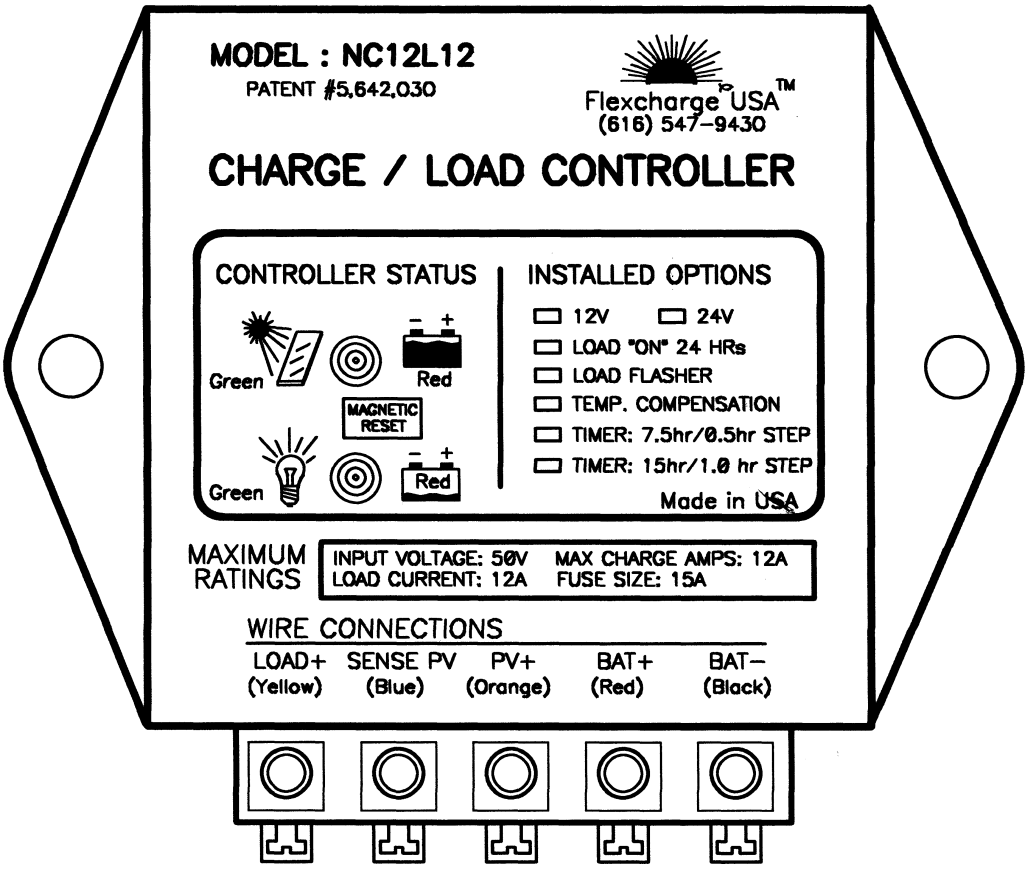
Flexcharge™ USA

Manual

Installation & Operation

Model: NC12L12
12A Solid State Solar Charging Regulator and 12A Load Controller.



Patent #: 5,642,030 Applies

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

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Warnings

When Installing, connect grounds first, then Battery+, PV+ and then install the Fuse in that order. This not required however it will reduce the risk of arcs and sparks.

ALWAYS SOLDER AND WEATHER SEAL ALL system wire-wire and wire-crimp terminal connections. The system will be plagued with operational problems shortly after it is installed if this is not done. This is true for any controller in a PV system.

Before touching the 12V/24V select wire on the back of the unit, touch and hold a system ground connection with one hand. This will help reduce any chance of potentially damaging High Level Static Discharge into the controller.

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Features

- Waterproof packaging.
- Reverse battery polarity connection protected.
- Easy to read LED indicators clearly display the controller's status.
- High efficiency charging circuitry. Insertion Loss resistance of only 0.080 Ohms on 12A Model. Only 0.008 Ohms on 30A model.
- Field select for 12V or 24V operation. Shipped ready for 12V systems, simply cut a wire jumper for 24V
- Order with Load ON at Dusk, OFF at Dawn operation, or Load always ON.
- Low Voltage Disconnect (LVD) Disconnects the load if the battery energy is depleted.
- Manual Load Test / LVD Reset magnetically operated switch located under the load status indicator. Easily reset the LVD circuit after installation and test the controller's load circuitry.
- Delayed Low Battery Disconnect to prevent disconnects during momentary high load currents.
- Delayed dawn sensing circuit to prevent load switching during momentarily bright light levels (i.e. Lightning flashes, vehicle lights).
- Small enclosure 3"H x 3"W x 1.5"D + mounting feet.

Options

- Temperature Compensation
- High current models (NC3012, NC1230, & NC3030) 30 ampere charge and/or load capacities.
- Integral Digital Load Timer. Use with Dusk to Dawn Model. Starts timer at dusk then turns the load OFF after the selected time has elapsed. Set Run times up to 7.5 hour in ½ hour increments or 15 hours in or 1 hour increments, includes SES Flexcharge Patented Dawn Override Circuitry.
- Integral Load Flasher circuitry. Order flash repeat times from 0.25 sec to 10 sec with ON-Times from 0.1 sec to 5 sec. Perfect for Solar Powered Marine Navigation Lightning Systems.
- Voltage sense wires allowing the controller to be installed anywhere between the PV panels and the batteries.

Installation Guide

- Unpack the controller and inspect it for shipping related damage.

- **12V / 24V Operation**

The controller is shipped ready for 12V systems. To select 24V, touch the copper part of the controller's black wire and using a small pair wire cutters, cut the loop of silver wire which protrudes through the potting material on the back of the controller.

- **Mounting**

Mount the Controller where it is protected from direct exposure weather, and where it will not be exposed to high vibration (i.e. on an engine block). Generally the ambient temperature should not exceed about 130°F.

The controller should be mounted within 8 wired feet of the battery bank for best voltage sensing.

- **Remove the Fuse prior to making wire connections.**

- **Wire Connections.**

(For 30A models use #10AWG or large gauge wire for connections)
You may choose to install a quick disconnect connector to the controllers wire pig tails provided it is rated for the system current levels and environment where it will be installed.

Connect wires from all system grounds (PV-, Load- & Earth Ground) to the battery negative terminal. Install a BLACK #12AWG (or larger) wire from the battery bank's negative terminal and solder it to the controller's Black wire.

Install a RED #12AWG (or larger) wire from battery bank's positive terminal to the controller, and solder it to the controllers RED wire.

Install a BLUE #18AWG (or larger) wire from the solar panel side of the blocking diode on ONLY ONE of the solar panels to the controller, and solder it to the controller's blue wire.

Install an ORANGE #12AWG (or larger) wire from the banded side of the blocking diode of each solar panel to the controller, and solder it to the controller's ORANGE wire.

Install an YELLOW #12AWG (or larger) wire from the Load's positive input terminal to the controller, and solder it to the controller's YELLOW wire.

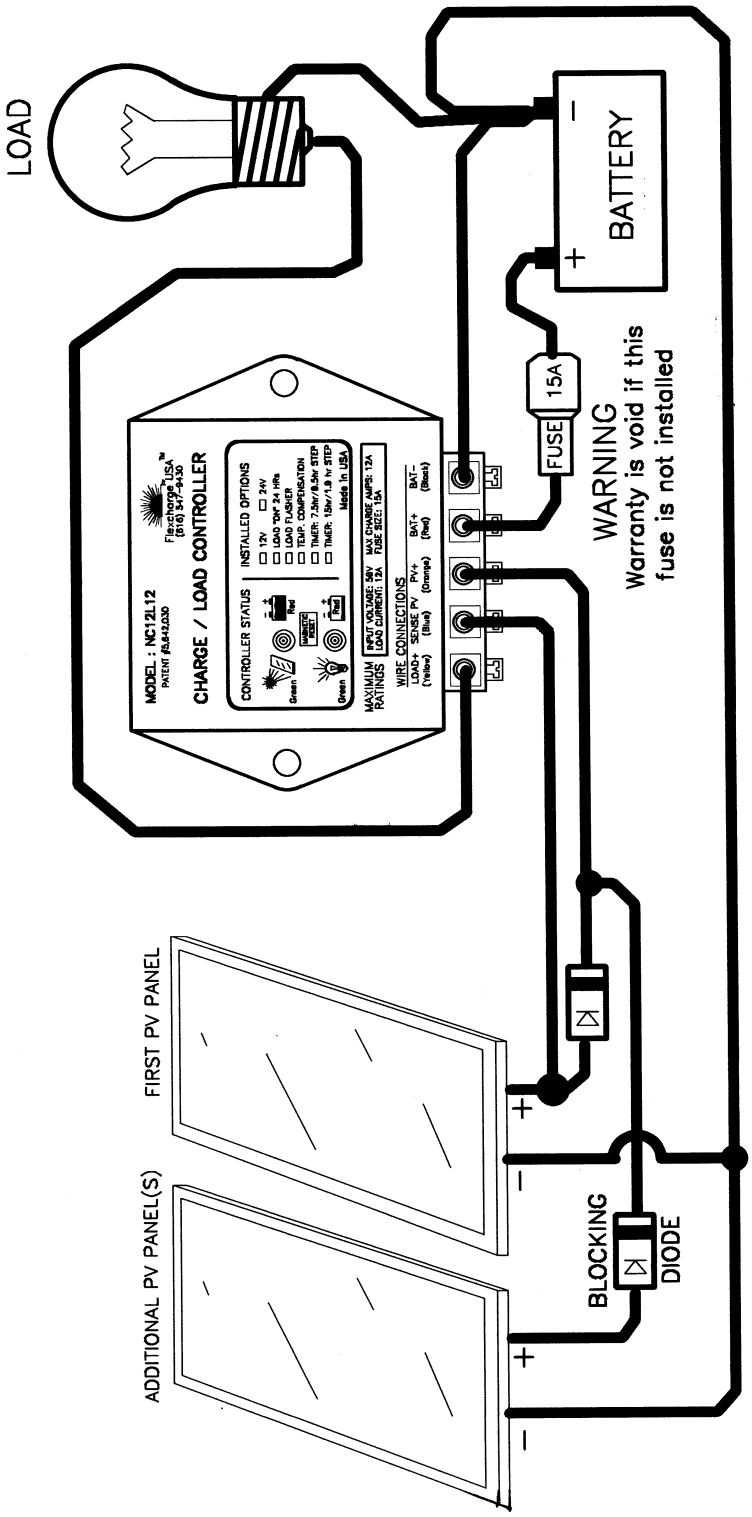
- If you purchased the Temperature Compensation option, place the sensor near or on the battery.

- Install the fuse.

- Pass a magnet over the Load indicator to reset the Low Voltage Disconnect circuit and to test the load.

- Installation complete.

Wiring Diagram



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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.

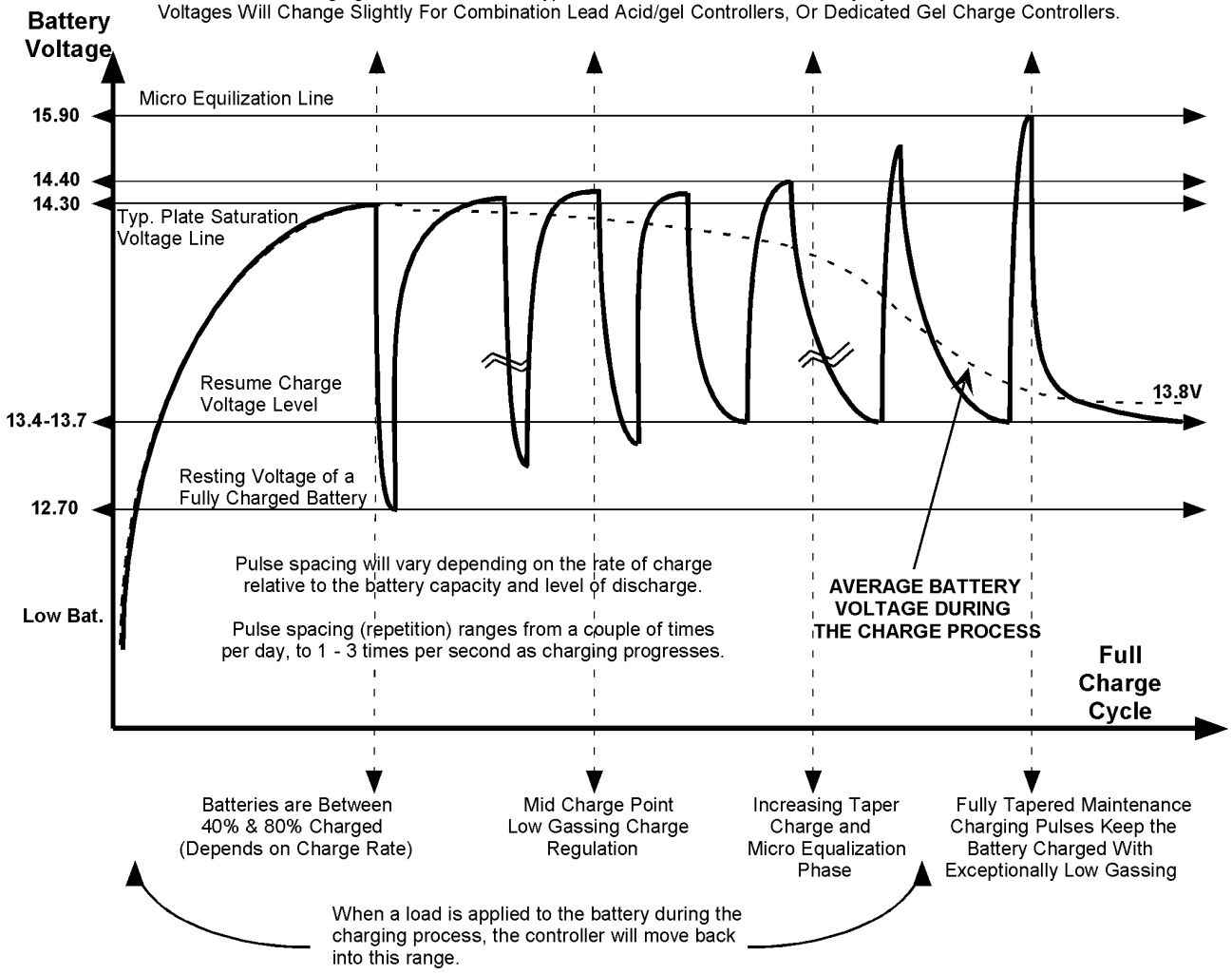
As charging begins the controller allows full charging current to pass directly to the battery. When the battery voltage rises slightly above the plate saturation point, the controller opens the charging circuit. Much like a sponge will continue to absorb water towards its center after it has taken it 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.

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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Troubleshooting Guide

Charge Section	
Charge LED does not illuminate while the battery is being charged. (Note: Using the Blue wire and Charging indicator is optional for always ON models. It is required for dusk to dawn equipped models.)	• Check the fuse both visually and with an Ohm meter. • Verify the blue wire is connected as shown in the installation diagram. • Verify the solar panels are generating at least the same voltage as the battery (Measure Blue wire to GND and Red wire to GND). • Check Solar panel negative wire connections. Check Controller black wire connections. • If all the above do not fix the problem the indicator may have failed.
Red LED indicator is ON when it seams the battery should be charging. (Voltages are different with temperature compensation feature)	• The Red LED will turn ON when the battery voltage has reached its peak voltage of 14.2V (28.4V for 24V systems). It will stay ON until the battery voltage falls to about 13.7V (27.4V for 24V systems). • If the battery is being charged by a second charging source which holds the battery voltage above 13.7V (27.4V) after reaching 14.2V (28.4V) the controller will stop PV charging and display the RED indicator.
Battery voltage overshoots during charging.	• If the duration is less than 2 seconds this is normal. (See the "Energy State Taper Charge" graph, micro-equalization). • If the battery voltage is held at 14.4V (28.8V) for more than 10 sec. The controller may have failed. You may call Flexcharge or return the unit for evaluation.
Charge voltage on the Orange wire measures the same as the battery voltage on the Red wire	• This is normal when the Green charge light is ON. It should be about 0.5V less with the Green **and** Red light OFF • When the RED charge indicator is ON and the PV panels are in sunlight, the PV voltage will go to its open circuit voltage of 18V to 22V (36V to 44V for 24V systems)
System will not charge when battery voltage is below 5V.	• The controller requires 5V minimum to operate its circuitry. Jumper the orange and Red wire together until the battery is charged up to at least 7V. You may allow it to charge as high as 14V in this configuration. Then put the wiring back to normal. Determine what load drained the battery. System monitoring equipment (i.e. volt meters, Amp hour meters are notorious for this).
Battery is not getting to its full charge voltage of 14.2V before the controller starts regulating.	• Check the Red and Black wire connections and the fuse between the controller and the battery. A high resistance (Bad) connection in these wires will cause this. • If you installed wire smaller than 12AWG or you mounted the controller more than 10 feet from the battery. Increase the Wire Gauge.
Load Section	
Model with Dusk to Dawn Load control does not come on at dusk	• Verify the Blue wire is connected to the solar panel side of the PV blocking diode on ONLY ONE of the PV panels. A PV blocking diode MUST BE INSTALLED on the panel that will be used for light sensing. An optional Photo cell light sensor is available for people who do not wish to install PV blocking diodes. • Check the Blocking diode at the solar panel. • Reminder; ALL PV manufacturers recommend that Blocking diodes be installed on each PV panel's positive wire.
Load disconnect activates (Red LED ON) when the battery should have a good charge level.	• Check the Red and Black wire connections and the fuse between the controller and the battery. A high resistance (Bad) connection in these wires will cause this. • You may have a weak cell in the battery bank. Check the specific gravity of battery's cells. • If you installed wire smaller than 12AWG or you mounted the controller more than 12 feet from the battery. Increase the Wire Gauge.
Green Load Indicator is ON However Load is not ON	• The power for the load indicator is taken from the Yellow wire, therefore check the wiring between the load and the controller, and check the load.

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Operating Characteristics

Parameter	12V Selected	24V Selected
Regulated Peak Charge Voltage	14.25V	28.50V
Charge Reconnect Voltage	13.70V	27.40V
Dusk - Load ON	15min to 30min After Sunset	15min to 30min After Sunset
Dawn - Load OFF	15min to 30min Before Sunrise	15min to 30min Before Sunrise
Low Voltage Disconnect (LVD)	10.92V	21.84V
Auto LVD Reset (continuous ON mode)	12.9V	25.8V
Auto LVD Reset (Dusk to Dawn mode)	With Charge LED ON	With Charge LED ON
Controller Parasitic current		
Charging	5.0mA	5.0mA
Standby	2.3mA	2.3mA
Load ON	4.0mA	4.0mA
LVD	5.6mA	5.6mA
Input Voltage/Current Limits (12A Model)		
PV Voltage	50V	50V
Battery Voltage	50V	50V
Charge Current	12A	12A
Load Current	12A	12A
Fuse Size	15A	15A

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.