

# BENTON®

DUAL BATTERY SYSTEM &  
SOLAR CHARGER



User's Manual

# 12V

## In-Vehicle DC-DC Charger

### DX-25/DX-40

Max Current

25A/40A

Solar MPPT

12/18/24V

12/24V Alternator

11-32V

Max Temperature

85°C

Congratulations on your purchase of the **BENTON® DX-25/DX-40** 7-Step fully automatic switch-mode battery charger, designed for charging a variety of lead-acid rechargeable & Lithium auxiliary batteries by providing proprietary algorithm to each specific battery type. **DX-25/DX-40** chargers include all features needed to achieve and maintain the auxiliary battery to its optimum condition, at all times. **DX-25/DX-40** chargers also feature MPPT (Maximum Power Point Tracking) solar regulator technology, allowing you to deliver maximum amount of power from the solar panels to the auxiliary battery.

### For Your Safety

Do not operate the battery charger unless you had read and understood this manual and installed the charger as per instructions.

Keep this manual in a safe place for future reference.

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## Safety Information

1. **BENTON® DX-25/DX-40** Battery Charger is designed for charging one 100-1000Ah 12V Standard Automotive Lead-Acid, GEL, AGM, Calcium, SLI, Deep Cycle type or one 25-1000Ah Lithium rechargeable battery. The charger is not intended to supply power to a low voltage electrical system other than to charge a battery. **Do not** use it for any other purpose.
2. **DO NOT ATTEMPT TO CHARGE A NON-RECHARGEABLE BATTERY (PRIMARY CELLS)**. They may burst and cause injury to persons and damage to property.
3. **Never** charge a frozen battery. **Never** charge a damaged battery.
4. **Explosion hazard!** A battery being charged could emit explosive gasses. Avoid smoking or open sparks or flames near the battery. Explosive and flammable substances such as fuel or solvents should not be kept near the charger or the battery.
5. **Danger of chemical burns!** Battery acid is highly corrosive. If your skin or eyes are exposed to acid, immediately rinse the affected part of the body with excessive water and seek medical advice.
6. **DO NOT** alter or disassemble the Battery Charger under any circumstances, incorrect reassembly may result in electric shock or fire. Unauthorized disassembly, repairs or modifications will void the official warranty.
7. **Never** place charger above battery being charged, gases from battery will corrode and damage charger.
8. During charging, batteries must be placed in the well-ventilated area.
9. Children or persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge should not use this appliance, unless a responsible person has supervised them. Children should be supervised to ensure that they do not play with the appliance.
10. Children shall not play with the appliance. Children without supervision shall not make cleaning and user maintenance.

## Product Package Contents

**DX-25** or **DX-40** Battery Charger

Battery Temperature Sensor 3.5m cable

Ignition Sensor M3 Ring Terminal

Remote Display DX-M2 (optional)

User's Manual

**DX-25** or **DX-40** Terminal Block (optional)

Ferrite Clamp (for **DX-40** only)

## Wire Size Recommendation

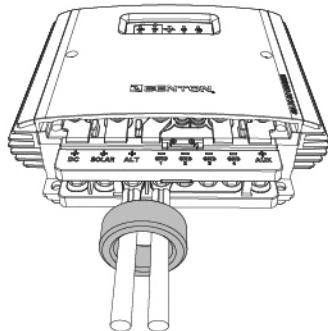
Use the recommended minimum cable cross section area (mm<sup>2</sup>) to avoid significant voltage drop (approx. 0.35V). Note: Radiated Emission was tested using 1m cable.

**Cable mm<sup>2</sup> @ 50°C Cable Temperature**

Cable Length	Current	
	25A	40A
1m	4 mm <sup>2</sup>	5 mm <sup>2</sup>
2m	7 mm <sup>2</sup>	10 mm <sup>2</sup>
3m	10 mm <sup>2</sup>	15 mm <sup>2</sup>
4m	13 mm <sup>2</sup>	20 mm <sup>2</sup>
5m	16 mm <sup>2</sup>	25 mm <sup>2</sup>

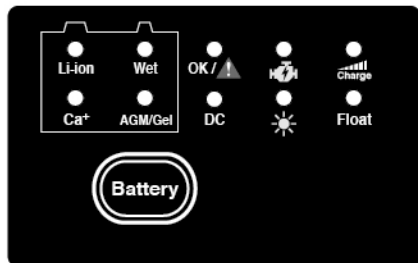
## Using the Ferrite Ring (DX-40 only)

For optimum EMI results, put the pair of input cables through the ferrite as per below diagram.

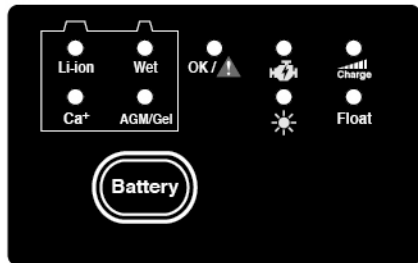


## LED Indications

### DX-40



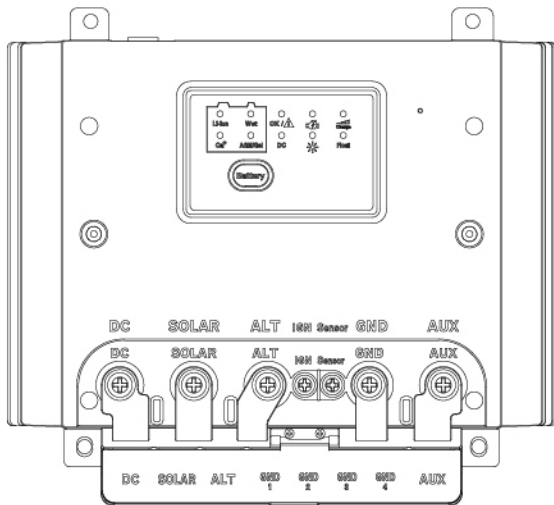
### DX-25



Item	Indication	LED
AGM/Gel	Battery Type Selection (default)	ON: Blue
Wet	Battery Type Selection	ON: Blue
Ca+	Battery Type Selection	ON: Blue
Li-ion	Battery Type Selection	ON: Blue
OK/Error	Battery OK.	ON: Green
OK/Error	Battery Bad/Charging Error/Fault	ON: Red
Alternator	Active Input Indication	ON: Yellow
Solar	Active Input Indication	ON: Yellow
DC (DX-40)	Active Input Indication	ON: Yellow
Charge	Bulk Charging Stage	Blinking: Blue
Charge	Absorption Charging Stage	ON: Blue
Float	Battery Analysis	Blinking: Blue
Float	Float Stage	ON: Blue

## Automatic Input Selection

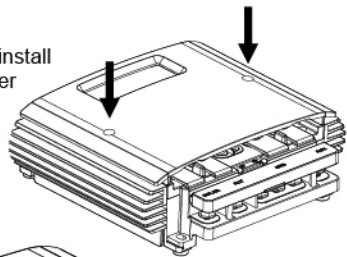
- No external relays needed.
- By default , when there are multiple inputs available, the charger smartly chooses which input should be active according to priority.
  - 1.Alternator linked to starter battery
  - 2.Unregulated solar power using built-in Maximum Power Point Tracking (**MPPT**) Solar Controller
  3. DC Supply (**DX-40 only**)
- **DX-40** has one more input terminal for DC voltage source i.e. ACDC power supply, wind turbines, etc. The charger tracks and utilizes the power capacity of the source.



## Removing the Cover

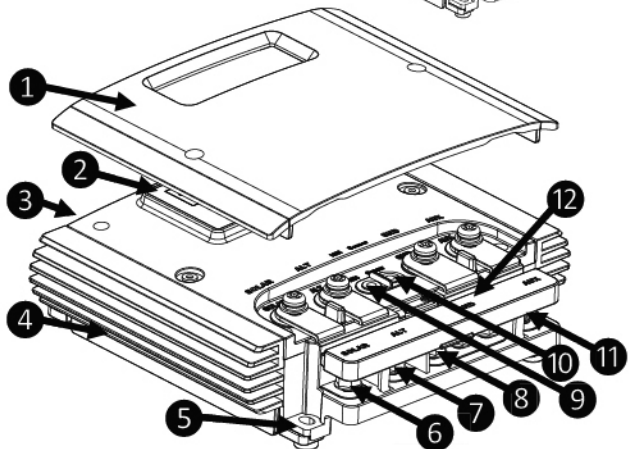
In order to access the charger terminal, select the battery type and to install the temperature compensation & ignition over-ride cables, the top cover needs to be removed.

Loosen the two screws as indicated to release the cover.



## Parts of the Charger

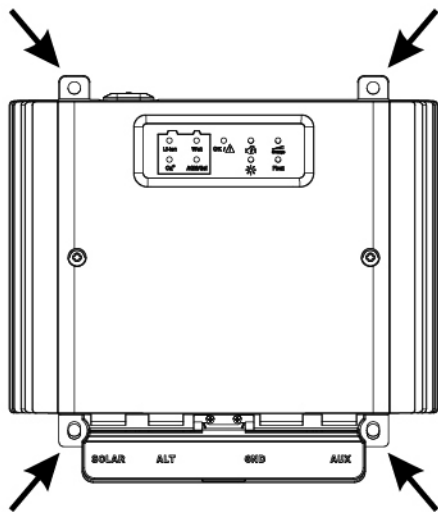
- 1 – Top Cover
- 2 – Status Membrane
- 3 – Remote Monitor Port
- 4 – Metal housing
- 5 – Mounting Feet
- 6 – Solar Terminal
- 7 – Alternator Terminal
- 8 – Common Ground Terminal
- 9 – Ignition Override Terminal
- 10 – Temperature Sensor Terminal
- 11 – Auxiliary Battery Terminal
- 12 – Terminal Block



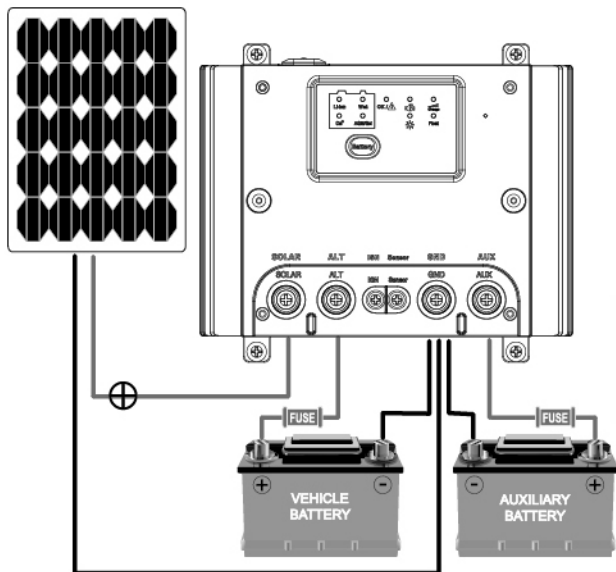


## Mounting the Charger

1. The charger can operate in harsh environments but it is best to locate far away from heat sources and excessive vibrations; and close to the auxiliary battery. It can be installed in any position, vertically or horizontally. However, vertical mounting is recommended for better result. Allow clearance for cables and ventilation.
2. Use the four mounting feet of the charger to attach to a secure flat surface.
3. Drill the four fixing holes and use the appropriate screws or bolts included in the package to fasten the unit.
4. Remove the top cover before wiring the charger. Put the top cover back after wiring for protection of the terminals.



## Connecting the Charger



**Note:**

Please tighten the screws properly and ensure that none of the screws are loose. Max torque is 3N·m for the M5 screws and 8N·m for the nuts.

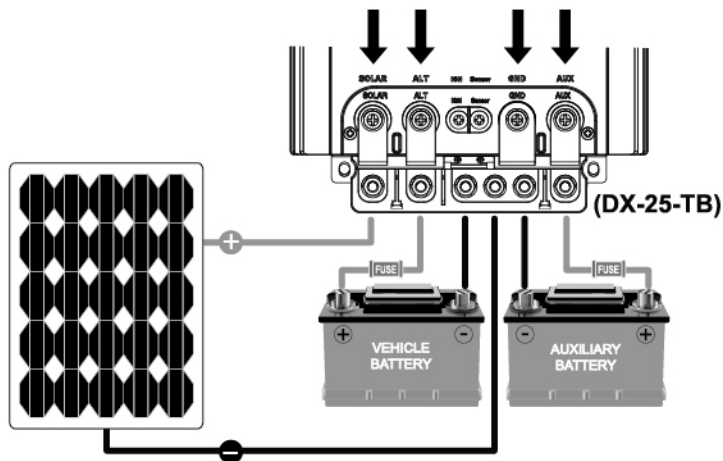
- a) Connect one end of the common ground cable to the “GND” terminal of the charger.
- b) Connect the grounds of solar panel, vehicle starter battery, DC input (**for DX-40 only**) and Auxiliary battery to the other end of the common ground cable.
- c) Connect one end of the auxiliary battery output cable to the “AUX” terminal.
- d) Connect the other end of the auxiliary battery output cable to the positive post of the auxiliary battery. Insert an inline 60A fuse near the Auxiliary battery.
- e) At this point, “OK/ERROR” LED should turn to GREEN if the auxiliary battery voltage is within the charging range and default “AGM/GEL” battery is selected.
- f) Connect one end of the alternator input cable to the “ALT” terminal of the charger.
- g) Connect the other end of the alternator input cable to the positive post of the Main battery. Insert an inline 60A fuse near the Main battery.
- h) At this point, “ALT” LED should turn-on if the alternator voltage is within the acceptable range.
- i) Connect one end of the solar input cable (if available) to the “SOLAR” terminal of the charger.
- j) Connect the other end of the solar input cable to the positive output of the solar panel.
- k) At this point, “SOLAR” LED should turn-on if the solar voltage is within the acceptable range.
- l) Connect one end of the DC input cable (if available) to the “DC” terminal of the charger (**for DX-40 only**).
- m) Connect the other end of the DC input cable to the positive output of the DC supply. Insert an inline 60A fuse for additional protection from short circuit i.e. cables touching the chassis (**for DX-40 only**).
- n) At this point, “DC” LED should turn-on if the DC voltage is within the acceptable range.
- o) “CHARGE” LED will begin blinking to indicate if charging is in progress.

## Selecting Battery Type

For safety reasons, battery type can only be selected when the auxiliary battery is not yet connected, “OK/ERROR” LED is RED.

Press the “Battery” button to select the correct auxiliary battery type to be charged (AGM/Gel, Standard Wet, Calcium, and Lithium-Ion).

## Connecting the Charger using the Terminal Block



(DX-40-TB)

**Note:**

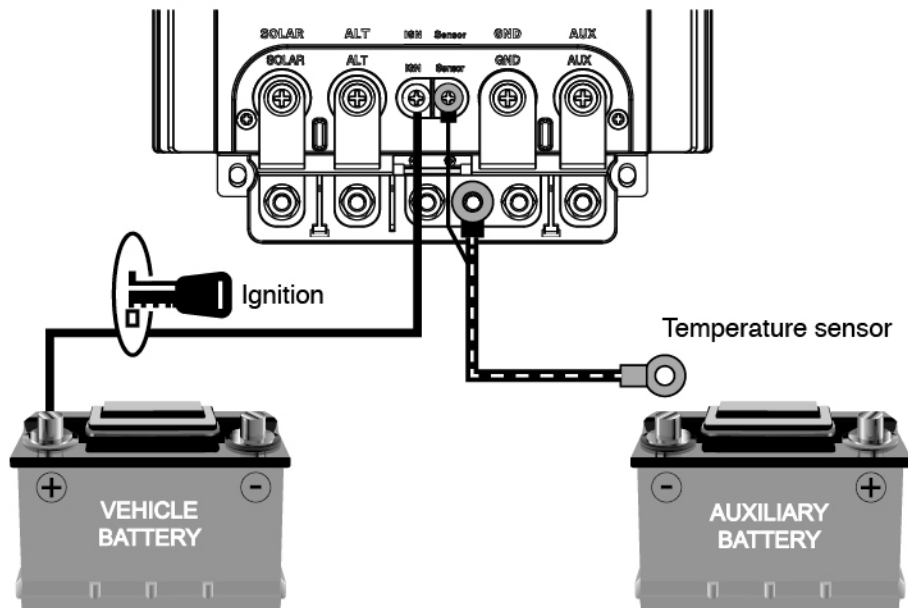
Please tighten the screws properly and ensure that none of the screws are loose. Max torque is 3 N·m for the M5 screws and 8 N·m for the nuts.

- a) Connect the matching terminal block to the charger and properly fasten the screws attaching the terminal block to the charger.
- b) Flip the terminal block cover to access the ports for the cables.
- c) Connect all the ground cables to any of the “GND” ports of the terminal block.
- d) Connect the other end of the ground cables to each of the grounds of main battery, solar panel, DC input (**for DX-40 only**), and auxiliary battery.
- e) Connect one end of the auxiliary battery output cable to the “AUX” port of the terminal block.
- f) Connect the other end of the auxiliary battery output cable to the positive post of the auxiliary battery. Insert an inline 60A fuse near the auxiliary battery.
- g) At this point, “OK/ERROR” LED should turn to GREEN if the auxiliary battery voltage is within the charging range and default “AGM/GEL” battery is selected.
- h) Connect one end of the alternator input cable to the “ALT” port of the terminal block.
- i) Connect the other end of the alternator input cable to the positive post of the main battery. Insert an inline 60A fuse near the main battery.
- j) At this point, “ALT” LED should turn-on if the alternator voltage is within the acceptable range.
- k) Connect one end of the solar input cable (if available) to the “SOLAR” port of the terminal block.
- l) Connect the other end of the solar input cable to the positive output of the solar panel.
- m) At this point, “SOLAR” LED should turn-on if the solar voltage is within the acceptable range.
- n) Connect one end of the DC input cable (if available) to the “DC” port of the terminal block (**for DX-40 only**).
- o) Connect the other end of the DC input cable to the positive output of the DC supply. Insert an inline 60A fuse for additional protection from short circuit i.e. cables touching the chassis (**for DX-40 only**).
- p) At this point, “DC” LED should turn-on if the DC voltage is within the acceptable range.
- q) “CHARGE” LED will begin blinking to indicate if charging is in progress.
- r) Close and latch the terminal block cover to protect the ports.

### Replacing the Battery

Remove the connections of all the input sources before disconnecting the battery.

## Temperature Sensor and Ignition Sensor Connection



## Ignition Sensor Installation

Ignition sensor is another optional feature used to detect vehicle ignition and identify that the vehicle is running. This ignition connection enables a “low input operation” mode for compatibility with smart (variable voltage) alternators found in modern vehicles.

1. Cut a desired length of cable (recommended AWG22) and crimp to the M3 ring terminal included with the package to make the Ignition Sensor cable.
2. Connect the ring terminal end of the Ignition cable to the “IGN” terminal of the charger.
3. Connect the sensor end of the Ignition cable to the ignition wiring of the vehicle.



## Temperature Sensor Installation

Temperature sensor is an optional feature used to compensate for the auxiliary battery temperature and protect the battery from overheating.

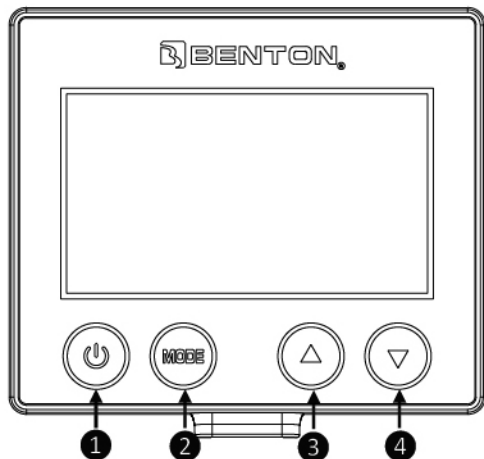
1. Connect the ground of the Temp Sensor cable to the “GND” terminal of the charger.
2. Connect positive of the Temp Sensor cable to the “Sensor” terminal of the charger.
3. Connect the sensor end of the Temp Sensor cable to the negative pole of the Auxiliary battery.



## DX-M2 Remote Display

**BENTON® DX-M2** (Monochrome LCD) is the display used for monitoring the charging status of **BENTON® DX-25 / DX-40**. This is another optional feature that helps the users to see the voltage, current, state of charge and any warnings related to the charging.

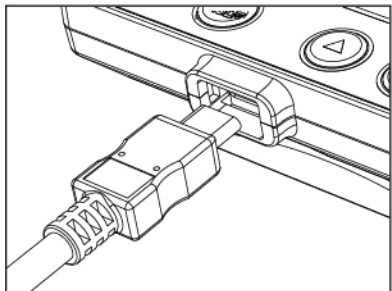
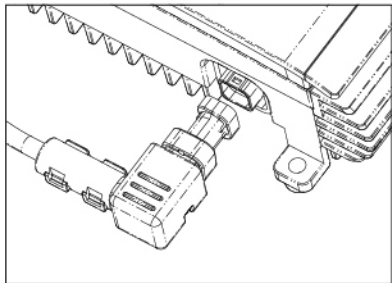
- 1 - **Power**: Single press toggles the display to standby mode or active mode.
- 2 - **Mode** : Single press toggles the display mode from three choices.
- 3 - **Brightness Up** : There are five levels of backlight brightness. Default is maximum level. Each single press will increase the brightness by one level up to the maximum level.
- 4 - **Brightness Down**: There are five levels of backlight brightness. Default is maximum level. Each single press will reduce the brightness by one level down to minimum level.





## Remote Display Installation

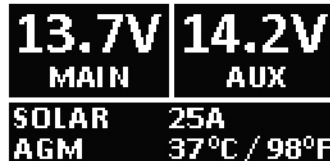
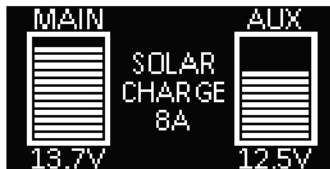
1. Choose an appropriate location for mounting the monitor. It should be visible enough to see while driving.
2. Fix the wall mount using screw or double-sided adhesive tape. Wall mount fixture enables adjusting the monitor for better viewing angle.
3. Attach the monitor housing to the wall mount fixture by fitting the joint ball stick to the slot at the back of the monitor and sliding it to lock.
4. Connect the USB Type-C end of the monitor cable to the **DX-M2** USB connector slot. Gently push the cable plug into the display mating connector until it clicks into position.
5. Connect the other end of the monitor cable to the **DX-25 / DX-40** 6-pin connector slot. Follow the marking on the cable plug and mating connector for correct orientation. Gently push the cable plug into the display mating connector until it clicks into position.
6. At this point, display icons should be visible in the screen if the charger is powered.
7. Press the Power button to toggle the monitor from standby mode and operating mode.
8. To disconnect Data Cable from the charger, apply little pressure on the sides of the Data Cable plug and slowly pull it back.





## Remote Display Interface

Important information are displayed in real time. Warning messages also appear incase there is an abnormal condition.

- Active Input Source:** Charger automatically chooses which input to use depending on the current condition. Shows STBY if not charging.
- Input Voltage:** Actual voltage level of the active input source.
- Output Current:** Actual current level that is being charged to the auxiliary battery.
- Output Voltage:** Actual voltage level of the auxiliary battery.
- Battery Temperature:** The temperature of auxiliary battery.
- Battery Type:** The type of auxiliary battery (AGM/Gel, Wet, Calcium, Li-ion).
- Percentage of Charge:** Actual level of charge of the main and auxiliary battery shown as graphs.



- a)  – **Low Voltage Warning or Battery not connected.** Main or Auxiliary battery voltage is lower than 11.4V or there is no connection to one of the batteries. Fuses and connections must be check.
- b) **Flashing Voltage with**  – **Battery Can't Store Energy**
- c) **OVP – Over Voltage Protection.** Too high voltage is detected to any of the SOLAR, ALT, AUX or DC terminals. Apply voltages as per specifications.
- d) **OCP – Over Current Protection.** The detected charge current is higher than specifications. Check short circuits or cable faults and then reset the whole system.
- e) **OTP – Over Temperature Protection.** Charging is suspended to prevent damage to the battery when the detected battery temperature is above 50°C. Charger also stops if internal temperature is above 115°C. Device would resume charging once temperature drops to a safe level.
- f) **REV – Reverse Polarity Protection.** Auxiliary battery connection is reversed. Check the connection.
- g) **BAD – Battery can't be recovered.** Charger has detected that auxiliary battery is unable to be charged safely. Inspect the battery, replace if necessary.

Problem	Indication	Possible Cause	Solution
No input voltage is within acceptable range	<ul style="list-style-type: none"> <li>● None of the input LEDs turn-on (ALT, SOLAR, DC).</li> </ul>	<ul style="list-style-type: none"> <li>● Input sources not properly connected to the charger</li> </ul>	<ul style="list-style-type: none"> <li>● Check the cable connections</li> </ul>
Can't change the battery type selection	<ul style="list-style-type: none"> <li>● Battery LED does not change after pressing the "Battery" button</li> </ul>	<ul style="list-style-type: none"> <li>● Auxiliary battery already connected to the charger</li> </ul>	<ul style="list-style-type: none"> <li>● Disconnect the auxiliary battery during selection of battery type</li> </ul>
Charging did not finish	<ul style="list-style-type: none"> <li>● Error LED turn RED after charging for some time</li> </ul>	<ul style="list-style-type: none"> <li>● Battery can't keep the charge</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the damage battery</li> </ul>
Can't detect the installed battery	<ul style="list-style-type: none"> <li>● Error LED remains RED after installing the battery</li> </ul>	<ul style="list-style-type: none"> <li>● Auxiliary battery not properly connected to the charger</li> <li>● Battery voltage level is not within the charging range</li> </ul>	<ul style="list-style-type: none"> <li>● Check the cable connections</li> <li>● Replace the dead battery</li> </ul>
Over Temperature	<ul style="list-style-type: none"> <li>● Error LED is RED</li> </ul>	<ul style="list-style-type: none"> <li>● Charger overheated</li> </ul>	<ul style="list-style-type: none"> <li>● Relocate to cooler location</li> <li>● Wait for charger temperature to drop</li> </ul>

Problem	Indication	Possible Cause	Solution
Intermittent charging	<ul style="list-style-type: none"> <li>● Charging starts then stops just after some time, indefinitely</li> </ul>	<ul style="list-style-type: none"> <li>● Input source is almost drained</li> <li>● High voltage drop on the cables</li> </ul>	<ul style="list-style-type: none"> <li>● Check the cable connections</li> <li>● Use thicker wires with lower resistance</li> </ul>
Remote Display has no power	<ul style="list-style-type: none"> <li>● Remote Display doesn't show anything</li> </ul>	<ul style="list-style-type: none"> <li>● Data cable is not properly connected</li> <li>● Data cable is broken</li> </ul>	<ul style="list-style-type: none"> <li>● Check the cable connections</li> <li>● Check if there are no bent pins on the charging device socket</li> <li>● Check the data cable wire connectivity</li> </ul>
Remote Display can't communicate with the charger	<ul style="list-style-type: none"> <li>● Remote Display shows "No Connection" or "Please check cable"</li> </ul>	<ul style="list-style-type: none"> <li>● Data cable not properly connected</li> <li>● Data cable is broken</li> </ul>	<ul style="list-style-type: none"> <li>● Check the cable connections</li> <li>● Check if there are no bent pins on the charging device socket</li> <li>● Check the data cable wire connectivity</li> </ul>

## Electrical Specifications

	DX-25	DX-40
<b>Input Range</b>		
Alternator		11-32 V
Solar		15-41 V
DC	n/a	11-32 V
<b>Solar MPPT</b>		
12V Panel	25 A max.	40 A max.
18V Panel	25 A max.	40 A max.
24V Panel	25 A max.	40 A max.
<b>12V Alternator Input</b>		
Low Voltage Turn OFF		12.6 V
Low Voltage Turn ON		13.2 V
Over Voltage Turn ON		14.8 V
Over Voltage Turn OFF		16 V
<b>24V Alternator Input</b>		
Low Voltage Turn OFF		25.2 V
Low Voltage Turn ON		26.4 V
Over Voltage Turn ON		29.6 V
Over Voltage Turn OFF		32 V
<b>Ignition Override</b>		
Low Voltage Turn OFF		11.5 V
Low Voltage Turn ON		12 V
Over Voltage Turn ON		31 V
Over Voltage Turn OFF		32 V

	DX-25	DX-40
<b>DC Input</b>		
Low Voltage Turn OFF	n/a	11 V
Low Voltage Turn ON	n/a	12 V
Over Voltage Turn ON	n/a	31 V
Over Voltage Turn OFF	n/a	32 V

	DX-25	DX-40
<b>Output</b>		
Voltage	3-15 V	
Current	25 A max.	40 A max.
Power	375 W max.	600 W max.
Operating Temp	-20 to 85 °C	
Protection Class	IP67	
Standard	EN55014, AS/NZS CISPR14	
Dimension (mm)	158x115x53	178x125x58
Weight (g)	800	1140
Remote Display	Optional	

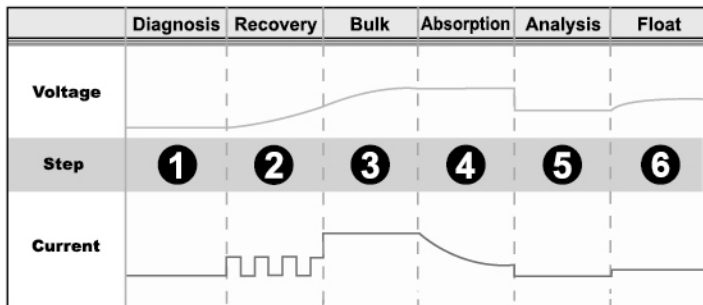
Battery Type	Bulk Voltage	Float Voltage
AGM / Gel	14.4V	13.6V
Standard Wet	14.6V	13.6V
Calcium	14.8V	13.6V
Lithium-Ion	14.4V	13.6V

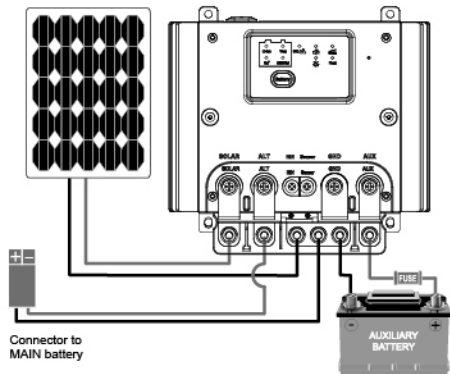
Battery Temperature Compensation	
High temperature	-17mV per °C above 30°C
Low Temperature	+17mV per °C below 21°C
Battery over-temperature protection	50°C
Device Protection	
	Reverse Polarity
	Over Voltage
	Over Current
	Over Temperature
	Bad Battery Detect

## Declaration of Compliance

Tested and approved by **Intertek** and conforms to  
 EN 60335-1  
 EN 60335-2-29  
 EN 55014-1  
 EN 55014-2  
 PAH Testing  
 RoHS 2.0  
 IP67

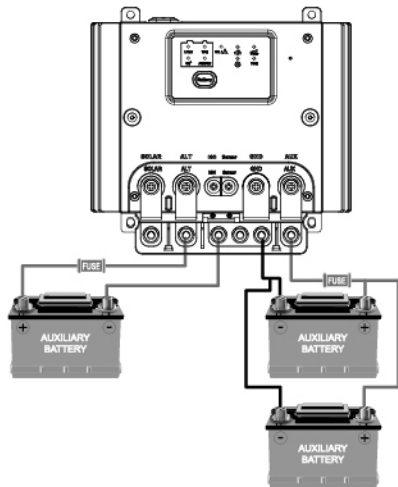
## Charging Algorithm





### Trailer or Caravan Installation

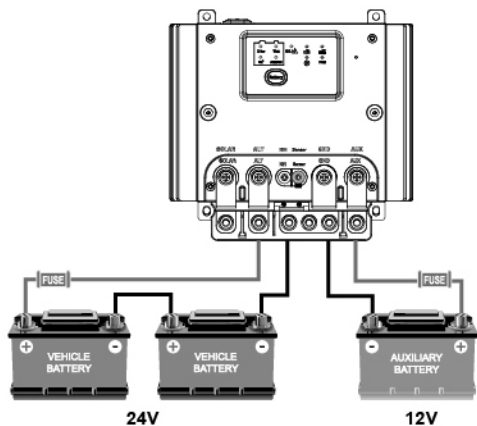
The **DX-25/DX-40** can be installed in a Trailer or Caravan that housed the auxiliary batteries. In this connection, the **DX-25/DX-40** can work as a stand-alone solar charger and also has a removable connection to the charging system of the towing vehicle. More than one solar panel of the same kind can be connected in parallel provided the maximum voltage is below 42V.



### More than one Auxiliary batteries

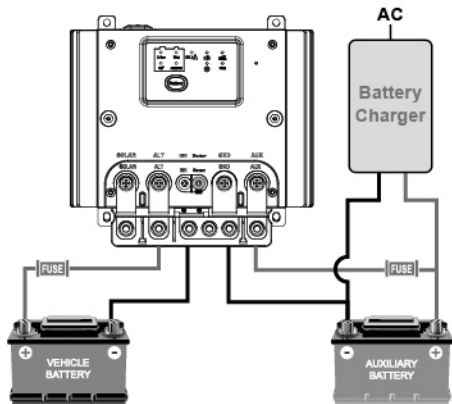
The **DX-25/DX-40** can charged multiple auxiliary batteries connected in parallel. This is common in trailers or caravans with large 12V battery banks. Ensure that the parallel batteries are matched in type, capacity and age for balance sharing.





### 24V vehicles

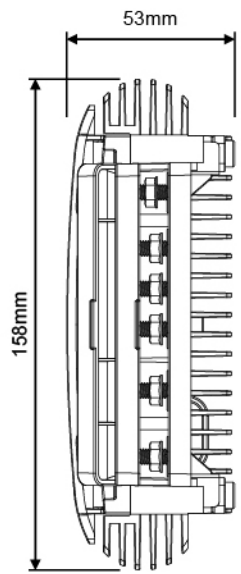
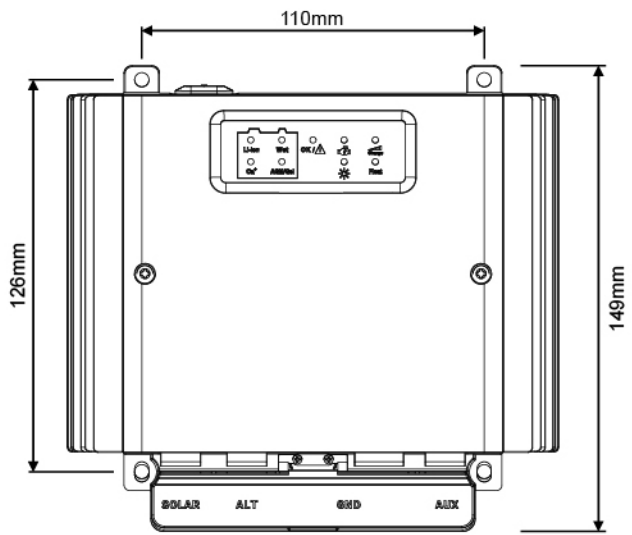
**DX-25 / DX-40** supports vehicles operating with 24V alternators. These vehicles usually have two 12V main batteries connected in series. The output of **DX-25 / DX-40** will charge 12V auxiliary battery or battery bank.



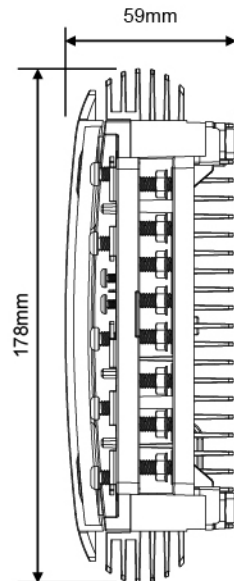
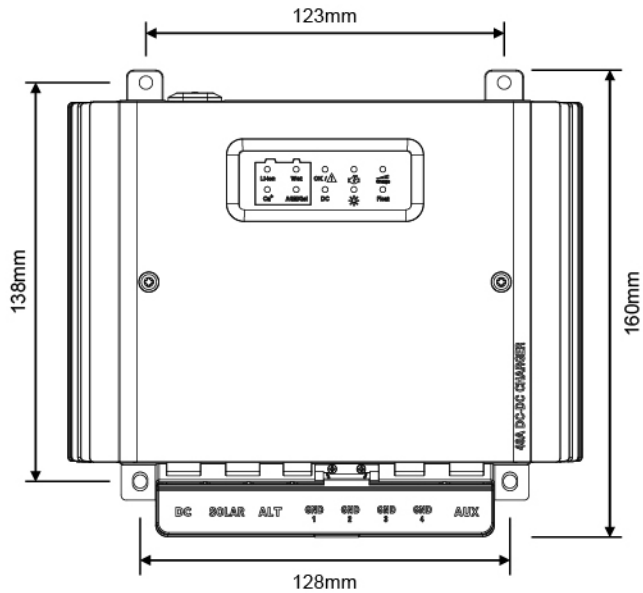
### External battery charger connection

An AC powered battery charger can be connected to the auxiliary battery without disconnecting the **DX-25 / DX-40** if it is currently on standby mode and not in any charging cycle.

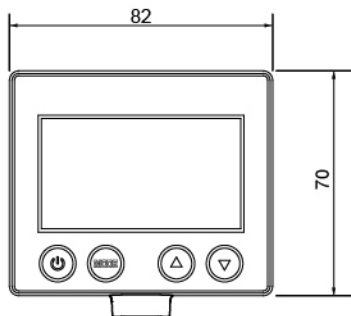
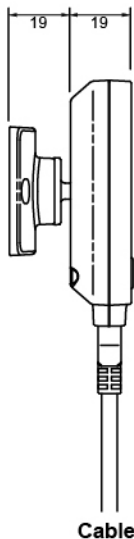
# DX-25 Dimensions



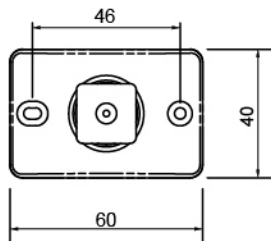
## DX-40 Dimensions



## DX-M2 Dimensions



**Remote Monitor DX-M2**



**Wall Mount Bracket**

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