In this configuration the controller will operate as follows:

PUMP ON

float switch closed = water tank low = pump ON

PUMP OFF

float switch open = water tank high = pump OFF

Water Level Electrodes

The water level electrodes interface serve as an automatic system shutdown when properly installed and configured. The PCA series of controllers are capable of two configurations; high or low level shutdown. The high level shutdown is typically used to interface with a water storage tank to achieve the same system control results as a float switch. The low-level shutdown is intended to monitor the well water level and shutdown the system if the water level in the well drops to a critical point.

To use this interface, three E-1s brass electrodes must be used. One is for the ground (reference), the second is for the low-level point and the third is for the high level point. Please refer to the system wiring diagrams and the following operation scenarios for configuration options.

With switch number 6 in the OFF position, the controller is configured to interface with electrode water level sensors for a water level HIGH pump shutdown and a LOW water level pump activation.

PUMP ON

low and high level electrode exposed = water tank low = pump ON

PUMP OFF

low and high level electrode submerged = water tank high = pump OFF

With switch number 6 in the ON position, the controller is configured to interface with electrode water level sensors for a water level LOW pump shutdown and a HIGH water level pump activation.

PUMP ON

low and high level electrode submerged = well water level ok = pump ON

PUMP OFF

low and high level electrode exposed = well water level critical = pump OFF

3.4 Adjustment Procedures

The PCA series controllers have several adjustment features. Some are system configuration adjustments are user selectable by a six positions DIP switch located on the face of the controller. These include pre-adjusted DC source selection, remote switch selection and water level cut-off. The remaining adjustments are for input and output voltage fine-tuning that are independently adjustable by high precision multiple turn (brass screw) trimmers.

The pre-adjusted DC source selection allows the user to choose the nominal input voltage and basic source configuration. These consist of four pre-adjusted voltage settings consisting of solar panel or battery in nominal 12 volt or 24-volt sources. The first four switches on the DIP switch are used for this selection. For proper controller operation, only one of these first four switches should be in the ON position. Please refer to the chart below for the switch position identification and setting options.

| Switch No. | Description | Setpoint | Note |
|------------|---------------|----------|------|
| 1 | 12 V. Battery | 11.80 V. | 1 |
| 2 | 12 V. Panel | 13.10 V. | 2 |
| 3 | 24 V. Battery | 23.60 V. | 1 |
| 4 | 24 V. Panel | 26.00 V. | 2 |
| 5 | Remote Switch | HI/LO | 3 |
| 6 | Remote Switch | HI/LO | 4 |

NOTES:

1. Set-point is Low Voltage Cut-off. The controller will turn off the pump if the battery voltage drops below set-point preventing excessive battery discharge conditions thereby helping to extend battery life.

2. Set-point is solar module input constant voltage hold approximately at solar modules maximum power point. These voltages will work with most standard solar modules available in the marketplace today. The voltage can be easily adjusted to optimize system performance, see procedure above. Use the "Panel" selection options when a non regulated wind generator is utilized as the power source.

3. With switch number 5 in the OFF position, the controller is configured to accommodate a Normally Open (N.O.) float switch; float switch open = water tank low = pump water or float switch closed = water tank high = shut off pump. With switch number 5 in the ON position, the controller

is configured to accommodate a Normally Closed (N.C.) float switch; float switch closed = water tank low = pump water or float switch open = water tank high = shut off pump.

4. With switch number 6 in the OFF position, the controller is configured to interface with electrode water level sensors for a water level HIGH pump shutdown and a LOW water level pump activation. With switch number 6 in the ON position, the controller is configured to interface with electrode water level sensors for a water level LOW pump shutdown and a HIGH water level pump activation.

The input and output voltage set-points are calibrated at the factory and typically will not require end user adjustment for proper system operation. However, if system "fine tuning" is desired for optimal performance, please refer to the adjustment procedures below.

INPUT VOLTAGE ADJUSTMENT

The purpose of this procedure is to adjust the voltage of the solar electric panel to its peak power point and thus obtain maximum water delivery from the system. In a solar electric application, this procedure should be performed with the solar electric panel at its normal operating temperature at mid-day to match as close as possible the worst case maximum voltage operating point. On a battery source system, it is not recommended to adjust the input voltage set-point.

1. With the system installed, controller properly configured and pumping water, turn the solar electric panel away from the sun until the pump flow rate is reduced by approximately 50%. If this is not possible then shade the panels slightly until the same results are obtained.
2. Connect an accurate DC volt meter to the pump side of the controller (L+ and L-).
3. Slowly turn the "Panel Input Voltage" trimmer located on the face of the controller until the highest possible output voltage is obtained.
4. Return the solar electric panel(s) to their normal or unshaded position. The pump will then operate at its maximum output.

NOTE: Counter Clockwise lowers input voltage and Clockwise increases input voltage.

OUTPUT VOLTAGE ADJUSTMENT

The purpose of this procedure is to adjust the output voltage of the controller to reduce the water flow of the pump. Typically this not recommended as the PCA controllers are factory calibrated for optimum voltage output for the SDS series of pumps.

A common case scenario as to when the controller might be readjusted for a lower voltage output would be an installation where the static water level drops rapidly when the pump system is performing at its peak, thus turning off the pump system. The low water level electrode located in the well would detect this low water level. The well could take a long time recharge to a water level high enough (as detected by the high water level electrode located in the well) to reactive the pumping process. This scenario could cause the pump system to cycle on and off unnecessarily through out the day and possibly reduce system water production as compared with the following solution. The solution in this case would be to reduce the controller output voltage to the pump, thereby reducing water flow to a level where the well can maintain the water level above the low

water level electrode. This allows a longer pumping duration at a lower rate and probably higher net water production per day.

1. With the system installed, controller properly configured and pumping water, connect an accurate DC volt meter to the pump side of the controller (L+ and L-).
2. Slowly turn the "Output Voltage" trimmer located on the face of the controller until desired output voltage and water production is achieved. This process will probably take a few attempts to "balance" the system for optimum water production.

NOTE: Counter Clockwise lowers input voltage and Clockwise increases input voltage.

4.0 Troubleshooting

PUMP DOES NOT RUN

1. Check wiring diagram for proper connections. Confirm all electrical terminations are tight and secure.
2. Check for proper voltage selector switch settings for your DC source input. If the incoming voltage is less than the set-point voltage, the controller will not turn on.
3. On battery sources systems, make sure the batteries are at a full state of charge and that the controller voltage selector switch is in the proper position for your nominal voltage input configuration.
4. Check for proper controller input and output with a volt meter. A quick look at the LED indicator lights will verify power coming from the DC source supply going to the controller (red), power going from the controller to the pump (green) and overcurrent shut down (yellow). If the red LED is on and the green and yellow LED's are not, make sure the system on/off switch is on, disconnect the remote switch and electrode wires, if used, and turn switch #5 and #6 off. If the green LED is still not on, disconnect the pump wires, L- and L+. If the green light does not turn on then check voltage on L- and L+ with a volt meter to confirm no output voltage. THEN WHAT?
5. For additional pump test, connect a jumper wire across terminals PV- and L-. This will bypass the controller and allow the pump to run directly from the DC source. This step will confirm pump operation. If the DC source is a solar array, the test must be conducted when full sunlight is available for a valid test.

RED AND GREEN LEDS ARE ON, YELLOW LED IS OFF AND THE PUMP DOES NOT RUN

To verify power coming out of the controller, connect a DC voltmeter across L+ and L-. If 12 Volts or more is coming out then:

1. Check the splice above the pump for proper connections.
 2. Check for broken wire leading to the pump.
- Check for open motor winding. With an ohmmeter set on the R x 1 scale, check between the two pump lead wires. The meter reading should be between .5 to 50 ohms. If the resistance is higher than this, disconnect the pump at the splice above the pump and check again.

NO VOLTAGE AT THE L+ AND L- TERMINALS

Note: To bypass all remote switching circuits, disconnect all wires from the sensor interface terminal block in the controller housing (the small terminal block) and switch program switches #5 and #6 to the OFF position.

1. Make sure the system ON/OFF switch is ON.
2. Check to see if the water level is above the top electrode when low water cut-off circuit is being used.
3. Check to see if the float switch, if used, is functioning properly.
4. Check the controller for proper programming and adjustment. If the voltage setting on the controller is higher than the incoming voltage, the controller will not turn on, (See controller adjustment section)

Make sure the Yellow LED (over-current shut down) is not on. If it is, switch OFF the system ON/OFF switch, wait a minute and then switch it ON.

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.
2. Check for skinned wires or faulty underwater splice.
3. Check for locked motor armature. With the pump out of the well, bypass the controller and connect power directly to the motor leads. If the pump still does not run and the current is over 1.5 amps, the pump is in a locked rotor condition and just be repaired.

5.0 Technical Specifications

Solarjack's Limited Warranty
PCA 10-30A Controllers
LIMITED WARRANTY - TWENTY-FOUR MONTHS

SOLARJACK warrants the product to be free from defects in materials and workmanship under normal applications and service conditions for twenty-four (24) months from date of sale to the original purchaser, but not to exceed (30) months from the date of manufacture. SOLARJACK will, at its option, either repair or replace the product if it fails due to a defect in material or workmanship during the period of this warranty.

This warranty is extended only to the original purchaser. A completed warranty card with the pump serial number and the controller serial number must be on file at the factory to validate the warranty. **No warranty performances will be rendered without a valid warranty card on file at the SOLARJACK factory.**

This warranty only covers failures due to defects in materials or workmanship that occur during normal use. It does not cover damage which occurs in shipment, or failures which are caused by products not supplied by SOLARJACK or failures which result from accident, misuse, abuse, neglect, mishandling, misapplication, alteration, modification or repairs by anyone other than SOLARJACK, or damage that is attributable to acts of God. Any disassembly whatsoever of the product voids all warranty.

Warranty limitations

There are no express warranties except as listed above. SOLARJACK shall have no responsibility for damage to property, persons, animals, or other loss or injury resulting from the use of this product.

UNDER NO CIRCUMSTANCES WILL SOLARJACK BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE, UNLESS OTHERWISE EXPRESSLY STATED HEREIN. ALL PRODUCTS ARE SOLD AS IS WITH ALL FAULTS.

Any warranties are limited to the warranty period described above. SOLARJACK'S maximum liability under any warranty, expressed, or implied, or statutory, is limited to the purchase price of the product. The purchaser's exclusive remedy shall be only as stated herein. This warranty is in lieu of all other warranties expressed or implied. This warranty gives you specific rights; your state law may provide for additional rights or may affect the time and other limitations set forth herein.

This Warranty Excludes: Labor, transportation and related costs incurred by the consumer to make the allegedly defective equipment available to the factory for inspection, re-installation, costs caused by interruption of service, or lost profits.

If a problem with the product develops during the warranty period, you may contact your dealer. If the problem is not handled to your satisfaction, contact:

Kyocera Solar, Inc. / SOLARJACK, 7812 E. Acoma Drive, Scottsdale, AZ 85260
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