DOMETIC GP-PWM-30-SB 30 AMP PWM Solar Controller User Manual

**30AMP PWM SOLAR
CONTROLLER**
User Manual
GP-PWM-30-SB (SINGLE BANK – LITHIUM COMPATIBLE)

Contents

INSTALLATION OVERVIEW

1.1 INTRODUCTION

A Solar Controller (or Charge Controller / Regulator) is an essential component of your photovoltaic solar system. The Controller maintains the life of the battery by protecting it from overcharging. When your battery has reached a 100% state of charge, the Controller prevents overcharging by limiting the current flowing into the batteries from your solar array.

The GP-PWM-30-SB uses Pulse Width Modulation (PWM) technology and a unique four-stage charging system that includes an optional equalize setting to charge and protect your battery bank. The GP-PWM-30-SB features an LCD digital display that shows the charge current of the solar array, battery voltage, and battery state of charge.

1.2 SYSTEM VOLTAGE AND CURRENT

The GP-PWM-10-FM is intended for use at 12 VDC nominal system voltage and is rated for a maximum continuous DC input current of 12.5A and input voltage of 35VDC.

Per the National Electric Code (NEC) article 690.7 and 690.8, PV module nameplate ratings at Standard Test Conditions (STC) must be multiplied by required values (typically 1.25 for both voltage and current) to obtain the true voltage and continuous current available from the module.

Applying the NEC factors, the maximum allowable nameplate PV Panel rated Isc is 10A (10A x 1.25 = 12.5A), and the maximum voltage, Voc is 28VDC (28VDC x 1.25 = 35VDC).

The voltage and current ratings of all equipment connected to PV panels must be capable of accepting the voltage and current levels available from PV panels installed in the field.

1.3 BATTERY TYPE

The GP-PWM-30-SB is suitable for use with lead-acid batteries (vented, GEL, or AGM) as well as some lithium iron phosphate (LiFePO4) batteries that are supplied with a Battery Management System (BMS).

1.4 LOW VOLTAGE DISCONNECT FUNCTION (USB PORT)

To protect the battery against over-discharge this function automatically switches off the USB output port when battery voltage is lower than 11.0 VDC. As soon as the battery reaches a voltage of 12.8 VDC the USB output port is switched on again.

1.5 REGULATORY INFORMATION

CE ROHS

1.6 SPECIFICATIONS

TABEL

WARNINGS

⚡ Disconnect all power sources	Electricity can be very dangerous. Installation should be performed only by a licensed electrician or qualified personnel.
☣ Battery and wiring safety	Observe all safety precautions of the battery manufacturer when handling or working around batteries. When charging, batteries produce hydrogen gas, which is highly explosive.
💥 Wiring connections	Ensure all connections are tight and secure. WOW, connections may generate sparks and heat. Be sure to check connections one week after installation to ensure they are still tight.
👓 Work safely	Wear protective eyewear and appropriate clothing during installation. Use extreme caution when working with electricity and when handling and working around batteries. Use properly insulated tools only.
⚠ Observe correct polarity at all times	Reverse polarity of the battery terminals will cause the controller to give a warning tone. The reverse connection of the array will not cause an alarm but the controller will not function. Failure to correct this fault could damage the controller.
Do not exceed the GP-PWM. 3058 Amp current and max voltage ratings 🔥 Do not exceed the GP-PWM. 3056 max voltage ratings	The maximum current of the solar system is the sum of parallel. connected PV module-rated short circuit Currents lig) multiplied by 1.25. The result. ing system Current is not to exceed 37.5A. If your solar system exceeds this value, contact your dealer for a suitable controller alternative. The maximum voltage of the array is the sum of the Pv module-rated open-circuit voltage of the series-connected modules multiplied by 1.25 for by a value from NEC 690.7 provided in Table 690.7 A). The resulting voltage is not to exceed 3W. If your solar system exceeds this value, contact your dealer for a suitable controller alternative.

TOOL AND MATERIALS NEEDED

- Flathead Screwdriver (for wire terminals)
- Philips Screwdriver (for mounting screws)
- Wire Cutter /Stripper

Note: If the GP-PWM-30-SB Controller was purchased with a Go Power! Solar Power Kit, then UV resistant wire is included. For instructions regarding the Go Power! Solar Power Kit installation, please refer to the Installation Guide provided with the Kit.

CHOOSING A LOCATION

The GP-PWM-30-SB is designed to be mounted flush against a wall, out of the way but easily visible.
The GP-PWM-30-SB should be:

- Mounted as close to the battery as possible
- Mounted on a vertical surface to optimize cooling of the unit
- Indoors, protected from the weather

In an RV, the most common controller location is above the refrigerator. The wire from the solar array most commonly enters the RV through the fridge vent on the roof or by using the Go Power! Cable Entry Plate (sold separately) that allows installers to run wires through any part of the roof. PV connections should connect directly to the controller. Positive and negative battery connections must connect directly from the controller to the batteries. Use of a positive or negative distribution bus is allowed between the controller and battery as long as it is properly sized, electrically safe, and adequate wire size is maintained.

INSTALLATION INSTRUCTIONS

1. **Prepare for mounting.** Use the template provided on page 17 to mark the four mounting holes and the cutting line for flush mounting your controller.
2. **Complete the installation of the solar modules.** If this GP-PWM-30-SB was purchased as part of a Go Power! Solar Power Kit, follow the Installation Guide provided. Otherwise, follow the manufacturer's instructions for solar module mounting and wiring.
3. **Select wire type and gauge.** If this GP-PWM-30-SB was purchased as part of a Go Power! Solar Power Kit, appropriate wire type, gauge, and length is provided. Please continue to Section 6, "Operating Instructions." If the GP-PWM-30-SB was purchased separately, follow the instructions included here.

   Wire type is recommended to be a stranded copper UV-resistant wire. Wire fatigue and the likelihood of a loose connection are greatly reduced in stranded wire compared to solid wire. Wire gauge should be able to sustain rated current and minimize voltage drop.

   Wire Strip Length

   Strip wires to a length of approximately 3/8 in (9 mm, as per strip gauge).

   Suggested Minimum Wire Gauge

   (Cable length 25 ft. max. from the solar array to battery bank)

   80 Watt Solar Module #10 Wire Gauge

   100 Watt Solar Module #10 Wire Gauge

   160 Watt Solar Module #10 Wire Gauge

   170 Watt Solar Module #10 Wire Gauge

   190 Watt Solar Module #10 Wire Gauge

   IMPORTANT: Identify the polarity (positive and negative) on the cable used for the battery and solar module. Use colored wires or mark the wire ends with tags. Although the GP-PWM-30-SB is protected, a reverse polarity contact may damage the unit.

   Wiring the GP-PWM-30-SB. Wire the GP-PWM-30-SB according to the wiring schematic in Section 6. Run wires from the solar array and the batteries to the location of the GP-PWM-30-SB. Keep the solar array covered with an opaque material until all wiring is completed.

   WIRING DIAGRAMS

   IMPORTANT:

   All wiring must be in accordance with National Electrical Code, ANSI/NFPA 70. Always use appropriate circuit

protection on any conductor attached to a battery.

4. Connect the battery wiring to the controller first and then connect the battery wiring to the battery.

5. Torque all terminal screws per the following:

Stranded Copper 90°C Wire	
Wire Size AWG	Rated Torque (in-lbs)
14	20
12	20
10	20

With battery power attached, the controller should power up and display information. Connect the solar wiring to the controller and remove the opaque material from the solar array. The negative solar array and battery wiring must be connected directly to the controller for proper operation. Do not connect

6. **Mounting the GP-PWM-30-SB**. Mount the GP-PWM-30-SB to the wall using the included four mounting screws.

   IMPORTANT: You must set the battery type on the GP-PWM-30-SB before you begin to use the controller (follow steps in Section 7).

   The default battery setting is for AGM/LiFePO4 batteries.

   Congratulations, your GP-PWM-30-SB should now be operational. If the battery power is low and the solar array is producing power, your battery should begin to charge.

7. **Re-torque:** After 30 days of operation, re-torque all terminal screws to ensure the wires are properly secured to the controller.

   ⚠ **WARNING:** This unit is not provided with a GFDI device. This charge controller must be used with an external GFDI device as required by Article 690 of the National Electric Code for the installation location.

WIRING DIAGRAMS

IMPORTANT: This diagram is valid only for version 1.5 and newer. Version 1.4 and older have different terminal locations.

The GP-PWM-30-SB Maximum 37.5A rating is based on a 30 amp total maximum short circuit current rating (Isc) from the parallel solar modules nameplate ratings. The National Electric Code specifies the PV equipment/system rating to be 125% of the maximum Isc from the PV module nameplate ratings (1.25 times 30 = 37.5A). Use the wiring diagram (below) to connect your battery to the battery terminals on the solar controller. First, connect the battery to the controller, and then connect the solar panel to the controller.

Note: The fuse or breaker used should be no larger than 50 amps.
Note: The controller will not work unless there is a battery connected to the battery terminals with at least 9V.

⚠**WARNING:** When the photovoltaic (solar) array is exposed to light, it supplies a dc voltage to this equipment

OPERATING INSTRUCTIONS
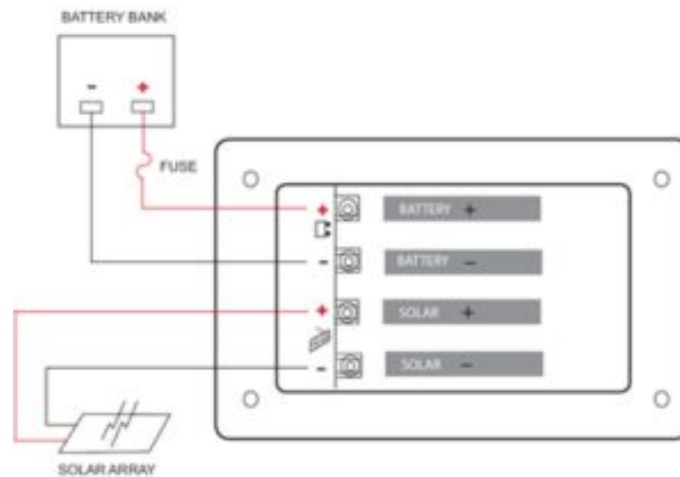
7.1 SYSTEM VOLTAGE AND CURRENT
When the GP-PWM-30-SB is connected to the battery, the controller will go into Power Up mode.
Icons Displayed: All segments of the numerical display; backlight blinks. Depending on the battery voltage when the GP-PWM-30-SB Power Up occurs, the controller may do a Boost Charge or quickly go into Float Charge. The Charging Profile selected will commence the following day after a Power-Up (refer to the Charging Profile Chart on page 11 for more details).

7.2 SETTING THE BATTERY CHARGING PROFILE
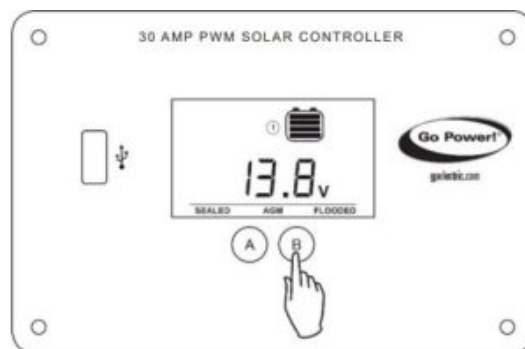
To select the battery charging profile, press and hold the **B Button**. This will cause the current battery type to flash.
Then, press the B Button to toggle through the profile options: Sealed/ Gel, AGM/LiFePO4, or Flooded.
To confirm the battery profile, press and hold the **A Button** for 3 seconds.

Non-volatile memory: Any settings made on the GP-PWM-10-FM will be saved even when the power has been disconnected from the controller.
Refer to the Battery Charge Profile Chart below for details on each profile.

7.3 BATTERY CHARGING PROFILE CHART

BATTERY TYPE	SEALED/GEL AGM FLOODED			LFP
Float Charge @ 25°C:	13.7V (+/- 0.1V)			N/A
Bulk/Absorption Charge @ 25°C: *Set to 30 minutes every morning. Applied for 2 hours if the* battery *voltage drops below 12.3 volts.*	14.1V (+/- 0.1V)	14.4V (+/- 0.1V)	14.4V (+/- 0.1V)	N/A
Equalization Charge @ 25°C: *Applied for hours every 28 days and if the battery voltage drops below 12.1 volts.*	N/A	N/A	14.9V (+/-0.1 V)	N/A
Absorption Charge voltage for LiFePO4: *Set to 30 minutes every morning*	N/A			14.4VDC
Float Charge voltage for LiFePO4:	N/A			14. VDC
Temperature Compensation:	-24mV/K			None

If a charging cycle is unable to complete in a single day, it will continue the following day. The terms SEALED/GEL, AGM, FLOODED and LFP (LITHIUM) are generic battery designations. Choose the charging profile that works best with your battery manufacturer's recommendations.

Note: If PV power is insufficient or too many loads are drawing power from the battery, the controller will not be able to charge the battery o the target charging voltage.
Auto Equalize: The GP-PWM-30-SB has an automatic equalize feature that will charge and recondition your batteries at least once a month at a higher voltage to ensure that any excess sulfation is removed.
Note: This mode should not be entered unless you are using a flooded battery.
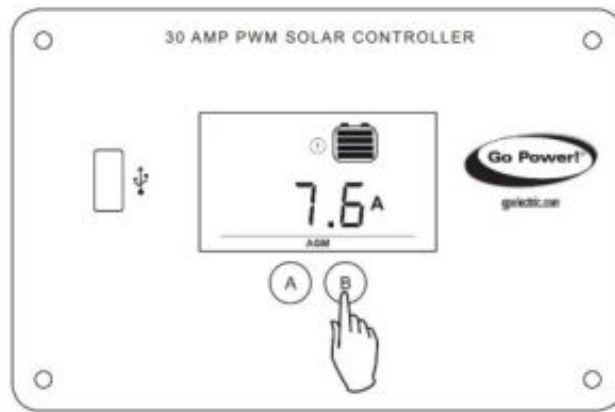
7.4 VIEWING THE CONTROLLER DISPLAY INFORMATION
To toggle between Battery Voltage, PV Charging Current, Battery State of Charge (SOC), and ampere-hours charged since the last reset, press the B Button.
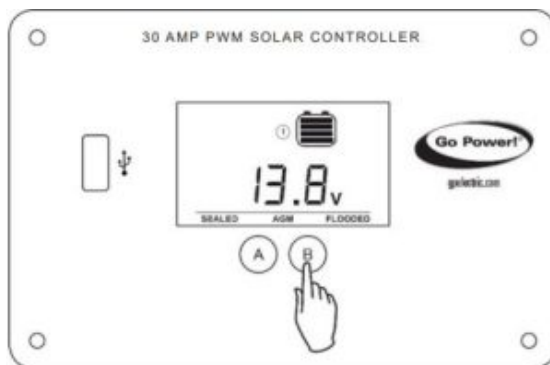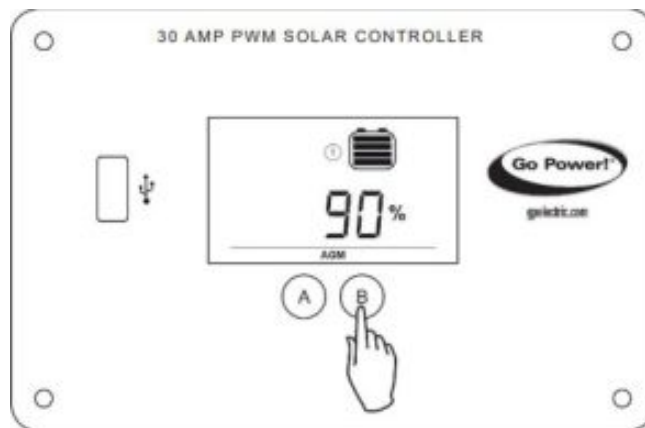

Push the **B Button** to show the battery voltage.
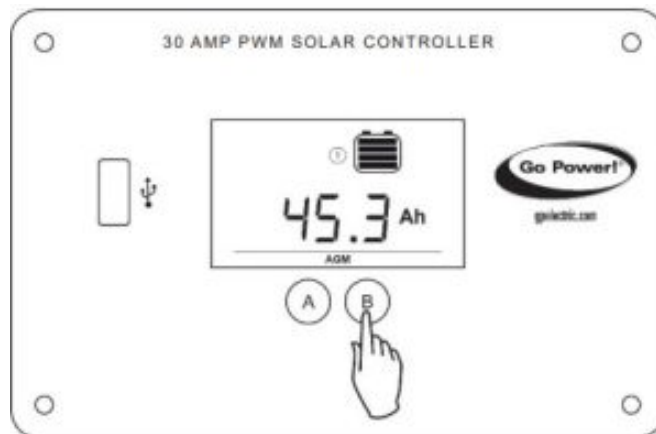**Icons Displayed: Battery** SOC, Volt Symbol (V)

Push the **B Button** to show the PV charging current.
Icons Displayed: Ampere Symbol (A), Battery SOC

Push the **B Button** to show the battery state of charge (shown as a percentage).
Icons Displayed: Battery SOC, Percent Symbol (%)A value of 100% will only be displayed after a Boost or Equalize charge completes.

Push the **B Button** to show the number of amp-hours charged since the last reset.
Icons Displayed: Amp-hours charged, Amp hour symbol (Ah) or kiloamp hour symbol (Kah)
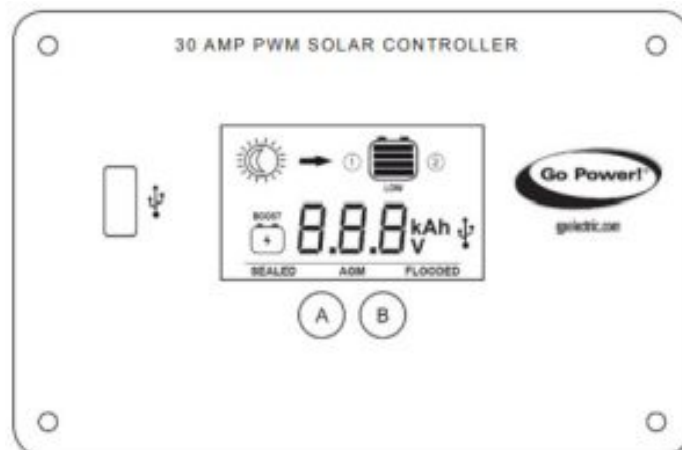
7.5 RESETTING THE AMPERE HOURS CHARGED
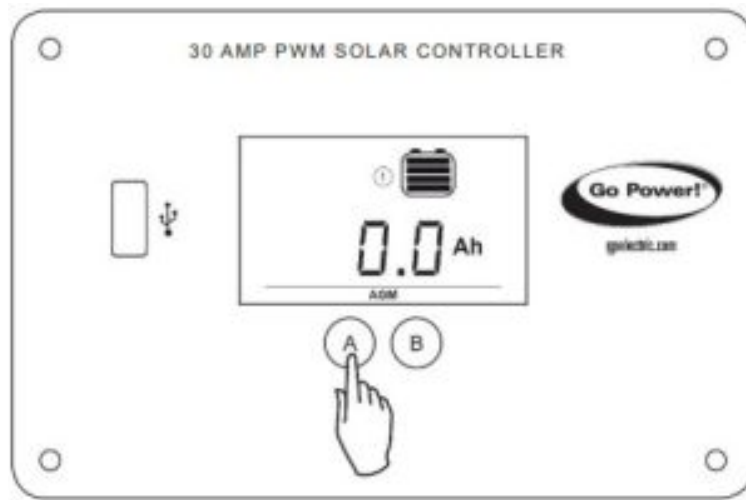
To reset the count of ampere-hours charged, toggle to the ampere-hours charged. Press and hold the **A Button** for 6 seconds to reset the counter to zero.
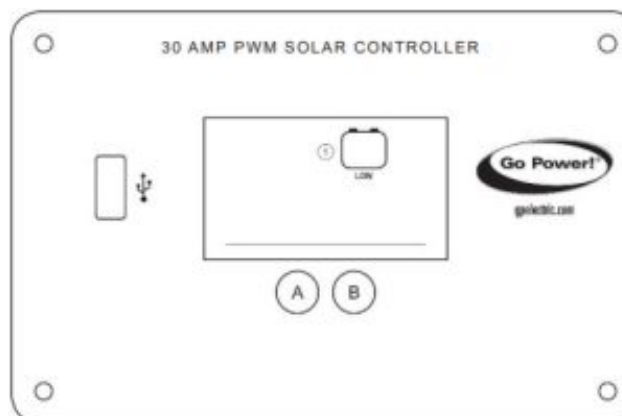
7.6 ERRORS

OVERVOLTAGE

If the GP-PWM-30-SB experiences a battery overvoltage (15.5V), the controller will stop operating, and the display will begin to flash with all icons. The controller will resume operating when the error is cleared.
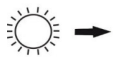**Icons Displayed:** All symbols

LOW VOLTAGE

If the battery voltage reaches 11 volts, the battery SOC symbol will show the text "LOW" beneath it. The controller will continue operating in this condition and will only stop operating if the voltage drops below 9 volts.
Icons Displayed: Battery SOC Symbol, LOW

SYMBOLS	INDICATOR FOR
☀ →	Day Time: PV Charge Current
☾ →	Night Time
▢	Battery Voltage
▤▢▢	Battery State of Charge
	Sealed/Gel
SEALED	AGM/LFP
AGE	Flooded
FLOODED	OTHER SYMBOLS
⬦ (USB symbol)	USB charger ON (when charger is OFF, no symbol will show)
LOW	Battery voltage is lower than 11.0V
The whole display will start to blink	Battery voltage > 15.5V

BATTERY STATE OF CHARGE

SYMBOLS	BATTERY VOLTAGE
	Shows only after full Boost or Equalization Cycle
	>= 12.6V
	>= 11.8 -12.6V
	> 11.0 -11.8V
LOW	<= 11.0V
100%	Shows only after full Boost or Equalization Cycle
90% $$SOC = \frac{battery\ voltage - 11.0V}{1.8V} * 90\%$$	>= 12.8V < 12.8V and > 11.0V
0%	<= 11.0V

USB CHARGING

The GP-PWM-30-SB offers a standard USB connector for delivering 5.0 VDC to small mobile appliances such as cell phones, tablets, or small music players. This charging port is capable of supplying up to 1500 mA of current. Remove the rubber cover of the USB terminal to access the terminal.
The USB charging port is always active when the USB symbol appears on the display.
The controller disables the USB charger automatically if the battery voltage drops below 11.0 VDC. If there is enough current from the PV panel/array available to charge the Battery to above 12.8 VDC, the USB terminal will be enabled again.

⚠ **WARNING:** Do not connect the charging device anywhere else! USB-Negative contact is connected to battery negative.

FREQUENTLY ASKED QUESTIONS

Before a problem is suspected with the system, read this section. There are numerous events that may appear as problems but are in fact perfectly normal. Please visit **gpelectric.com** for the most up-to-date FAQs.

It seems like my flooded batteries are losing water over time.
Flooded batteries may need to have distilled water added periodically to replace fluid loss during charging. Excessive water loss during a short period of time indicates the possibility of overcharging or aging batteries.

When charging, my flooded batteries are emitting gas.
During charging, hydrogen gas is generated within the battery. The gas bubbles stir the battery acid, allowing it to

receive a fuller state of charge.

Important: Ensure batteries are in a well-ventilated space.

My voltmeter shows a different reading than the GP-PWM-30-SB display.
The meter value on the GP-PWM-30-SB display is an approximate reading intended for indication purposes only. There is an approximate 0.1-volt inherent error present that may be accentuated when compared with readings from another voltmeter.
There may be a slight difference between the battery voltage displayed on the GP-PWM-30-SB display and the battery voltage measured at the battery terminals. When troubleshooting using a voltmeter, check both the battery voltage at the GP-PWM-30-SB controller terminals and battery voltage at the battery terminals. If a difference of more than 0.5 volts is noted, this indicates a large voltage drop possibly caused by loose connections, long wire runs, small wire gauge, faulty wiring, a faulty voltmeter, or all the above. Consult the Suggested Minimum Wire Gauge chart in Section 5 for
wiring suggestions and checking all connections.

What causes a warning signal and when are the warnings triggered?

CONNECTION	WARNING	NOTES	LCD
Battery reverse polarity	"POL" on LCD and constant audible alarm		POL
PV reverse polarity	"POL" on LCD and constant audible alarm	The battery must be connected with correct polarity	POL

Why does the battery SOC% never reach 100%?
A 100% value will only appear after a 2-hour Boost or Equalize charge has been completed. The charge voltage must be maintained for an extended period of time to replenish the energy in the battery bank back to its rated capacity.
If the charge voltage cannot be maintained continuously, then the actual time it takes to complete Boost or Equalize charging may take much longer than 2 hours, even more than 1 day.
If loads are consuming more power than the solar panels can supply, then the battery bank cannot be charged to 100%.

TROUBLESHOOTING PROBLEMS

How to Read this Section
Troubleshooting Problems is split into three sub-sections, grouped by symptoms involving key components. Components considered irrelevant in a diagnosis are denoted 'Not Applicable' (N/A). A multimeter or voltmeter may be required for some procedures listed.

Note: It is imperative all electrical precautions stated in the Warning Section and outlined in the Installation Section are followed. Even if it appears the system is not functioning, it should be treated as a fully functioning system generating live power.

11.1 ERRORS

Display Reading: Blank
Time of Day: Daytime/Nighttime

Possible Causes:
Battery or fuse connection and/or solar array connection
(Daytime only) or battery or fuse connection (Nighttime only).

How to tell:

1. Check the voltage at the controller battery terminals with a voltmeter and compare it with a voltage reading at the battery terminals.
2. If there is no voltage reading at the controller battery terminals, the problem is in the wiring between the battery and the controller. If the battery voltage is lower than 6 volts the controller will not function.
3. For the solar array, repeat steps 1 and 2 substituting all battery terminals with solar array terminals.

Remedy:
Check all connections from the controller to the battery including checking for correct wire polarity. Check that all connections are clean, tight, and secure. Ensure the battery voltage is above 6 volts.
Display Reading: Nighttime
Time of Day: Daytime
Possible Causes:
The panel is covered by something; the PV panel is too dirty to supply a high enough voltage to charge the battery; PV panel is not connected.
Remedy:
Check the panel to ensure it is not obscured. Clean the panel if it is dirty. Check that PV cables are connected to the controller.

11.2 PROBLEMS WITH VOLTAGE

Voltage Reading: Inaccurate
Time of Day: Daytime/Nighttime
Possible Causes:
Excessive voltage drops from batteries to controller due to loose connections, small wire gauge, or both.
How to tell:

1. Check the voltage at the controller battery terminals with a voltmeter and compare it with the voltage reading at the battery terminals.
2. If there is a voltage discrepancy of more than 0.5 V, there is an excessive voltage drop.

Remedy:
Check all connections from the controller to the battery including checking for correct wire polarity. Check that all connections are clean, tight, and secure. Shorten the distance from the controller to the battery or obtain a larger gauge wire. It is also possible to double up the existing gauge wire (i.e. two wire runs) to simulate a larger gauge wire.

11.3 PROBLEMS WITH CURRENT
Current Reading: 0 A
Time of Day: Daytime, clear sunny skies

Possible Cause:
Current is being limited below 1 Amp as per normal operation or poor connection between solar array and controller.

How to tell:

1. The State of Charge (SOC) screen is close to 100% and the Sun and Battery icons are present with an arrow between them.
2. With the solar array in sunlight, check the voltage at the controller solar array terminals with a voltmeter.
3. If there is no reading at the controller solar array terminals, the problem is somewhere in the wiring from the solar array to the controller.

Remedy:
Check all connections from the controller to the array including checking for correct wire polarity. Check that all connections are clean, tight, and secure. Continue with the solutions below for additional help on low current readings.

Current Reading: Less than expected
Time of Day: Daytime, clear sunny skies

Possible Causes:

1. Current is being limited below 1 Amp as per normal operation.
2. Incorrect series/parallel configuration and/or wiring connections and/or wire gauge.
3. Dirty or shaded module or lack of sun.
4. The blown diode in the solar module is when two or more modules are connected in parallel.

How to tell:

1. Battery State of Charge screen is close to 100% and the Sun and Battery icons are present with an arrow in between.
2. Check that the modules and batteries are configured correctly. Check all wiring connections.
3. Modules look dirty, the overhead object is shading modules or it is an overcast day in which a shadow cannot be cast.
   Note: Avoid any shading no matter how small. An object as small as a broomstick held across the solar module may cause the power output to be reduced. Overcast days may also cut the power output of the module
4. Disconnect one or both array wires from the controller. Take a voltage reading between the positive and negative array wire. A single 12-volt module should have an open circuit voltage between 17 and 22 volts. If you have more than one solar module, you will need to conduct this test between the positive and negative terminals of each module junction box with either the positive or the negative wires disconnected from the terminal.

Remedy:

1. Reconnect incorrect configuration. Tighten all connections. Check wire gauge and length of wire run. Refer to Suggested Minimum Wire Gauge in Section 5.
2. Clean modules, clear obstruction or wait for conditions to clear.
3. If the open-circuit voltage of a non-connected 12-volt module is lower than the manufacturer's specifications, the module may be faulty. Check for blown diodes in the solar module junction box, which may be shorting the power output of the module.

11.4 CONTROLLER FLASHING

Possible Cause:

This behavior is usually the controller dealing with a very high C or voltage rate (Above 15.5 volts). Even though the controller can handle up to 30A if the battery capacity is too small for the panel input current. The voltage shoots up too high, too quickly, tripping the high voltage flashing. The solution increases battery capacity.

Can also be caused by an unregulated converter or alternator, in the system that is putting current to the batteries at the same time.

Remedy:

The solution here is to unplug shore power and reset the controller, which can be done in two ways:

1. **Soft Reset** – This is done by holding down all 4 buttons on the front of the controller for 15 seconds. If this does not work or you do not have a 4-button controller, a hard reset is required.

1. **Hard Rese**t – Remove all 4 wires from the back of the controller for 15-20 minutes, then reconnect the wires. Determine if this clears the error state.

If the problem was "fixed," then it was because the user started using loads that divert some of the input currents because the panels became dusty or shaded, or because there was less sunlight.

LIMITED WARRANTY

Go Power! warrants the GP-PWM-10 for a period of five (5) years from the date of shipment from its factory. This warranty is valid against defects in materials and workmanship for the five(5) year warranty period. It is not valid against defects resulting from, but not limited to:

- Misuse and/or abuse, neglect, or accident

- Exceeding the unit's design limits

- Improper installation, including, but not limited to, improper environmental protection and improper hook-up

- Acts of God, including lightning, floods, earthquakes, fire, and high winds

- Damage in handling, including damage encountered during shipment

This warranty shall be considered void if the warranted product is in any way opened or altered. The warranty will be void if any eyelet, rivets, or other fasteners used to seal the unit are removed or altered, or if the unit's serial number is in any way removed, altered, replaced, defaced, or rendered illegible.

12.1 REPAIR AND RETURN INFORMATION

Visit **www.gpelectric.com** to read the "frequently asked questions" section of our website to troubleshoot the problem. If trouble persists:

1. Fill out our online Contact Us form or Live Chat with us

2. Email **techsupport@gpelectric.com**

3. Return defective product to the place of purchase

Documents / Resources

	DOMETIC GP-PWM-30-SB 30 AMP PWM Solar Controller [pdf] User Manual GP-PWM-30-SB, GP-PWM-30-SB 30 AMP PWM Solar Controller, 30 AMP PWM Solar Controller, Solar Controller

Manuals+,