



Model PV7 /D & PV14 Owners Manual

**High Efficiency, Industrial Grade,
Alternative Energy Battery Charge Controller
for Smaller PV Systems**

**For Flooded Lead Acid &
Sealed Gel Battery Technologies**

**MODEL: PV7 & PV7D (12V & 24V)
PV14 (12V & 24V)**

PV7



PV7D



PV14



Manual Edition: Rev 01
July 10, 2000

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WARNINGS & IMPORTANT INFORMATION

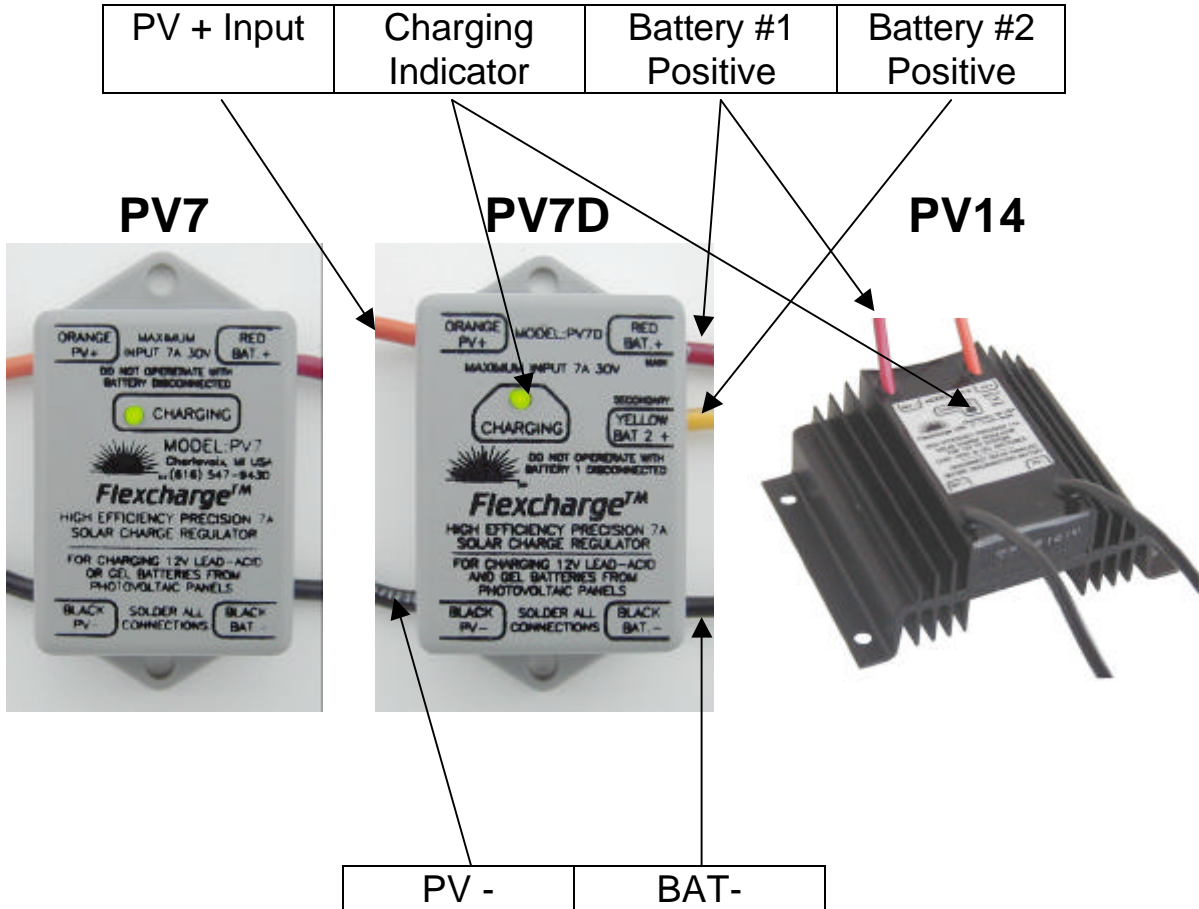
- THE PV7 & PV14 CONTROLLERS ARE "ON/OFF" REGULATORS, NOT CONSTANT VOLTAGE REGULATORS, AND THEREFORE CAN NOT BE TESTED BY SIMPLY MEASURING THE OUTPUT VOLTAGE OF CONTROLLER. THE CONTROLLER MUST BE CONNECTED AS SHOWN IN ONE OF THE SCHEMATICS BEFORE IT WILL REGULATE.
- READ THIS ENTIRE MANUAL TO LEARN HOW THE CONTROLLER FUNCTIONS BEFORE CONCLUDING THAT YOUR CONTROLLER IS NOT REGULATING.
- ALL WIRE TO WIRE AND CRIMP CONNECTIONS MUST BE SOLDERED OR TREATED WITH AN ANTI-OXIDATION COATING FOR THIS, OR ANY CHARGE CONTROLLER TO OPERATE DEPENDABLY.
- THE PV7 & PV14 CONTROLLERS ARE DESIGNED FOR USE WITH SOLAR (PV) AND OTHER CURRENT LIMITED CHARGING SOURCES. (*SOURCES WHERE THE POSITIVE AND NEGATIVE WIRES COULD BE CONNECTED TOGETHER CONTINUOUSLY WITH OUT DAMAGING THE CHARGING SOURCE*).
- DO NOT USE THIS CONTROLLER WITH TOWED WATER AND WIND GENERATORS, OR OUTBOARD MOTORS. IT WILL BE DAMAGED.

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Controls and Indicators





Features

- **2 Year Warranty**
- **Assembled in the USA using high quality surface mount components.**
- **High charging efficiency**
- **Charges batteries from 0 (Zero) volts with full uninterrupted power.**
- **Expandable into a high ampere controller. Use up to 4ea 100A contactors to regulate 400 amperes. Charge divert feature is available (Optional).**
- **The PV7 and PV14 circuitry consumes only 4mA (0.004A).**
- **Charges batteries at full power, below the plate saturation point. This charges batteries quickly while reducing the electrolyte depletion (water loss) by up to 90% over conventional constant voltage methods such as “PWM” & “High Frequency” charge regulators.**
- **Batteries begin charging at only 0.005A of charging current.**
- **Fuse protected.**
- **Highly accurate voltage sensing make these controllers great for smaller, or when expanded, for larger photovoltaic systems.**
- **U/L 94V-O Rated Enclosure**
- **Electronics are completely sealed and potted for use in 100% humidity environments.**



INSTALLATION PRECAUTIONS

MOUNTING

Choose a mounting location that will not exceed 140° F., where it will be exposed to solvents such as diesel fuel or gasoline, or be subject to excessive vibration like on an engine block. The controller should be mounted within 5 wired feet of the battery for best performance. The controllers electronics are sealed in a UL listed polymer epoxy making the controller completely splash proof. NOTE: The fuse is not waterproof. Move the fuse to a protected location near the battery if the controller will be mounted in a potentially wet environment.

SOLDERING

Always solder or use an anti-oxidation coating on all crimp and wire to wire connections. As long as the wire connections are exposed to oxygen, they are highly susceptible to corrosion. This will cause your unsoldered connections to degraded or fail typically within a year after the installation.

OPERATING PRECAUTIONS

Do not operate the controller with the battery wires disconnected and the solar panel(s) exposed to light. In some *rare* circumstances, the controller may overheat. Shut down the solar panel, or first disconnect the PV+ wire from the controller before removing the battery. For best results, install a fuse in the PV+ wire near the controller as mentioned below.

WIRE SIZES

Use at least #14 AWG to #10 AWG size wire for extensions. This will allow for good charging efficiency an accurate voltage sensing by the controller.

BLOCKING DIODES

The PV7 and PV14 controllers isolate the solar panels from the batteries when they are not producing power. Therefore a blocking diode is not necessary on the solar panel; however, if you are using more than one panel in parallel, place a blocking diodes in each panel's + wire or junction box. This will protect a good panel from being drained into a potentially damaged panel. Individual panel blocking diodes should always be used on all Amorphous type panels (Uni-solar).

EXTRA PROTECTION

We highly recommended that a 10A (for PV7) or 20A (for PV14) fuse or DC circuit breaker be installed in the orange wire between the solar panel(s) and the controller. This will offer a higher level of protection against over charging current conditions and short circuit protection. In addition, it will provide a convenient place to disconnect the solar panel(s) before disconnecting the battery.

Installation Tools

#6 or # 8 MOUNTING SCREWS - SCREWDRIVER - SOLDER & SOLDERING IRON
(NON GROUNDED MODEL) - TAPE or HEAT SHRINK TUBING – RTV SEALER - SMALL
CRESCENT WRENCH FOR BATTERY TERMINALS - HOOKUP WIRE

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Flexcharge™ USA
INSTALLATION INSTRUCTIONS
PV7, PV7D & PV14D CHARGE CONTROLLERS

IMPORTANT

When installing the system wiring, make sure all wire connections are making good electrical and mechanical connection. Splice connections should be soldered. Connections that are not made with screw tightened terminals should have anti-oxygen / anti-corrosion coatings applied to the connections before inserting the wires.

Note: Step numbers correspond to the numbers in the installation schematics.

1. **Choose a good mounting location no more than 10 wired feet from the battery you are charging.** Although these controllers have been designed for mounting in semi-harsh locations, mounting them in a more protected environment will help to extend the operational life.
2. **Splice a #14 to #10 AWG black wire to the BLACK BAT- WIRE on the controller, and connect it to the BATTERY BANK'S negative (-) terminal and/or the system's negative battery bus.** If you are using a smart battery fuel meter that measures total Input to Output Amp/Hours, it will usually have a shunt in the (-) connection to the battery. Connect the (-) wire from the controller to the same terminal as the other loads on the shunt as shown in the meter's manual.
3. **Splice a #14 to #10 AWG black wire to the BLACK PV- WIRE on the controller, to the SOLAR PANEL'S negative (-) terminal(s).**
4. **Splice a #14 to #10 AWG red wire to the RED BAT+ WIRE on the controller, and connect it to the BATTERY BANK'S positive (+) terminal and/or the system's Positive battery bus.** In dual bank systems the Red wire connects to the Primary House Battery bank. **For single battery banks systems, a fuse should be installed in the red positive wire. It should be located as close to the battery as possible for the best protection. The Bat+ Fuse is rated at 8A for the PV7 and 15A for the PV14.**
5. **Splice a #14 to #10 AWG orange wire to the ORANGE PV+ WIRE on the controller, and connect it to the combined positive (+) output of all the SOLAR PANELS.** For added protection and ease of maintenance, we highly recommend that you install a fuse somewhere in the orange PV+ wire. It will provide protection against its accidental connection to a high current source and fully protect the controller. It also will serve as a convenient place to disconnect the charging source from the controller when the battery is removed from the system while the charging source remains active.

For Dual Battery Charging Models

6. **If you will be using the PV7D's dual battery charging feature, Splice a #14 to #10 AWG yellow wire to the YELLOW BAT(2)+ WIRE on the controller, and connect it to the SECOND BATTERY BANK'S positive (+) terminal and/or the second system's positive battery bus.** If you will not be using the dual battery charging feature simply tape or place a wire nut over the end of the yellow wire to isolate it electrically and protect it from moisture.



Expanding to Charge Additional Battery Banks (PV7 and PV7D Only)

7. To modify/expand the PV7 and PV7D controllers to charge multiple battery banks please follow these additional steps.
- a) Obtain the appropriate quantity of 8A 80SQ045 Schottky diodes required for your application (One for each additional battery bank). The Diodes are available from Flexcharge directly, or through our dealers.
 - b) Solder a piece of #16 to #14 AWG stranded wire to each lead on the diode. Excess heat, mechanical stress and electrostatic discharge will damage these diodes. An acceptable alternative to soldering is to connect the diode leads directly into a terminal block that will accept #20 to #12 AWG solid or stranded wire. It must have screw tightened terminals to hold the wires in place. Make sure the diode's leads are insulated and cannot come in contact with other wires, or the ground buss.
8. **Additional steps to expand the PV14 for High Ampere charging.**
- A. Obtain the appropriate contactors (relays) from a Flexcharge dealer or Flexcharge directly.
 - B. After mounting the contactor(s) vertically within 50 feet of the PV14 Controller, connect a #20 to #14 AWG wire at the splice where the controller's RED BAT+ wire connects to the wire from the battery's positive terminal. Using the same size wire, connect the opposite end of the wire to the top connection of the contactor(s)
9. **Connect the controller's Orange wire to the lower terminals of the contactor(s)**

If the controller does not function as you think it should, first check the troubleshooting guide in this manual, then call your dealer or Flexcharge USA at the numbers shown below

HOOKUP WIRE SIZE CHART		
This chart provides the minimum wire size to minimize power loss. Larger wires would be always better for operating efficiency		
Max Charging Capacity	WIRE SIZE FOR 1 TO 10FT LENGTHS	WIRE SIZE FOR 10 TO 20FT LENGTHS
0A TO 3A	#14 AWG	#12 AWG
3A TO 6A	#12 AWG	#12 AWG
6A TO 12A	#10 AWG	#10 AWG
12A TO 18A	#10 AWG	#8 AWG



Solar Panel Blocking Diode Selection Table

(One on each solar panel)

Ampere Rating	Voltage Rating	Part Number	Type	Manufacturer
1A	40V	1N5819	Schottky	Diodes Incorporated
3A	40V	1N5822	Schottky	International Rectifier
5A	100V	50SQ100	Schottky	International Rectifier
8A	45V	80SQ045	Schottky	International Rectifier
1A	400V	1N4004	Silicon	Diodes Incorporated
3A	400V	1N5404	Silicon	Diodes Incorporated
6A	1000V	6A10	Silicon	Diodes Incorporated

**If you cannot find these parts locally, contact Flexcharge USA.
All the above diodes are in stock.**

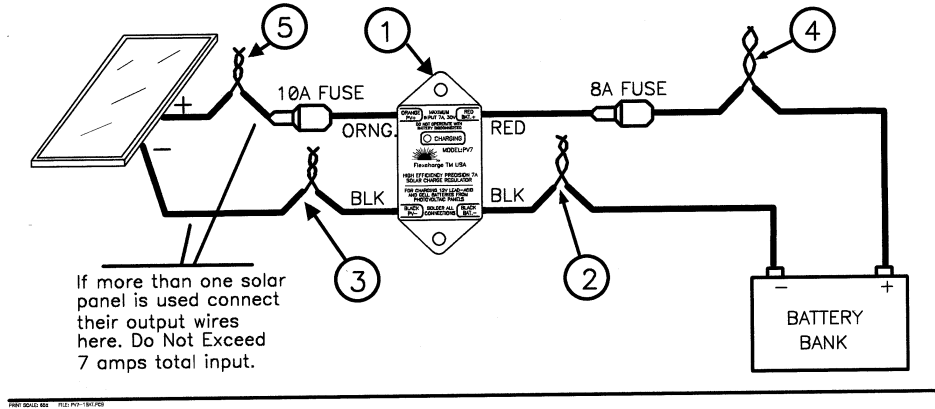
Controller Specifications

Parameter	(12V)			(24V)		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
INPUT VOLTAGE (BAT or PV)	0V	-	30V	0V	-	50V
PROGRAMMED OVERSHOOT VOLTAGE (MICRO - EQUALIZATION)	-	-	15.9V	-	-	31.8V
CHARGING CURRENT						
• PV14	4mA	-	15A	4mA	-	15A
• PV7	4mA	-	8A	4mA	-	8A
PV7D Must not exceed 8A total input current						
CONTROLLER STANDBY CURRENT (NIGHT)	2mA	2.6mA	3mA	2mA	2.6mA	3mA
CONTROLLER STANDBY CURRENT (Charging)	4mA	5mA	6mA	4mA	5mA	6mA
CHARGE DISCONNECT VOLTAGE (Regulation Voltage)	14.20V	14.25V	14.30V	28.40V	28.50V	28.60V
CHARGE RECONNECT VOLTAGE	13.50V	13.60V	13.70V	27.00V	27.20V	27.40V
VOLTAGE DROP ACROSS CONTROLLER	0.2V	0.4V	0.56V	0.2V	0.4V	0.56V
TRANSIENT SURGE SUPPRESSION	-	-	600W	-	-	600W
HUMIDITY	5%	-	100%	5%	-	100%
OPERATING TEMPERATURE	-40°C	25°C	60°C	-40°C	25°C	60°C
MTBF (Mean Time Between Failures)	-	-	30 Years	-	-	30 Years
CASE SIZE	H=1.2" W=4.75" L=3.0"					

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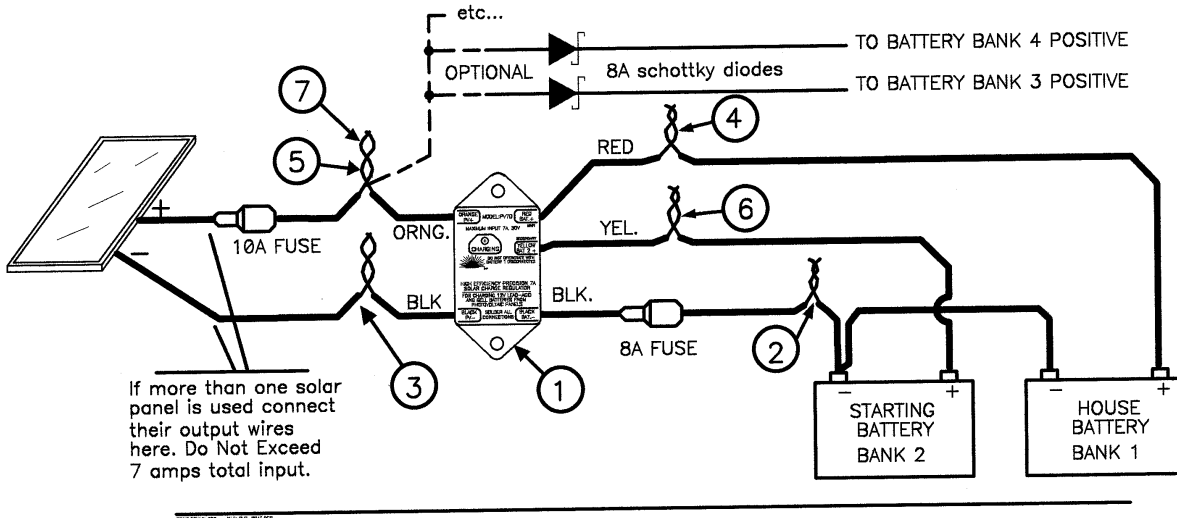
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Figure 1:
INSTALLATION INSTRUCTIONS
MODEL: PV7 FOR SINGLE BATTERY BANKS



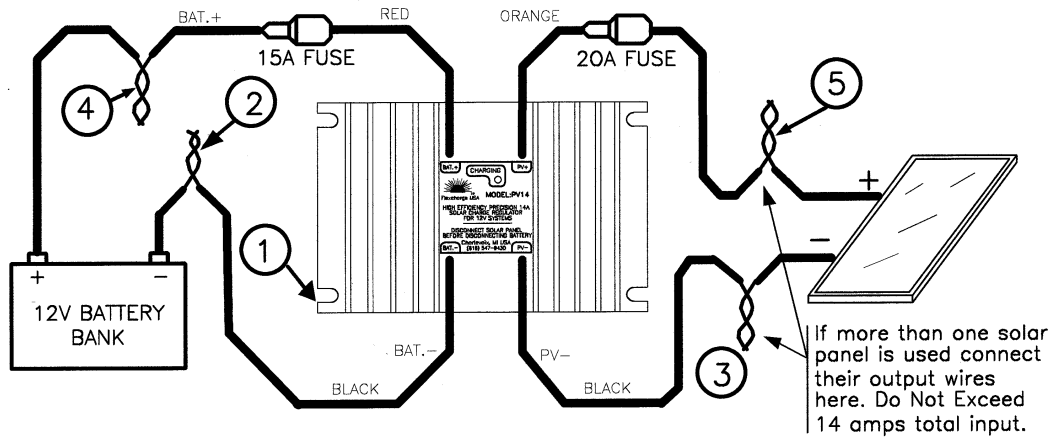
- PLEASE READ INSTALLATION INSTRUCTIONS
- USE #16 to #12 AWG WIRE FOR EXTENSIONS
- Numbers Correspond to Installation Instructions

Figure 2:
INSTALLATION INSTRUCTIONS
MODEL: PV7D FOR TWO OR MORE BATTERY BANKS



- PLEASE READ INSTALLATION INSTRUCTIONS
- USE #16 to #12 AWG WIRE FOR EXTENSIONS
- Numbers Corrospound to Installation Instructions

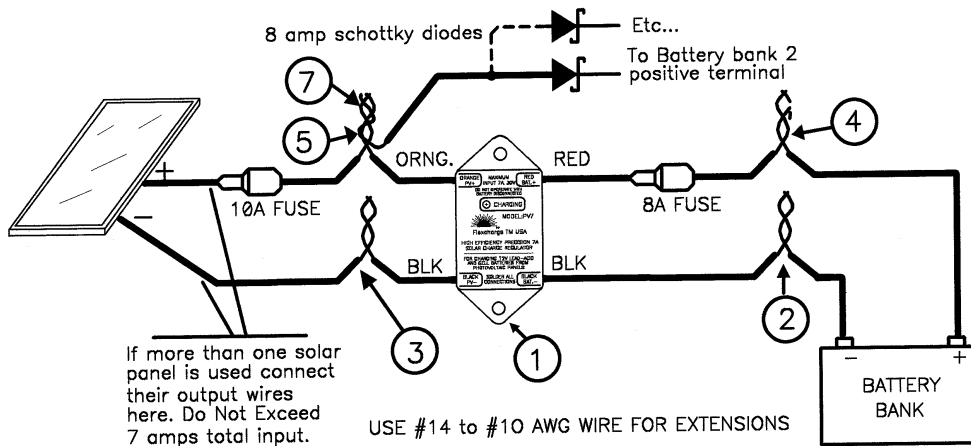
Figure 3:
PV14 CHARGING A SINGLE BATTERY BANK



Scale: 80% PV14-18A.PCB

- PLEASE READ INSTALLATION PRECAUTIONS AND INSTRUCTIONS
- USE #14 to #8AWG WIRE FOR EXTENSIONS
- Numbers correspond to installation instructions

Figure 4:
INSTALLATION INSTRUCTIONS
MODEL: PV7 EXPANDED TO CHARGE MULTIPLE BATTERY BANKS



CAUTION: Never disconnect the red wire from battery bank #1 without first disconnecting the solar panel. The remaining batteries on the system will be over charged, and the controller may overloaded.

Print Scale: 80% TEL: PV7-18A.PCB

- PLEASE READ INSTALLATION INSTRUCTIONS
- USE #16 to #12 AWG WIRE FOR EXTENSIONS
- Numbers Correspond to Installation Instructions

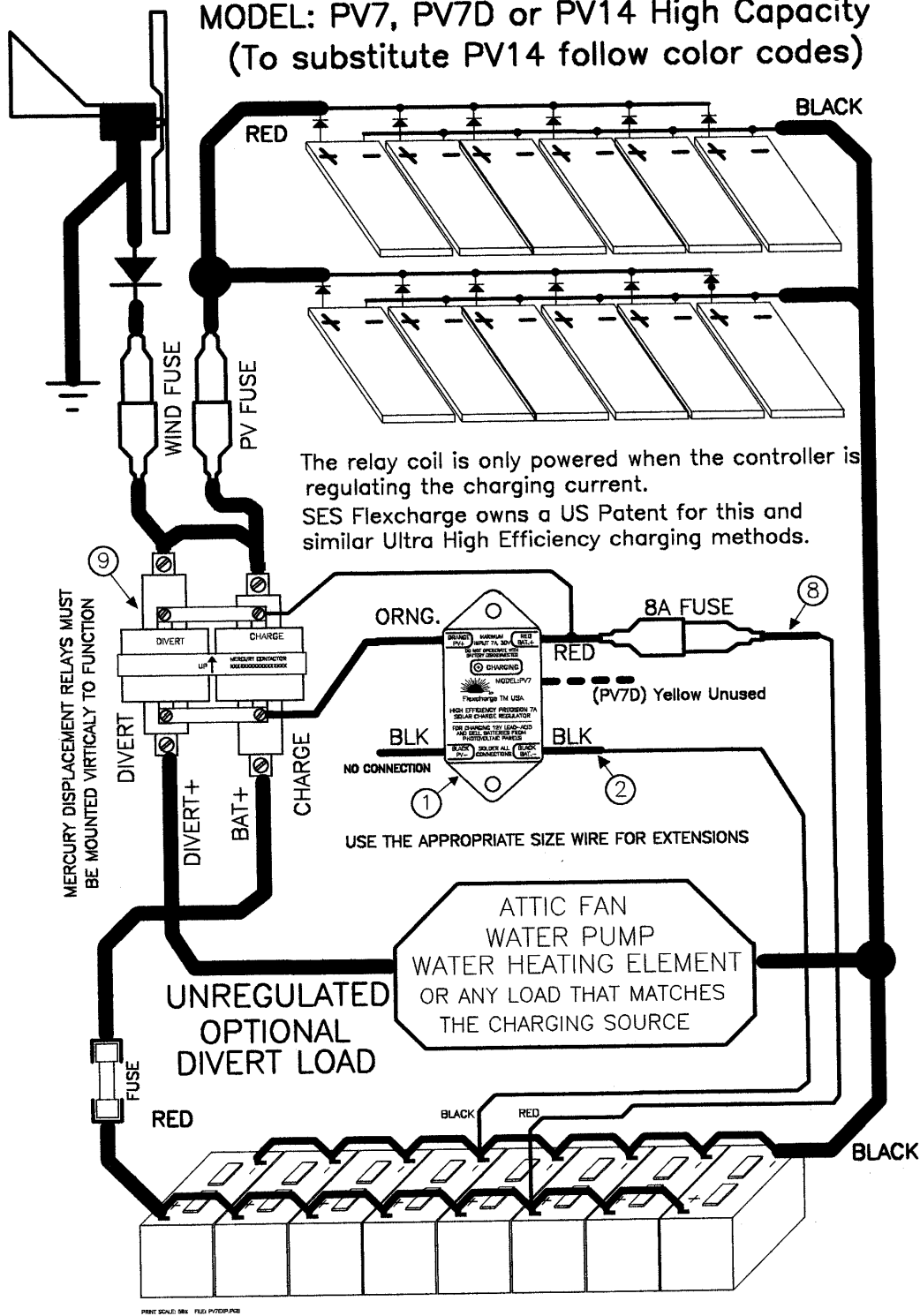
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Figure 5:

INSTALLATION SCHEMATIC

MODEL: PV7, PV7D or PV14 High Capacity
(To substitute PV14 follow color codes)





The Flexcharge™ Energy State Taper Charge Process

Monitors the battery for the full charged resting voltage of the cells.

Discover the tremendous advantages using controllers with this charge method.

- Zero overcharging
- Exceptionally low gassing (Up to 90% less)
- No RFI or EMI emissions to interfere with radio equipment.
- Non-Destructive Micro-Equalization at each full charge
- The chemical processes of the battery actually control the charging.

The need for temperature compensation is also greatly reduced because the plate voltage is not held constantly at the critical plate saturation voltage. Voltage Tapering is controlled by the battery's level of charge rather than with timers, or fixed voltages as in PWM and other constant voltage charge methods. The battery takes exactly what it needs rather than being forced to take a set voltage. With the Flexcharge method, you can charge your battery bank indefinitely without any possibility of overcharging. The batteries will last longer, require less watering maintenance, and hold a better charge.

As charging begins the controller allows full charging current to pass directly to the battery. When the battery voltage rises slightly above the plate saturation point, the controller opens the charging circuit. Much like a sponge will continue to absorb water towards its center after it has taken it all into its surface, the chemical charging process continues after the charging current has been removed. As the charge is absorbed, the battery's voltage will fall. When the battery voltage has floated down to approximately 13.5V to 13.8V it is ready to accept another charge pulse. This charge regulation method is actually controlled by the battery's ability to accept and absorb energy. When the battery needs more energy indicated by plate voltage, the controller applies it. Mid way in the charging process, the controller will cycle ON and then OFF sending full charge current pulses into the plates. This process charges with very low gassing, and equalizes the plates with each full charge. As the battery reaches a higher level of charge, the amount of time the controller spends in charge is reduced, and the time in rest is increased. At full charge, the controller will apply short duration pulses to maintain the battery at an average voltage of about 13.75 volts. This keeps gassing to a minimum while effectively trickle charging, and equalizing at the same time.

There has been a great deal of discussion over which charge process is better, PWM, or this method. To add fuel to the fire, each company making "ON-OFF" controllers has chosen different voltages to set the disconnect and reconnect points. A number of PWM controller manufacturers have gone to great lengths to discredit "Low Frequency PWM or ON-OFF regulators" by studying a controller that was not set up with the proper connect/reconnect voltages. At Flexcharge we have analyzed controllers using a version of this method where the reconnect voltage on a 12V system was set at 12.6V @ 70°F. On this system the batteries would never see more than 80% charge, and likely much less. Obviously PWM type controllers will regulate the charging of your batteries. With proper temperature compensation, heat sinks, and the correct Bulk-Regulate-Float (3 stage) algorithm will do a pretty good job of it, but why settle for this when you can get so much more in a charge regulator. Instead of three stages with PWM you get an infinitely variable charge process which will supply the battery with exactly what it needs, only when it needs it. You will realize less plate saturation gassing, non-destructive equalization and Zero EMI and RFI as well. Electrico-Magnetic-Interference, and Radio Frequency Interference is electronic noise that can interfere with radio and navigation equipment.

Charge Controllers using the Energy State Taper Charge are best suited for charging systems where the charging current is less than 1/4 of the amp hour rating of the battery bank. If your charging system is designed to charge at a rate higher than 1/4 the battery bank's capacity, then the power switching element should be solid state to provide the longer term reliability. At Flexcharge we make use of both types of switching elements in our controllers depending on the task. They are implemented in such a way as to provide exceptional levels of dependability. To determine these ratings, first add up the total amp/hour capacity of your battery bank then divide that number by 4. If the result is larger than the maximum current your charging source can produce, then the Energy State Taper Charge Process is the best method for your system.

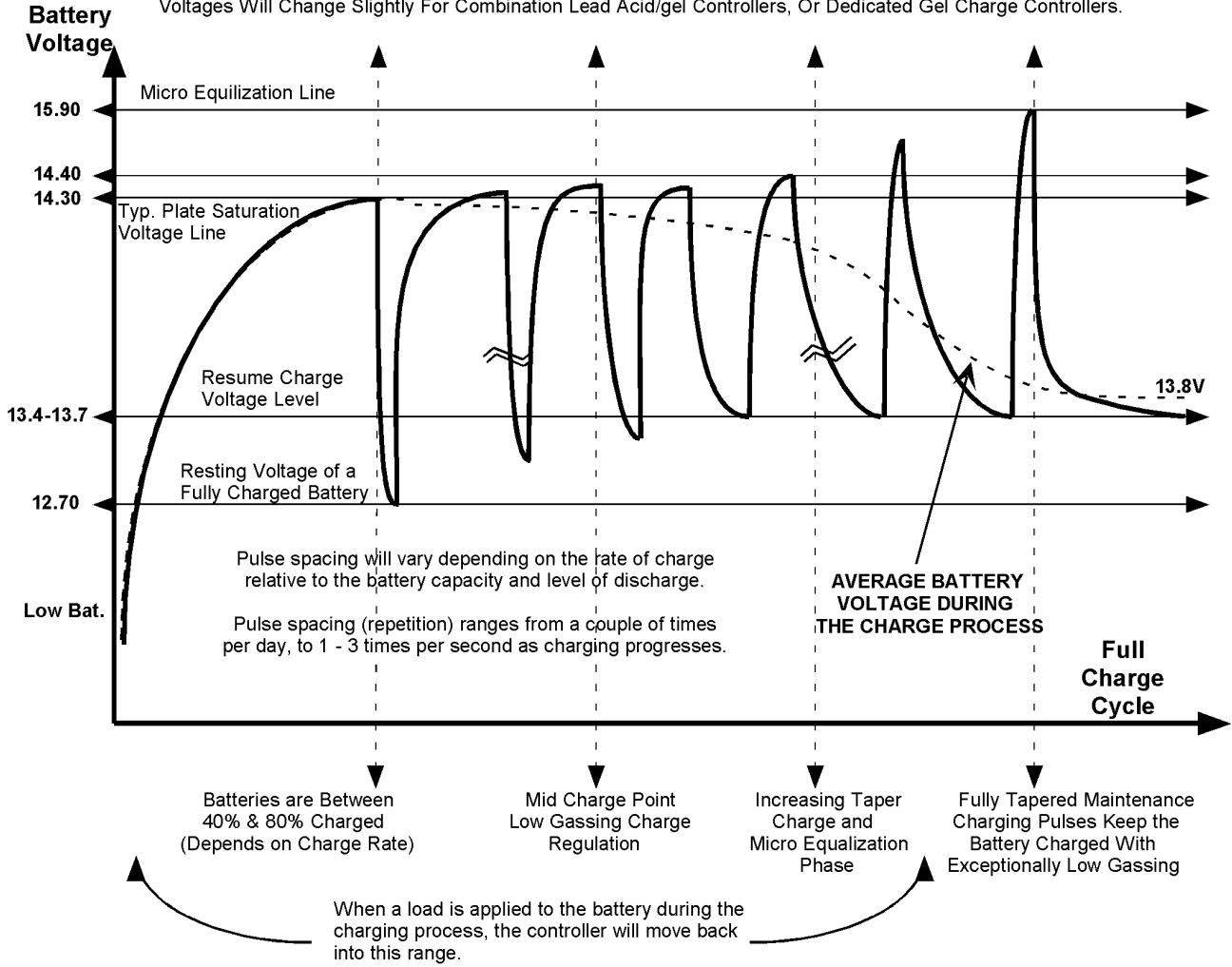
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Flexcharge™ Energy State Taper Charge Method.

Charging Wave Form For A Typical Flooded Lead Acid 12v Battery System.
Voltages Will Change Slightly For Combination Lead Acid/gel Controllers, Or Dedicated Gel Charge Controllers.



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***Please Read!!* IMPORTANT: USING or NOT USING BLOCKING DIODES ON YOUR PV CHARGING SYSTEM?**

There has been a great deal of discussion in the solar electric (Photovoltaic) industry over the use of blocking diodes. In an effort to clarify the confusion **Flexcharge™** USA has called, met with, or gathered information pertaining to this topic from the following solar panel and equipment manufacturers; Seimens, Astro Power, United Solar, & Solarex.

The following is a condensed version of the information to assist you in designing a failure resistant system.

What is a blocking diode?

A blocking diode is a one way valve for electricity. The band on the case of the diode is the output, which should be installed towards the battery in the positive wire from each solar panel. There are two primary types of diodes, *Schottky* (sensitive to damage but low loss type) and *Silicon* (tough, but higher loss). They are rated by the amount of current that can pass through them in amps, and the amount of voltage they can withstand backwards.

What is the function of blocking diodes in a Photovoltaic (PV) system?

- 1 To prevent the flow of electricity into the panels when the panels are not making electricity, and to prevent voltage spikes in the system from reaching the panels,
- 2 To prevent a damaged panel which has shorted (a common type of failure) from draining the battery system, or drawing power from the remaining good panels.

There are the three popular types of solar electric panel technologies being used today.

- 1) SINGLE CRYSTALLINE 2) POLY CRYSTALLINE 3) AMORPHOUS

How should blocking diodes be used with each type of panel?

SINGLE CRYSTALLINE panels are glass covered rigidly mounted panels. They have a low nighttime back flow of power from the batteries. The loss at night is actually a little less than the amount of loss you get by adding a blocking diode to the panel. You will get more out of your panel if you do not using blocking diodes on these type of panels, ***BUT!!*** on multiple panel arrays, blocking diodes should be used, *especially* on unattended remote systems, to guard against a failed panel. Because they are glass covered, a stray falling branch, hail stones, a child with a rock, or bored hunter could bring the entire system down by damaging only one panel. Diodes help protect the rest of the system from these events.

POLY CRYSTALLINE panels are also glass covered rigidly mounted panels. They have a slightly higher nighttime draw of power from the batteries when compared to single crystalline panels. The loss at night is near equal to the loss you get by adding a blocking diode to the panel. You may or may not get more out of your panel by using blocking diodes on these type of panels, ***BUT!!*** on multiple panel arrays, blocking diodes should be used, *especially* on unattended remote systems, to guard against a failed panel. Because they are glass covered, a stray falling branch, hail stones, a child with a rock, or bored hunter could bring the entire system down by damaging only one panel. Diodes help protect the rest of the system from these events.

AMORPHOUS panels are a very different when compared to the other types of panels. They have a fairly substantial nighttime draw of power from the batteries when compared to single crystalline panels. The loss at night is higher than the loss you get by adding a blocking diode to the panel; *in addition, these type panels will actually draw enough power from the batteries at night to damage themselves if diodes are not used.* To compensate for the diode loss, most amorphous panels are designed to have a higher operating voltage, which compensates for the voltage drop losses of the diode.

Blocking diodes should be used on all systems when panels have been connected in series to charge 24V, or higher voltage batteries, or when using an inverter on the system. Inverters can cause voltage spikes as high as 60 volts on the DC system. This is enough voltage to damage most solar panels.

In conclusion; blocking diodes should be used on all systems except, one panel single crystalline 12V systems. If your system is so marginal that using, or not using diodes will make the difference, consider adding another solar panel to your system.



*Flexcharge*TM CHARGE CONTROLLER TROUBLESHOOTING GUIDE

IF YOU ARE USING CRIMP ELECTRICAL CONNECTORS IN YOUR SYSTEM WIRING, THEY SHOULD HAVE BEEN SOLDERED, OR TREATED WITH AN ANTI-OXIDIZING COMPOUND. WITHOUT THESE STEPS CRIMP CONNECTIONS WILL ONLY MAKE GOOD CONNECTION FOR A SORT PERIOD OF TIME, ESPECIALLY IN A MARINE OR OUTDOOR ENVIRONMENT.

PROBLEM	SOLUTIONS
<p>CONTROLLER IS NOT CHARGING WHEN THE PANEL IS MAKING POWER Or CHARGE INDICATOR IS PULSING EVERY SECOND OR SO</p>	<ol style="list-style-type: none"> 1. Check the fuse. If necessary, replace it with an 8A fuse for the PV7, or a 15A fuse for the PV14. Never install a fuse larger than these ratings. The controller could be damaged. 2. Check the fuse and wire connections between the controller and the battery. A poor connection here will cause this symptom. 3. If you connected the regulator to your battery selector switch, make sure the switch is NEVER in the OFF position. Just as your engine alternator cannot be run when the battery switch which is turned OFF, neither can most solar charge regulators.
<p>THE CHARGING LIGHT IS OFF WHEN THE SOLAR PANEL IS MAKING POWER</p>	<p>If the battery is being charged by another charging source (i.e. alternator, shore battery charger or wind generator) the battery may be near its peak voltage. In these circumstances the controller is sensing that battery does not need the charging current from the solar panels and the light will be OFF. If however the battery voltage is below 13.6V (27.2V on 24V systems) and the solar panel is making power, the controller's charge light should be ON. Check the wire connections between the solar panels and the controller.</p>
<p>THE SOLAR PANEL'S OUTPUT VOLTAGE DROPS TO ALMOST THE SAME AS THE BATTERY VOLTAGE WHEN IT IS CHARGING</p>	<p>THIS IS NORMAL. Except for voltage differences caused by losses in the wiring, the voltage in the charging system will always be the same no mater where you measure it.</p> <p>When the panel's positive wire is disconnected from the controller its voltage can then rise to its natural open circuit voltage for solar panels of 16V to 22V (For 12V Systems).</p> <p>NOTE: The battery voltage will not instantly come up to 14.3V when it is being charged unless the charging source has enough charging current capacity (50 amps or so) to push them there very quickly. You will usually see a slowly rising voltage dependent on the amount of charging current generated by your solar panel(s).</p>
<p>THE SOLAR PANEL VOLTAGE MEASURES NEARLY ZERO VOLTS WHEN IT SEEMS IT SHOULD BE CHARGING</p>	<p>THIS IS NORMAL IF THE CHARGE INDICATOR LED IS OFF, AND THE BATTERY VOLTAGE IS ABOVE 13.6V, (27.2V on 24V systems) after the batteries have reached the disconnect voltage.</p> <p>The Solar Panel's Voltage will cycle between near battery voltage and zero volts with the charge indicator light. See "Energy State Charge Process" for and explanation of the charge regulation process.</p> <p>When the light is ON the Solar panel voltage will be about the same as the battery voltage. When it's OFF it will be near zero volts.</p>

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<p>THE CONTROLLER IS GETTING VERY WARM</p>	<ol style="list-style-type: none"> 1. Make sure the controller is connected to the battery by checking the wiring or fuse. 2. Measure your charging current to make sure it is less than 8A (PV7) or 15A (PV14) on the PV+ side of the controller. To check charging current, remove the fuse and insert the amp meter in its place. When the charging light is on, view the amp meter <p>It is a good idea to install a fuse in the orange wire (PV+) side of the controller.</p>
<p>THE CHARGE INDICATOR NEVER COMES ON</p>	<p>Remove the fuse when the panel is charging (in the sun) and first, view the charge indicator. It should be pulsing every second or so. Next, install an amp meter with a 20A rating in place of the fuse to check if the controller is passing the current being made by the panel, to the batteries.</p> <p>If the light is not ON, the battery voltage is less than 13.4V, the wire connections are good and current is not flowing the controller has probably failed.</p>
<p>THE BATTERY IS BEING OVER-CHARGED</p>	<p>Ensure that the batteries are not being charged by another source.</p> <p>If the battery voltage is constantly over 14.4V, the charge light is ON and the batteries are not being charged by another source then the controller may have failed.</p> <p>Remove the fuse. While the solar panels are producing power the controller's charge light should be flashing every second or so. If the charge indicator is not flashing, it is likely that the controller has failed.</p>

***Flexcharge™* USA PRODUCT WARRANTY**

Flexcharge USA products are warranted for a period of two years (five years on NC series charge controllers, and one year on lighting products) from the date of purchase, subject to the conditions set forth below, to the original purchaser to be free from material and workmanship defects. During the warranty period, the product will be repaired or replaced, at the option of Flexcharge USA, free of charge. Products from other manufacturers that are incorporated into Flexcharge USA products such as solar panels and batteries, are covered by warranties from those manufactures.

CONDITIONS

1. **Proper delivery:** The product must be packed to prevent damage and shipped to *Flexcharge USA, 1217 State St., Charlevoix, MI 49720 USA*, freight prepaid and including:
 - a. Proof of purchase. (invoice showing product and date)
 - b. Description of problem.
2. **Abuse, misuse, negligence, unauthorized repairs:** The warranty is void if any defects are caused by abuse, misuse, negligence, or unauthorized repairs. Damage caused by lightning is considered an act of God and is not warranted.
3. All liability for incidental or consequential damages is specifically excluded. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply.

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Come See us at <http://www.flexcharge.com>