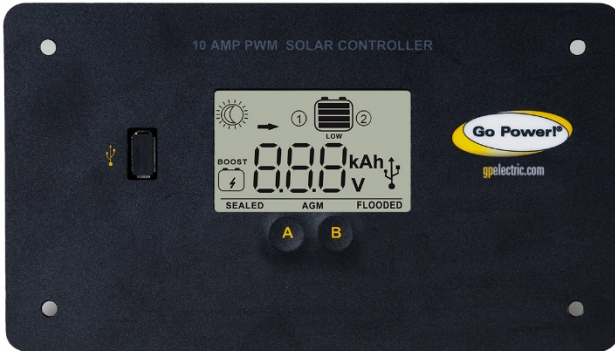


# GP-PWM-10-FM

## User Manual



# Contents

<b>1.0</b>	<b>Installation Overview</b>	<b>3</b>
1.1	<i>Introduction</i>	3
1.2	<i>System Voltage and Current</i>	3
1.3	<i>Battery Type</i>	3
1.4	<i>Low Voltage Disconnect Function (USB Port)</i>	4
1.5	<i>Regulatory Information</i>	4
1.6	<i>Specifications</i>	4
<b>2.0</b>	<b>IMPORTANT SAFETY INSTRUCTIONS</b>	<b>5</b>
<b>3.0</b>	<b>Tools and Materials Needed</b>	<b>8</b>
<b>4.0</b>	<b>Choosing a Location</b>	<b>8</b>
<b>5.0</b>	<b>Installation Instructions</b>	<b>9</b>
<b>6.0</b>	<b>Wiring Diagram</b>	<b>12</b>
<b>7.0</b>	<b>Operating Instructions</b>	<b>13</b>
7.1	<i>Power Up</i>	13
7.2	<i>Setting the Battery Charging Profile</i>	13
7.3	<i>Battery Charging Profile Chart</i>	14
7.4	<i>Viewing the Controller Display Information</i>	14
7.5	<i>Resetting the ampere hours charged</i>	16
7.6	<i>Errors</i>	17
<b>8.0</b>	<b>Display Symbols</b>	<b>18</b>
<b>9.0</b>	<b>USB Charging</b>	<b>19</b>
<b>10.0</b>	<b>Frequently Asked Questions (FAQs)</b>	<b>19</b>
<b>11.0</b>	<b>Troubleshooting Problems</b>	<b>21</b>
11.1	<i>Problems with the Display</i>	21
11.2	<i>Problems with Voltage</i>	22
11.3	<i>Problems with Current</i>	23
<b>12.0</b>	<b>Limited Warranty</b>	<b>26</b>
12.1	<i>Repair and Return Information</i>	26
<b>13.0</b>	<b>Installation Template</b>	<b>26</b>

# 1.0 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-10-FM 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-10-FM 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  $I_{sc}$  is 10A ( $10A \times 1.25 = 12.5A$ ), and the maximum voltage,  $V_{oc}$  is 28VDC ( $28VDC \times 1.25 = 35VDC$ ).

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-10-FM is suitable for use with lead acid and lithium batteries (vented, GEL, LiFePO<sub>4</sub> (LFP) or AGM type).

## 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



## 1.6 Specifications


Description	Value	Dimensions (H x W x D):
Model	GP-PWM-10-FM	149 x 98 x 32 mm 5.87 x 3.86 x 1.26 in Weight: 260 g / 9.2 oz
Nominal System Voltage	12 VDC	Maximum Wire Gauge: #4 AWG Warranty: 5 years
Range of Battery Input Voltage	9 – 15.5 VDC	<ul style="list-style-type: none"> <li>• PWM Charging</li> <li>• 4 Battery Charging Profiles</li> <li>• 4-Stage Charging</li> <li>• Monthly Equalize Option</li> <li>• Displays Charging Current, Battery Voltage, Battery State of Charge, and Amp Hours Charged Since Last Reset</li> <li>• Reverse Polarity Protected</li> <li>• Temperature</li> </ul>
Maximum Solar Continuous DC Charge Current Input	12.5 ADC	
Charging Output DC Voltage Range	9 – 14.9 VDC	
Maximum Solar DC Input Voltage	35 VDC	
Maximum Series Fuse or Circuit Breaker Solar/Battery	15 A	
Operating Consumption (Display backlight on)	15 mA	
Operating Consumption (Display backlight off)	6 mA	
Battery Types Supported	Vented & Sealed Lead Acid (GEL, AGM, Flooded, etc.). Lithium (LiFePO4)	






Bulk/Absorption Voltage (Sealed/GEL, AGM/LFP, Flooded)	14.1/14.4/14.4 VDC (25°C / 77°F), 30min / Day or 2hr if battery voltage < 12.3 VDC	Compensated <ul style="list-style-type: none"> <li>• RoHS Compliant, Environmentally Safe</li> <li>• Accepts up to 160 Watts of Solar at 12 Volts</li> </ul>
Float Voltage	13.7V (25°C / 77°F), 14.0V (LFP)	
Equalization Voltage	14.9V (25°C / 77°F), 2h / 28 Days or if battery voltage < 12.1 VDC	
Temperature Compensation	- 24mV/°C / -13mV/°F	
USB charger	5V, 1500mA	
Low Voltage Disconnect (USB)	11.0 VDC Reconnects once battery reaches 12.8 VDC	
Operating Temperature	- 40 to 85°C / - 40 to 185°F	
Display Operating Temperature	- 10 to 55°C / 14 to 131°F	
Humidity	99% N.C.	
Protection	Battery Reverse Polarity, Solar Array Reverse Polarity, Over Temperature, PV Short Circuit, Over Current	

## 2.0 IMPORTANT SAFETY INSTRUCTIONS

### SAVE THESE INSTRUCTIONS

THIS MANUAL CONTAINS IMPORTANT INSTRUCTIONS FOR MODEL GP-PWM-10-FM THAT SHOULD BE FOLLOWED DURING INSTALLATION AND MAINTENANCE OF THE GP-PWM-10-FM.


	<b>Disconnect all power sources</b>	Electricity can be very dangerous. Installation should be performed only by a licensed electrician or qualified personnel.
---	-------------------------------------	--

	<b>Battery and wiring safety</b>	Observe all safety precautions of the battery manufacturer when handling or working around batteries. When charging, batteries produce hydrogen gas, which is highly explosive.
	<b>Wiring connections</b>	Ensure all connections are tight and secure. Loose connections may generate sparks and heat. Be sure to check connections one week after installation to ensure they are still tight.
	<b>Work safely</b>	Wear protective eyewear and appropriate clothing during installation. Use extreme caution when working with electricity and when handling and working around batteries.
	<b>Observe correct polarity</b>	Reverse polarity of the battery terminals and array will cause the controller to give a warning tone. The controller will not function unless battery terminals are connected to a battery with proper polarity. Failure to correct this fault could damage the controller.
	<b>Do not exceed the GP-PWM-10-FM Amp current and max voltage ratings</b>	The maximum current of the solar system is the sum of parallel-connected PV module-rated short circuit Currents (Isc) multiplied by 1.25. The resulting system current is not to exceed 12.5A. If your solar system exceeds this value, contact your dealer for a suitable controller alternative.
	<b>Do not exceed the GP-PWM-10-FM max voltage ratings</b>	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 (or by a value from NEC 690.7 provided in Table 690.7 A). The resulting voltage is not to exceed 35V. If your solar system exceeds this value, contact your dealer for a suitable controller alternative.

## IMPORTANTES INSTRUCTIONS DE SECURITE

### CONSERVEZ CES INSTRUCTIONS

CE MANUAL CONTIENT DES INSTRUCTIONS IMPORTANTES POUR LE MODÈLE GP-PWM-10-FM QUI DOIVENT ÊTRE SUIVIES PENDANT L'INSTALLATION ET L'ENTRETIEN DU GP-PWM-10-FM.

	<b>Débranchez toutes les sources d'énergie</b>	<p>L'électricité peut être très dangereuse. L'installation ne doit être effectuée que par un électricien agréé ou du personnel qualifié.</p>
	<b>Sécurité de la batterie et du câblage</b>	<p>Respectez toutes les consignes de sécurité du fabricant de la batterie lorsque vous manipulez des batteries ou que vous travaillez à proximité de celles-ci. Lors de leur chargement, les batteries produisent de l'hydrogène gazeux hautement explosif.</p>
	<b>Branchements de câblage</b>	<p>Assurez-vous que tous les branchements sont serrés et sûrs. Des branchements lâches peuvent produire des étincelles et de la chaleur. Vérifiez tous les branchements une semaine après l'installation pour vous assurer qu'ils sont toujours serrés.</p>
	<b>Travaillez en toute sécurité</b>	<p>Lors de l'installation, portez des lunettes de protection et des vêtements adaptés. Faites preuve d'une grande prudence lorsque vous travaillez avec du matériel électrique et lorsque vous manipulez des batteries ou que vous travaillez à proximité de celles-ci.</p>
	<b>Respectez la polarité correcte</b>	<p>Une polarité inversée des bornes de la batterie 1 provoquera un signal sonore du régulateur. Une polarité inversée de la batterie 2 ne provoquera pas d'alarme. Cependant, le régulateur ne chargera pas et <u>n'affichera pas</u> d'informations relatives à la batterie 2 sur l'écran CL. Le régulateur ne fonctionnera que si ses bornes batterie 1 sont connectées à une batterie avec la polarité appropriée. Si ce défaut n'est pas corrigé, le régulateur risque d'être endommagé.</p>
	<b>Ne dépassez pas le courant nominal maximum du GP-PWM-10-FM</b>	<p>Le courant maximum du système solaire est la somme des courants de court-circuit (Isc) des modules PV connectés en parallèle, multipliée par 1,25. Le courant du système qui en résulte ne doit pas excéder 12,5 A. Si votre système solaire dépasse cette valeur, veuillez contacter votre revendeur pour obtenir un régulateur plus approprié.</p>

	<p><b>Ne dépassez pas la tension nominale maximum du GP-PWM-10-FM</b></p>	<p>La tension maximum des panneaux est la somme de la tension à vide du module PV des modules connectés en série, multipliée par 1,25 (ou par une valeur de l'article 690.7 du Code National Électrique fournie dans le tableau 690.7 A). La tension qui en résulte ne doit pas excéder 35 V. Si votre système solaire dépasse cette valeur, veuillez contacter votre revendeur pour obtenir un régulateur plus approprié.</p>
--	---	--

### 3.0 Tools and Materials Needed

- Flathead Screwdriver (for wire terminals)
- Phillips Screwdriver (for mounting screws)

#### NOTE

If the GP-PWM-10-FM 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.

### 4.0 Choosing a Location

The GP-PWM-10-FM is designed to be mounted flush against a wall, out of the way but easily visible.

The GP-PWM-10-FM 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 an adequate wire size is maintained.



## 5.0 Installation Instructions

1. **Prepare for mounting.** Use the template provided on **page 27** 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-10-FM was purchased as part of a Go Power! Solar Power Kit, follow the Installation Guide provided. Otherwise, follow manufacturer's instructions for solar module mounting and wiring.

	<p><b>Do not exceed the GP-PWM-10-FM Max current ratings</b></p>	<p>The maximum current of the solar system is the sum of parallel-connected PV module-rated short circuit Currents (Isc) multiplied by 1.25. The resulting system current is not to exceed 37.5A. If your solar system exceeds this value, contact your dealer for a suitable controller alternative.</p>
	<p><b>Do not exceed the GP-PWM-10-FM Max voltage ratings</b></p>	<p>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 (or by a value from NEC 690.7 provided in Table 690.7 A). The resulting voltage is not to exceed 35V. If your solar system exceeds this value, contact your dealer for a suitable controller alternative.</p>

	<p><b>Ne dépassez pas le courant nominal maximum du GP-PWM-10-FM</b></p>	<p>Le courant maximum du système solaire est la somme des courants de court-circuit (Isc) des modules PV connectés en parallèle, multipliée par 1,25. Le courant du système qui en résulte ne doit pas excéder 12,5 A. Si votre système solaire dépasse cette valeur, veuillez contacter votre revendeur pour obtenir un régulateur plus approprié.</p>
	<p><b>Ne dépassez pas la tension nominale maximum du GP-PWM-10-FM</b></p>	<p>La tension maximum des panneaux est la somme de la tension à vide du module PV des modules connectés en série, multipliée par 1,25 (ou par une valeur de l'article 690.7 du Code National Électrique fournie dans le tableau 690.7 A). La tension qui en résulte ne doit pas excéder 35 V. Si votre système solaire dépasse cette valeur, veuillez contacter votre revendeur pour obtenir un régulateur plus approprié.</p>

- 3. Select wire type and gauge.** If this GP-PWM-10-FM 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-10-FM 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 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-10-FM is protected, a reverse polarity contact may damage the unit.

**Wiring the GP-PWM-10-FM.** Wire the GP-PWM-10-FM according to the wiring schematic in **Section 6**. Run wires from the solar array and the batteries to the location of the GP-PWM-10-FM. Keep the solar array covered with an opaque material until all wiring is completed.

**IMPORTANT:** All wiring must be in accordance to 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 the negative solar array or negative battery controller wiring to the chassis of the vehicle.

6. **Mounting the GP-PWM-10-FM.** Mount the GP-PWM-10-FM to the wall using the included four mounting screws.

**IMPORTANT:** You must set the battery type on the GP-PWM-10-FM before you begin to use the controller (follow steps in **Section 7**). The default battery setting is for AGM/LiFePO<sub>4</sub> batteries.

Congratulations, your GP-PWM-10-FM 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.

## 6.0 Wiring Diagram

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

The GP-PWM-10-FM Maximum 12.5A rating is based on a 10 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 10 = 12.5A). 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**

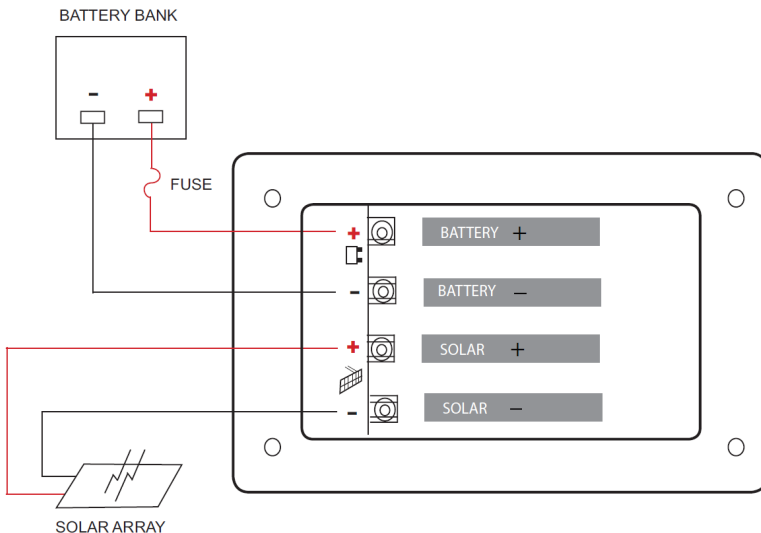
The fuse or breaker used should be no larger than 15 amps.

**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



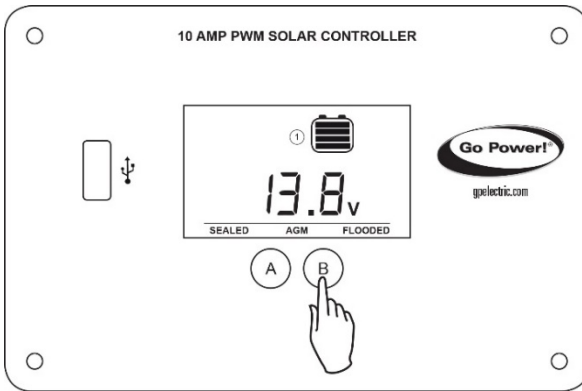
## 7.0 Operating Instructions

### 7.1 Power Up

When the GP-PWM-10-FM 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-10-FM 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/LiFePO<sub>4</sub> 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
<b>Float Charge @ 25°C:</b>	13.7V (+/- 0.1V)			N/A
<b>Bulk/Absorption Charge @ 25°C:</b> Set to 30 minutes every morning. <i>Applied for 2 hours if the battery voltage drops below 12.3 volts.</i>	14.1V (+/- 0.1V)	14.4V (+/- 0.1V)	14.4V (+/- 0.1V)	N/A
<b>Equalization Charge @ 25°C:</b> <i>Applied for 2 hours every 28 days and if the battery voltage drops below 12.1 volts.</i>	N/A	N/A	14.9V (+/-0.1V)	N/A
<b>Absorption Charge voltage for LiFePO<sub>4</sub>:</b> <i>Set to 30 minutes every morning</i>	N/A			14.4VDC
<b>Float Charge voltage for LiFePO<sub>4</sub>:</b>	N/A			14.0VDC
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 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 to the target charging voltage.

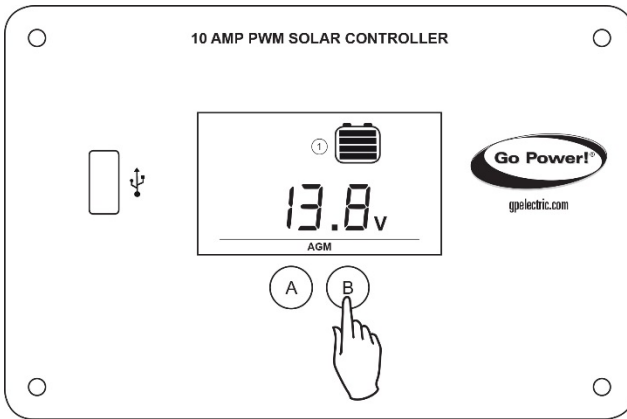
**Auto Equalize:** The GP-PWM-10-FM has an automatic equalize feature that will charge and recondition your batteries at least once a month at a higher voltage to ensure that any excess sulfation is removed.

**NOTE**

This mode should not be entered unless you are using a flooded battery.

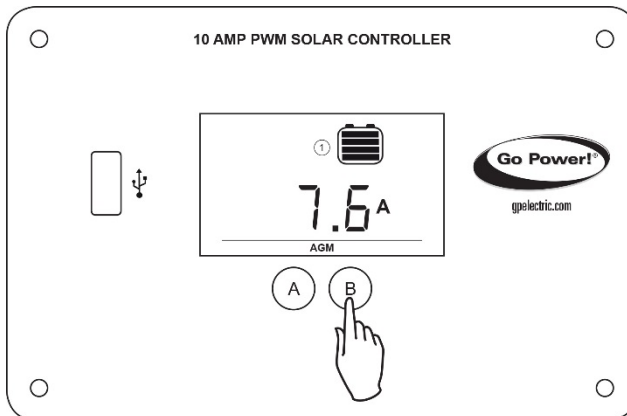
### 7.4 Viewing the Controller Display Information

To toggle between Battery Voltage, PV Charging Current, Battery State of Charge (SOC), and ampere hours charged since last reset, press the **B Button**.



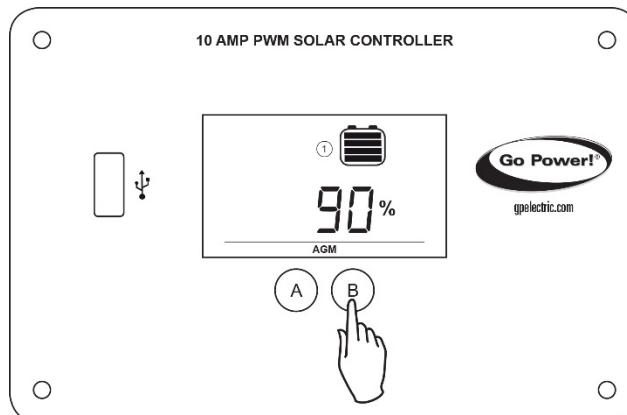
Push the **B Button** to show the battery voltage.

**Icons Displayed:**  
Battery SOC, Volt Symbol (V)



Push the **B Button** to show the PV charging current.

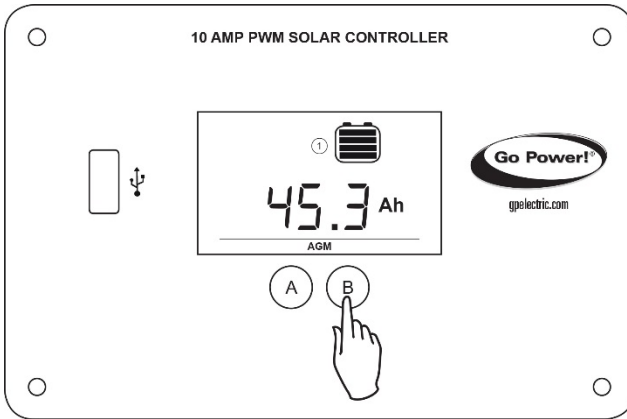
**Icons Displayed:**  
Ampere Symbol (A), Battery SOC



Push the **B Button** to show the battery state of charge (shown as a percentage).

**Icons Displayed:**  
Battery SOC, Percent Symbol (%)

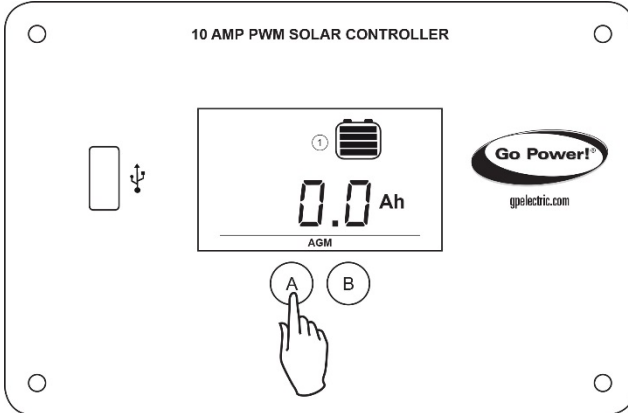
A value of 100% will only be displayed after a Boost or Equalize charge completes.



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

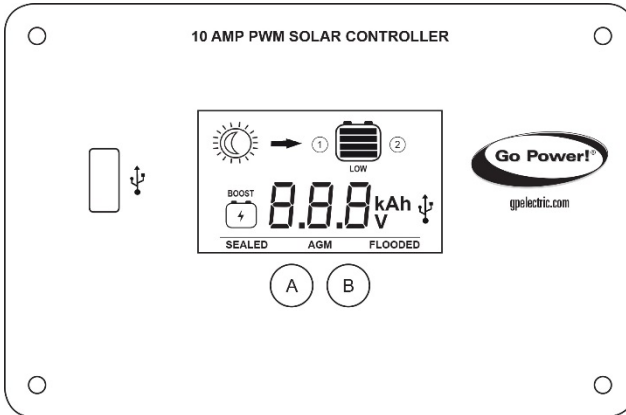


To reset the count of ampere hours charged, toggle to the ampere hours charged. Press and hold the **A Button** for 6 seconds to reset the counter to zero.



## 7.6 Errors

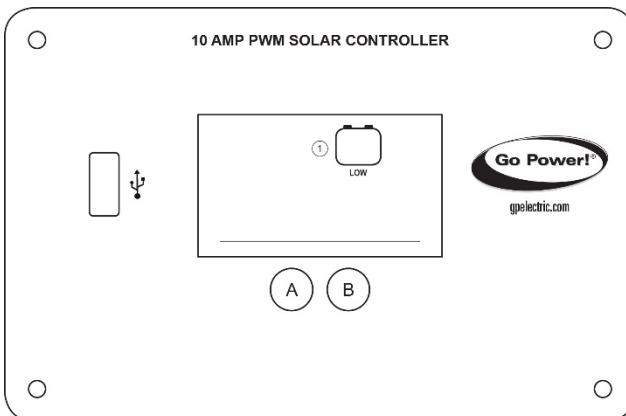
### Over Voltage



If the GP-PWM-10-FM experiences a battery over voltage (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

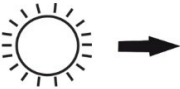








### Low Voltage




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

## 8.0 Display Symbols

Symbol	Indicator For:
	Day Time: PV Charge Current
	Night Time
	Battery Voltage
	Battery State of Charge
<b>SEALED</b>	Sealed/Gel
<b>AGM</b>	AGM/LFP
<b>FLOODED</b>	Flooded
<b>Other Symbols</b>	
	USB charger on (When charger is off, no symbol will show)
<b>LOW</b>	Battery voltage is lower than 11.0 VDC
Whole display will start to blink	Battery voltage > 15.5 VDC
<b>Battery State of Charge</b>	
Symbol	Battery Voltage
	Shows only after full Boost or Equalization Cycle
	>= 12.6 VDC
	>= 11.8 -12.6 VDC
	> 11.0 -11.8 VDC

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

## 9.0 USB Charging

The GP-PWM-10-FM 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.

## 10.0 Frequently Asked Questions (FAQs)

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](http://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-10-FM display.**

The meter value on the GP-PWM-10-FM 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-10-FM display and the battery voltage measured at the battery terminals. When troubleshooting using a voltmeter, check both the battery voltage at the GP-PWM-10-FM 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 check 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	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 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%.

# 11.0 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 Problems with the Display

**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 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:**

Panel is covered by something; PV panel is too dirty to supply a high enough voltage to charge the battery; PV panel is not connected.

**Remedy:**

Check the panel and 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 Cause:**

Excessive voltage drop 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 with the voltage reading at the battery terminals.

2. If there is a voltage discrepancy of more than 0.5 VDC, 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 battery or obtain 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.

**Voltage Reading:** Controller flashes entire LCD for battery overvoltage

**Time of Day:** Daytime/Nighttime

**Possible Causes:**

1. Solar current is too large with respect to battery capacity
2. Electrical short
3. Unregulated charging source
4. Damaged/Old battery bank

**How to tell:**

1. Calculate the total solar array  $I_{sc}$ . Find or calculate the battery bank capacity in amp hours (Ah). Divide the capacity by the total  $I_{sc}$ . If this number is greater than 5, then consider increasing the battery bank size. (Note: This is a simplified rule of thumb and does not cover all system sizing situations.)
4. Have your battery bank tested.

**Remedy:**

Turn off any secondary charging sources such as a generator. If possible, turn off solar circuit breakers if the error does not clear after turning off secondary charging sources. If you suspect an electrical short, seek the help of a qualified professional or your dealer. Consider having your battery bank tested or replacing your battery bank. Battery capacity deteriorates with age and extreme use. Wait for the battery voltage to fall. Batteries self-discharge over time.

## 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 icon are present with an arrow between.
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:**

1. 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 solar panel configuration and/or wiring connections and/or wire gauge (for multiple panel systems).
- (3) Dirty or shaded module or lack of sun.
- (4) Blown diode in solar module 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, 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 decrease 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 23 VDC. 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:**

(2) Reconnect in correct configuration. Tighten all connections. Check wire gauge and length of wire run. Refer to Suggested Minimum Wire Gauge in **Section 5**.

(3) Clean modules, clear obstruction, or wait for conditions to clear.

(4) 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.

## 12.0 Limited Warranty

Go Power! warrants the GP-PWM-10-FM 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, high winds, and hail.
- 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.

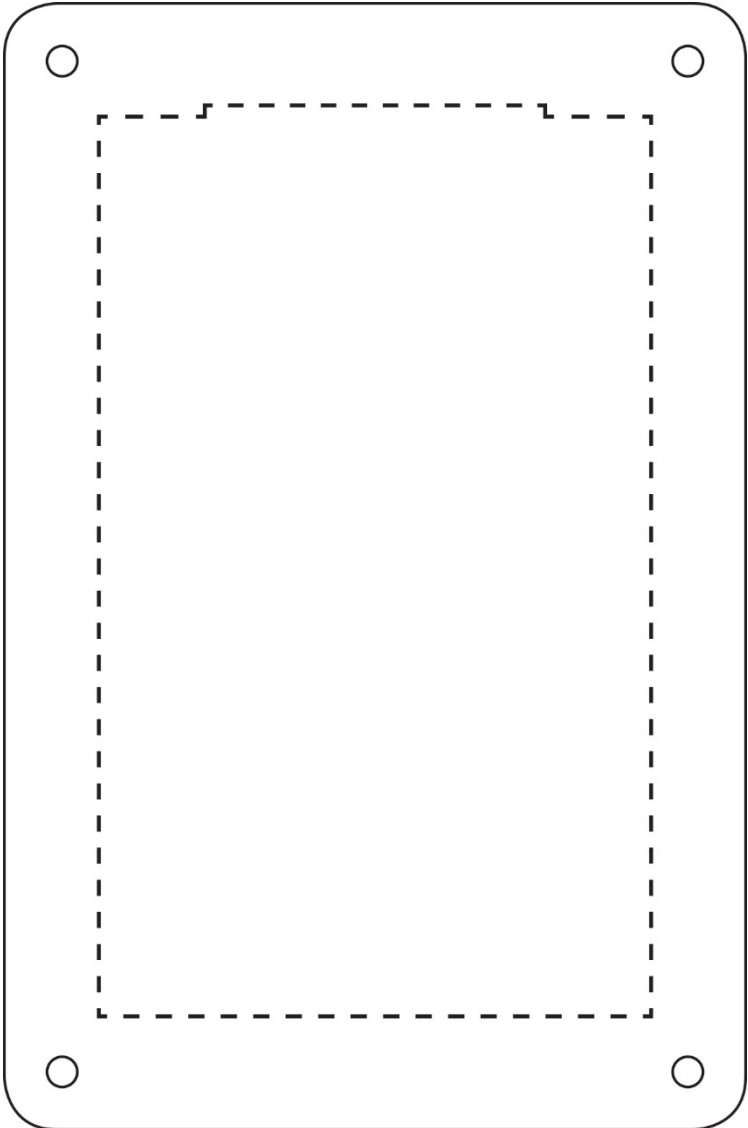
### 12.1 *Repair and Return Information*

Visit [www.gpelectric.com](http://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](mailto:techsupport@gpelectric.com)
3. Return defective product to place of purchase

## 13.0 Installation Template

Use the template on page 27 for flush mounting the controller.





© 2019 GO POWER!®

MOBI\_MAN\_GP-PWM-10-FM\_RevD

**gp**electric.com