1 Introduction

This section of the handbook will guide you through the operation of the electrical system.

Further technical details are contained later in this document or in the supporting technical manual available from www.sargentltd.co.uk

For the safe operation of all electrical equipment within your leisure vehicle it is important that you read and fully understand these instructions. If you are unsure of any point please contact your dealer / distributor for advice before use.

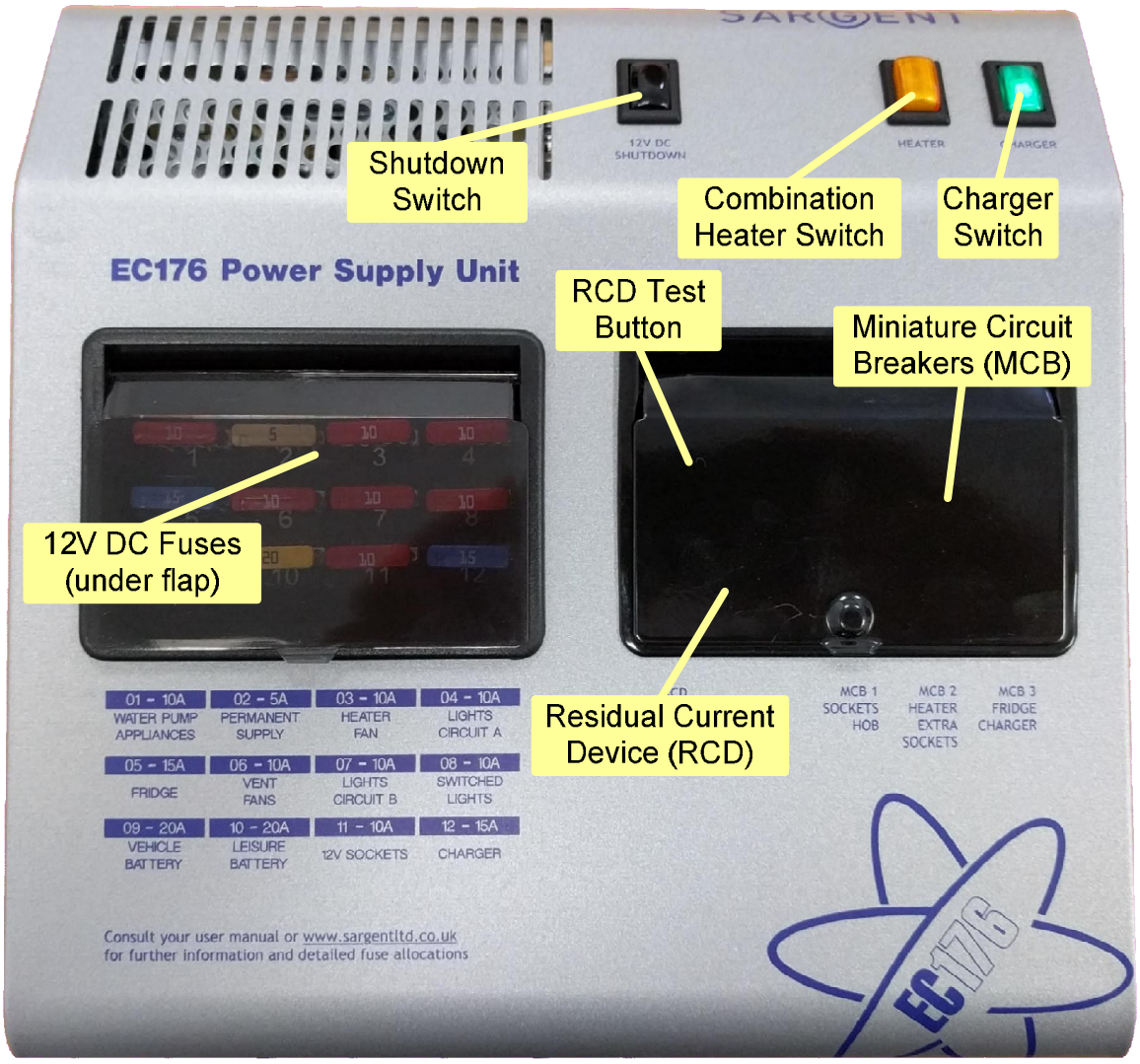
The system has a number of key components that you will need to be familiar with before attempting to use the system, these are:

- **The EC176 series Power Supply Unit (PSU)** - a combined mains 230V / 12V consumer unit and charger / controller located in the front bed box.
- **The EC361 or EC362 series Control Panel (CP)** - a remotely located user control panel used to turn 12V circuits on and off and to display battery and water tank information (where applicable).

2 Using the System

The PSU is located in the front offside upper locker and similar locations.

2.1 EC176 Power Supply Unit – Component Layout



2.2 Activating the System

The EC176 system has a shutdown feature that should be used when the vehicle is in storage or is not being used for long periods of time. This allows the leisure electronics to be turned off when not required to save battery power. When in the off state the supply for an optional alarm and tracking system is still active, most other supplies are turned off.

Before using the system please ensure the system shutdown switch is in the on position (button in).

PSU – 12V Controls	
	The black system shutdown button is shown on the left. In is ON and out is OFF. The other two switches are for 230V, and are covered in section 2.3

2.3 Connecting to the Mains 230V supply and Safety checks

For your safety it is IMPORTANT that you follow these connections instructions each time your vehicle is connected to a mains supply. This section assumes that the system is complete and that a Leisure battery has been installed (see 4.3).

A) **Ensure suitability of the Mains Supply**. Your vehicle should only be connected to an approved supply that meets the requirements of BS7671 or relevant harmonised standards. In most cases the site warden will hold information regarding suitability of supply. If using a generator you also need to comply with the requirements / instructions supplied with the generator. Please note that some electronic generators may not be compatible with your leisure system. Further generator operational information is contained in section 4.4.

B) **Switch the PSU internal Power Converter OFF**. Locate the green 'Charger' power switch on the PSU and ensure the switch is in the off position (button out) before connection to the mains supply.

C) **Connect the Hook-up Lead**. Firstly connect the supplied hook-up lead (orange cable with blue connectors) to the vehicle and then connect to the mains supply.

D) **Check Residual Current Device operation**. Locate the RCD within the PSU and ensure the RCD is switched on (lever in up position). Press the 'Test' button and confirm that the RCD turns off (lever in down position). Switch the RCD back to the on position (lever in up position). If the test button failed to operate the RCD see section 4.1 & 4.8.

E) **Check Miniature Circuit Breakers**. Locate the MCB's within the PSU (adjacent to the RCD) and ensure they are all in the on (up) position. If any MCB fails to 'latch' in the on position see section 4.1 & 4.8.

F) **Turn the PSU ON.** Locate the black 'Shutdown' button and ensure it is in the on position (press button to change, button in = on, button out = off). Locate the green 'Charger' switch on the PSU and turn to the on position (press button to change, button in = on, button out = off). The charger switch will illuminate when turned on.

G) **Check operation of equipment**. It is now safe to operate the 12V and 230V equipment.

PSU – 230V Controls	
	Lever type switch, far left – Residual Current Device (RCD) and main 230V on / off switch.
	Push button, far left – RCD Test button.
	3 x lever switches, right – Miniature Circuit Breakers (MCB). Note the lever colour and MCB rating may vary. See the safety and rating sticker adjacent to the PSU for further details.
	Green push switch, far right – Charger switch, this switch turns the 12V battery charger on or off. In is ON out is OFF.
	Amber push switch – Heater switch, this switch turns the 230V supply to the combination water heater / central heating system on or off. In is ON out is OFF.
	Note the far left 12V DC Shutdown switch is covered in section 2.2.

2.4 Operation while driving

The EC176 system is designed to shutdown parts of the system whilst the vehicle engine is running. This is to meet Electro Magnetic Compatibility (EMC) regulations and to ensure the safe operation of the system.

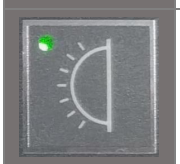
Please ensure the system shutdown switch on the PSU is in the “on” (button in) position before driving (see 2.2). This will ensure the electronic system is active and will therefore be able to control the charging process, supply the refrigerator and monitor other system circuits.

2.5 Control Panel - Component Layout

EC361 Digital Control Panel with LCD display

EC362 Digital Control Panel with LCD display

2.6 Control Panel Overview

Button	Button Description
	Power button. Press the power button to turn the leisure power on. Press the button again to turn the power off. The adjacent LED will illuminate when the power is on, and also the voltage of the selected battery will be displayed on the screen. When the vehicle engine is running this LED will flash to indicate the leisure battery is being charged.
	Pump button. With the power on, press the pump button to turn the water pump on. Press the button again to turn the pump off. The adjacent LED will illuminate when the pump is on, and also the level of the water tank will be displayed on the screen.
	Light button. With the power on, press the light button to turn a selection of internal lights on. Press the button again to turn these lights off. The adjacent LED will illuminate when the lights are on. The lights will be turned on and off automatically each time the power button is operated.
	**Awning Light button**. With the power on, press the awning light button to turn the awning light on or off. The adjacent LED will illuminate when the light is on.
	Levels / scroll button. Use this button to scroll through the various levels screens / menu items or to cancel alarms / warnings. Note: The screen illumination / backlight will turn off after a period of time. Press the levels button to reactivate the illumination.
	Select button. Use this button to select options / items or to change settings.

3 Control Panel Operation

3.1 Screen Illumination

The screen illumination (backlight) is turned on and off automatically. Pressing the levels button will reactivate the illumination.

3.2 Header Area

LBatt 13:45 V113

The header area of the screen shows the following information;

LBatt or VBatt	Leisure battery selected. This symbol indicates that the leisure battery is selected as the battery to use or to charge. This is the default setting. Vehicle battery selected. This symbol indicates that the vehicle battery is selected as the battery to use or to charge.
13:45	Clock display. This shows the current time in a 24 hour format.
V113	This shows the software version of the control panel.

3.3 LED Bar Graph

The LED Bar Graph displays the voltage of the selected battery.

LED	Colour		Voltage reading
1	Red		< 9.5 (<9 LED Flashes)
2	Red		9.5 - 10.9
3	Amber		11 - 11.4
4	Amber		11.5 - 11.9
5	Amber		12.0 - 12.4
6	Green		12.5 - 12.9
7	Green		13.0 - 13.4
8	Green		13.5 - 13.9
9	Green		14.0 - 14.4 (>15.4 LED Flashes)

When the control panel power is on, pressing the levels button will display the battery voltage on the bar graph.

3.4 Information Area

The main information area can display a variety of system information screens. These have been designed to present the information in a clear and concise form, while retaining technical detail for the more advanced users.

The selected screen can be changed by using the levels / scroll button, and work on a continuous loop basis (when the last screen is reached the scrolling returns to the first). The selected screen may be changed automatically by the system depending on the action being performed.

1 – Leisure Battery	Leisure Battery 13.9V GOOD	Here leisure battery information is shown. The digit display shows the battery voltage followed by a guide to the battery charge condition (i.e *POOR, FAIR, GOOD, CHARGING*). The voltage is also shown on the LED bar graph below the display. Pressing the levels button to move to the next screen.
2 – Vehicle Battery	Vehicle Battery 12.2V FAIR	Here vehicle battery information is shown. The digit display shows the battery voltage followed by a guide to the battery charge condition (i.e *POOR, FAIR, GOOD, CHARGING*). The voltage is also shown on the LED bar graph below the display. Pressing the levels button to move to the next screen.
3 – Water Tank	Water Tank Levels FRESH 50% WASTE 0%	The 3rd screen shows information relating to optional on-board water tank. This screen is only available when the relevant tank is fitted. The fresh water level is shown in ¼ steps (i.e. 0%, 25%, 50%, 75% & 100%) The waste water level is shown in 1 step (i.e. 0% & 100%) The displayed level is continuously refreshed if the water pump is turned on. Pressing the levels button to move to the next screen.
4 - Select Battery	Select Battery Battery = LEISURE	Here you can select which battery to use or charge. By default the leisure battery is automatically selected. If the mains supply is connected and the charger turned on, this battery will also be charged. If you need to select the vehicle battery press the select button to change the selected battery from leisure to vehicle (or vice versa). The relevant symbol (LBatt) or (VBatt) will be shown in the header area. Information relating to the selected battery is shown on the screen. Pressing the levels button to move to the next screen.
7 – Adjust Hour	Adjust Hour Hour = 13	Here you can adjust the hour display. Press the select button to increase the value by 1. Press and hold the button to rapidly increase the value. Pressing the levels button to move to the next screen.
8 – Adjust Minute	Adjust Minute Minute = 45	Here you can adjust the minute display. Press the select button to increase the value by 1. Press and hold the button to rapidly increase the value. Pressing the levels button to move to the next screen.

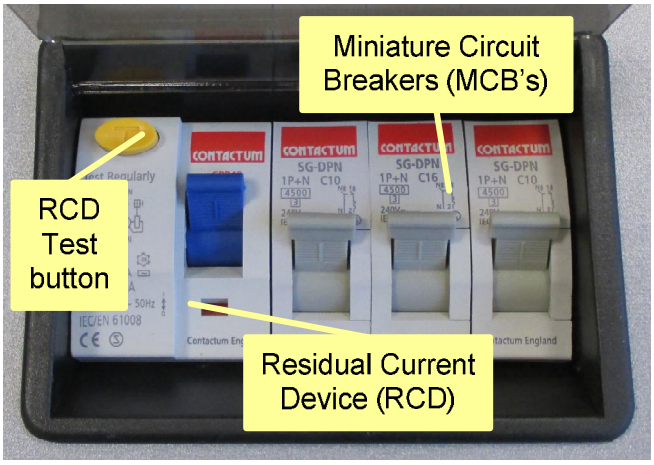
9 – System Info	SARGENT EC361 LCD Control Panel	Here you can view the control panel model number (i.e. *EC361*). Note that the software version number is also shown in the top right. Pressing the levels button to move to the first screen.

The system can display a number of warnings. The control panel will beep and display the appropriate message. Press the levels button to cancel the warning. See 4.6 for further details.

4 System Technical Information

The following section provides further technical information relating to the electrical system.

4.1 Residual Current Device & Miniature Circuit Breakers



The Residual Current Device (RCD) is basically provided to protect the user from lethal electric shock. The RCD will turn off (trip) if the current flowing in the live conductor does not fully return down the neutral conductor, i.e. some current is passing through a person down to earth or through a faulty appliance.

To ensure the RCD is working correctly, the test button should be operated each time the vehicle is connected to the mains supply (see section 2.3).

The Miniature Circuit Breakers (MCB's) operate in a similar way to traditional fuses and are provided to protect the wiring installation from overload or short circuit. If an overload occurs the MCB will switch off the supply. If this occurs you should investigate the cause of the fault before switching the MCB back on.

The following table shows the rating and circuit allocation for the three MCB's

MCB	Rating	Description (cable colour)
1	10 Amps	230V Sockets / Cooker (white)
2	16 Amps	Combination water heater / central heating system (yellow) / Extra 230V Sockets (white)
3	10 Amps	Fridge (black) / 12V Charger (internally connected)

4.2 Battery Charger

The EC176PSU incorporates a fixed voltage battery charger / power converter. The battery charger / power converter also powers the leisure equipment when the mains supply is connected. This module supplies 13.8V DC to the leisure equipment up to a maximum of 12 Amps (155 Watts), therefore the available power is distributed between the leisure load and the battery, with the leisure load taking priority as per the following example:

Leisure load	Available power for battery charging
3A	9A
6A	6A
9A	3A
12A	0A

WARNING

Under heavy loads the power supply unit case may become hot. ALWAYS ensure the ventilation slots have a clear flow of air. Do not place combustible materials against / adjacent to the EC176. The PSU will shutdown if overheated and will restart automatically when cool.

4.3 Leisure Battery

4.3.1 Type / Selection

For optimum performance and safety it is essential that only a proprietary brand LEISURE battery is used and it is suggested to select a battery from the NCC Verified Battery Scheme with a typical capacity of 75 to 120 Ah (Ampere / hours). Depending on the prospective use of the vehicle the correct type should be selected (A, B or C). A normal car battery is NOT suitable. This battery should always be connected when the system is in use.

The PSU is configured to work with standard lead acid leisure batteries, and in most cases is also compatible with the latest range of Absorbed Glass Matt (AGM) batteries. Before fitting non-standard batteries please check that the fixed charging profile described in 4.2 is suitable for the type of battery by referring to the battery documentation or battery manufacturer.

The battery feed is fitted with an inline fuse between the battery and the electrical harness, which is usually located immediately outside the battery compartment or within 500mm of the battery. The maximum rating of this fuse is 20A.

4.3.2 Installation & Removal

Always disconnect the 230V mains supply and turn the PSU green charger switch to the off position (button out) before removing or installing the battery.

When connecting the battery, ensure that the correct polarity is observed (black is negative [-] and red is positive [+]) and that the terminals are securely fastened. Crocodile clips must not be used.

WARNING

Explosive gases may be present at the battery. Take care to prevent flames and sparks in the vicinity of the battery and do not smoke.

4.3.3 Operation / Servicing

Under normal circumstances it should not be necessary to remove the battery other than for routine inspection of the terminals and “topping up” of the battery fluid where applicable. Please see instructions supplied with the battery.

Note: Do not over discharge the battery. One of the most common causes of battery failure is when the battery is discharged below the recommended level of approximately 11.5V. Discharging a battery below this figure can cause permanent damage to one or more of the cells within the battery.

To prevent over discharge, the EC176 system incorporates a battery protect circuit that warns the users and then disconnects the batteries when they fall below set values. See 3.6 below for details.

4.4 Generator Usage

Caution should be used before connecting a generator to your vehicle.

WARNING

Never start or stop the generator while electrical loads are connected and switched on. Start the engine, let it stabilise and then connect the electrical load. To stop the engine, disconnect the electrical load and let engine stabilise before switching off

Whilst some generators use electronic inverter technology, others use a more basic principle to generate the 230V supply. Preference should be to choose a generator which produces a consistent sinusoidal wave form with accurate voltage control.

4.5 Awning Light Operation

The awning light is controlled by the control panel awning light button.

4.6 System Warnings

The system incorporates a number of warnings that are active at specific times. These are summarised below, and also covered by relevant sections of this manual.

Warning	When	Type
Fresh water level low	With pump turned on and fresh water level low (less than 25% full) Only available when an onboard tank is fitted	Message on screen and 30 second audible beep
Leisure battery voltage low	With control panel power on and leisure battery selected (as active battery) and the voltage level falls below 10V	Message on screen and 30 second audible beep.
	With control panel power on and leisure battery selected (as active battery) and the voltage level is below 9V	Message on screen and 30 second audible beep. If no action taken after 30 seconds then the system will switch the power of to prevent severe discharge of the battery
	Note: This is an emergency cut off level to protect the battery from severe damage. You should not rely on this cut off level during normal operation, but manage your power consumption to a discharge level of 11.5V or above. This cut off only applies to power drawn from the battery by the leisure equipment that is controlled by the control panel power switch; it will not protect the battery from discharge by permanently connected equipment.	
Leisure battery voltage high	With control panel power on or off and leisure battery is selected (as active battery) and the voltage level rises above 15.4V	Message on screen and repeated beeps from the control panel. The beeping will not stop until the fault is cleared.
Vehicle battery warnings	If the vehicle battery is selected instead of the leisure battery, then the same warnings described above for the leisure battery are applied to the vehicle battery.	
Engine running	When the engine is started the system power will be turned off	Message on screen and power button LED flashing indicating both batteries are connected for charging.

4.7 12 Volt DC Fuses

WARNING

When replacing fuses always replace a fuse with the correct value. NEVER replace with a higher value / rating as this could damage the wiring harness. If a replacement fuse 'blows' do not keep replacing the fuse as you could damage the wiring harness. Please investigate the fault and contact your dealer.

The following table shows the fuse allocation for the 12 fuses fitted to the PSU. Please note that fuses are dependant on PSU versions and installation, so not all fuses may be present or used.

Fuse	Rating	Fuse Colour	Description
1	10 Amps	Red	Water Pumps / Appliances
2	5 Amps	Tan	Permanent Supplies / Electronics
3	10 Amps	Red	Heater Fans
4	10 Amps	Red	Lighting Circuit A

5	15 Amps	Blue	Fridge Element (during towing)
6	10 Amps	Red	Ventilation Fans
7	10 Amps	Red	Lighting Circuit B
8	10 Amps	Red	Switched Lights (from control panel lights button)
9	20 Amps	Yellow	Vehicle Battery
10	20 Amps	Yellow	Leisure Battery
11	10 Amps	Red	12V Sockets
12	15 Amps	Blue	Charger

The following table shows details of the fuse(s) located at the Leisure battery.

Fuse	Rating	Fuse Colour	Description
Battery 1	20 Amps	Yellow	Fuse remotely located near battery

4.8 Common Fault Table

Fault	Possible Cause	Proposed Fix
No 230 volt output from PSU	Connecting lead between the site and Leisure Vehicle not connected	Check and connect lead as per 2.3C
	RCD switched off	Reset RCD as per 2.3D
	RCD not operating correctly	Check supply polarity; if the RCD continues to fail contact your Dealer as there is probably an equipment or wiring fault.
	MCB switched off	Reset MCB by switching OFF (down position) then back ON (up position), if the MCB continues to fail contact your Dealer as there is probably an equipment or wiring fault.
	No or deficient supply from site	Contact site Warden for assistance.
	Other fault	Contact your Dealer.
Control Panel Problems	Control Panel has no display	Backlight / illumination may have switched off. Press the power button or select button to reactivate the backlight. Check batteries and fuses, turn PSU shutdown switch and charger switch on and ensure mains supply is connected. Check control panel connecting lead at PSU and behind Control Panel. Contact your Dealer.
	12v Power turns off	Battery protect feature has operated to protect the Vehicle battery and or the Leisure battery. See 3.6 Engine has been started, all equipment has been disconnected to meet EMC requirements. See 2.4
	Control Panel locked / erratic function	Observe control panel handling instructions Control panel software may have crashed. Reboot control panel by turning off the PSU isolate switch. Wait 30 seconds then turn the switch back on.
No 12 volt output from PSU	No 230v supply	Check all above.
	Charger not switched on	Turn charger switch on, switch will illuminate.
	Battery not connected and / or charged	Install charged battery as per 3.3
	Power button on control panel not switched to on	Turn power on at control panel.
	Battery flat / Battery fuse blown	Recharge battery, check fuses, check charging voltage is present at battery.
	Fuse blown	Check all fuses are intact and the correct value fuse is installed as per fuse table.

Fault	Possible Cause	Proposed Fix
	Equipment switched off / unplugged	Check equipment is switched on and connected to the 12v supply.
	PSU overheated / auto shutdown operated	Reduce load on system. Allow PSU to cool down. PSU will automatically restart when cool.
	Other fault	Contact your Dealer.
Pump not working	Fuse blown	Replace fuse with correct value as per fuse table.
	Pump turned off	Turn pump on by pressing the pump button at the control panel.
	Setting incorrect	Both the internal and external pump feeds are controlled from the control panel. To alter the setting of the pump switch see your dealer. Ensure the setting matches your desired requirement.

4.9 Contact details

Sargent Electrical Services Limited, provide a technical help line during office hours. Please contact 01482 678981 if you require technical help. For out of hour support please refer to the tech support section of the Sargent web site www.sargentltd.co.uk

5 Technical Data & Approvals

5.1 Outline specification – EC176PSU & EC361/362 Control Panel

INPUT 230V	230 Volts / 0 to 16 Amps	+ / - 10%
OUTPUT 230V	RCD protected, 3 x MCB outputs of 1x16A and 2x10A Separate switched channels for combination heater and charger	
INPUT 12V	2 x 20A battery inputs via 9 way connector	
OUTPUT 12V	20A total output via multiple switched channels protected by 12 fused outputs	
Built in CHARGER	Input 220-240 Volts AC +/- 10%, Frequency 50 Hz +/- 6%, Current 3A max. DC Output 13.8 Volts nominal, Current 12 Amps max (155 Watts).	
Signal INPUT	4 x Fresh water level (direct to control panel), 1 x Engine running, plus multiple vehicle connections	Fresh water negative sensed
Data IN / OUT	Data communication to Control Panel via 8 way connector	
IP rating	IP31	
Operating temperature	Ambient 0 to 35° Centigrade PSU case temperature with full load 65° C Max	Automatic shutdown and restart if overheated / overloaded
EC176 PSU	Overall size (HxWxD) 260 x 273 x 110mm Clearances 75mm above, 20mm below, 50mm left & right	Fixing centres 262 x 224mm Weight 2.2 Kg
EC361 & EC361 Control Panel	Overall size (HxWxD) 95 x 200 x 25mm Cut-out size (HxW) 82 x 178mm	Fixing centres 190mm Weight 180 g

5.2 Approvals

System: BSEN 1648-1, BSEN1648-2 compliant, BS7671: 2008 compliant

Residual Current Device: RCD 40A 30mA trip to BS EN 61008

Miniature Circuit Breakers: MCB's type C 6000A breaking capacity to BSEN 60898

Electro Magnetic Compatibility (EMC) directive 89/336/EEC

Integrated Charger Module: BS EN 60335-1/2.29, 89/336/EEC, IEC61000-3.2/3:1995, EMC certificate 5A121501E 3rd party tested.

Low Voltage Directive: 2006/95EC TUV-014900-A1, EN55022, Class B, EN55024/ Level 2

5.3 Declaration of Conformity

Equipment: Leisure Power Control System *Model name:* EC176, EC361, EC362

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced approvals. The unit complies with all essential requirements of the Directives.

Signed:	*Name:*	*Position:*	*Manufacturer:*
	I L Sargent	Technical Director	Sargent Electrical Services Ltd Unit 39, Tokenspire Business Park Woodmansey, Beverley East Yorkshire, United Kingdom
Date:			

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