

# Electrical Installation of ELV Low Level Cycle Signals (Swarco Futurit)

## Part no. 667/CI/52551/000

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## CHANGE HISTORY:

Version	Date	Change	Author
A	09/01/2017	Initial Draft for internal review	C.Horder
1	30/01/2017	Formal issue	C.Horder

**Table 1 - Issue History**

## 1 Overview

### 1.1 Purpose

This document is intended for use by Field Service Engineers and other person(s) involved in the planning, design and installation of ELV low level cycle aspects. It covers the electrical installation of the ELV Low Level Cycle Aspects.

### 1.2 Scope

This document covers the types of ELV low level cycle aspects, electrical connection of the aspects and earth bonding of different parts of the chassis.

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## 2 Design Requirements

### 2.1 Objective

The Electrical Installation shall comply with current edition of the IET Wiring Regulations (BS7671).

### 2.2 Required Tools and Equipment

- Torx Screwdriver
- Crimping tool
- Male/Female bullet crimp pair
- Battery Combination Driller and 4mm HSS Drill Bit
- Crimp ring terminals – M4
- M4 \* 15mm bolts
- Grommet to fit 21mm diameter
- 2.5mm Yellow / Green Earth cable
- Continuity tester (DVM)

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### 3 ELV – Low Level Cycle Aspect Installation

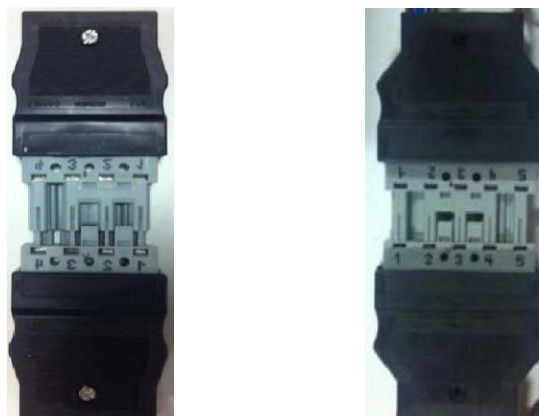
#### 3.1 Cycle Aspect Configurations

The cycle aspects are formed of 2 different configurations. A 3 aspect red, amber and green or a 4 aspect which includes the 3 aspect and an additional regulatory sign.



**Figure 1 – Signal configurations (3 and 4 in-line)**

The aspects are all terminated in a similar way except the 3-in-line aspect configuration is terminated in a 4 way and the 4-in-line aspect is terminated in a 5 way supplied connector.



**Figure 2 – Connectors (4 and 5 way)**

Each lamp on the cycle aspect is connected to and driven by an LSLS output from the LSLS phase drive card, whereas the regulatory sign is driven by the HPU or the regulatory signs expansion kit. Following on the red, amber and green aspects share a return core but the regulatory sign uses its own dedicated return core.

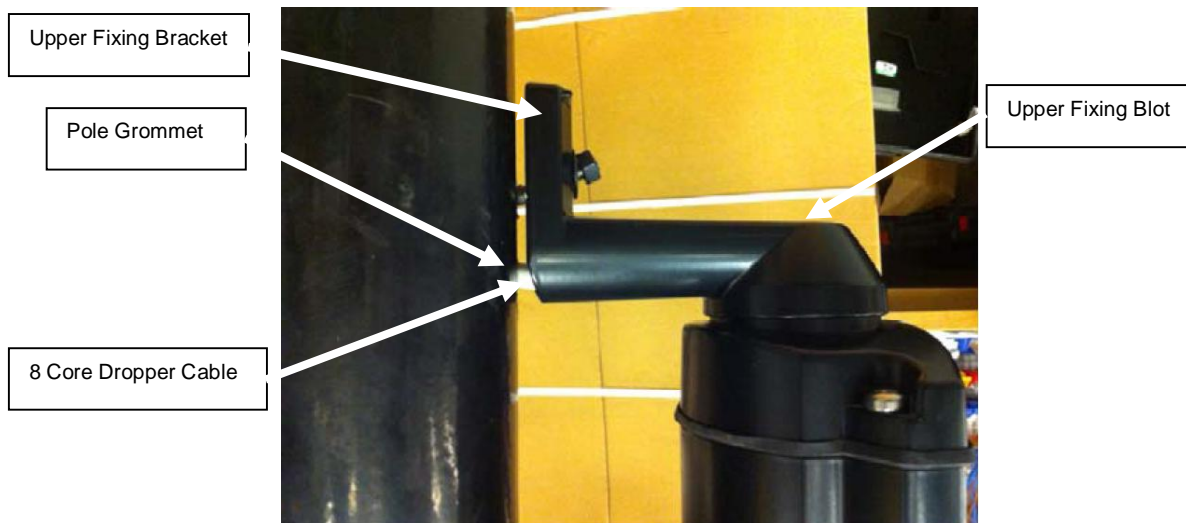
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### 3.2 Connecting the 3-in-line

This unit is delivered with the 3 aspects already terminated within the unit to the female connector. The cable from the pole top needs to be terminated within the 4 way male part of the connector.

### 3.3 Connecting the 8 Core Dropper Cable from the pole top

The 8 Core Dropper Cable from the pole top is fed via the pole cap into the unit, through the hollow part of the upper fixing bracket. A grommet is to be installed into the hole in the pole through which the cable is fed.



**Figure 3 – Cable through upper fixing bracket**

The unit has to be opened from the top in order to get access to the already connected female part of the connector block. A torx screwdriver is required to open the bolts to release the top part of the unit. The female terminal block is then extracted from the unit. If the terminal block cannot be extracted then the top red aspect may have to be removed to gain access.



**Figure 4 – Female terminal block extracted**

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### 3.4 Core Identification - 8 Core Dropper Cable

The cores are to be isolated and terminated into the supplied Male connector as shown in the table below in Figure 5. Cores 5 & 6 denoted by BS are for the 4-in-line configuration, which includes the regulatory sign.

8 Core Dropper Cable		
Function		Cores
1	Signals Return	1
2	Red	2
3	Amber	3
4	Green	4
5	BS Return	5
6	BS	7
7	Earth = Green/Yellow	Green/Yellow

Figure 5 – Core tagging order

### 3.5 Termination of cores for 3-in-line aspect

Each core shall be push fit into the connector as shown below.

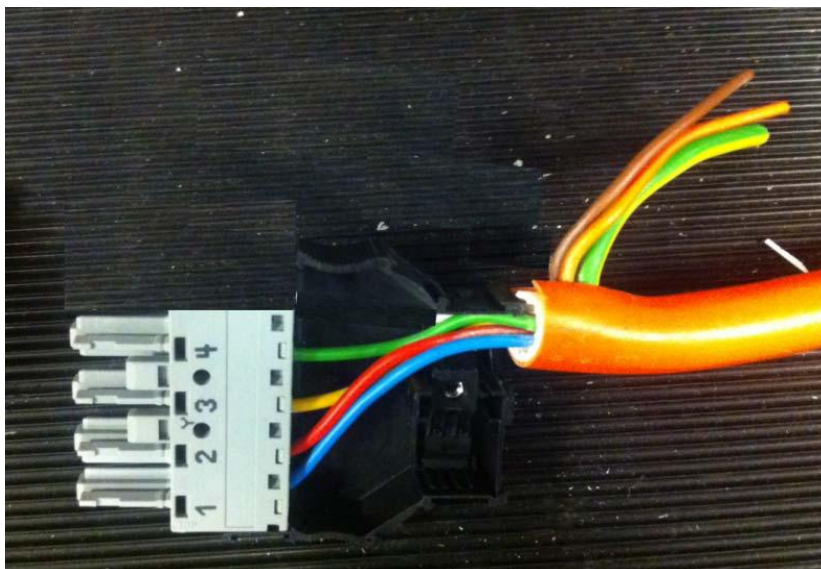


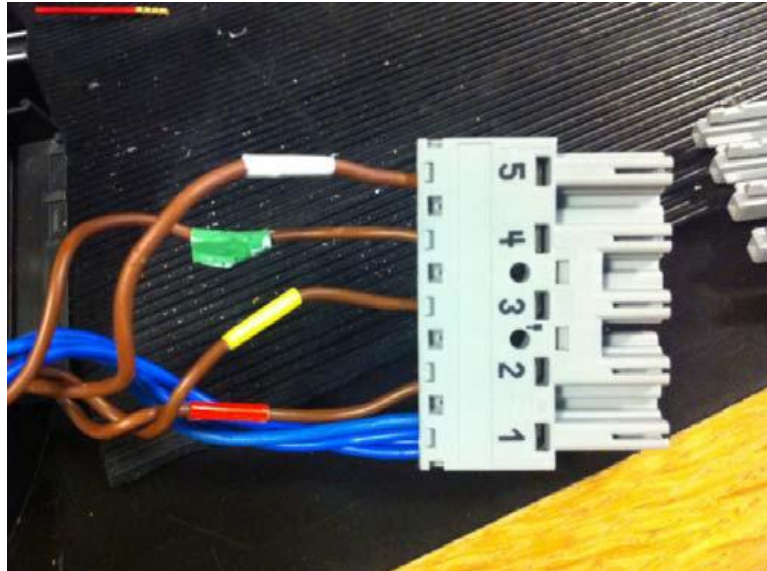
Figure 6 – Female connector – 4-way for 3-in-line RAG aspect

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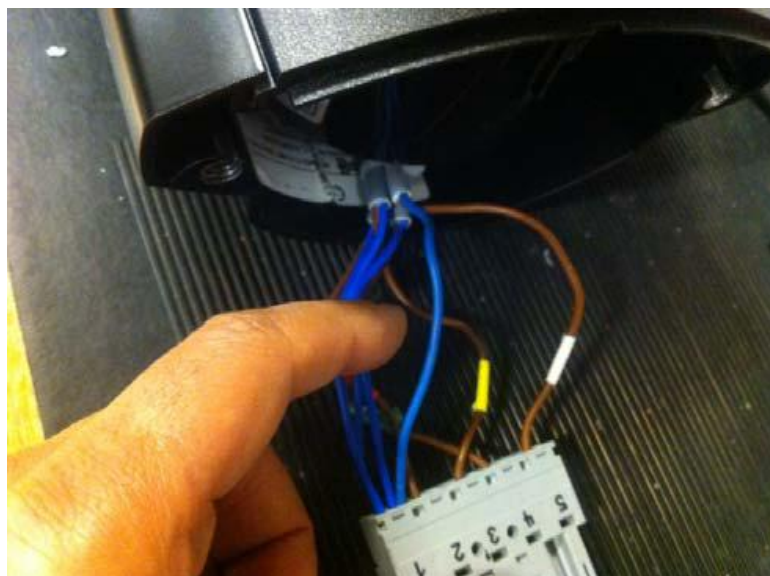
### 3.6 Re-configuring the 4-in-line unit

The 4-in-line unit with the regulatory sign is delivered with the blue return cores for all 4 aspects connected to a common terminal 1 in the Female connector as shown in Figure 7. The line cores are identified by the brown insulation and coloured tape, red, yellow (amber), green and white for the regulatory sign as connected to terminals 2 to 4 and 5 respectively.



**Figure 7 – Female connector – 5-way**

In order to connect the 4-in-line unit, it has to be dismantled in order to separate the return cores for the regulatory sign from the 3 RAG return cores. The top part of the unit is opened to gain access as described in section 3.3. Once access is gained to the terminal block, the neutral core for the regulatory sign is identified from the other 3 RAG return cores.



**Figure 8 – Identify return core for Regulatory Sign**

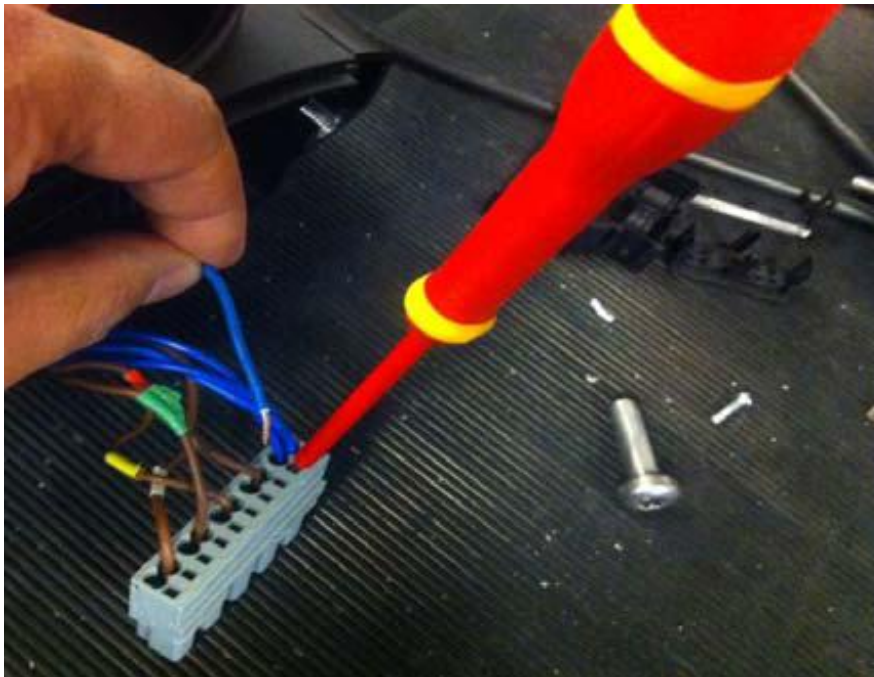
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The return core should then be released from the terminal block with the aid of a narrow screw driver.



**Figure 9 – Release return core for Regulatory Sign**

Ensure that the remaining 3 RAG return cores are still securely fixed within terminal 1 of the terminal block.



**Figure 10 – Released return core for Regulatory Sign**

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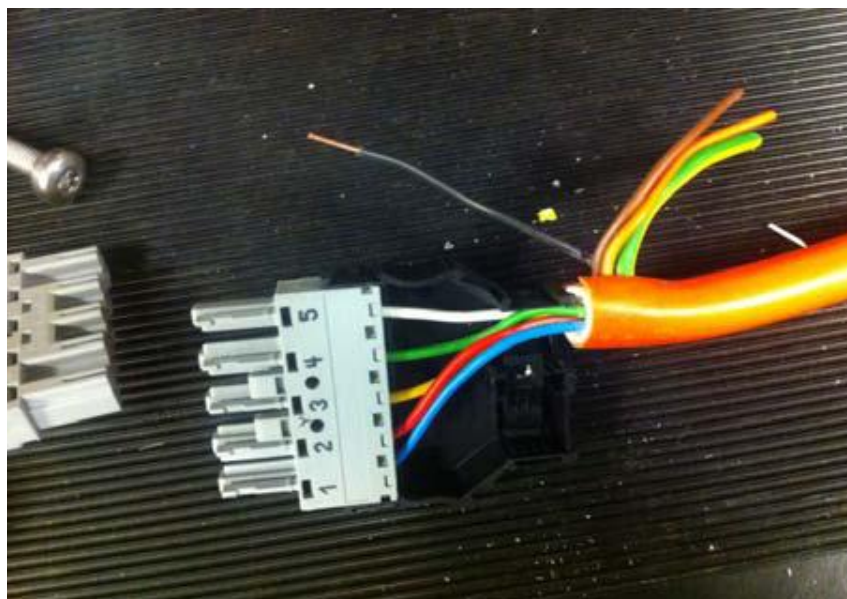
The return core is then crimped with a Female part of the bullet crimp pair.



**Figure 11 – Crimped return core for Regulatory Sign**

### 3.7 Terminating cores for 4-in-line aspect

Again each core shall be push fit into the connector as shown below.

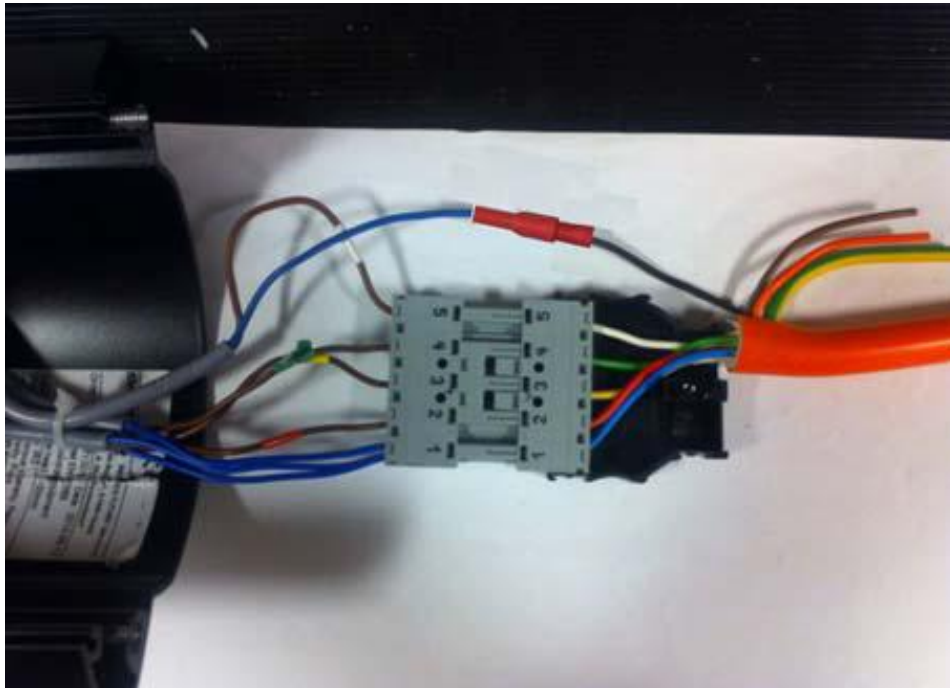


**Figure 12 – Cores for 4-in-line terminated into 5-way Male connector**

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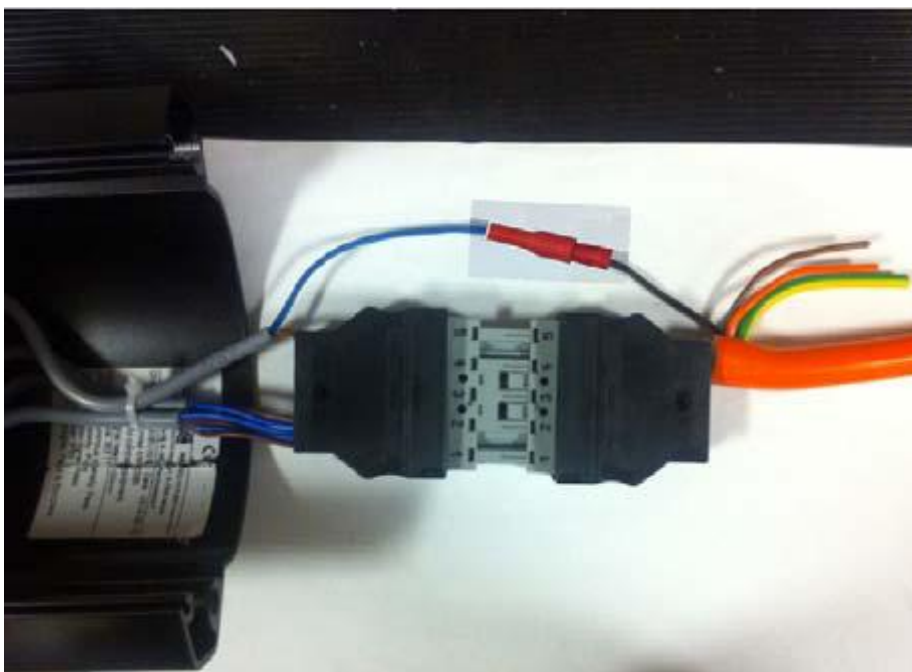


The black return core is to be crimped with the Male part of the bullet crimp pair and the Male and Female bullet connected together as shown in Figure 13.



**Figure 13 – Return core for regulatory sign crimped and connected**

The terminal blocks can then be reassembled with their protective casing and the Male and Female connectors connected together as shown in Figure 14.



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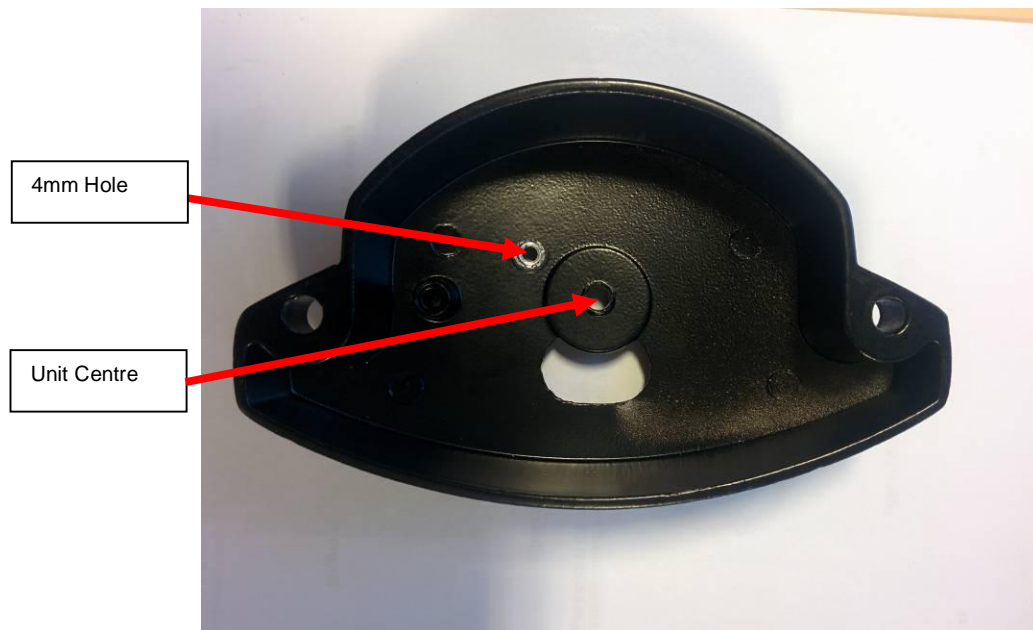
**Figure 14 – Male and Female connectors assembled and connected**

### 3.8 Earth connection to maintain the equipotential bonding

The 3 metal parts of the units' chassis housing do not have very good conductivity between them. Therefore each part must have its own earth bonding point.

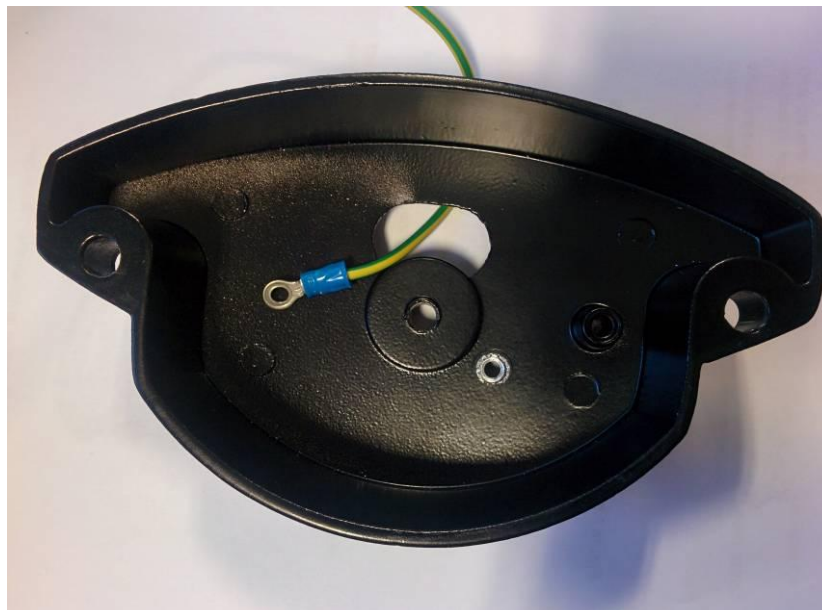
The top and bottom parts are prepared as shown in Figures 15, 16, 17 and 18. An Earth wire shall be fastened to the chassis using an M4 x 15mm bolt.

Drill a hole 20mm from the centre of the unit using the 4mm HSS Drill Bit.



**Figure 15 – Drilled hole to secure earth wire**

The earth wire is crimped with an M4 crimp ring terminal.



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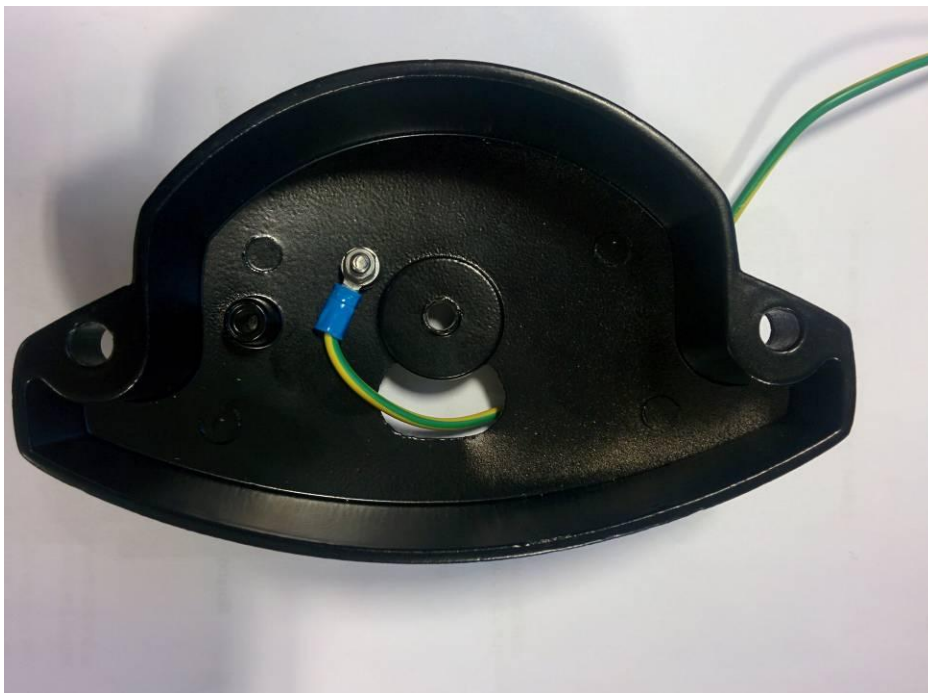
**Figure 16 – Crimped earth wire**

Secure the M4 x 15mm bolt to the housing using a nut with star washer.



**Figure 17 – M4 x 15mm Bolt through housing**

Secure the earth wire using a flat washer and nut.



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**Figure 18 – Secure earth wire**

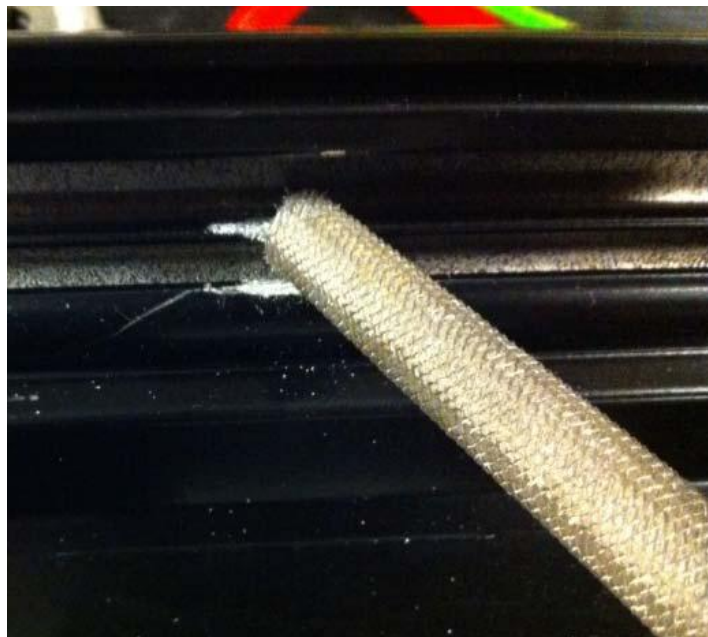
### 3.8.1 Equipotential bonding of the chassis

. The middle section is prepared as shown in the following sequence of figures.



**Figure 19 – Location to feed bolt**

Remove an area of the paint finish to ensure a sufficient conductivity.



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**Figure 20 – Paint removed to enable good earth conductivity**

Use an M4 x 15mm bolt. Slide the bolt approximately halfway down the chassis and fix in place with a flat washer where a section of paint has been removed to ensure good earth conductivity.



**Figure 21 – Fixing bolt to be passed through**



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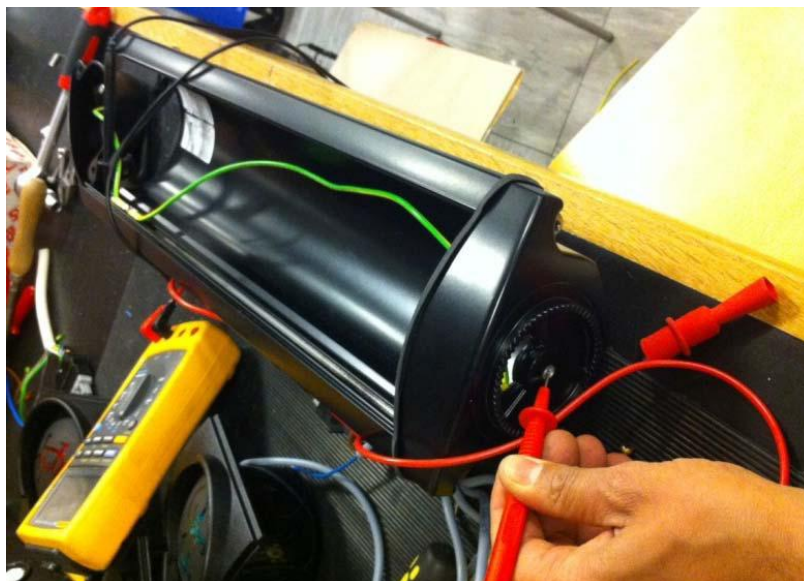
**Figure 22 – Fixing bolt secured in place**

As before crimp the earth wire with an M4 crimp ring terminal and fix to the bolt using a flat washer and nut.



**Figure 23 – Three sections bonded together**

The continuity between the 3 sections **MUST** be checked to ensure good earth conductivity. The continuity check shall be carried out by probing on the exposed metal parts of the 3 sections, between the top and the main body and the bottom and the main body.



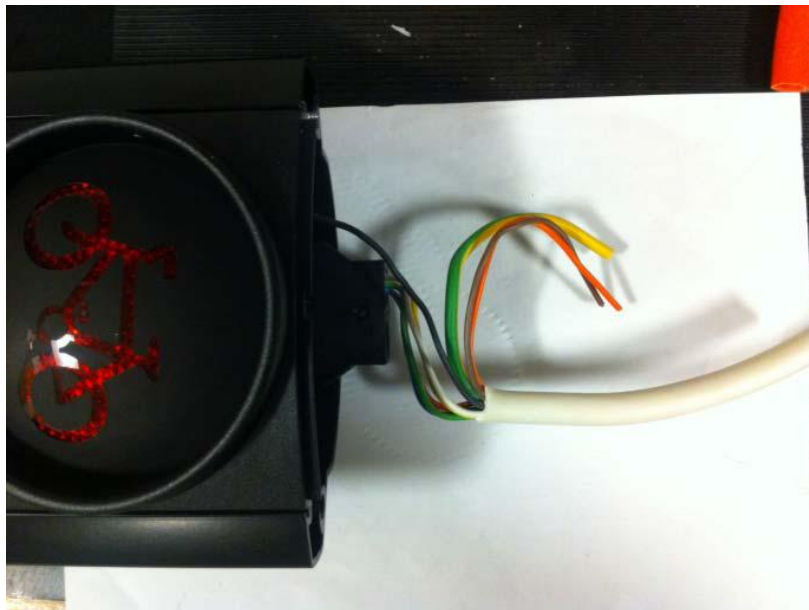
**Figure 24 – Test earth bonding between sections**

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### 3.9 Reassembly of unit

Once the earth bonding has been completed it is easiest to re-assemble the unit from the top starting with connectors and the red aspect.

Whilst the connector is held in place at the back of the housing, the red aspect is guided carefully over it and followed by the other aspects.



**Figure 25 – Connector and red aspect reassembled**

The top lid of the unit is re-assembled by first setting the seal in place. Please note the correct orientation of the seal; it should fit the rim of the end part.



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## Figure 26 – Orientation of rubber seal

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