Flexcharge™ USA

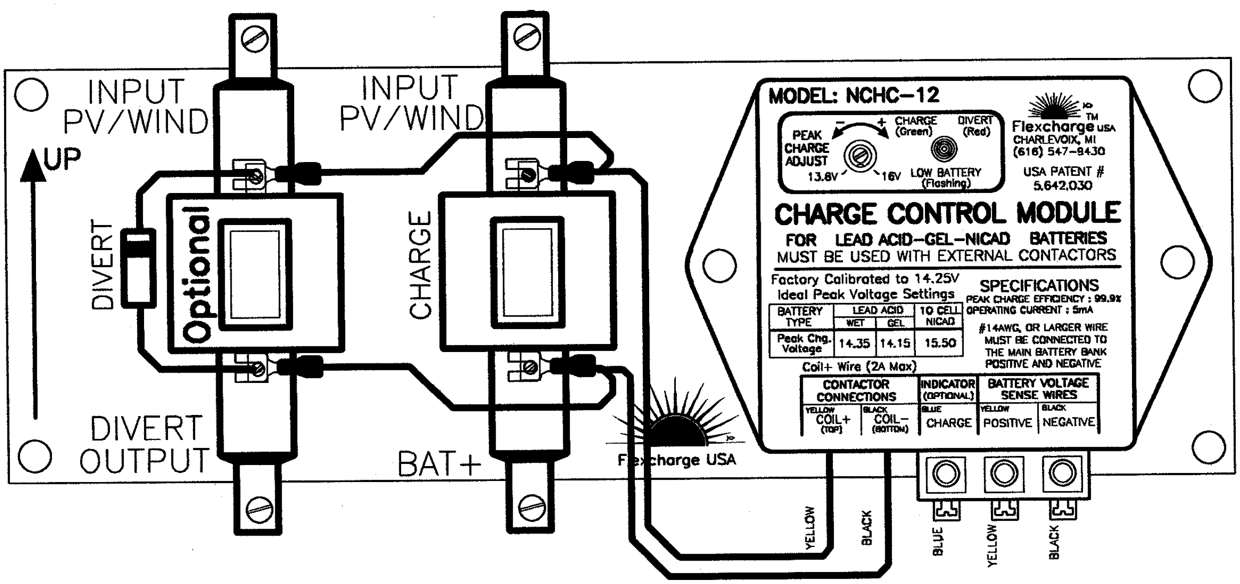
Model NCHC-xx
Owners Manual

Ultra High Efficiency

Industrial Grade, High Ampere, Alternative Energy Battery Charge Controller

MODEL: NCHC-12, 24, 36, 48

For GEL, AGM, and Flooded Cell Lead Acid Batteries



Patented

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

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*** Warnings ***

ALL WIRE TO WIRE AND CRIMP CONNECTIONS MUST BE SOLDERED FOR THIS, OR ANY CHARGE CONTROLLER TO OPERATE DEPENDABLY

IMPORTANT INFORMATION

THE NCHC CONTROLLER IS AN "ON/OFF" REGULATOR NOT A CONSTANT VOLTAGE REGULATOR, AND THEREFORE IT 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 ALL OF THIS MANUAL TO LEARN HOW THE CONTROLLER FUNCTIONS BEFORE CONCLUDING THAT YOUR CONTROLLER IS NOT REGULATING.

Using this controller with Alternator or Generator based systems (wind, hydro, etc.)
A divert load must be used with these charging sources to prevent over speed of revolving generators, and to eliminate the high voltages that will occur at the charge input terminals to the controller. These voltages can be in the 1000V range and could be a safety hazard. Please call or email Flexcharge if you have any questions about this topic. We have load resistors available.

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Features

- **5 Year Warranty**
- **Assembled in the USA Using high quality surface mount components.**
- **Unbeatable 99.5% charging efficiency**
- **Charges batteries from 0 (Zero) volts with full uninterrupted power.**
- **Works with GEL, AGM, and Flooded Cell Lead Acid Batteries. Also for flooded Ni-Cad Batteries**
- **High Ampere charging capacity. Use up to 4ea 100A contactors to regulate 400 amperes. With a special driver circuit, you can expand the NCHC to regulate as much as 2000 Amperes.**
- **Charge divert feature is available (Optional) (required for alternator and generator based systems)**
- **Stable Charge Divert circuitry prevents divert drop-outs even if charge source voltage varies.**
- **Diverts only when voltage and current are at useable levels. Perfect for motor type divert loads (Fans, Pumps, etc..)**
- **Adjustable peak regulation voltage.**
- **Charges accurately through battery isolators, and works perfectly with battery combiners.**
- **The NCHC circuitry uses only 4mA (0.004A) while charging and at night (only 2mA when the charge indicator is not used).**
- **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 start charging at only 0.005A of charging current.**
- **Controller can withstand open circuit input voltage spikes of 1000V without damage.**
- **Reverse polarity and transient voltage protection on the battery sense wires.**
- **No power wasting sample periods.**
- **Voltage Sensing Wires allow greater freedom for mounting the controller further from the battery bank and for accurate charging when shunts and other devices are in the charge path.**
- **Stainless Steel, Nickel, Brass Material used for Connector and contactor terminals**
- **U/L 94V-O Rated Enclosure**
- **Electronics are completely sealed and potted for use in 100% humidity environments.**
- **Other models available for 12, 24, 36, 48 volts and 35, 60, 100 & 200 amp capacities standard.**
- **Custom systems are available in capacities up to 2000 amperes, also with unbeatable operating efficiencies.**

Peak Charge Voltage Adjustment

Factory Calibrated for use with Lead acid and Gel Battery Technologies. Look for the small calibration dent in the case

Do not move this adjustment unless you have special battery voltage requirements.

Multi Function Indicator

See the table on page 7 for description of operation

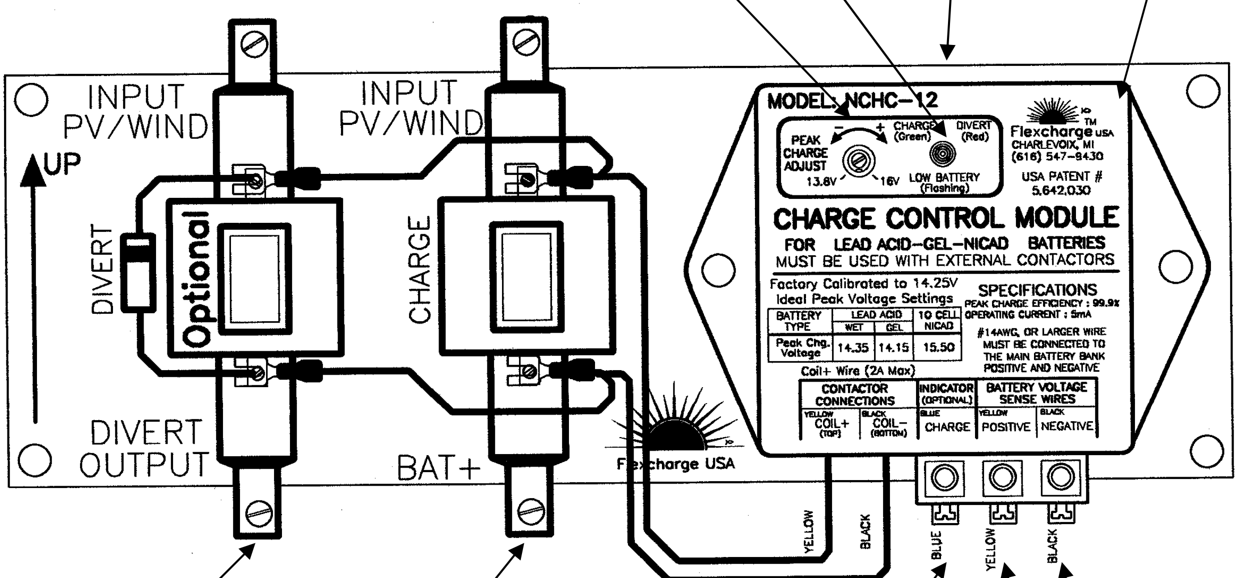
Call Direct to the Manufacturer. Technical Questions, Warranty info, etc

System Voltage

12= 12V, 24=24V, 36=36V, etc

Charging Input

Connect the Positive Wire from the Charging Source Through a Fuse then Connect Here.



Divert Output

Connect to the Divert Load Positive (Optional)

CONNECT THROUGH A FUSE, THEN TO THE BATTERY'S POSITIVE (+) TERMINAL

See Installation Drawings.

Using the charge Indicator is optional

Controller Power and Battery Voltage Sensing

Connect Positive to a 5A Fuse then to Battery

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INSTALLATION INSTRUCTIONS

Flexcharge™ USA NCHC

ULTRA HIGH EFFICIENCY CHARGE CONTROLLERS

Congratulations, you will soon be using the most efficient controller on the market. Using this controller has the direct equivalency of increasing your charging source by approximately 3% over most other controllers.

1. **Choose a good mounting location.** Even though the controller has been designed for mounting in semi-harsh locations, mounting it in a more protected environment will help to extend it's operational life. *The controller MUST BE mounted on a wall or bulkhead vertically. See the up arrow on the mounting plate. It will not operate in any other position. But can tip up to 45 degrees from vertical temporally.*

2. **Install the NEGATIVE BATTERY SENSE WIRE from the controller's BAT- terminal to the battery bank negative (-) terminal. *You should use at least #16 to #14 awg black wire.***

3. **Install the POSITIVE BATTERY SENSE WIRE from the controller's BAT+ terminal to a 5A fuse and then to the battery bank's positive (+) terminal. *You should use at least #16 to #14 awg yellow or red wire.***

   IMPORTANT
   When installing the ring terminals on the sense wires for connection to the battery, crimp then solder the terminals to the wire. Make absolutely sure these wires make very good electrical and mechanical connection with the battery's terminals. If either of these connections were to loosen, or corrode, the controller will have no way to sense battery voltage, causing it to switch to an un-regulating mode and overcharge the batteries. The sense wires can be extended up to 50 feet using #14 AWG wire or farther using larger wire. *All splice joints must be soldered*. If you are charging multiple isolated battery banks through a battery isolator, connect the SENSE wires to the primary (most used) battery bank. The other batteries will follow the primary battery's voltage, and will not be over charged.

   IMPORTANT
   For steps 4 to 7, see the Wire Size Table to select the correct size wire for your charging current and length of wire.

4. **Connect the charging source negative (-) wire to the negative (-) terminal on the battery and/or the system's negative battery bus.** If you are using a smart battery monitor that measurers total Input to Output Amp/Hours, it will usually have a shunt in the (-) connection to the battery. Connect the (-) wire from the charging source to the shunt as shown in the meters manual.

5. **Install the wire from the bottom terminal on the Charge Contactor to the battery's positive terminal. *A fuse must be installed in the positive wire near the battery.***
   Choose a fuse that is 1.5 times larger than the maximum charge current, but no larger than 1.5 times the capacity of the contactor you are using. NOTE: The PEAK CHARGE ADJUST was set at the factory to 14.25V, 28.5V, 42.75V or 57.0V, for 12V, 24V, 36V or 48V battery systems respectively. This calibrated position was marked with a small indent in-line with the slot in the adjuster. If you move the adjustment, and want to put it back near the factory setting, line up the slot with the small indent (dot). **WARNING: Mis-adjustment of the controller could seriously damage your batteries.**

6 **Connect the positive wire from each charging source through a fuse or DC circuit breaker (Code Requirement) to the charge Contactor and optional Divert, Contactor's PV/WIND INPUT, terminals.** CAUTION: IF THE SOLAR PANELS ARE EXPOSED TO LIGHT, THEY WILL BE GENERATING POWER. FREE SPINNING WIND SYSTEMS CAN PRODUCE VOLTAGES NEAR 1000V. For safer installation you should cover the solar panels and stop the generator to connect this wire. If possible, mechanically stop wind generators. If the charging source(s) are active you will see a spark when you connect this wire. The spark will not damage the controller, however it could "pit" the contactor's terminal slightly.

7 **CHARGE INDICATOR LIGHT. It is not necessary to use the Charge Indicator Light**. If you wish to use it, connect the CHARGE INDICATOR TERMINAL on the controller's terminal block to one of the charging source's diodes, at the source end. For example; on a solar panel it would connect to the solar panel end of the diode. See the wiring diagrams. In order to maintain the ultra high charging efficiencies in the NCHC, it may not be feasible to use the charge indicator while charging from outboard motors or on certain wind generators. If you have access to the blocking diode in the charging source, then you can use the charge indicator. A ***much*** more informative indication of charging is an amp meter installed into the Red BAT+ wire anywhere between the controller and the battery.

8 **DIVERT Option.**

If you are installing a Divert Load, the following steps must also be followed.
The DIVERT feature is optional, and requires an additional contactor. The DIVERT allows you to use the unregulated charging energy when the NCHC is in the "FLOAT/DIVERT" mode. **It must be used** with generators and alternators and will also keep a load on charging source when the battery can no longer accept any more charge..

a) **Connect the Divert Load's negative (-) wire to the negative (-) terminal on the battery or the system's negative battery bus.** If you are using a smart battery fuel meter that measurers total Input to Output Amp/Hours, it will usually have a shunt in the (-) connection to the battery. ***Connect the (-) wire from the Divert Load to the battery (-) not to the shunt as shown in the meter's manual. Reason:*** *The DIVERT load is operating from excess (free) power generated by the alternative charging system. No energy is flowing into, or out of the batteries to the divert load when the controller is in DIVERT.*

Choosing the right Divert Load

The Divert output from the controller is unregulated. This means that when the controller is in Divert mode, this terminal is directly connected to the charging source, just as if there were no controller installed.(i.e. The generator is connected directly to the Divert Load) If the divert load draws less current than the maximum charging current of your system, the voltage on the load would approach the open circuit voltage of the solar source causing allowing over speed of the generator. The best rule of thumb is, use a Divert Load with a voltage rating the same as the batteries, and has a current rating equal to the maximum current your system can generate. The Divert feature is useful for running a fans, pumps, heating elements, etc.

This concludes the installation section.

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

For an explanation of the multi function indicator operation, see the Indicator Function Table (refer to the index)

Controller Calibration

Every Flexcharge NCHC controller is calibrated at the factory prior to shipping. No calibration is required unless you wish to change the Peak Charge Adjustment setting, or you have moved it. Follow this procedure to re-calibrate your controller.

Setting the Peak Charge Adjustment Voltage to a new value

WARNING: **Mis-adjustment of the controller could seriously damage your batteries over time.** NOTE: The PEAK CHARGE ADJUST was set at the factory to 2.375V per cell (14.25 volts for 12V systems). The Ideal voltage setting for Wet Cell Lead Acid Batteries at typical room temperatures is 2.39V per cell, (14.35V for 12V systems). The Ideal setting for Sealed Gel batteries is 2.35V per cell (14.15V for 12V systems). The 2.375V per cell position is marked with a small indent in-line with the slot in the adjuster. The 2.37V per cell voltage setting works well with Wet Cell Lead Acid, AGM and gel battery Technologies. If you move the adjustment and want to put it back near the original setting, line up the slot as closely as possible with the small indent (dot) in the case. **You should re-calibrate the controller if the adjustment is moved.**

1) Setting a new regulation voltage, or checking the regulation voltage of your controller.

NOTE: THE BATTERY BANK MUST BE FULLY CHARGED TO MAKE THIS TEST, AND THE DIVERT LIGHT MUST BE *OFF* LONGER THAN 10 SECONDS AT A TIME. If the charge indicator light is switching from OFF to ON too quickly you may cover some the solar panels or wait until the sun is very low in the sky or the wind is lighter.

a) **Connect an accurate digital voltmeter on the terminals of the battery you are charging.**

b) **If you are only checking the unit, skip this step, and step "d".** Turn the adjustment most of the way Clock Wise (CW) The dot in the case near the adjustment is the factory setting of 2.375V per cell**.**

c) **Watch the voltmeter for the highest voltage you wish the batteries to charge to.**

d) **SLOWLY Turn the adjustment Counter Clock Wise (CCW) until the DIVERT indicator comes ON (steady red or orange).**

e) **Allow the controller to cycle a few times while watching the voltmeter, and fine tuning the adjustment for the exact upper switch voltage you desire.** ***Remember the controller will switch ON and OFF (Charge to Divert then back to Charge) while you are performing this test, and if it is switching too fast your voltmeter readings will be inaccurate which could cause you to set the controller at the wrong voltage. This is because of the programmed switching delays (filtering) in the voltage detection circuitry.***

Easier Calibration Method (You must have a regulated charging source such as the engine alternator, or a portable generator.

Start your engine, and allow the engine alternator to charge your batteries up to about 14.4 volts (for 12V systems). Then simply turn the adjustment on the NCHC (CW) until the DIVERT light turns OFF then **slowly** turn it back (CCW) until the RED DIVERT light comes ON. The NCHC will now regulate the battery voltage at the same voltage as your engine alternator, which is usually about 14.4V

Coat the battery's terminals with battery terminal grease to prevent future problems caused by corrosion.

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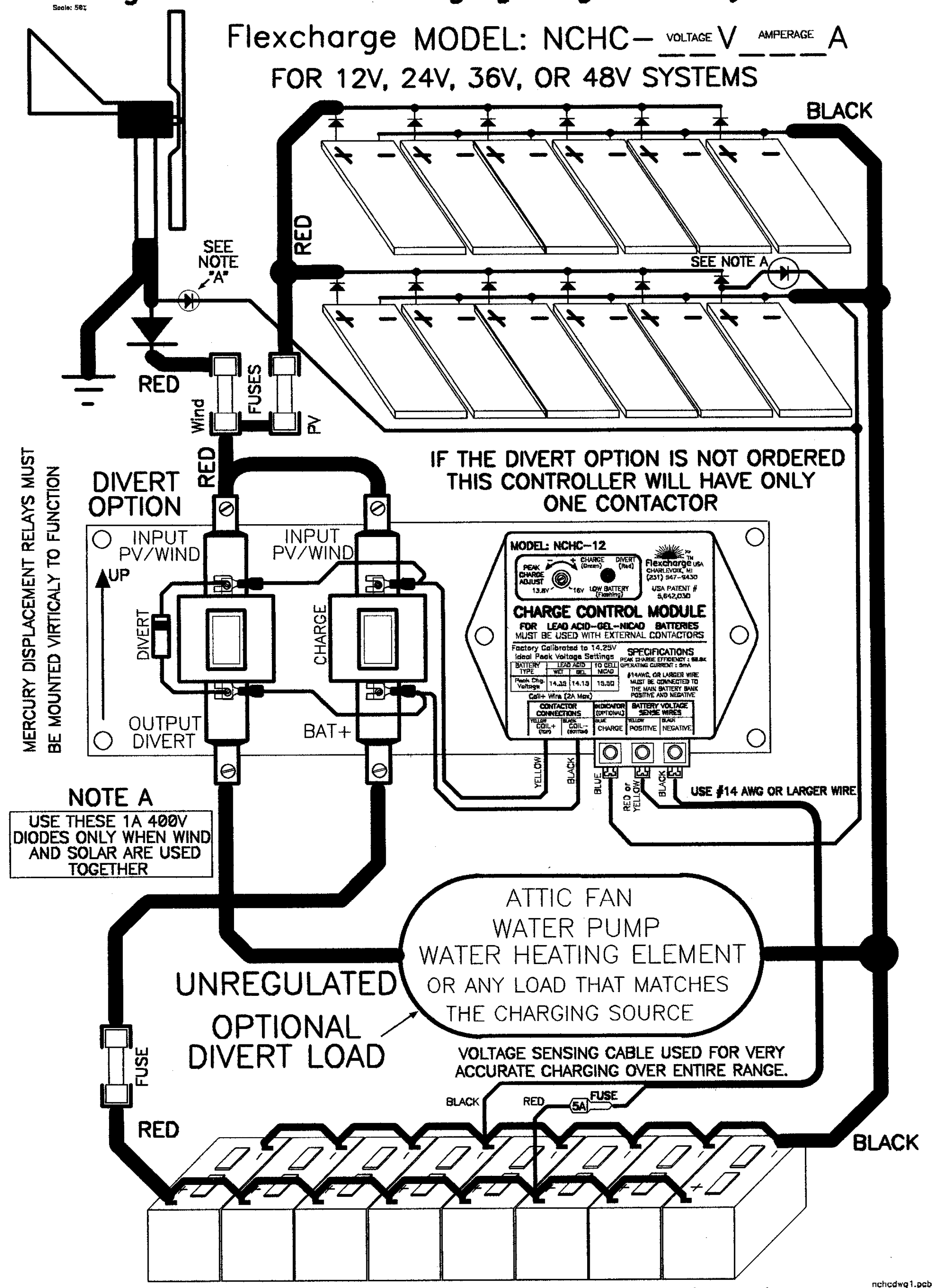
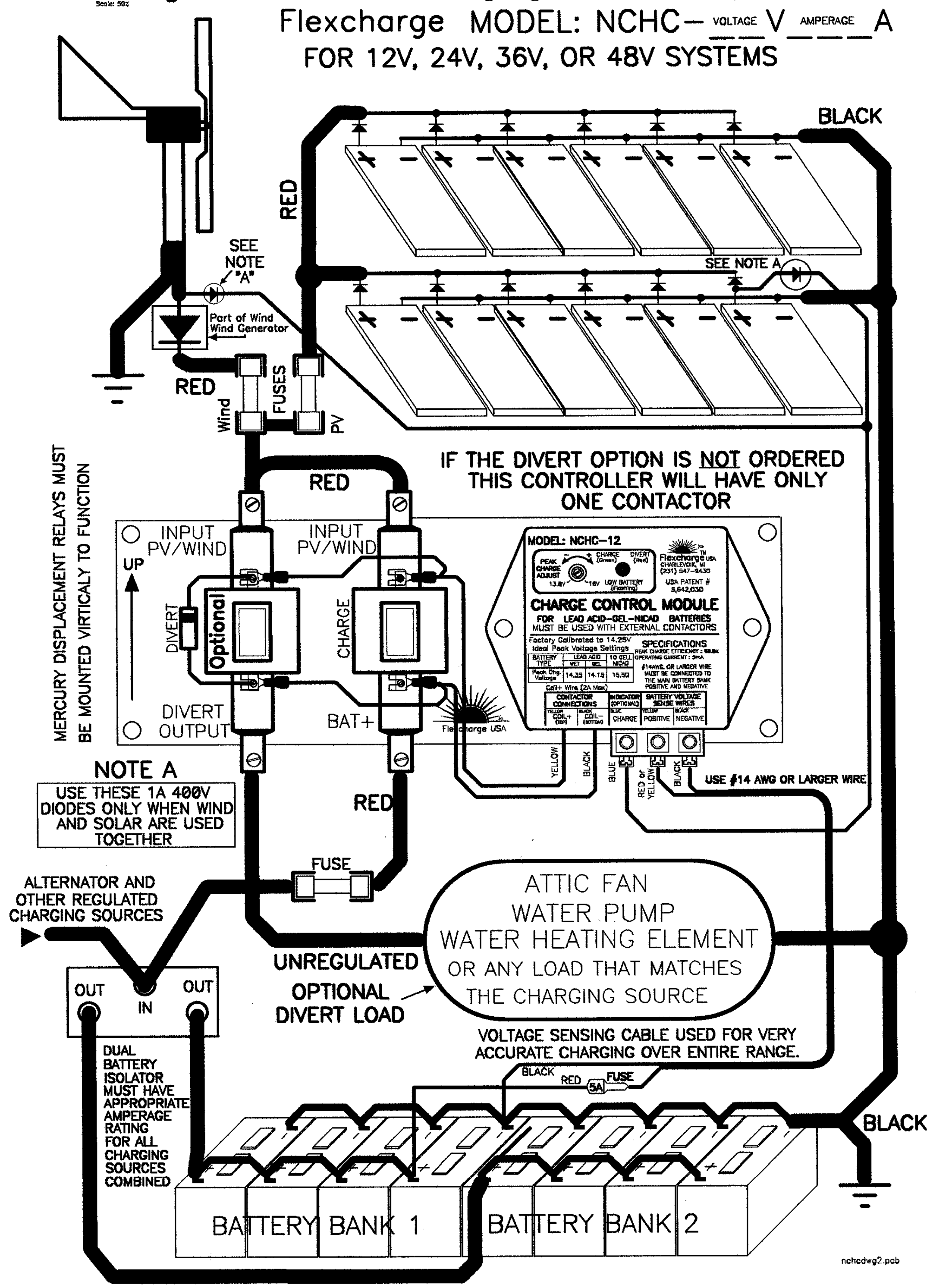
Wiring Schematic – Charging Single Battery Banks



12V System is shown. Different voltage systems will require that the solar panels and batteries be wired appropriately.

Wiring Schematic – Charging Dual Battery Banks



12V System is shown. Differnt voltage systems will require that the solar panels and batteries be wired appropriately.

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Controller Specifications

Flexcharge NCHC	Min	Max	Min	Max	Min	Max	Min	Max
Model Number	NCHC-12V		NCHC-24V		NCHC-36V		NCHC-48V	
Input Voltage Transients	-	1000V	-	1000V	-	1000V	-	1000V
Input Voltage Continuous	0V	100V	0V	100V	0V	100V	0V	100V
Operating Current (Charging & Standby)	2 mA	5 mA	2 mA	5 mA	2 mA	5 mA	2 mA	5 mA
System Size Limits	0.1A	Contactor Rating	0.1A	Contactor Rating	0.1A	Contactor Rating	0.1A	Contactor Rating
Total Efficiency	98.9%	99.90%	98.9%	99.92%	98.9%	99.96%	98.9%	99.98%
Insertion Loss Resistance (Ohms)	0.0005	0.002	0.0005	0.002	0.0005	0.002	0.0005	0.002
Divert Current Capacity	-	Contactor Rating	-	Contactor Rating	-	Contactor Rating	-	Contactor Rating
Operating Temp.	-20°C	+60°C	-20°C	+60°C	-20°C	+60°C	-20°C	+60°C
Storage Temp.	-40°C	+70°C	-40°C	+70°C	-40°C	+70°C	-40°C	+70°C
Dimensions	9"W x 4 1/2"H x 2 3/8"D							

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.

Description of Status Indicator Operation

(Voltages are for 12V System)

Indicator Function Description	Charge Indicator *Not Used*	Charge Indicator *Used*
Charging (Battery Voltage Is Above 11V)	**None**	**STEADY Green**
Charging (Battery Voltage Is Below 11V)	**FLASHING Red**	**FLASHING- Green to Orange**
Not Charging (Battery Voltage Is Below 11V)	**FLASHING Red**	**FLASHING Red**
Charge Divert	**STEADY Red**	**STEADY Orange**
Not Charging (Charging Source is NOT Making Power & Battery is Above 11V)	**None**	**None**
Fault / Installation Error (Sense Wire(s) are not making good connection to the battery)	**None**	**None**

The *Flexcharge*™ Energy State Taper Charge Process

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

Discover the tremendous advantages 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 battery's chemical processes actually control the charging.

The need for temperature compensation is 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.

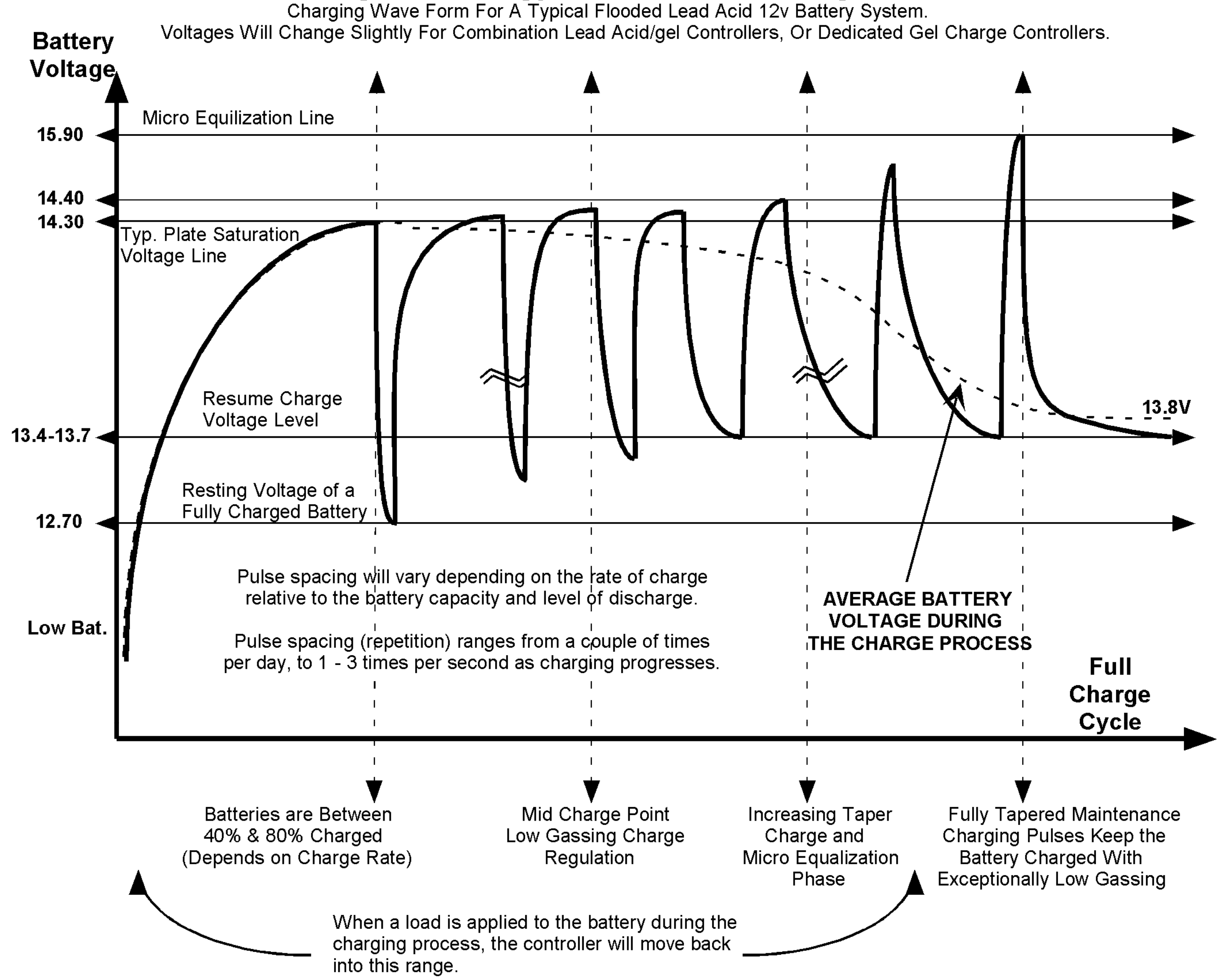
As charging begins the controller allows full charging current to pass directly to the battery. When the battery voltage rises slightly above the plate saturation point, the controller opens the charging circuit. Much like a sponge will continue to absorb water towards its center after it has taken it 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 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. A process, which 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 allot 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. We have seen 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, and 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 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 and only when it needs it. You will realize less plate saturation gassing, non destructive equalization and Zero EMI and RFI as well. Electro-Magnetic-Interference (EMI), and Radio Frequency Interference (RFI) is electronic noise that can interfere with radio and navigation equipment.

Charge Controllers which use the Energy State Taper Charge Method and purely mechanical power switching elements are best suited for charging systems where the charging current is less than 1/4 the amp hour rating of the battery bank due to the higher number of switching operations required for charge regulation. 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, however we implement them in such a way as to provide exceptional levels of dependability.

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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READ THIS!! 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 many solar panel and equipment manufacturers; 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 main types of diodes, *Schottky* (sensitive to damage but low loss type) and *Silicon* (tough, but higher loss type). 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 positive wires. This is enough voltage to damage most solar panels. Note: the diodes that come in the solar panels are "By-Pass" diodes and do not serve the same function as a blocking diode.

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 increase the power.

HOOKUP WIRE POWER LOSS TABLE

(FROM Anaconda Wire Co. Data Sheets)

System Charging Current (Amperes)

Wire Gauge	Resistance Per Foot (Ohms)	10A	20A	40A	60A	80A	100A
8	0.0006498	0.0650	0.2599	-	-	-	-
6	0.0004088	0.0409	0.1635	0.6541	-	-	-
4	0.0002571	0.0257	0.1028	0.4114	0.9256	-	-
2	0.0001617	0.0162	0.0647	0.2587	0.5821	1.0349	-
1	0.000102	0.0102	0.0408	0.1632	0.3672	0.6528	1.0200
1/0	0.0001016	0.0102	0.0406	0.1626	0.3658	0.6502	1.0160
2/0	0.0000798	0.0080	0.0319	0.1277	0.2873	0.5107	0.7980
3/0	0.000063	0.0063	0.0252	0.1008	0.2268	0.4032	0.6300
4/0	0.00005	0.0050	0.0200	0.0800	0.1800	0.3200	0.5000

Watts Of Power Wasted Per Foot Of System Wiring

Your goal is to keep wiring losses to less than 3%.

TO USE THIS TABLE:

DETERMINE THE DISTANCE BETWEEN THE CHARGING SOURCE AND THE BATTERIES, THEN MULTIPLY BUY 2. THIS WILL GIVE YOU THE TOTAL CONDUCTOR LENGTH.

FIND THE COLUMN CORRESPONDING TO YOUR MAXIMUM CHARGE CURRENT.

MULTIPLY YOUR TOTAL CONDUCTOR LENGTH BY THE PER-FOOT POWER LOSSES FOR DIFFERENT SIZE WIRES THAT YOU ARE CONSIDERING USING.

WHEN SELECTING A WIRE SIZE, BIGGER IS ALWAYS BETTER; HOWEVER YOU WILL NEED TO BALANCE THE AMOUNT OF WASTED POWER YOU CAN LIVE WITH, AND THE COST OF THE WIRE. TRY TO KEEP THE WASTED POWER LESS THAN 3%, OR 0.03 TIMES YOUR MAXIMUM CHARGE POWER. $P_{LOSS\ max.} = 0.03 \times 14_V \times I_C$

EXAMPLE: What is the power loss in the system wiring if #6 AWG wire is used on a 40 amp 12V system when the solar panels are 20 feet from the batteries?

Recommended Max. power loss = 3% x (Peak Charge Voltage) x (Max. Charge Current)
= 0.03 x 14.2V x 40A = 17 Watts

Total conductor length = 2 x (Wire distance between charging source and batteries)
= 2 x 20 ft. = 40 ft.

Power loss = (Total conductor Length) x (Power Loss From Table)
= 40ft. x 0.6541W/ft$_{\text{from table}}$ = 26 Watts wasted power

SELECT A LARGER WIRE AND RECALCULATE.

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Flexcharge™ CHARGE CONTROLLER TROUBLESHOOTING GUIDE

IF YOU ARE USING CRIMP CONNECTORS IN YOUR SYSTEM WIRING, THEY MUST BE SOLDERED. CRIMP CONNECTIONS WILL ONLY MAKE *GOOD* CONNECTION FOR ABOUT 8 MONTHS, EVEN LESS IN A MARINE OR OUTDOOR ENVIRONMENT.

PROBLEM	SOLUTIONS
Charge Indicator does not light.	Using the Charge Indicator is optional Verify that the Charge Indicator terminal is wired to the NON-BANDED side of a blocking diode on ONE OF THE SOLAR PANELS, or on the wind generator. (SEE THE INSTALLATION INSTRUCTIONS). When charging through a diode type battery isolator the charge indicator terminal may be connected directly to the Input + terminal on the controller. If the charge indicator is connected to the charge input terminal it will illuminate whenever the batteries are being charging from other charging sources. Check the connection on the battery sense wires. The charge indicator will not light if the ground wire is not connected. Disconnect the wire from the Charge Indicator terminal, and temporary jumper the terminal over to the controllers battery + terminal. You can use the Battery's Positive terminal (The Sense wires must be connected). It should light. If it does not see warranty return instructions.
Charge Indicator is ON all the time.	Verify that the Charge Indicator terminal is wired to the NON-BANDED side of a blocking diode on ONE OF THE SOLAR PANELS, or on the wind generator. (SEE THE INSTALLATION INSTRUCTIONS). The diodes found on the back of most Solar Panels are bypass diodes not blocking diodes. You will need to add blocking diodes. If you are using the NCHC with a Battery Combiner the Charge Indicator wire must be connected to the charging source side of the blocking diode, also, connect the battery sense wires to the Primary battery bank.
The Divert Light is ON when the PV or Wind system is not generating power.	The batteries are being charged by another source, such as an engine alternator. The NCHC will switch to Divert whenever the battery voltage is driven above the peak charge voltage setting on the NCHC. This feature isolates the charging source(s) from the batteries when the battery is charged by any source to the plate saturation voltage, and it is automatically reconnected when the battery voltage falls to approximately 2.28V per cell. You can use this as an indictor showing when the batteries are between 50% and 100% charged no matter what charging source is being used.

The Divert Indicator does not Illuminate.	**The controller must first reach the peak charge voltage before Divert will engage.** This Indicator will only illuminate while the battery voltage is between the peak charge voltage and reconnect voltage (factory set at 14.25V / 13.7V, but is user adjustable). Check **ALL** the system power wire connections. **Check the Battery Sense Ground Wire for a good connection.** These wires are the only way the controller can determine battery voltage and control charging. A poor connection here could over charge the batteries and cause SERIOUS DAMAGE to your battery bank, and other electronics connected to it. Return the unit for warranty repair or replacement if it is less than 5 Years old and you have proof of purchase (See warranty restrictions).
The controller does not switch to FLOAT/ DIVERT when the battery voltage is equal to, or above the Peak Charge Point.	**Check the Battery Sense Wires for good connections.** These wires are the only way the controller can determine battery voltage and control charging. A poor connection here could cause SERIOUS DAMAGE to your battery bank, and other electronics connected to it. **Make Sure ALL wire to wire and crimp connections are soldered.** Check the position of the Peak Charge Adjustment. Unless you have custom set this adjustment, it should be set to the dot on the case.
The battery is being overcharged.	Check the position of the Peak Charge Adjustment. It should be set at the small calibration dot on the case, unless you have custom set your peak charge voltage. **DO NOT MOVE THE ADJUSTMENT unless you have calibrated test equipment and a fully charged battery bank to re-calibrate the controller**. **MIS-ADJUSTMENT COULD CAUSE SERIOUS DAMAGE TO YOUR EXPENSIVE BATTERY BANK. If it is not at the dot and you did not custom set your peak charge voltage, see the installation instructions for the calibration procedure, or call your dealer.** Check the continuity of the Fuse, and Battery Sense Wires for very good connections. These wires are the only way the controller can determine battery voltage and control charging. Make Sure ALL wire to wire and crimp connections are soldered .
The batteries are not being charged when the charging source is generating power	This problem indicates the power carrying wires have a poor or non-connection between the charging source and the battery. **Check all connections and , <u>MAKE SURE ALL wire to wire and crimp connections are soldered</u>**. Insert an Amp Meter in place of the controller's Bat+ fuse. With the solar panels in full sun and the Charge/Divert light in charge mode, verify that the amp meter reads an expected amount of current. If the divert light is ON the amp meter will read approximately 0.1 to 0.4 amps.
Controller makes a "Klunk – Klunk" or Buzzing sound.	This will happen when the charging source is charging while the wire from the Controller's Battery + Terminal and the Sensing+ terminal wire are connected together, but removed from the Battery terminal. This could happen if you wired the Sense+ and Bat+ wires through a Battery switch, similar to the ones found on medium size boats, and the switch is turned OFF. *If left in this state for even a few minuets the controller will be damaged.* Disconnect the charging source, or separate the Controller's battery + terminal and the Sense + wires until the installation is completed. Removing either the Charge+ or Sense+ fuse will also work.

Flexcharge™ USA

Flexcharge™ USA PRODUCTS WARRANTY

Flexcharge USA products PV model controllers 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. This warranty to the original purchaser, warrants the products 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. Shipping not included 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 SES *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.