

# ***POWERTECH***



## **Dual Input 20A DC/DC Multi-Stage Battery Charger MB-3683 User Manual**



## THANK YOU

Keep this manual in a safe place for quick reference at all times.

This manual contains important safety and operation instructions for correct use of the battery charger. Read through the manual and pay special attention to the markings and labels of the charger, battery and equipment connected to the battery system. Pay special attention to these two types of notices used in this manual.

**WARNING:** Failure to heed this warning may cause injury to persons and damage to Equipment.

**CAUTION:** Failure to observe this warning may result in damage to equipment and improper functioning of the Charger.

## WARNING!

- The charger is not designed for any life saving application.
- The charger is designed for in-door use. Protect the charger from ingress of water.
- This charger is made to charge only properly sized lead acid and Lithium Fe PO4 (LFP) batteries.
- Don't recharge non-rechargeable batteries.
- Charging other types of battery or under-sized lead acid batteries may cause fire or explosion.
- Install the charger in accordance with all local codes.
- Do not use the charger if it has been dropped or damaged.
- Do not remove casing of the charger, there is no user -serviceable parts inside.
- Do not charge the battery on boats. Remove the battery and charge on shore.
- Never attempt to charge a frozen battery.
- Never attempt to charge a damaged battery.
- Wear protective goggles and turn your face away when connecting or disconnecting the battery.
- Never place the charger on top of a battery.
- Never smoke, use an open flame, or create sparks near battery or charger during normal charging operation as batteries may give out explosive gas.
- Do not charge batteries in an enclosure (box- in) due to possible explosion of entrapped explosive gas.
- Use of parts not recommended may cause risk of fire, electric shock.
- Disconnect the mains supply before connecting or disconnecting the links to the battery.
- If the charger does not work properly or if it has been damaged, unplug all DC connections.



## INTRODUCTION

### Especially designed for the Euro 6 vehicles

The unit is designed to address to the issues of wide swing of output voltages from the smart alternator, braking regenerative EURO 5/6 vehicles in fully charging the house battery. It is suitable for use with all old alternator system and distant house battery.

The built-in vibration sensor makes it possible to use the charger by just connecting to the starter battery terminal without touching the car's electrical /electronic wiring thus avoiding any possible excuse of revoking the car's warranty.

This is a fully automatic Dual Input, Solar & Alternator-battery, DC-DC charger for charging the 12V deep cycle lead acid batteries and Lithium Fe Po4 battery. The built in Solar charge controller uses Maximum Power Point Tracking (MPPT) technology which maximizes the PV power from your solar panels to your house battery.

The digital control and auto-select design of MB-3683 make it automatically adapt to 12V or 24V input alternator/ battery system, and with the Solar power (solar panel of 14.5V to 30V voc with under 400Watt) to charge the 12V deep cycle house battery.

With the 12V Input alternator/battery system, the 12V house battery will be charged by both the Solar and alternator simultaneously to ensure sufficient charging power to the house battery.

With the 24V Input Alternator/ battery system, the 12V house battery will be either charged from the engine while underway, or via the solar panels when stationary.

### Multistage Charging Process

This is a select (battery type) and forget charger designed for fast and accurate recharge of your deep cycle house battery. The smart multistage charging enables the charger to be connected permanently to your battery banks without the worry of over charging or drying out the electrolyte.

Also with both inputs permanently connected, you can be rest assured of charging your batteries whenever you are on the move or when the sun shines on your solar panel.

### Lead Acid Based Battery

A 3 Stage Bulk, Absorption & Float charging profile with maximum constant charging current at the Bulk Stage and a Constant Voltage with decreasing charging current at the Absorption Stage and a reduced voltage Float Charge for maintenance when battery is full.

### LiFePO4 (LFP) Battery

A 2 Stage charging is specially for the LiFePO4 battery and charging current stops at the end of Absorption Stage.

## BOX CONTENTS

- 1 x Dual Input 20A DC/DC Multi-Stage Battery Charger
- 1 x Remote LED Indicator Module
- 1 x Plastic Wire Guide
- 4 x Eye Terminals
- 1 x Mounting Tape Strip





## FEATURES

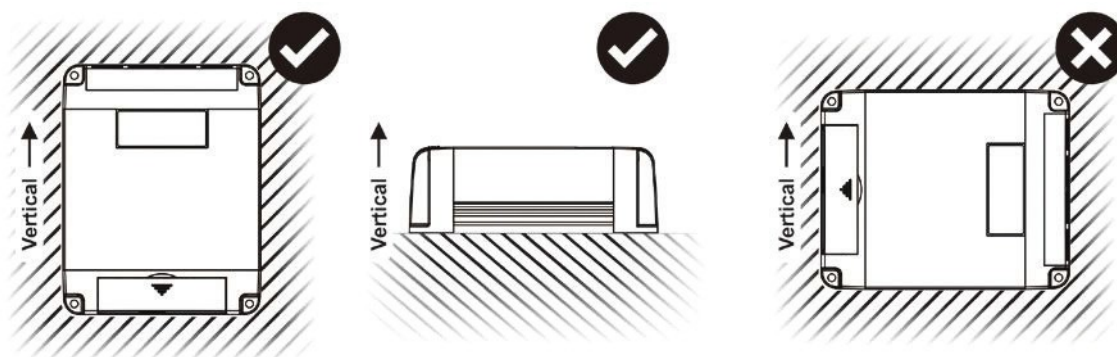
- Car battery with Alternator Input and Solar Input.
- Suitable for 12V or 24V standard and variable Voltage or Smart Alternator.
- Suitable for standard Lead Acid, AGM, Gel, Calcium and Lithium Fe PO4 battery.
- 3 Stage charge for Lead Acid battery.
- Specific 2 Stage charge for LiFePO4 battery.
- Wide DC input range 9-32V without solar connection.
- Auto /Manual /Off settings of Ignition Control for charging.
- Low Voltage Disconnect Protection for Starting Battery in all conditions & battery system.
- Self Recoverable Protections for:
- Input Under Voltage, Output Over Voltage, Over Load, Over Temperature.

## INSTALLATION PROCEDURE

### CAUTIONS:

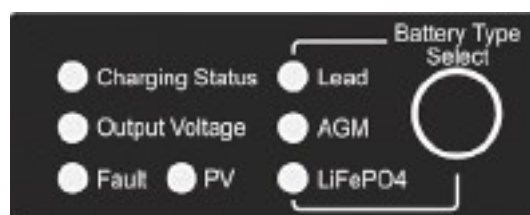
This unit is designed only for internal mounting and meant to be indoor away from direct sunlight, heat and rain. Do NOT install this unit in the vehicle engine bay, allow at least 80mm of space at both ends for ventilation. We recommend wiring by a qualified automobile electrician to ensure local safety and on-board standard are followed

1. We recommend mounting the unit in a vertical position whenever possible with the terminal end facing downwards to provide best cooling effect.
2. Connect a 12V battery to the output to check the unit's LED and try out the settings.
3. It is a good practice to have a fuse installed close to the house battery.



## BATTERY TYPE SELECTION

1. Press and hold the only Set Button for about 5 seconds until the LED flashes.
2. Light quick presses will move the LED from Lead--> AGM--> LiFePO4--> Lead.
3. Stop at the chosen battery type and wait till LED stops flashing to confirm your selection.





## SOLAR PANEL & DC SOURCE DUAL INPUTS

The charger support Solar panel and DC source inputs. Both inputs can be connected simultaneously to the charger or either one. Charger uses Solar energy as priority source to charge battery to maximize the usage of Solar panel. The output will be switched ON whenever the Solar panel has sufficient energy for charging. The PV LED will turn ON to indicate Solar panel has sufficient energy and is being used for charging. During Solar panel being used, no matter single input or dual inputs configuration, the Ignition Control and the Vibration Sensor have NO effect on output ON/OFF control.

\* The allowable maximum power rating of solar panel is 400Watt with maximum 30V OCV

## FACTORY DEFAULT MODE, IGNITION CONTROL MODE & VIBRATION SENSOR MODE

There are three operation modes for the charger:

1. The charger comes in the factory default mode: Ignition control and Vibration Sensor are deactivated, it starts operation when output and inputs are set up. This mode will limit the input voltage range to protect over discharge of car's battery. This model is not recommended for modern cars.
2. The Ignition Control Mode requires wiring connection to the car's electrical circuit, charger only operates when car's ignition has tuned on.
3. The Vibration Sensor Mode will over ride the Ignition Control Mode. It turns on the charger when vibration is detected, vibration can come from the car's engine and road. Use of vibration sensor does not touch the car's electrical circuit and avoid problem in car's warranty.

**\*\* We strongly recommend to set the Ignition Control to AUTO-ON MODE for EURO 6 car due to wide swing of the smart alternator's charging voltage, see section Safeguarding the starting battery by LVD.**

## TO SET IGNITION CONTROL OF THE CHARGER TO AUTO-ON

Connect the Ignition Pin (Fig: Terminals & 8 Pin Connectors diagram) to the car's hot wire (that is the wire that has a positive dc 9 to 32V when car's ignition is turned on).

The charger only operates when the car is running, and charger stops charging once ignition is off.

## TO SET IGNITION CONTROL OF THE CHARGER TO MANUAL ON-OFF OPERATION

You can wire up a push switch with one end to the Vout for Ignition Pin and the other to Ignition Pin, see Fig: Terminals & 8 Pin Connectors diagram. Shorting both pins will turn on the charger, disconnect will turn off the charger.





## HOW TO DEACTIVATE THE IGNITION CONTROL ON MODE

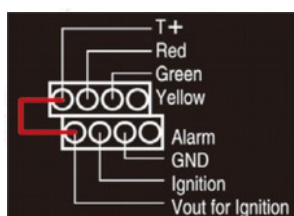
The Ignition Control Mode will stay with the charger once it has been activated even if the charger is taken out from the system and re-installed in another car. That is once the Ignition Control Mode has been activated, charger will only be turned on when there is a positive voltage (+9V to +32V) at the Vout for Ignition, otherwise the charger stays in off mode.

Reset charger to factory default state with Ignition Control in deactivated mode, such that the charger will start charging the house battery as soon as input and output connections are made.

To deactivate the Ignition Control mode:

1. Disconnect any wire to the Ignition Pin in the charger.
2. Press and hold Set Button for about 15 seconds until 3 battery type LED flash.
3. Release button to complete the deactivation of the Ignition Control Mode.

## ENABLE BUILT-IN VIBRATION SENSOR



The built-in vibration sensor is enabled by connection the T+ to Vout for Ignition. The vibration sensor is in standby mode and waiting for vibration. The output is OFF when vibration sensor at this standby mode. The sensor is triggered by vibration which causes it to go the active mode and after around 8 seconds delay, the output will be switched ON for about 100 seconds continuously.

Any further vibration during the 100 seconds active mode, it will extend the output ON for further 100 seconds. The output will be switched OFF if no more vibration within 100 seconds of last vibration.

## OVER RIDE OF IGNITION CONTROL BY VIBRATION SENSOR

Built-in vibration sensor dominates the control of output and the Ignition Control is over ridden by the Vibration sensor. That is only vibration can make the charger start charging with output ON.

Disabled built-in vibration sensor: Disconnect the T+pin from Vout for Ignition

## INDICATORS AND CONTROLS

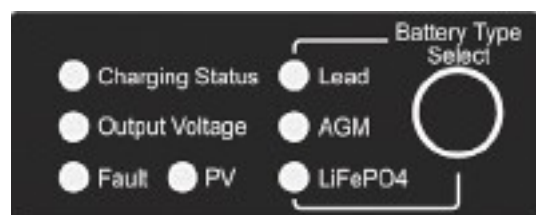


Figure showing 7 LED indicators and one SET button.



### CHARGING STATUS LED FOR LEAD ACID BATTERY - 3 STAGES

Charging Status LED	Charge Stage
Fast Flashes	Bulk Charge
Slow Flashes	Absorption
Solid	Float

### CHARGING STATUS LED FOR LITHIUM FE PO4 BATTERY - STAGES

Charging Status LED	Charge Stage
Fast Flashes	Bulk Charge
Slow Flashes	Absorption

### OUTPUT VOLTAGE LED

This LED shows the voltage level at the V OUT terminal, it is the battery voltage when there is no load connected to the battery.

LED Status	Battery Voltage Level
Fast Flashes	Battery Voltage lower than 12.5V
Slow Flashes	Battery Voltage between 12.5V and 13.6V
Solid	Battery Voltage higher than 13.6V

### PV LED

The PV LED is lit when battery is being charged by PV panel .  
In the case of **DC input higher than 14.4V in 12V car system , the PV LED is lit even no PV panel is connected**. However , this is not a fault and charger is in normal charging operation from DC input . And as soon as the DC input drops below 14.4V , PV LED is off again

### SINGLE DC INPUT OPERATION

Without the Solar Input, the charger can operate with a DC source from 9V to 32V to charge the 12V house battery.



## SAFEGUARDING THE STARTING BATTERY BY LOW VOLTAGE DISCONNECT (LVD)

In the factory default setting, neither the Ignition Control Mode nor Vibration Sensor mode is activated so the charger will start charging when input & output connection are set up.

The car's starting battery is prone to over discharge, so the normal workable DC input voltage range (9 to 32V) will be narrowed down to safeguard the starting battery against over discharge as shown in the table below.

### LVD & LVR (LOW VOLTAGE RECOVERY) OUTPUT STATUS FOR DIFFERENT SETTING MODES

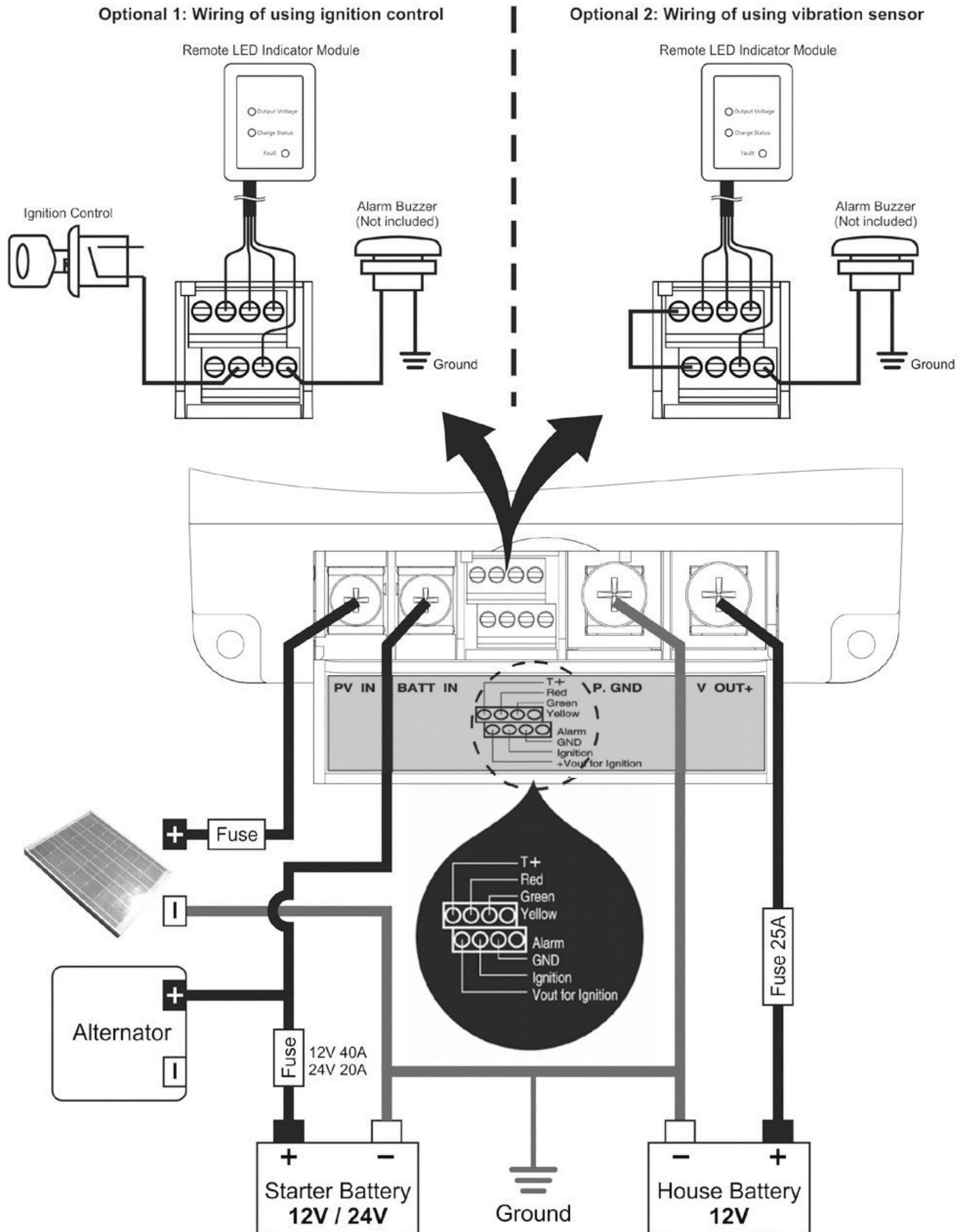
12V System	DC Input Voltage Level	DC Output Status (Charging)
Factory Default Mode (Ignition & Vibration deactivated)	BATT. V IN < 12.2V	OFF (Disconnect)
	BATT. V IN > 12.8V	ON (Reconnect)
Ignition or Vibration Mode activated	BATT. V IN < 9V	OFF (Disconnect)
	BATT. V IN > 11V	ON (Reconnect)

24V System	DC Input Voltage Level	DC Output Status (Charging)
Factory Default Mode (Ignition & Vibration deactivated)	BATT. V IN < 24.4V	OFF (Disconnect)
	BATT. V IN > 25.6V	ON (Reconnect)
Ignition or Vibration Mode activated	BATT. V IN < 18V	OFF (Disconnect)
	BATT. V IN < 22V	ON (Reconnect)



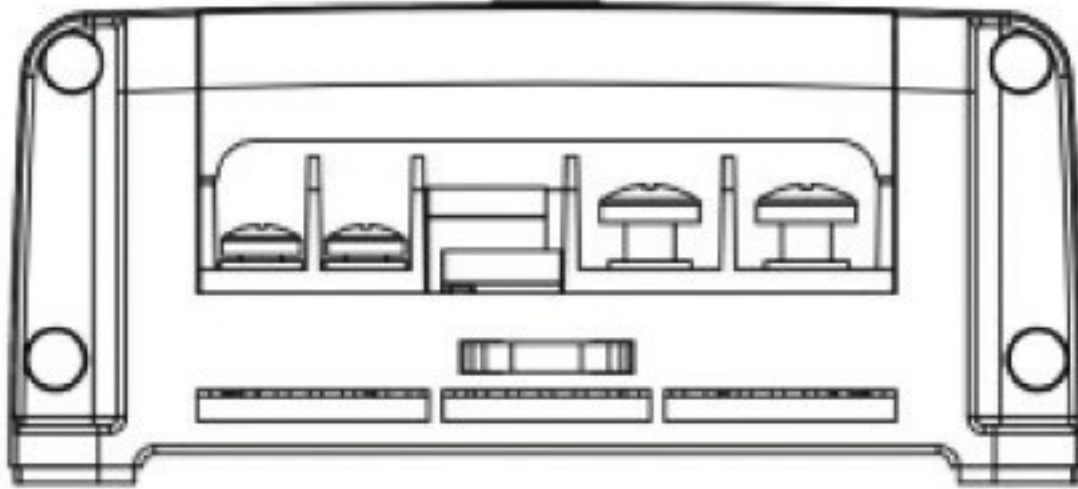
## CONNECTING & WIRING DIAGRAM

Individual fuse/ breaker is required to be close to starting battery (charger input) and close to house battery (charger output wire). Fuse at the solar panel to the rating of the short circuit current of the solar panel.



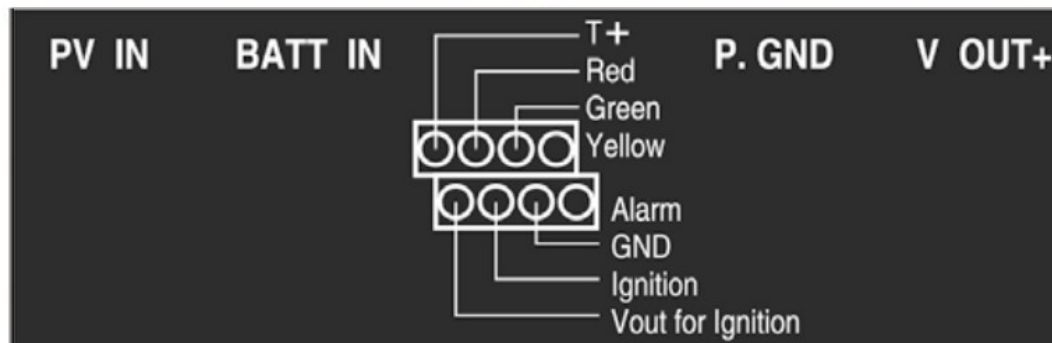
## CONNECTION

After both input and output are connected, the charger will produce output after 10sec.



Front View

Terminals & 8Pin connectors.



1. **Vout for Ignition:** 12V Voltage signal. Short this pin to Ignition pin to enable ignition control of unit. Short this pin to T+ to enable vibration sensor.  
\*This pin is for Ignition and Vibration sensor only. Do not connect to other devices.
2. **Ignition:** Connect this pin to ignition car ignition to make the charger operate in sync with vehicle ignition control.
3. **GND:** Ground pin for remote module. Connect to remote control black wire.
4. **Alarm:** Alarm output pin. Alarm output voltage equals to system input voltage.
5. **Yellow:** Connect to remote module yellow wire.
6. **Green:** Connect to remote module green wire.
7. **Red:** Connection to remote module Red wire.
8. **T+:** Vibration sensor enable pin. Connect to Vout for Ignition to enable Vibration sensor.



## SPECIFICATIONS

Rated output power	20A at 13.8VDC	
Efficiency	≥ 90%	
Input Voltage		
DC Input Voltage Range	9-16VDC (12VDC Input) / 18-32VDC (24VDC Input)	
Max. Solar Panel Open Circuit Voltage	30VDC	
Output (Charge) Voltage		
Battery Type	Absorption	Float
Lead	14.4V	13.3V
AGM	14.7V	13.6V
LiFePO4	14.8V	Stop
Alarm Output	12V / 50mA	
Size(L x W x H)mm	130 x 188 x 55mm	
Weight	Approx. 870g	
Recommended Cable Size		
Cable Length	Recommended SAE	
1 – 5 Meters	8AWG	
5 – 9 Meters	6AWG	
Recommended PV panel Size		
PV Panel Size	400Watt With Maximum 30V Open Circuit Voltage	





## TROUBLE SHOOTING

The Fault LED is solid on when a protection is triggered and output of the charger is off . When the cause of the fault has been clear up, Fault LED becomes off and charger returns to normal operation. Almost all the protections are by software design and self recoverable, once the cause of fault has been dealt with. There are two layers of protection for Input and Output Over-Voltage , the first layer is by software and the second layer by hardware as a double insurance to protect the charger and the connected devices.

Problem	Indication	Possible causes	Suggested solution	Recovery condition
Low Voltage Disconnect (LVD) Ignition Control is not set to Auto On	Fault LED ON	12V battery system: Input voltage < 12.8V for 20s.	Check the starter battery voltage.  Use correct size cable between charger and starter battery	12V battery system: Automatic recovery when input voltage rises above 13.4V for 60s.
	Fault LED ON	12V battery system: Input voltage < 12.8V for 20s.		24V battery system: Automatic recovery when input voltage rises above 26.8V for 60s.
Low Voltage Disconnect (LVD) Ignition Control is set to Auto On	Fault LED ON	12V battery system: Input voltage < 9V for 5s	Check the starter battery voltage.  Use correct size cable between charger and starter battery	12V battery system: Automatic recovery when input voltage rises above 11V for 5s.
	Fault LED ON	24V battery system: Input voltage < 18V for 5s		24V battery system: Automatic recovery when input voltage raise above 22V for 5s.
Output Over Voltage Protection (Output OVP)  Two layers of protection First layer by software Second layer by hardware	Fault LED ON	Software OVP: Output terminal voltage > set absorption Voltage +0.6V for 2s.	Disconnect any load to battery and check battery voltage . If no load connected to battery in first place. Check battery voltage if over set absorption voltage , disconnect battery.	Software OVP: Automatic recovery when the voltage on output terminal is reduced below absorption Voltage +0.3V for 3s.
	Fault LED ON	Hardware OVP: Output terminal voltage >17.0V. FUSE will blow		Hardware OVP: Does not automatic recovery Required to replace the blown FUSE.
Input Over Voltage Protection (Input OVP)  Two layers of protection First layer by software Second layer by hardware	Fault LED ON  PV LED may also be on at the same time	Software input OVP: Charger output will be shutdown when input DC voltage higher than 32V.	Check input battery voltage is not higher than 32V.	Software Input OVP: Automatic recovery when the voltage on input terminal is reduced below 31.5V for 5s.





## TROUBLE SHOOTING

Problem	Indication	Possible causes	Suggested solution	Recovery condition
Input Over Voltage Protection (Input OVP) by hardware.	All LEDs OFF including the FAULT LED.	Hardware Input OVP: The FUSE will blow when input terminal voltage higher than 33.5V.	Find out about the Input source condition & spec such as voltage surge etc. Before replacing with the new fuse.	Hardware input OVP: Does not automatic recovery Required to replace the blown FUSE.
Over Temperature Protection (OTP)	Fault LED ON	Charger internal temperature is too high.	Check input & exhaust ends have no blockage and a minimum 10mm clearance.	Automatic recovery when charger temperature reduce to normal level.
FAN fault	Fault LED ON	FAN not working.	Check for objects jamming fan or Fan is out of order.	Remove objects which jamming the fan.

