

SBC-5936 24V In-Car Charger Dual Input (Solar MPPT & DC)

Operation manual

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.



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



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 batteries and Lithium Fe PO4 (LFP).
- Don't recharging 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.
- Never attempt to charge a frozen LEAD BASED battery or **Lithium FePo4 battery below 0 C.**
- 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.
- If the charger does not work properly or if it has been damaged, unplug all DC connections.

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Introduction

Especially designed for vehicles with Smart Alternator, Start-Stop, Regenerative Braking system

This charger is designed to deal with the issue 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.

The digital control and auto-select design of SBC charger make it automatically adapt to 12V or 24V input alternator/ battery system.

Multistage Charging Process

This is a select (battery type) and forget charger designed for fast and accurate recharge of your 24V lead acid deep cycle or Lithium Fe Po4 house battery. The smart multi-stage charging enables the charger to be connected permanently to your battery banks without the worry of over charging or drying out the electrolyte of lead acid battery.

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.

Three Charge Control Methods

- Ignition Control : Charger starts charging only when ignition is on and stops charging when Ignition is off.
- Vibration Sensor Control : Charger starts charging when repeated vibrations are detected and stops charging when no vibration is detected for over 2 minutes.
- Input Voltage Control : This is for non-intelligent alternators with sufficient high & uniform voltage. Charging is cut off easily due to high threshold voltage to protect the starting battery.

Features

- Dual input from car battery with alternator input and Solar panel.
- Auto select for 12V or 24V car system.
- Design all alternators, conventional, smart alternators, start-stop & regenerative braking.
- 4 DC Charge Mode Selection
 1. Vibration Sensor Control Mode.
 2. Ignition Control Mode with Automatic on when ignition is on and off when Ignition is off
 3. Manual on /off Control of charger by external switch connection (see page 10 fig 3).
 4. Direct connection to the car 's battery using its Voltage levels for automatic on and off of charger
- Suitable for standard Lead Acid, AGM and Lithium Fe PO4 battery.
- 3 Stage charge for Lead Acid based batteries.
- Specific 2 Stage charge for LiFePO4 battery.

Protections

- Self Recoverable Input Under Voltage Protection.
- Self Recoverable Output Over Voltage Protection.
- Self Recoverable Over Temperature Protection.
- Self Recoverable Over Load Protection (C.C.) with constant current at decreased output voltage.
- Self Recoverable Input Reverse Polarity Protection.
- Output Reverse Polarity Protection by thermal fuse.

Supplied Accessories

- Remote LED Indicator Module (with 2M cable) like the unit front panel.
- 4 heavy duty electrical eye connectors.
- One plastic wire guide.
- Double side sticker tape for the Remote Indicator Module.
- Two thin wires for Pin Connections
- One spare 8 Pin Connection sticker label



Installation Procedure



Do NOT install this unit in the **vehicle engine bay**.

This is a fan cooled electronic device not for use in high temperature, corrosive and dusty environment which will drastically shorten the life and performance of the charger.



This charger is designed only for internal mounting and away from direct sunlight, heat and rain. 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. To provide the best cooling effect, mount the unit in vertical position with the terminal end facing downwards due to the top front exhaust design.
2. First install the charger as close to the house battery as possible via a fuse.
3. Check the LED indicators by a few presses on the Select Button.
4. Before connect input to DC Alternator, check on type of alternator of car, for new car with smart alternator select ether Vibration Sensor Mode or Ignition Feed Mode.
5. Do not charge LFP battery without built in Battery Management System.
6. Do not charge LFP battery below 0°C.& discharge below minus 5°C. Check with battery maker.

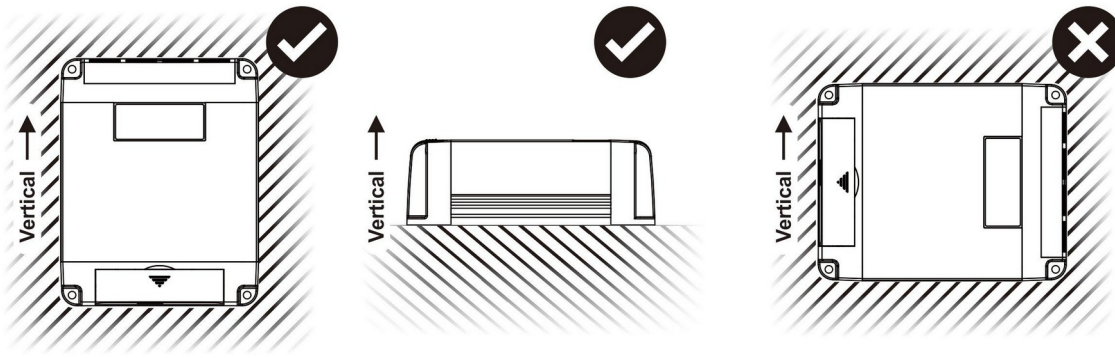
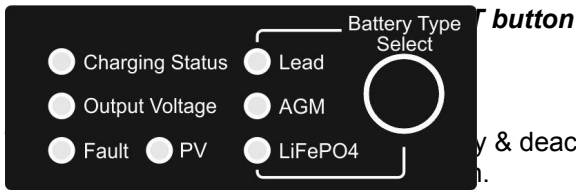


Fig. 1: correct installation direction

Indicators and Controls



15 second long press to deactivate Ignition Control Mode.

15 second long press to deactivate Ignition Control Mode.

Charging Status

Charging Status LED for LEAD ACID Battery - 3 Stages

Charging status LED	Charging stage
Fast flashes	Bulk charge
Slow flashes	Absorption
Solid	Float

Charging Status LED for Lithium Fe PO4 Battery - 2 Stages

Charging status LED	Charging stage
Fast flashes	Bulk charge
Slow flashes	Absorption

Output Voltage

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.

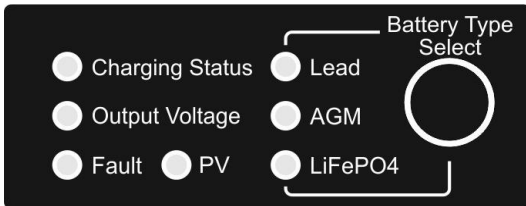
LED status	Battery Voltage Level
Fast Flashes	Battery Voltage level is low
Slow Flashes	Battery Voltage level is medium
Solid	Battery Voltage level is high

PV LED

The PV LED is ON when voltage from PV panel is >14.4V. PV LED flickers with the changes of PV voltages. PV LED is off at night time. This is a good way to check for open-circuit in the solar connection in day time.

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.



Connections

After both input and output are connected, the charger will have output after 10 Sec.

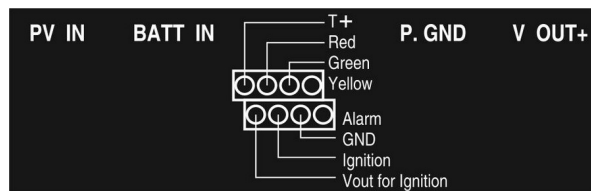
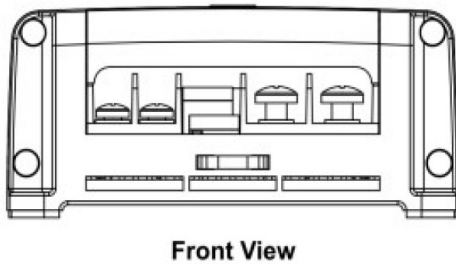


Fig 3. : Terminals & 8PIN connectors

- 1 **T+:** Vibration sensor enable pin. Connect to Vout for Ignition pin to enable Vibration sensor control.
- 2 **Red:** Connection to remote module Red wire.
- 3 **Green:** Connect to remote module green wire.
- 4 **Yellow:** Connect to remote module yellow wire.
- 5 **Alarm:** Alarm output pin. 12V 50mA for external alarm.
- 6 **GND:** Ground pin for remote module. Connect to remote control black wire.
- 7 **Ignition:** Connect this pin to ignition car ignition to make the charger operate in sync with vehicle ignition control.
- 8 **Vout for Ignition:** Short this pin to pin 7 (Ignition) to enable manual ignition control of unit to ON. Short this pin to Pin1(T+) to enable vibration sensor mode.
*This pin is for Manual On/Off or Vibration sensor only. Don't connect to other devices.

Solar panel and DC source Dual inputs

The charger supports 12V Solar panel and 12V or 24V 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 PV LED and charging output will be switched ON whenever the Solar panel has sufficient energy for charging. The Vibration sensor, automatic ignition control and manual on off control have on effect on solar panel input charge.

*The allowable maximum power rating of solar panel is 400 Watt with maximum 30V Open Circuit voltage.

Charger Control Modes

There are 3 automatic charge modes plus one manual ON-OFF to switch on and off the charger to give the optimal charging current to the auxiliary battery.

Automatic Ignition Control Mode

It synchronizes ON/OFF of the DC-DC charger with the car's ignition.

This mode requires connection to the car's Ignition Signal **Terminal 15** see wiring diagram (page 10) electrical circuit which gives out a positive DC Voltage from the car's electrical wiring when the ignition is turned on. The ignition control will set to ON once the **Ignition Pin 7** is applied with 9-32V voltage. The charging operation stops when Ignition is off & engine stops running.

This mode is recommended for all alternator types including Europe 6, 6+plus with start/ stop energy saving.

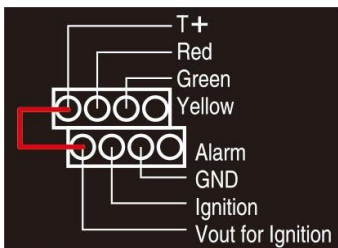
Manual Control

You can wire a contact switch with one end to the **Ignition Pin 7** and the other to **Vout for Ignition Pin 8**. Shorting both pins will turn on the charger, disconnect will turn off the charger.(page 9)

Vibration Sensor Control Mode

The built in vibration sensor with special software control turns on the charging when trains of vibrations are detected. Installation is simple and quick and without touching the car's electrical system for the sensor to work.

Enable build-in vibration sensor



The built-in vibration sensor is enabled by connecting the **T+ pin 1 to Vout for Ignition pin 8**.

Initially the charger output is off when the vibration sensor is in standby mode. Continuous vibrations with over 8 minute duration triggers it into the active mode. The output will be switched ON for about 100 seconds continuously. Any further vibration during the 100 seconds active mode, will extend the output ON for another 100 seconds. The output will be switched OFF if no more vibration within 100 seconds of last vibration.

Over-riding Ignition Feed by Vibration Sensor

Built-in vibration sensor when enabled dominates the control of output and over-rides all other Modes including the Ignition Feed. That is only vibration can make the charger start charging with output ON.

To disable the Vibration Sensor: Take out the connection between the **T+ pin 1** from **Vout for Ignition pin 8**.

CAUTION:

DO NOT USE VIBRATION SENSOR CONTROL WHEN CAR IS ON FERRY, TRAIN OR OTHER TRANSPORT PLATFORMS WITH REGULAR VIBRATIONS & SHOCKS.

REMARK

Once the Vibration Sensor Mode is disabled, the charger will return to the last selected mode.

If you are not sure about your last selected mode, you can set the charger to your desired mode.

Cancel Ignition Control

- i) Take out connection to the **Ignition pin 7**.(page 8)
- ii) Press and hold button for around 15 seconds until the 3 LED battery type flash at the same time.
- iii) Release button and charger changes to Input Voltage Control.

Input Voltage Control Mode

This mode requires increased voltage (>13.4V) of the starter battery which is only possible with short thick cable connection and old type alternator with sufficiently high and stable charging voltage. This Control Mode is not suitable for modern cars due to wide voltage range such as Euro 5/6.
Cancel the Ignition Control first in order to get into this mode.

Summary of 3 Control Modes Operation voltages

CHARGE MODE	12V CAR		24V CAR	
	CHARGE ON	CHARGE OFF	CHARGE ON	CHARGE OFF
Vibration Sensor Mode when sensor is triggered by vibration from car	11-16V	<9V	22-32V	<18V
Ignition Feed – Automatic Mode connect to Ignition switch when Ignition is on	11-16V	<9V	22-32V	<18V
Factory Preset Mode Vibration Sensor & Ignition Feed Inactive	12.8-16V	<12.2V	25.6-32V	<24.4V

Connect & 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.

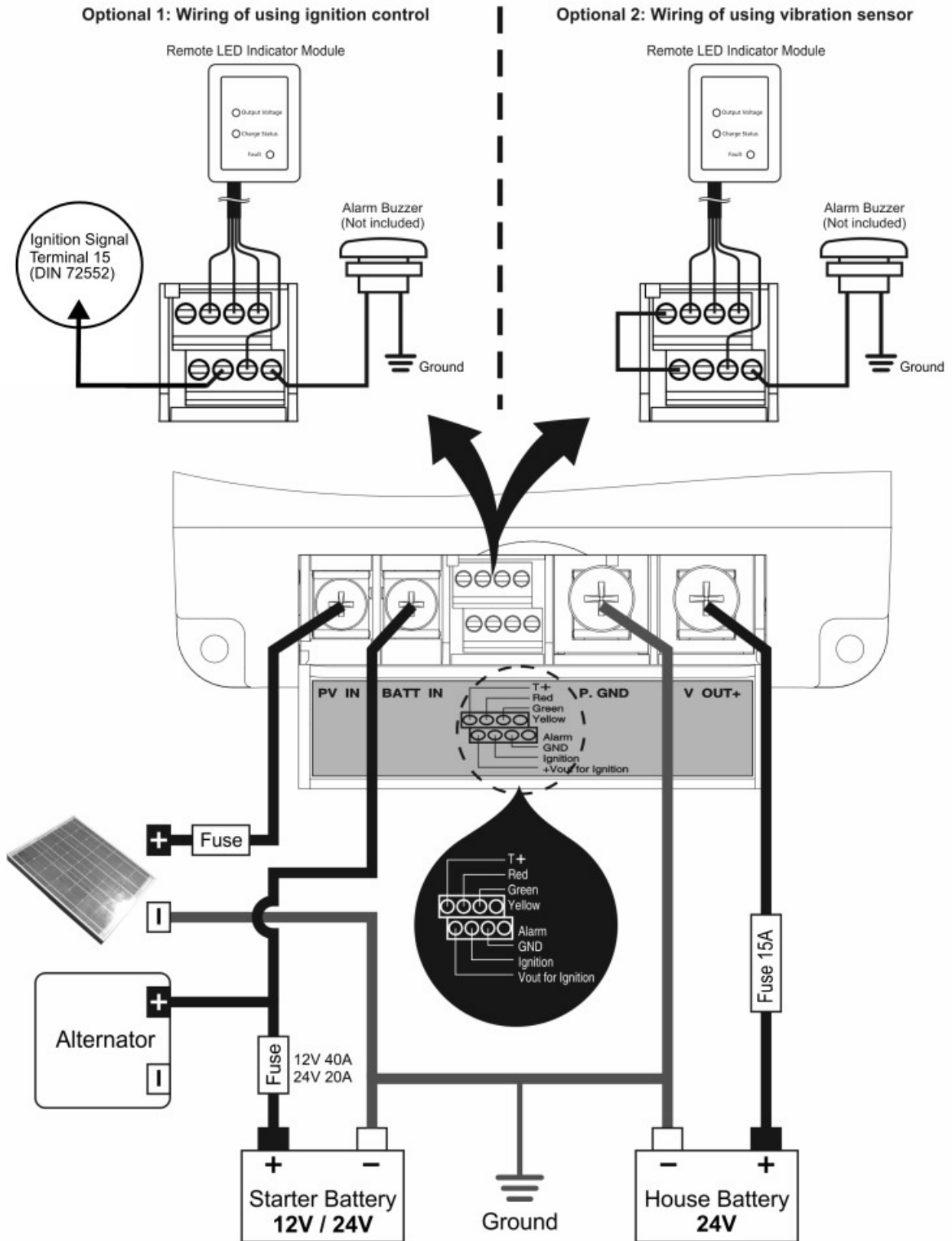


Fig. 4: Connection Diagram

Specification

Rated output power	12A at 27.6VDC			
Efficiency	≥90%			
Input Voltage				
DC Input Voltage Range	9 - 16VDC (12VDC Input) / 18 - 32VDC (24VDC Input)			
Max. Solar Panel Open Circuit Voltage	30VDC			
No load input current	<25mA			
Output (Charge) Voltage				
Battery Type	Absorption	Float		
Lead	27.6V	26.6V		
AGM	29.4V	27.2V		
LiFePO4	29.6V	Stop		
Alarm Output	12V / 100mA			
Size(L x W x H)mm	130 x 188 x 55mm			
Weight	Approx. 870g			
Operating Temperature	-10 to +40°C (Ambient Temperature)			
Recommended Cable Size				
Cable Length	Recommended SAE			
1 – 5 Meters	8AWG			
5 – 9 Meters	6AWG			
Operating Mode				
	12V CAR		24V CAR	
Vibration Sensor Mode	Charge ON 11-16V	Charge OFF <9V	Charge ON 22-32V	Charge OFF <18V
Ignition Feed – Automatic Mode	Charge ON 11-16V	Charge OFF <9V	Charge ON 22-32V	Charge OFF <18V
Factory Preset Mode	Charge ON 12.8-16V	Charge OFF <12.2V	Charge ON 25.6-32V	Charge OFF <24.4V
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	24V battery system: Input voltage <25.6V 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 >34.0V. 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.
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 .