



THE POWER CONVERSION SPECIALISTS

Smart Start®

BATTERY MANAGEMENT SYSTEM

BMS1215



Warnings and Safety Instructions

This manual contains important information relating to the safe installation and operation of the Smart Start[®] BMS. Please read and understand these instructions before attempting to install or use the Smart Start[®] BMS.



WARNING

Throughout this manual, warnings like this will appear to identify conditions or practices that could result in harm to the user and/or damage to the Smart Start[®] BMS or other equipment.



IMPORTANT

Throughout this manual, important information that the user should know will be denoted like this.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they are supervised or have been instructed how to use the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

Do NOT disassemble the Smart Start[®] BMS - the internal circuitry contains hazardous voltages. Attempting to service the unit yourself may result in electric shock or fire and will void the unit warranty.

Do NOT use the Smart Start[®] BMS to charge non-rechargeable batteries. Doing so may result in harm to the user and/or damage to the Smart Start[®] BMS. Only use the Smart Start[®] BMS for charging Standard Lead Acid, Calcium content, Gel & AGM type 12V batteries.

Features and Benefits

1. The Smart Start[®] BMS incorporates five products in one, negating the need for separate AC 240V charger, solar regulator, DC-DC charge system, battery monitor and vehicle battery isolator. The Smart Start[®] BMS will automatically select between charging sources, requiring no input from the operator during its operation.
2. The Smart Start[®] BMS has no fan, which makes it SUPER quiet and very reliable.
3. The Smart Start[®] BMS is designed and manufactured in Australia, for Australian conditions, using the latest electronic and design technologies. It is manufactured with high-quality components to ISO9001 quality and ISO14001 environmental standards and backed with Redarc's quality service and two-year warranty.
4. The Smart Start[®] BMS's DC-DC charging enables optimal charging of house batteries, even if they have different chemical characteristics from the vehicle battery. The input voltage can be above, equal to or below the output voltage.
5. State of Charge (SOC) indication means you will always know how fully charged the battery is and how much longer it will need to achieve full charge. An easy to operate, high-quality, user friendly liquid crystal display (LCD) module lets you know what's going on at all times.
6. The Smart Start[®] BMS is very reliable and includes in-built non-sparking battery connection, reverse polarity protection (without depending on fuses) and short circuit protection. The unit has undergone stringent safety & electrical compliance testing.
7. The units easily selectable charging profiles make it suitable for charging all battery types commonly used in modern caravans and motorhomes.
8. The unit disconnects automatically from the vehicle battery, so there is always power to start the car.
9. Sophisticated fault detection monitors the house battery condition during all stages of charge, keeping you and your caravan/ camper/ RV safe.
10. The Smart Start[®] BMS has a separate battery temperature sensor for automatic temperature compensation and cut-out.

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1 Introduction

1.1 General Description

The Smart Start[®] BMS is designed to offer a complete solution to battery charging and maintenance needs for recreational automotive applications.

The Smart Start[®] BMS incorporates AC, DC and Solar inputs to achieve the best charge to a house battery.



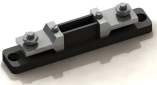




1.2 The Remote Monitor

The Smart Start[®] BMS comes with a Remote Monitor designed to give you house battery information and charge status along with critical system information while charging is in progress.

With the Remote Monitor, you can customise how your house battery is charged and monitor where the charge is coming from, keeping you in control at all times.

The Remote Monitor can be surface mounted on a wall, or flush mounted (into the dashboard of an RV for example).

1.3 The Kit Includes

- | | | | |
|---|---------------------------|--|---|
| 1 | Main Unit..... |  | |
| 2 | Remote Monitor..... | |  |
| 3 | Current Shunt..... |  | |
| 4 | Temperature Sensor..... | |  |
| 5 | Remote Monitor Cable..... |  | |
| 6 | Power Cable..... | |  |
| 7 | Shunt Wire..... |  | |

1.4 Specifications

Electrical Specifications

Inputs

AC Input

I/P Voltage Range	220 - 240V AC, 50 - 60Hz
Power Rating	280W
Efficiency	92%
Connection	Mains Plug

DC Input

I/P Voltage Range	9 - 18V
Power Rating	260W
Efficiency	94%
Connection	Terminal Block (See figure 2.4.3)

Solar Input

I/P Voltage Range	9 – 18V
Power Rating	260W
Efficiency	93%
Connection	Terminal Block (See figure 2.4.3)

Max Charging Volts @ Battery Terminals

	Storage Mode	Touring Mode
Gel Setting	14.4V	14.4V
AGM Setting	14.4V	14.4V
Calcium Setting	16.0V	15.2V
Standard Lead Acid Setting	15.5V	14.8V
Float Voltage		13.5V
Output Voltage Ripple		<15mV
Output Current (Nominal)		15A
Temperature Compensation		-5mV / Batt. Cell / °C
Limit Temperatures		0°C - 75°C (5°C Hysteresis)
Over Temperature Shutdown		Yes
Recommended Total Batt Capacity		40 – 400Ah
Required Number of Cells in Series		6 (12V Battery)
Non-Sparking Connection		Yes
Memory Save on Battery Disconnect		Yes

O/P Protection

Short Circuit Protection	Yes
Surge Protection	Yes
Reverse Polarity Protection	Yes
Overload Protection	Yes

Compliance

C-Tick	EMC-CISPR.11
Safety	AS/NZS 60335.2.29
	AS/NZS 60335.1
Environmental	ROHS Compliant

General Specifications

Main Unit Dimensions	350x185x79mm
Remote Dimensions	186x74x29mm
Kit Weight	2.43 kg
Warranty	2 years

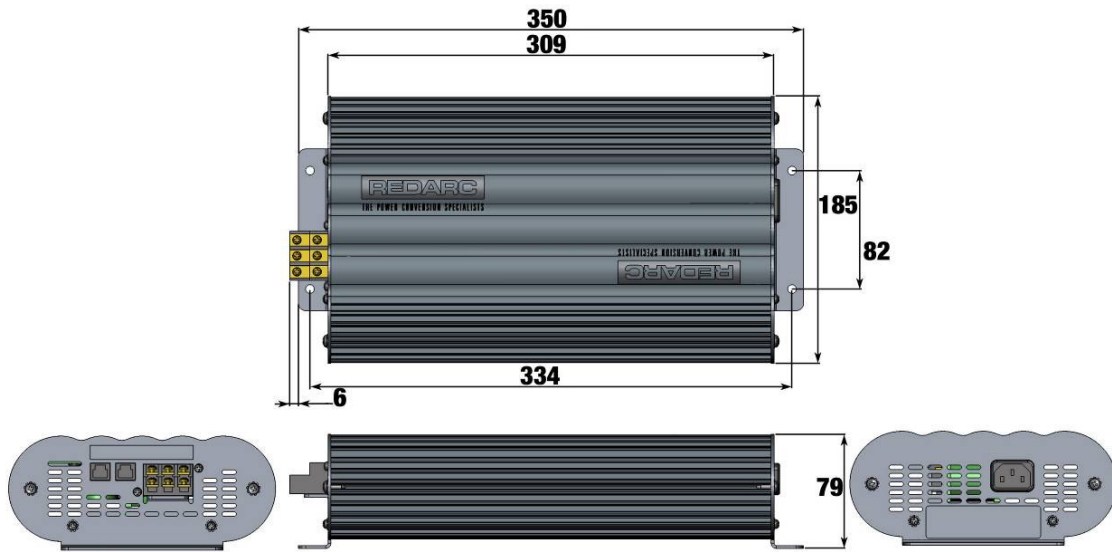


Figure 1.4.1 – Main Unit Dimensions



Figure 1.4.2 – Remote Dimensions

All dimensions shown are in millimetres (mm).

1.5 Multi-stage Charging Process

The Smart Start[®] BMS incorporates two different multi-stage charging profiles – Touring (3-stage) and Storage (5-stage) – which can be selected in the Battery Mode menu on the Remote Monitor.

Touring Mode

Touring mode is designed for use when ‘on the road’. Touring mode offers a 3-stage charging profile consisting of Boost, Absorption and Float stages (see Figure 1.4.1). In Touring mode, the house battery is monitored to detect only a limited number of faults such as short circuit, over current and over voltage. This allows the Smart Start[®] BMS to operate correctly even when loads are connected to the house battery. This mode will always produce an output (unless a fault condition is detected) and will cycle through the three stages as required to maintain the house battery as outlined in Figure 1.4.1.



IMPORTANT

Touring mode will achieve its best charge level if a Storage mode charge has been recently performed.

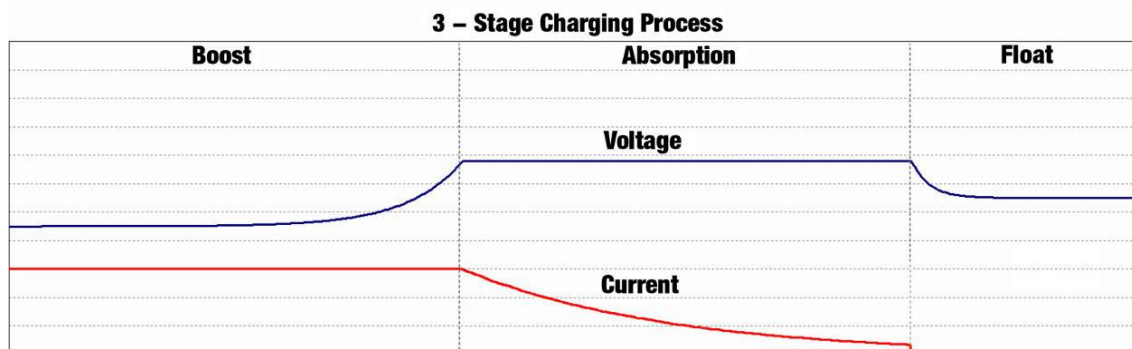


Figure 1.4.1 – 3-stage charging profile

Storage Mode

Storage mode is designed to charge the house battery to its optimal level and maintain that level while your caravan is in storage. This mode requires all loads to be switched off or disconnected from the house battery before charging. It uses a 5-stage charging profile consisting of Boost, Absorption, Equalise, Float and Maintenance stages (see Figure 1.4.2). Storage mode is designed to detect a wide range of battery fault conditions, for more information on these fault conditions, please refer to the Troubleshooting section of this manual. Unlike Touring mode, Storage mode does not cycle. This means that when the cycle is completed, the Smart Start[®] BMS will always remain in either Float or Maintenance stages. Float stage will provide the house battery with a 'trickle' charge whenever the house battery voltage drops below a predetermined threshold to ensure the battery stays charged. Maintenance stage turns the Smart Start[®] BMS output off, but continues to monitor the house battery and will revert to Float stage when necessary.



WARNING

Remove all loads from the house battery before starting a Storage mode charge. Failure to do so could result in an insufficient charge on the house battery or damage to sensitive loads connected to the house battery.

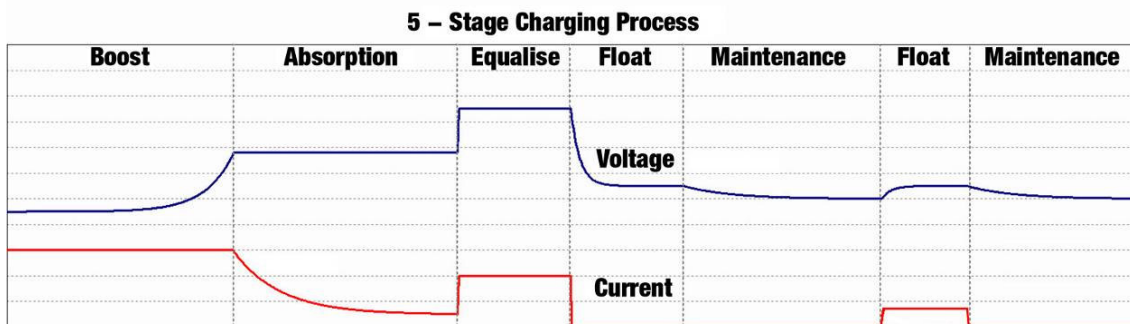


Figure 1.4.2 – 5-stage charging profile

2 INSTALLATION Guide

2.1 System Layout

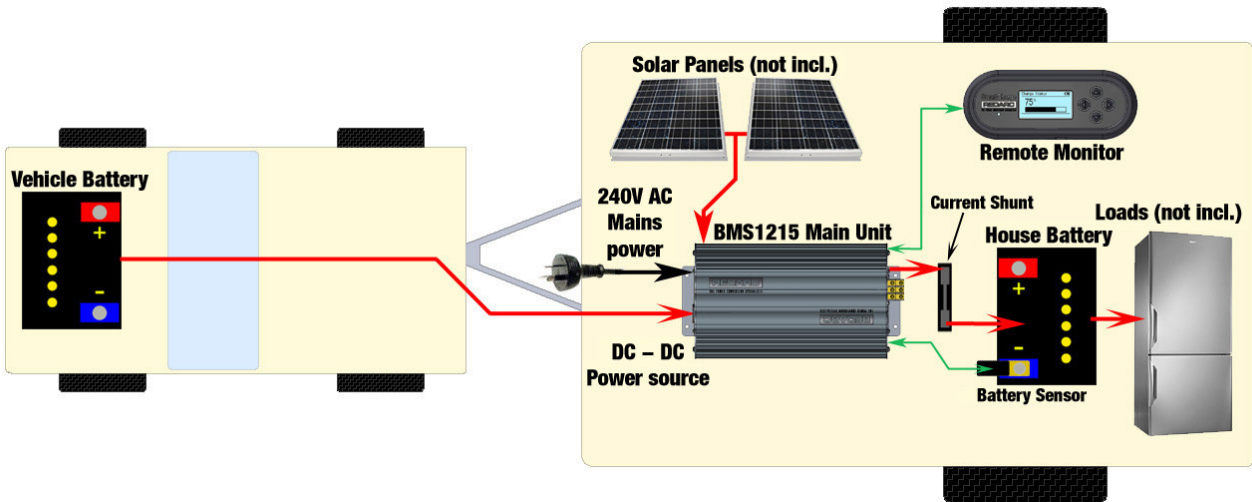


Figure 2.1.1 - System Layout

2.2 Mounting Instructions

This section describes how to mount the four major components of the Smart Start[®] BMS: the Main Unit, the Remote Monitor, the Current Shunt and the Battery Sensor.



Figure 2.2.1 – The BMS System

2.2.1 Mounting the Main Unit

Do NOT expose the Main Unit to rain, snow, spray or bilge water. For optimum operation, the Smart Start[®] BMS should be mounted where the temperature is nominally below 35°C and does not exceed a maximum of 60°C.

The Main Unit must not be installed in a location with any less than 10cm clearance at the top of the Main Unit, to allow for airflow across the heatsink fins. Care must be taken not to obstruct the ventilation holes at the end of the Main Unit.

The Main Unit should be installed as close as possible to the house battery. The cable length should be less than 2m.

The Main Unit must be mounted to a solid support, preferably the vehicle chassis, using M6 sized screws or bolts, using all four mounting holes.



WARNING

The Main Unit must be fixed using suitable screw mounts. Do NOT use adhesive to mount the unit because this is unreliable.

Redarc recommends that the Main Unit be mounted to optimise airflow past the heatsink. Mounting the unit horizontally (see Figures 2.2.1.1 and 2.2.1.2) is acceptable. Do NOT mount the unit as shown in Figure 2.2.1.3 or Figure 2.2.1.4.



Figure 2.2.1.1 – Horizontal mounting: acceptable



Figure 2.2.1.2 – Horizontal mounting: acceptable



Figure 2.2.1.3 – Do NOT mount the unit this way



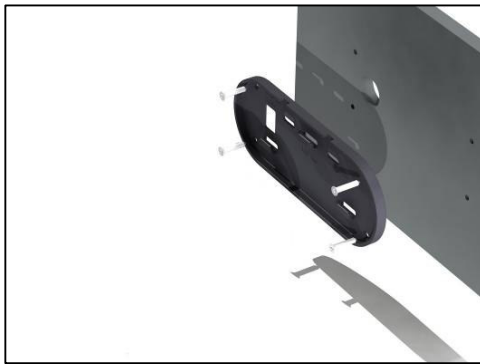
Figure 2.2.1.4 – Do NOT mount the unit this way

2.2.2 Mounting the Remote Monitor

The Remote Monitor should be mounted inside the caravan or RV. It is acceptable, however, to mount the Remote Monitor in any convenient location.

Figures 2.2.2.1 and 2.2.2.2 illustrate how to wall mount and flush mount the Remote Monitor unit.

Wall Mount



1 Use the template provided to mark position, and drill mounting holes into the wall.



2 Feed the Remote Cable through the hole provided & mount the Back Plate to the wall.



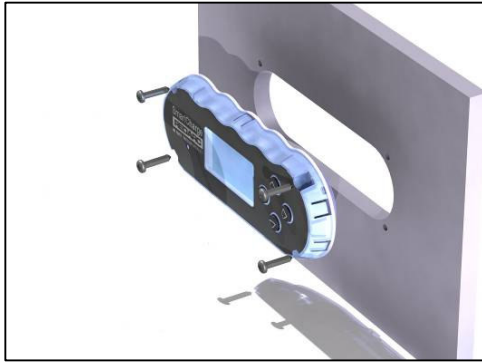
3 Connect the Remote cable to the Remote & clip the Inner Assembly to the Back Plate.



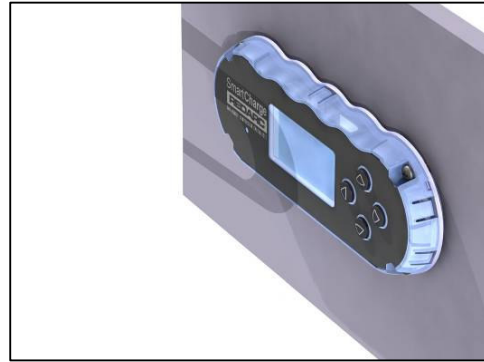
4 Clip the Front Face to the Inner Assembly. Remote is now Wall Mounted.

Figure 2.2.2.1 – How to wall mount the Remote Control

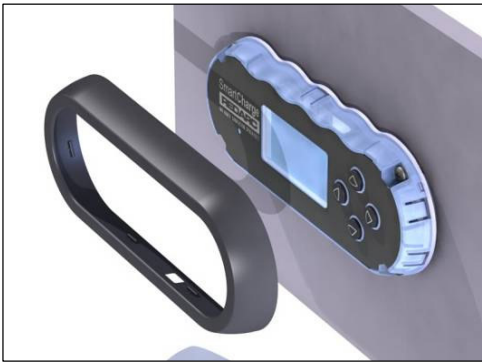
Flush Mount



1 Use template provided to mark position, and drill mounting holes into the wall. Cut a hole in the wall to fit the Inner Assembly as shown.



2 Connect the Remote Cable & fasten the Inner Assembly to the wall.



3 Clip the Front Face to the Inner Assembly.



4 Remote is now Flush Mounted.

Figure 2.2.2.2 – How to flush mount the Remote Control

2.2.3 Installing the Current Shunt

Bolt the Current Shunt between the **negative** terminal of the house battery and the common negative terminal block using the outside connections as shown in figure 2.2.3.1. Connect the sense terminals on the Battery Management System to the Current Shunt with a twisted pair of wires. The shunt positive wire is connected to the screw terminal on the end of the Current Shunt closest to the house battery. The shunt negative terminal on the Smart Start[®] BMS must be fixed under the screw terminal on the Current Shunt nearest the common negative connection.

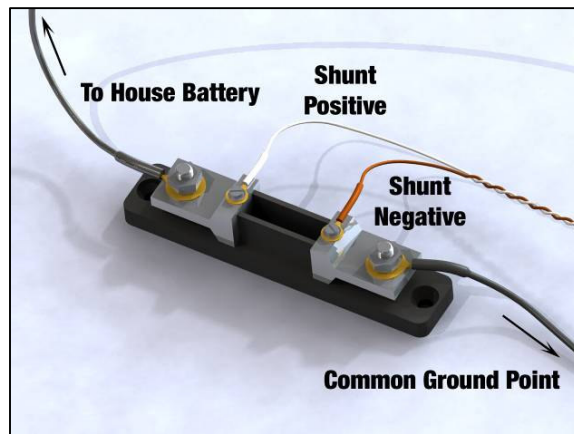


Figure 2.2.3.1 – Current Shunt Installation
(Wire sizes not to scale)

2.2.4 Installing the Battery Sensor

Bolt the large lug of the Battery Sensor to the **negative** terminal of the house battery, with the ring terminal of the red wire bolted to the **positive** terminal of the house battery as shown in Figure 2.2.4.1.

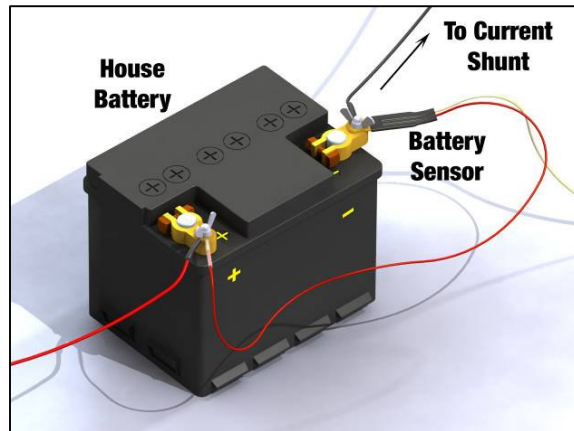


Figure 2.2.4.1 – Battery Sensor Installation
(Wire sizes not to scale)

2.3 DC Cable Size Requirements



WARNING

Cable and fuse sizes are specified by various codes and standards which depend on the type of vehicle the unit is installed into. Selecting the wrong cable or fuse size could result in harm to the installer or user and/or damage to the Smart Start[®] BMS or other equipment installed in the system. The installer is responsible for ensuring that the correct cable and fuse sizes are used when installing this device.

Input Wire Diameter Selection

The Smart Start[®] BMS is capable of drawing up to 30A from the vehicle battery, which may be several metres from its installation location. The installer needs to ensure the appropriate cable is used to connect the positive and negative connections of the Smart Start[®] BMS to the vehicle battery. While the Smart Start[®] BMS will operate with less efficient cabling, for best performance, high-quality cable connections should be used to minimise voltage drop and efficiency losses.

Redarc recommends the installer use cabling and connections between 6mm automotive and 6B&S. The recommended maximum cable length between input vehicle battery and the Smart Start[®] BMS should not be longer than 10m for 6mm auto or 20m for 6B&S.

Though the Smart Start[®] BMS will operate with less efficient cabling, Redarc recommends that the input wire be of the size outlined in Table 2.3.1.

Distance (metres) from source battery to BMS1215	Recommended Diameter [mm ²]	Recommended Diameter Equivalent
1	4	6mm auto
2	6	8 B&S
3	10	6 B&S
4	12	6 B&S
5 +	16	6 B&S

Table 2.3.1 – Recommended cable sizes for safe cable heating and efficiency losses

Output Wire Diameter Selection

To ensure the house battery is charged as quickly as possible, use the appropriate cable to connect the Smart Start[®] BMS to the battery to be charged. The Smart Start[®] BMS should be mounted as close as possible to the battery being charged. Table 2.3.2 lists the recommended cable sizes based on a cable voltage drop of 0.3V @ 15A.

Minimum cable size is 2.9 mm² or 5mm auto (less than 1m length).
Maximum cable size is 8mm² or 6B&S (no need to use values higher than this). For longer runs using 8mm² is recommended, however this will reduce efficiency below 3% (the recommended maximum length is 5m).

Distance (metres) from BMS1215 to house battery	Recommended Diameter [mm ²]	Recommended Diameter Equivalent
0.5	2.9	5mm auto
0.75	3.2	6mm auto
1	4	6mm auto
1.25	5	8 B&S
1.5	6	8 B&S
1.75	7	8 B&S
2	8	6 B&S

Table 2.3.2 – Recommended cable sizes based on a cable voltage drop of 0.3V @ 15A

NOTE: Redarc has determined these recommended cable sizes based on 50°C maximum ambient temperature, a single cable loom and does not include any connection losses. The installer is responsible for ensuring that these cables are indeed suitable for the vehicle installation.

2.4 Connections



WARNING

Redarc recommends that this unit be installed by a suitably qualified person.



WARNING

The AC power connection **must** be connected to an earthed socket outlet. Do not use the Smart Start[®] BMS AC input if the cord is damaged. If the AC power cord is damaged, replacement cords are available from Redarc, manufactured in accordance with national wiring rules.



WARNING

During connection of the unit, the positive battery terminal must be connected first, followed by the chassis terminal. The chassis connection should be made away from the battery and fuel lines. Supply mains should be connected last in accordance with national wiring rules.

When disconnecting, the supply mains should be disconnected first, followed by the chassis connection, then the battery connection.

Refer to Figures 2.4.1, 2.4.2 and 2.4.3 for required connections and to Figure 2.4.4 for a typical setup.

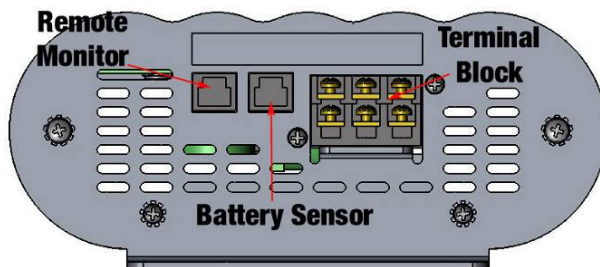


Figure 2.4.1

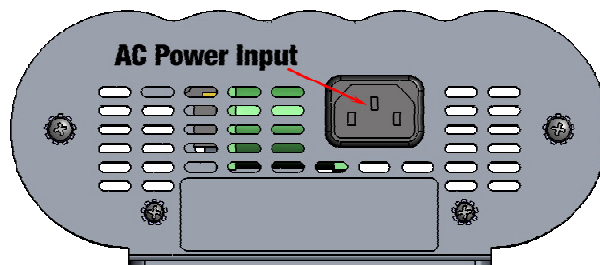


Figure 2.4.2

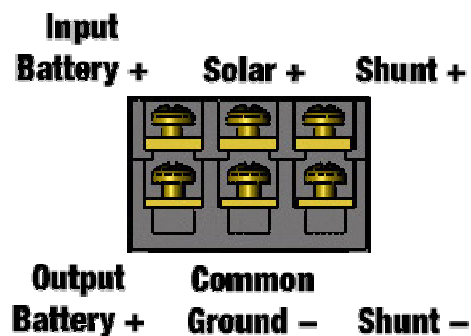


Figure 2.4.3

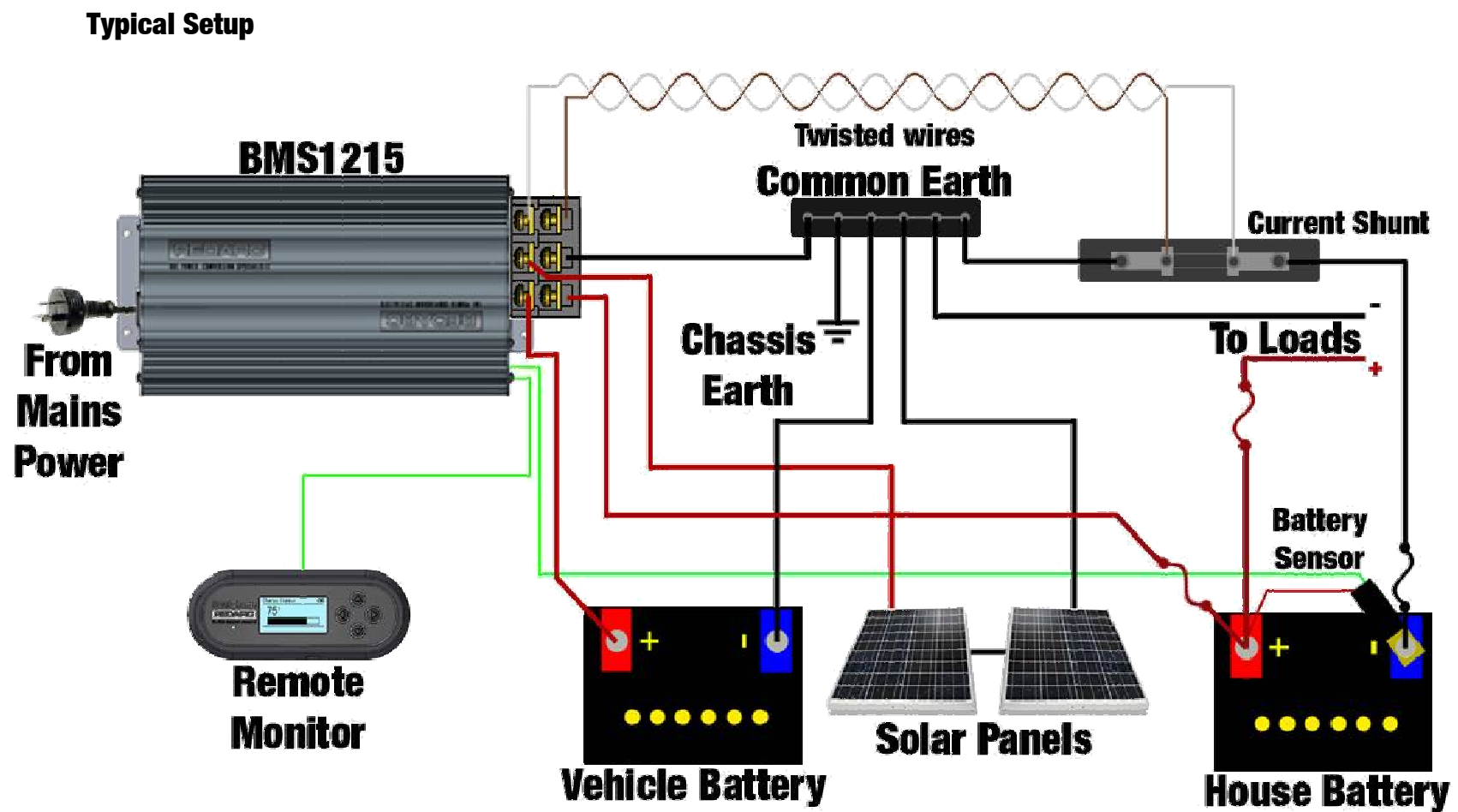


Figure 2.4.4 – Typical setup

2.5 Batteries



WARNING

Explosive gases can be generated by the house battery during the charge process, therefore the battery should be kept in a well ventilated area.



WARNING

When charging a battery, make sure the settings at the Battery Setup menu on the Remote Monitor are correct for the type of battery under charge. Charging a battery with the wrong profile may cause the Smart Start[®] BMS to indicate a fault or give misleading results and could result in damage to the battery. Noticeable oscillations between Boost and Absorption stages indicate the wrong choice of battery type. Check and adjust battery type. If you are unsure of the battery type or settings to use, set the Smart Start[®] BMS to the Gel setting.

Figure 2.5.1 and 2.5.2 show standard wiring for batteries in series and parallel respectively.

Series Battery Connection 12V System

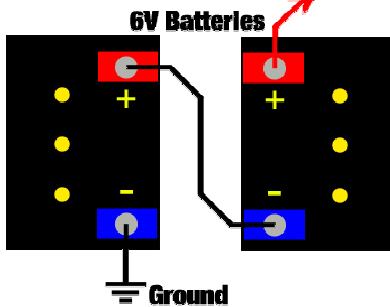


Figure 2.5.1 –
Standard wiring for
batteries in series

Parallel Battery Connection 12V System

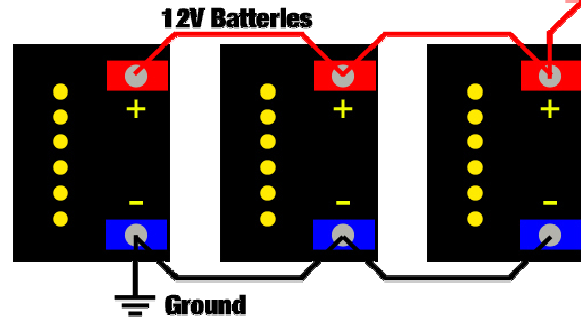


Figure 2.5.2 –
Standard wiring for
batteries in parallel

To ensure that all batteries are equally charged, loads and Smart Start[®] BMS should be connected with ground and 12V power connected diagonally opposite across all batteries as shown in Figure 2.5.1 and 2.5.2.

2.6 MPPT Solar Regulator

Solar Input

The Smart Start[®] BMS is designed for use with 12V solar panels (panels that have a maximum output voltage of up to 25V). A minimum input voltage of 14V is required to start charging from a solar source. Once charging has started, the operating voltage range of the solar input can go as low as 9V and as high as 25V; outside of this range, charging will stop.

Maximum Power Point Tracking

The power output from solar panels varies depending on the amount of sunlight and the electrical load on the solar panel output. The Smart Start[®] BMS utilises a Maximum Power Point Tracking (MPPT) algorithm on the solar input, to ensure that the greatest charge possible is being transferred from the solar panels to the battery under charge. As conditions change, the MPPT algorithm adjusts its parameters accordingly, in order to maintain the optimum point at which the solar panels can deliver the most power.

Solar Connections

An array of solar panels can be connected to the Smart Start[®] BMS solar input, on the condition that the open circuit output voltage of the array is at least 14V and does not exceed 25V*. For this reason, 12V panels (or pairs of series connected 6V panels) must be connected in parallel (Refer to Figure 2.6.1 and

Figure 2.6.4). So long as the voltage requirements are met, there is no limit to the number of panels that can be connected in a solar array; however the Smart Start[®] BMS will not draw more than 260W from the solar input. For installations with a single 12V solar panel, a blocking diode is not necessary. For installations with an array of solar panels, please refer to the panel manufacturer's instructions for requirement and/or fitment of diodes.

*Note: The maximum output voltage of a "12V" solar panel is not 12V. "12V" solar panels are designed to be able to operate in a 12V charging system, and thus may have a maximum open circuit output voltage anywhere from 14V to 23V or more.

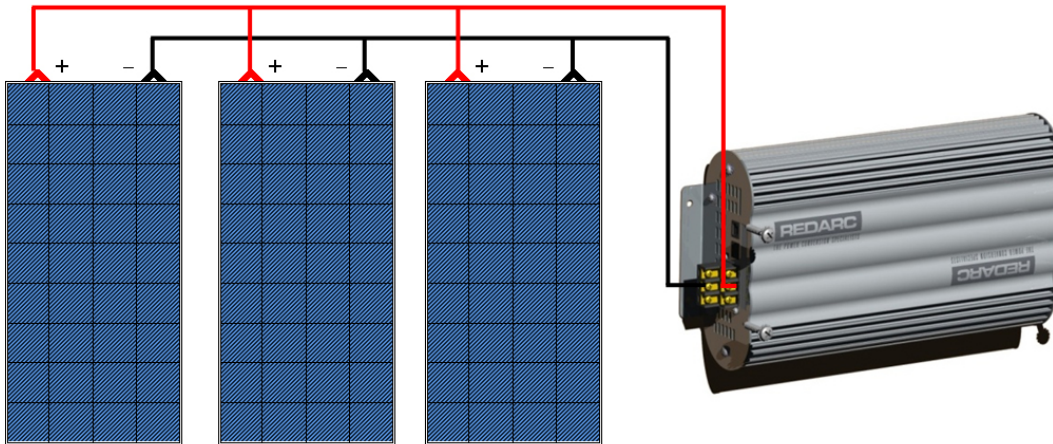


Figure 2.6.3 - Array of 12V Solar Panels

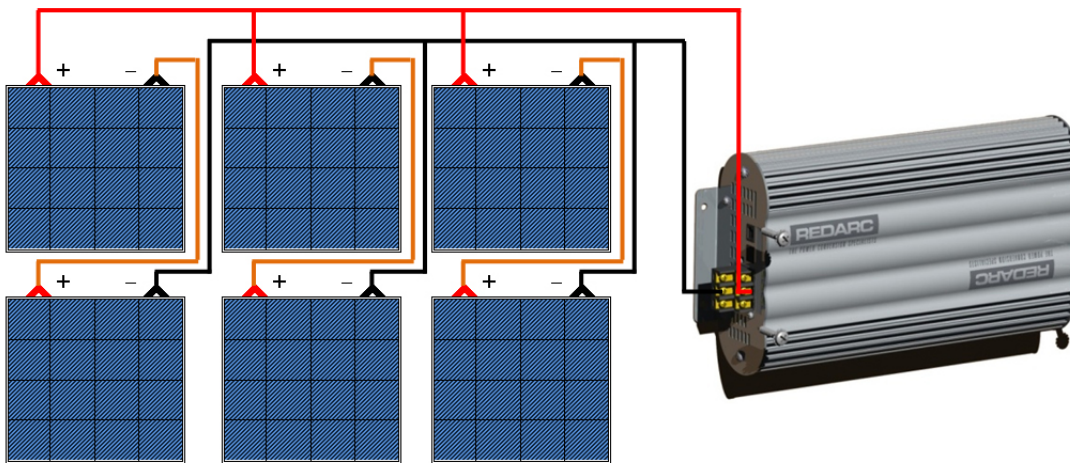


Figure 2.6.4 - Array of 6V Solar Panels

3 USER Guide

3.1 Remote Monitor

The Remote Monitor is designed to give you control of how the battery is being charged, as well as up-to-date house battery and charge information at any time during the charging process. You can check battery charge status, estimated charge time and State of Charge (SOC) per hour over a day and per day over a month. It also allows you to select charging profiles specific to the battery type and size. The four controls 'Up', 'Down', 'Enter' and 'Exit' allow you to select options or move in and out of menu items.



Figure 3.1.1 – The Remote Control

3.2 Understanding the Display

The top left corner of the screen always displays the title of the present menu. Use the 'Up' and 'Down' buttons to move between menus and to change settings such as battery type and contrast level. At any time during operation, the 'Exit' button will take you back to the last level, unless otherwise specified. At any time during operation, the menu at the bottom of the screen will explain the function of the 'Enter' and 'Exit' buttons.

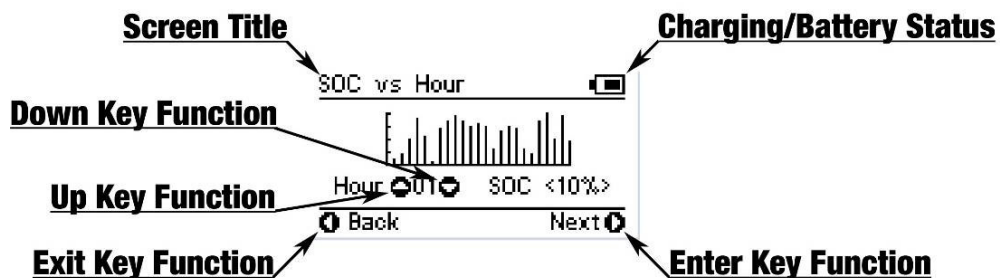
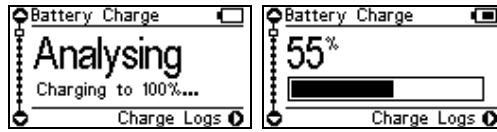
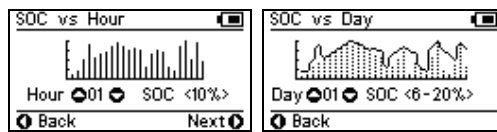


Figure 3.2.1 – The LCD Display

3.3 Navigating the Menu

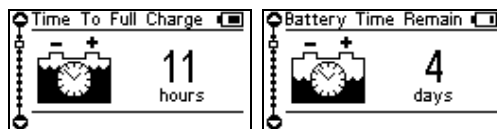


The Smart Start® BMS monitors current in and out of the house battery, keeping track of the charge remaining in the battery. This screen displays the estimated state of charge of the house battery in percentage along with a bar graph. During and for the duration of the initial charge cycle for a new battery this screen will show 'Analysing'. This is when the Smart Start® BMS is gathering information about the battery under charge. Press the 'Enter' key to view the State of Charge (SOC) graphs by hour or by day.



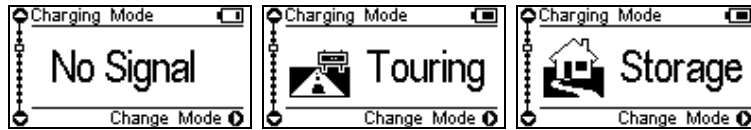
These screens display the State of Charge of the battery under charge per hour across the course of the last day, or per day across the course of the last month. These screens will record the present State of Charge for the hour and the maximum and minimum States of Charge for the day and display them at the bottom of the screen as shown. Pressing the 'Up' key at this screen will take you to the State of Charge screen for the previous hour or day. Similarly, pressing the 'Down' key at this screen will take you to the State of Charge screen for the next hour or day. The most recent day or hour is always numbered as 1, and is the left most line on the graph. Pressing the 'Exit' button from the SOC by day screen will take you back to the SOC by hour screen. Pressing the 'Exit' button from the SOC by hour screen will take you back to the Charge Status screen.

Pressing 'Down' from the Charge Status screen will take you to the Battery Status screen.

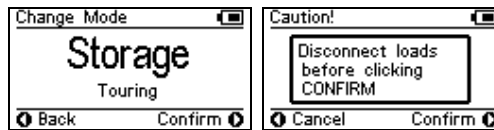


This screen will display either the Time to Full Charge or the Battery Time Remaining, depending on whether the house battery is currently being charged or discharged. The Smart Start® BMS uses the estimated State of Charge value to calculate - based on the current into or out of the house battery - the time to reach 100% State of Charge. You may use this to decide when to disconnect AC power, for example. Similarly, the Smart Start® BMS uses the estimated State of Charge value to calculate - based on the power usage of the system (e.g. of loads such as fridges, lighting) - the useful time remaining of the battery.

Pressing 'Down' from the Battery Status screen will take you to the Charge Mode screen.



The Smart Start® BMS can be configured via this setting to use either a 3-stage (Touring) or a 5-stage (Storage) charging mode to get the best charge for the situation. Storage mode should only be used while loads are turned off (such as when the caravan is in storage). It will perform an equalise charge on your battery as well as performing health checks on the house battery. Touring mode will maintain charge output as much as possible and will only perform critical status checks to ensure maximum charge is output to the house battery from your source (while on the road or when loads are connected). Pressing the 'Enter' key at any of these screens will give you the option of changing the charge mode.



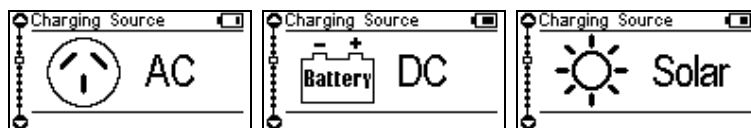
While at this screen, pressing 'Up' or 'Down' will change the mode, and pressing the 'Enter' key will confirm the change. When changing from Touring to Storage mode, a Caution screen will appear, asking you to disconnect all loads. This must be done before selecting storage mode, as the Storage charging profile requires no interference from system loads during the charging process. Pressing the 'Exit' key at this Caution screen will cancel the change.

Press 'Down' from the Charge Mode screen to display the Charge Source screen.



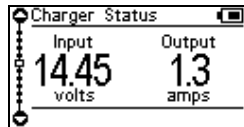
IMPORTANT

When changing the charge mode from Touring to Storage, make sure that all loads are disconnected from the house battery under charge. Failure to do so may cause the house battery to be under charged, give false readings on the State of Charge indicator and possibly cause damage to any loads connected to the system.



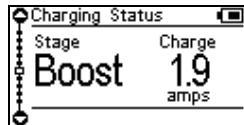
This menu displays the selected input source for the battery charger. The Smart Start® BMS operates on a charge priority setup, with AC being the highest priority, followed by DC and then Solar.

Pressing 'Down' from the Charge Source screen will take you to the Charge Status screen.



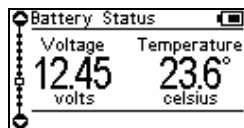
This screen displays the voltage into and the total current out of the Smart Start® BMS.

Pressing 'Down' from the Charger Status screen will display the Charging Status screen.



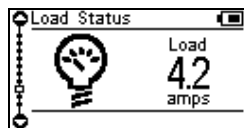
This screen displays the charging status of the Smart Start® BMS, including Charge Stage and Charging Current.

Pressing 'Down' from the Charging Status screen will display the Battery Status screen.



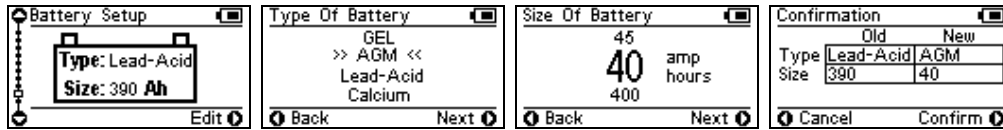
This screen displays the status of the battery under charge, including Battery Voltage and Battery Temperature.

Pressing 'Down' from the Battery Status screen will display the Load Status screen.



This screen displays the Current drawn from the battery under charge, by other equipment in the system.

Pressing 'Down' from the Load Status screen will display the Battery Setup menu.



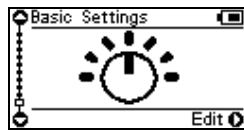
The first screen in this menu displays the selected battery settings for the battery under charge. Pressing the 'Enter' key allows you to edit these settings. The menu will ask what type of battery is going to be charged, followed by what the size of the battery is. When you have chosen these values, the menu will ask for confirmation of the settings while displaying them on the screen. Pressing 'Enter' at this screen will confirm the settings and return to the Battery Setup screen.

Pressing 'Down' from the Battery Setup screen will display the Basic Settings menu.



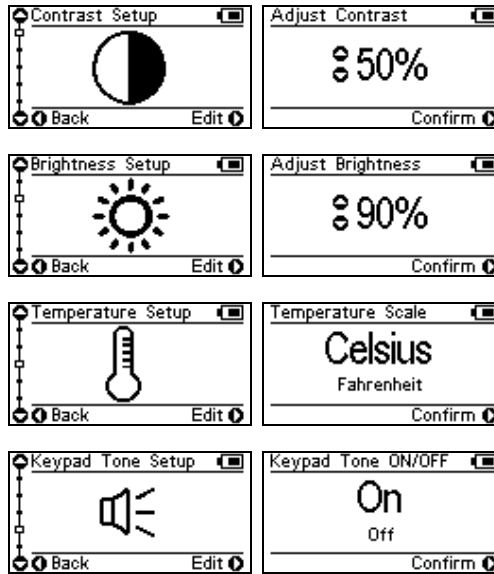
WARNING

When charging a battery, make sure the settings at the Battery Setup menu on the Remote Monitor are correct for the type of battery under charge. Charging a battery with the wrong profile may cause the Smart Start[®] BMS to indicate a fault and could result in damage to the battery. If you are unsure what battery type or settings to use, set the Smart Start[®] BMS to the Gel setting. These settings should be reviewed and/or changed every time the battery is connected to the Smart Start[®] BMS.



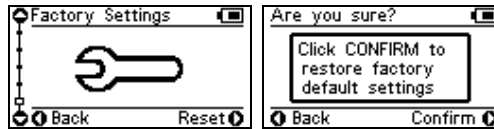
Via this menu, you can change settings relating to the Remote Display and its operation. Pressing the 'Enter' key at this screen allows you to configure settings for Contrast, Brightness, Temperature and Keypad Tones as well as restoring the Factory Settings of the Smart Start[®] BMS.

Pressing 'Enter' at this menu will display the Basic Settings menu items. Pressing 'Down' at this screen will return to the Charge Status screen.



Pressing the 'Up' and 'Down' keys at this menu will cycle through the available settings for adjustment. Pressing the 'Enter' key at any of these screens allows you to adjust the selected setting. The settings are adjusted by pressing the 'Up' and 'Down' keys. Once the desired setting is selected, pressing the 'Enter' key will take you back to the Title screen for the setting that was just altered.

Pressing the 'Exit' button from the title screens will take you back to the Basic Settings screen.

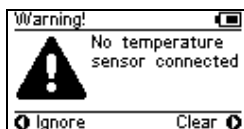


This screen is also found in the Basic Settings menu and gives you the option of restoring the Factory Settings for the Smart Start[®] BMS. To restore Factory Settings press the 'Enter' key. A caution screen will ask 'Are you sure?'. Pressing the 'Enter' key will restore all Factory Settings.

Pressing 'Back' at the Factory Settings screen will take you back to the Basic Settings screen.

Factory Settings

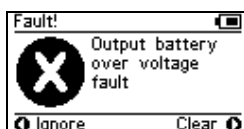
Battery Type	GEL
Capacity	40 Ah
Charge Mode	TOURING
Temperature Scale	Celsius
Key Tone Status	ON
Contrast	50%
Brightness	90%



If the Smart Start[®] BMS detects a problem with the charging system that **does not prevent it** from charging the battery, it will alert you via a Warning screen and an alarm buzzer, and continue charging. The screen will give a brief description of the problem and allow you to select either 'Clear' or 'Ignore' via the 'Enter' and 'Exit' buttons. Both options will clear the warning screen. After selecting 'Clear', however, the Smart Start[®] BMS will immediately check to see if the fault condition still exists. If it does, it will display the warning screen again. Selecting 'Ignore' will prevent the Smart Start[®] BMS from detecting the same fault for up to one minute.

NOTE: If "Ignore" is selected but the fault is not removed, when the warning re-appears after one minute, it will **not** be accompanied by the alarm buzzer.

The troubleshooting section of this manual contains a description of faults detected.



If the Smart Start[®] BMS detects a problem with the charging system that **prevents it** from continuing to charge the battery, it will alert you via a 'Fault' screen and an alarm buzzer, and will instantly terminate the charging cycle until the fault condition is cleared. The screen will give a brief description of the problem and will allow you to select either 'Clear' or 'Ignore' via the 'Enter' and 'Exit' buttons. Both options will clear the fault screen. After selecting 'Clear', however, the Smart Start[®] BMS will immediately check to see if the fault condition still exists. If it doesn't, the unit will restart charging. Selecting 'Ignore' will simply hide the fault screen for up to one minute. It will not allow the Smart Start[®] BMS to recommence charging unless the Smart Start[®] BMS itself detects the removal of the fault condition.

NOTE: If "Ignore" is selected but the fault is not removed, when the warning re-appears after one minute, it will **not** be accompanied by the alarm buzzer.

The troubleshooting section of this manual contains a description of faults detected.

3.4 Troubleshooting

The Redarc Smart Start[®] BMS is one of the most advanced Battery Management Systems on the market. It has been designed to detect and advise the operator of a variety of fault conditions and will terminate the charging cycle immediately should a critical fault be detected. This ensures that it will not attempt to charge a faulty battery, which protects the Smart Start[®] BMS, house battery and most importantly the user.

The Remote Display is used to inform the user of the nature of the problem whenever possible. These indicators should be used to diagnose, and if possible correct any faults that may occur. If after attempting to rectify the situation, a fault still occurs, please send the unit back to Redarc for diagnosis. When attempting to diagnose a fault, cabling should be over-rated and all components, including all input sources and house battery should be connected as close as possible to the Smart Start[®] BMS.

FAULT MESSAGE	CAUSE	ACTION
Smart Start [®] BMS over current fault	An internal error has caused excessive current draw	Return to supplier
Output battery over voltage fault	The output battery voltage is too high (above 18V)	Check battery is correct type (12V, 6 cell)
Internal temp sensor short circuit fault	There is an error with the internal temperature sensor	Return to supplier
Internal temp sensor open circuit fault	There is an error with the internal temperature sensor	Return to supplier
Unit over temperature fault. Allow to cool	The unit has over heated	Allow to cool, charging will recommence automatically
Output battery under temperature fault	Output battery is below 0°C	Smart Start [®] BMS will halt charging until battery is above 5°C
Output battery over temperature fault	Output battery is above 60°C	Smart Start [®] BMS will halt charging until battery is below 55°C
Internal solar relay open circuit fault	There is an error with an internal relay	Return to supplier
Internal solar relay short circuit fault	There is an error with an internal relay	Return to supplier
Internal DC relay open circuit fault	There is an error with an internal relay	Return to supplier
Internal DC relay short circuit fault	There is an error with an internal relay	Return to supplier
Internal output relay open circuit fault	There is an error with an internal relay	Return to supplier
Internal output relay short circuit fault	There is an error with an internal relay	Return to supplier
Dry cell detected in output battery	Smart Start [®] BMS has detected a dry cell in output battery	Replace battery
Shorted cell detected in output battery	Smart Start [®] BMS has detected a shorted cell in output battery	Replace battery
Fault detected in output battery	Smart Start [®] BMS has detected a fault in output battery	Replace battery

WARNING MESSAGE	CAUSE	ACTION
AC supply over voltage	The internal AC converter output voltage is too high	Return to supplier
AC supply under voltage	The internal AC converter output voltage is too low	Return to supplier
DC supply over voltage	The DC input voltage is too high (over 18V)	Check DC input, refer to specified input range
DC supply under voltage	The DC input voltage is too low (below 9V)	Check DC input, refer to specified input range
Solar supply over voltage	The solar input voltage is too high (over 25V)	Check solar input, refer to specified input range
Solar supply under voltage	The solar input voltage is too low (below 9V)	Check solar input, refer to specified input range
No temperature sensor connected.	The supplied battery sensor is not connected or is faulty	Connect battery sensor, if faulty return to supplier
LIN over current. Please check connections	The remote cable may be shorted	Check and/or replace remote cable
Low battery State of Charge	House battery is almost flat	Reduce/Remove loads on house battery

Other problems

FAULT	ACTION
Low output current can occur when the unit is hot and temperature derating is implemented to protect the Smart Start [®] BMS.	Check that the unit is in a well ventilated space.
The current display shows a negative current when there are no loads on the house battery and the house battery is charging.	The current shunt connection is reversed.
The unit clicks on and off when the input wiring is too long for the wire gauge used or there is a high resistance connection.	Check the wiring and/or use thicker wire.
The display shows wrong voltage or temperature.	Check the polarity of the voltage and temperature connections.
Noticeable oscillations between Boost and Absorption stages indicate wrong choice of battery type.	Check and select correct battery type.

TWO YEAR WARRANTY

REDARC Electronics warrants to the original purchaser that the product(s) on the reverse side of this sheet ("Product") will be free, under normal use and maintenance, from defects in material and workmanship for a period of TWO YEARS from the date of purchase, subject to the conditions shown below.

1. Warranty

Unless otherwise stated in this warranty, Redarc Electronics will at its sole discretion either replace or repair any of the Product that is defective in material or workmanship within the abovementioned period without charge to the original purchaser.

2. Other Warranty

Subject to any terms implied by law, this warranty contains the whole of the Redarc Electronics' obligations and any distributor and the agents, officers and employees of such distributor and of Redarc Electronics are not authorised to vary or extend the terms of the warranty. The benefits conferred by this warranty are in addition to the conditions and warranties implied by applicable legislation conferring rights upon consumers, which apply only to the extent to which they may not by law be excluded.

3. Exclusions

This warranty shall not apply to, or include, any of the following:

- 3.1 Any defect or failure due to accident, misuse, abuse, movement of the Product to a new site, negligence, non-observance of any of the instructions supplied with the Product including the instructions on the reverse side of this sheet ("Operating Instructions") or local regulations on the part of any user, choice of location, improper installation, configuration or connection, or faulty power supply.
- 3.2 If the Product is installed, repaired or serviced by a person who is not a qualified auto electrician or electronics technician, or if non-approved parts have been fitted.
- 3.3 Failure to obtain proper maintenance for the Product or any associated equipment or machinery.
- 3.4 Failure to pay for the products in full or comply with Redarc Electronics' Trading Terms.
- 3.5 If the Product is used other than for any reasonable purpose for which it was manufactured, or is used in a way not specified by Redarc Electronics.
- 3.6 If the original purchaser sells, leases or otherwise parts with possession of the Product.
- 3.7 Deterioration due to normal use and exposure, including abnormal environmental conditions such as lightning strike, flood and extreme heat.
- 3.8 Any freight, packing and insurance expenses relating to transportation of the Product.
- 3.9 Any expenses relating to installation and/or removal of the Product.
- 3.10 Any damage, indirect or incidental, of whatever nature.

4. Limitations

- 4.1 Redarc Electronics is not liable for any consequential, indirect or accidental loss or damage or for any service not expressly provided herein (including without limitation liability for any loss or damage caused by a fault in the Product or its external wiring connections) and the liability of Redarc Electronics under this warranty is limited to the repair or replacement of defective material or workmanship by a qualified auto electrician or electronics technician, provided such person and work is approved by Redarc prior to commencement. Subject to **clause 2**, Redarc Electronics is hereby excluded to the maximum extent permitted by law from all other liability in respect of the Product.
- 4.2 While Redarc Electronics warrants, where applicable, that the Product is free from defects in materials and workmanship under normal use at the time of delivery, Redarc Electronics does not warrant that the Product will meet any user specific requirements or that the operation of the Product will be uninterrupted or error-free.

5. Owner's Responsibilities

- 5.1 Maintenance of the Product and associated equipment and/or machinery is the responsibility of the owner. The owner must retain evidence that proper maintenance has been performed on the Product by Redarc Electronics or a qualified auto electrician or electronics technician. Claims made during the warranty term will not be accepted if resulting from lack of maintenance rather than faulty material or workmanship.
- 5.2 The owner must operate the Product in accordance with all of the Operating Instructions.
- 5.3 Upon discovery of a fault the owner must return the Product to the distributor with full details of the nature of the fault. Removal of the Product must be done by a qualified auto electrician or electronics technician to ensure that the warranty remains valid. A written report describing the circumstances of failure must accompany the returned Product with proof of purchase which clearly shows the date of such purchase by the original purchaser.
- 5.4 If the Product is found to be working satisfactorily on return to Redarc Electronics, a reasonable charge will be made for the cost of testing, packing and freight. The Product will be returned on receipt of the amount charged.

FREE TECHNICAL ASSISTANCE



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Quality System

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