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## User Manual for PFC Series Charger

### 1. Overview

The PFC series chargers are suitable for charging lithium ion battery packs such as those used in electric vehicle applications. The PFC series chargers are designed to work seamlessly with Elite Power Solutions' Energy Management System through the CAN interface or digital input for safe battery charging. Standard safety features include protection against a short circuit on the charger output, reverse polarity, over charging, over temperature, etc.



## 2. Technical Parameters

### 2.1 Specifications

- Model: PFCXX-YY (XX: Output Voltage, YY: Output Amps)
- Power factor:  $\geq 99\%$
- Efficiency:  $\geq 92\%$
- Input voltage range: AC 85 ~ 242V
- Frequency range: 45 ~ 65Hz
- Communication: CAN and 12V Digital Input

### 2.2 Operating Environment

- Altitude:  $\leq 2000$  Meters
- Temperature:  $-35^{\circ}\text{C} \sim 65^{\circ}\text{C}$
- Storage environment:  $-40^{\circ}\text{C} \sim 100^{\circ}\text{C}$  – Keep away from combustible materials
- Vibration: SAEJ1378
- Water resistance: IP31
- Installation Stress:  $\leq$  level 5
- Humidity: 5%~70% RH – No condensing, keep away from exposure to moisture

## 3. Charging Status and Alarm Status Indication

### 3.1 Alarm Indication

- |   |                                    |
|---|------------------------------------|
| <input type="checkbox"/> Reverse polarity or low voltage: | Red light blinking, 20% light on   |
| <input type="checkbox"/> Charger over heating:            | Red light blinking, 40% light on   |
| <input type="checkbox"/> Ambient temperature too high:    | Red light blinking, 60% light on   |
| <input type="checkbox"/> Charging time out:               | Red light blinking, 80% light on   |
| <input type="checkbox"/> Over Voltage Protection:         | Red light blinking, 100% lights on |
| <input type="checkbox"/> BMS alarm/charging interruptions | All LED's blinking                 |

### 3.2 Charging Status Indication

- |   |                     |
|---|---------------------|
| <input type="checkbox"/> Shutdown status: | Six lights blinking |
|---|---------------------|

- |                                  |  |
|----------------------------------|--|
| □ Charging stage:                | Percent light indicating pack voltage vs. max charging voltage |
| □ Battery presence not detected: | Red light blinking, 20% light on                               |
| □ Charging complete:             | All green lights on  |

#### 4. Functions

4.1 Output short circuit protection.

4.2 Over-temperature protection:

Temperature less than 85°C – Full charging power

Temperature is 85°C to 95°C – Power reduced to 50%

Temperature is greater than 95°C – No output

4.3 Reverse polarity protection: charger will not turn on if the battery pack is connected backwards (or less than 5V).

4.4 A switch on the charger marked “Override” is used to select either external or internal controlled charging.

Override Off – Use with EMS system, either CAN or digital input

Override On – Charger program based on pack voltage only (recommended for testing purposes only, do not use for normal charging).

4.5 When external control is selected and a CAN signal is used, if any cell reaches the recharge set point (default 3.7V as signaled by the EMS) the charger will automatically enter the final recharge cycles.

4.6 Recharge cycles. When the EMS detects any cell has reached the recharge set point (default 3.7V) or above, the charger reduces the charge current to zero amps for five minutes to allow the EMS to balance the battery pack. The charge will resume after five minutes at half the previous charge current and will again charge until it receives a signal from the EMS that a cell has reached the recharge set point. These recharge cycles continue until the charging current reaches the minimum charging current to complete the charging process.

4.7 Digital alarm input:

0.0V – 2.0V: Charging stopped

2.5V – 12.0V: Enable charging or resume charging

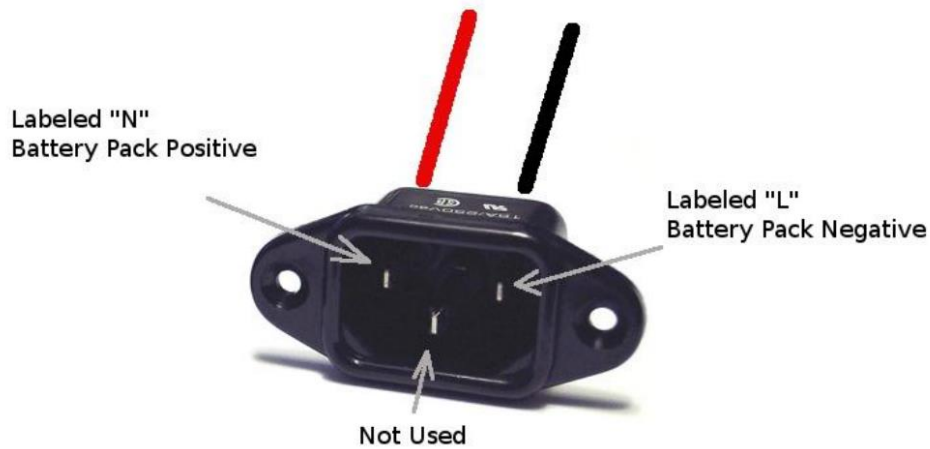
4.8 When both CAN and the digital control signals are available the charger is controlled by the CAN communication signal.

## 5. Connections

### 5.1 IEC Connector

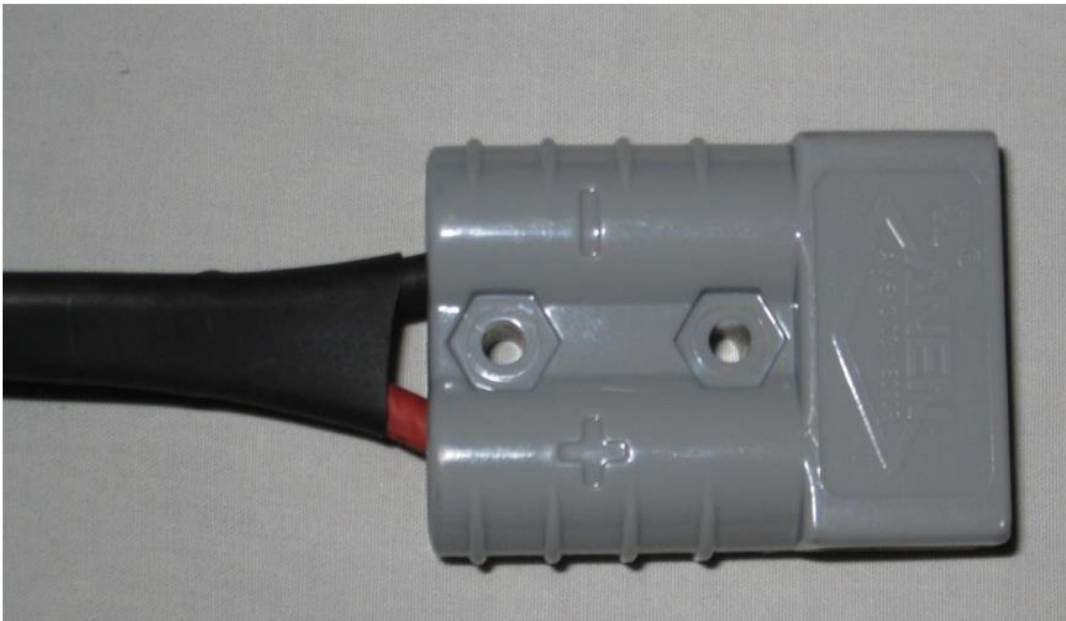
For PFC chargers which output 10A or less the charger comes with an IEC type connector for the output. The connections to the battery pack are made as follows:

### 6A and 10A Charger Connector



### 5.2 Anderson SB50 Connector

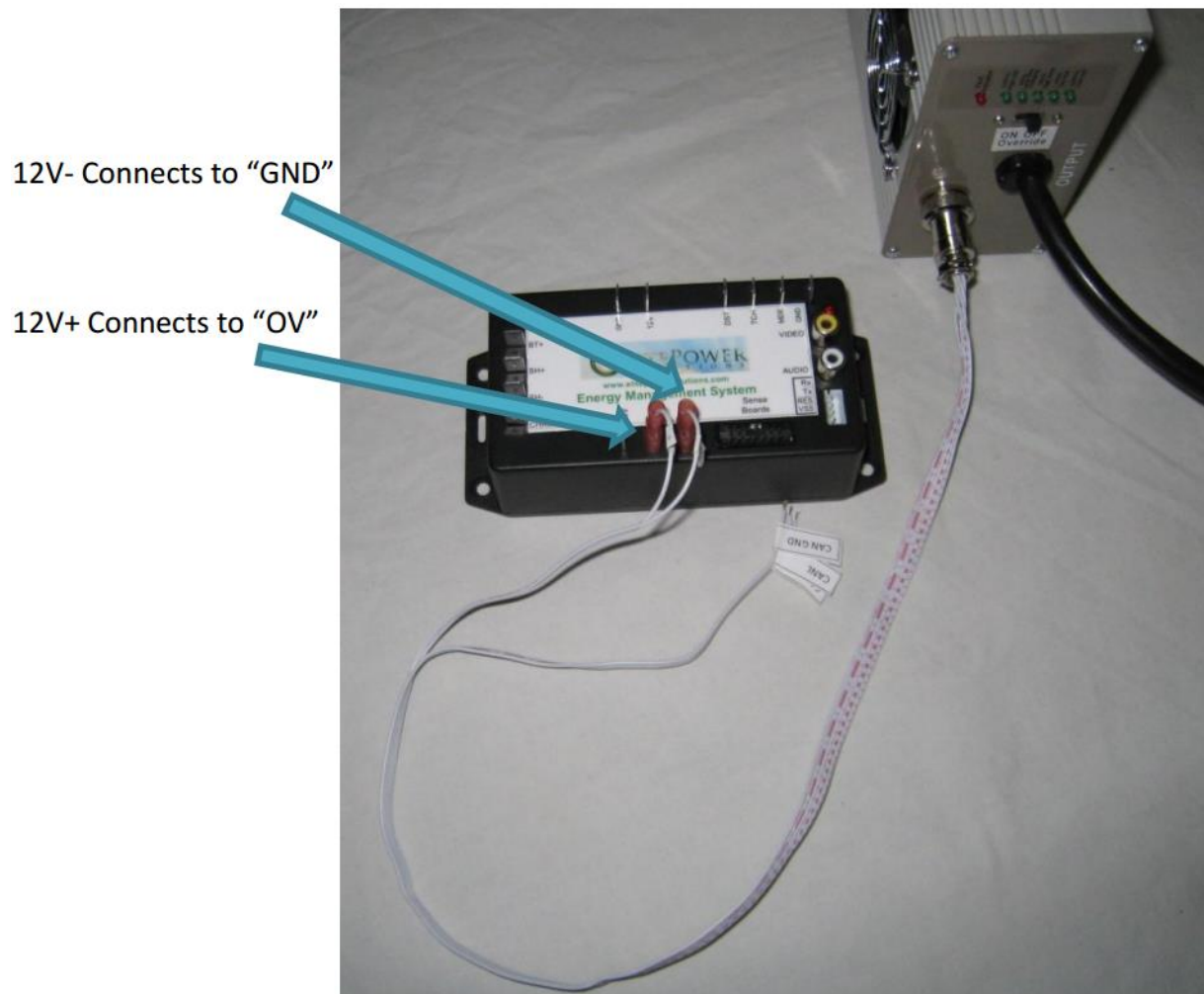
PFC Chargers with output greater than 10A come with an Anderson SB50 style connector for the output. These connectors are labeled "+" and "-". A mating connector comes with the charger.



### 5.3 CAN and Digital Input Controls

A five wire connector connects to the charger for interfacing with the BMS. Three wires have a white connector attached, these three wires are the CAN interface. The other two wires are labeled “+ 12V” and “- 12V”, these wires are the digital input used to control the charger from the EMS CPU. Connect the “+ 12V” to the OV connection on the EMS CPU and the “- 12V” to the GND connection on the EMS CPU.

The EMS CPU will output a 12 volt signal from the “OV” terminal whenever a pack normal situation is detected. During charging if a cell exceeds the maximum voltage limit this will drop to 0 volts which will trigger the charger to temporarily pause charging until the high voltage cell can return to a normal voltage. All green LED’s on the charger will flash when this occurs.



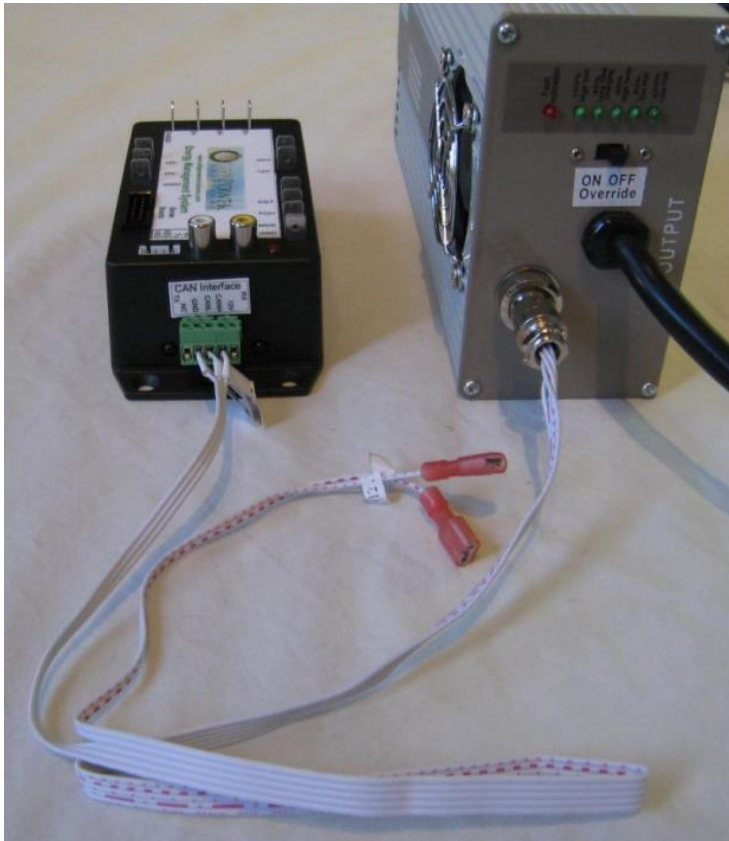
For a CAN communication connection connect the CANH, CANL and CAN GND to the matching connection on the CAN connection on the EMS CPU. The white connector may be cut off of the cable; however, note which wires are which before doing so.



CANH

CANL

CAN GND





If both the CAN communication and the digital inputs are connected CAN communications will take priority over the digital input for charge control. CAN communications requires the optional CAN board be installed on the EMS CPU.

## 6. Cautions

- Make sure charger voltage output matches to the number of cells in the battery pack.
- Make sure positive output of the chargers is connected to a positive connection to the battery pack, and the negative output of the charger is connected to a negative connection of the battery pack.
- After a complete charge, disconnect the power source from the charger and then disconnect the connection between the charger and the battery pack.
- A BMS system must be used during the charging process either through CAN communication or through the digital alarm input to prevent over-charging.

## 7. Troubleshooting

- The charger must be installed in a cool well-ventilated area which is free of dust
- If the charger is not charging unplug the charger from the AC line and battery pack, then check for poor connections, short circuits, over heating conditions as well as alarm status from the Energy Management System.

- If charger does not display any LED's when plugged in and charging does not occur the fuse may be blow. Unplug the charger from the battery pack and AC line and check the fuse by unscrewing the cap with a #2 Philips screw driver. If the fuse is blown replace with an equivalent size fuse of the same voltage and amperage rating.
- If the charger finishes charging too early make sure that the connection from the charge to the battery pack is good and does not have high resistance.