

OTS-EL

OUTLET TEST SYSTEM – EARTH LEAKAGE

User Manual

Version: 4, April 2024

Designed and manufactured in Australia by Ampcontrol Pty Ltd



WARNING!



The **warning** symbol highlights a potential risk of **injury or death**.
Please share these warnings with other operators.

CAUTION!



The **caution** symbol highlights a potential risk of **damage to equipment**.
Please share these cautions with other operators.

NOTE



The **note** symbol highlights **key information**.
Please share these notes with other operators.

ENVIRO



The **enviro** (environmental) symbol highlights areas which may have an impact on the surrounding **fauna and/or flora**.

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Before You Begin

Thank you for purchasing the Ampcontrol OTS-EL.

WARNING!



In the interests of **safety and correct equipment operation**, please take the time to read and understand the content in this manual.

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1 SAFETY AND OTHER WARNINGS

For safety reasons, the OTS-EL must be installed, operated and serviced only by competent personnel. Please read and understand this instruction manual completely before installing, operating or servicing this equipment. Failure to install or operate this instrument in accordance with the instructions contained in this manual may create hazardous operating conditions.

1.1 Safe Use of Equipment

The equipment supplied has been designed and manufactured to ensure safe operation. The equipment must only be used within the design parameters.

The instructions within this manual must be observed as an aid towards achieving the safest possible installation.

Persons responsible for installation, maintenance, or operation, must observe the following instructions:

1.1.1 Changes to Equipment

Changes in the design and modifications to the equipment are not permitted. Unauthorised changes made to the hardware or operating firmware will void the manufacturer's warranty and may compromise the integrity of the system into which it is installed and other connected equipment.

1.1.2 Equipment Knowledge

Experience with, or understanding of, this equipment is essential for the safe installation and removal of the equipment. Therefore, please read and understand this manual prior to use. Competency based training courses are recommended and are available on request.

1.1.3 Manual Handling

Precautions have been taken to ensure all equipment is safe to handle and free from sharp edges. However, care should always be taken when handling enclosures and gloves should be worn.

1.1.4 Installation

Correct operation and safety depend on the Outlet Test System and associated equipment being installed correctly. Mechanical and or electrical installation and maintenance of plant and equipment must only be carried out by appropriately qualified personnel and must be tested thoroughly prior to operation.

1.1.5 Operation

The OTS-EL is not a primary safety device: it is periodically operated to ensure the correct operation of the primary earth leakage protection on an outlet. It is therefore necessary that it is operated only by trained and competent personnel who can correctly interpret and verify the test results obtained through the use of the OTS-EL.

2 RECEIVING AND STORAGE

2.1 Receiving

All possible precautions are taken to protect the equipment against damage or losses during shipment; however, before accepting delivery, check all items against the packing list or bill of loading. If there is evidence of physical damage, notify Ampcontrol immediately.

Notify Ampcontrol immediately in the case of any discrepancies to the packing list. Keep a record of any claims and correspondence. Photographs are recommended.

Where practicable do not remove protective covers prior to installation unless there are indications of damage. Boxes opened for inspection and inventory should be carefully repacked to ensure protection of the contents or else the parts should be packaged and stored in a safe place. Examine all packing boxes, wrappings and covers for items attached to them, retain and store any approval documentation for your safety file as applicable prior to wrapping being discarded.

2.2 Inspection

Equipment that is found to be damaged or has been modified away from its published specifications must not be used. Please contact Ampcontrol if the equipment is suspected to be different than that ordered or if it does not match the published specifications.

2.3 Storage after Delivery

When the equipment is not to be installed immediately, proper storage is important to ensure protection of equipment and validity of warranty.

All equipment should be stored indoors between 0-40 °C, preferably on shelves and protected from moisture and sunlight.

2.4 Unpacking of Equipment

The method of packing used will depend on the size and quantity of the equipment. The following cautions should be interpreted as appropriate.

CAUTION!



Take care when unpacking crates as the **contents may have shifted during transport.**

ENVIRO



The disposal of packaging materials, replaced parts, or components must comply with environmental restrictions without polluting the soil, air or water.

Ensure that any timber and cardboard used as **packaging is disposed of in a safe and environmentally responsible manner.**

Where possible, dispose of all waste products i.e. oils, metals, plastic and rubber products by using an approved recycling service centre.

3 PRODUCT OVERVIEW

3.1 Description

The Ampcontrol Outlet Test System – Earth Leakage (OTS-EL) provides a fully automated outlet earth leakage testing facility. The OTS-EL completely eliminates paper-based record keeping by concurrently updating a historical database with the latest test data.

The OTS-EL is comprised of an OTS-EL module, embedded within the outlet electrics, and an OTS Comms Module, mounted on the door to provide Bluetooth connectivity to the outlet tester.

All tests are initiated wirelessly via the OTS Application Software, which is installed on compatible Bluetooth enabled devices. Each outlet is able to be individually targeted.

All local test records are managed within the OTS Application Software until the tablet performs an authorised sync with the AWARE cloud storage. When this occurs all local test reports are uploaded to the cloud, and then all Assets and Users are refreshed for selected site. All OTS test records can be accessed by anyone with internet access and authorisation (user account).

The OTS-EL will measure both the contactor opening time in addition to the true earth leakage clearing time (time for back EMF voltages to fall below ELV).

3.2 Key Features

The OTS-EL has the following key features:

- Fully automated, outlet protection function testing
- Wireless outlet testing
- Earth Leakage (EL) protection testing (contactor operating and back EMF clearing times)
- Test data logging (Uploads to cloud storage)
- DIN rail mounted

3.3 Application

The OTS-EL System can be installed into Ampcontrol Substations, Distribution Boards and Outlet Control Boxes. The OTS-EL greatly simplifies the statutory testing process, performing a hands-free, automated testing function whilst simultaneously providing a comprehensive record management tool.

3.4 Supplementary Documents

The OTS-EL User Manual is expected to be read in conjunction with the following documents:

- MAG-199 OTS Application User Manual
- MAG-204 OTS Dashboard User Manual

4 INSTALLATION

4.1 General Warnings

These instructions have been designed to assist users of the OTS-EL with installation.

Before the OTS-EL can be installed, there are a number of things that need to be considered and understood to prevent incorrect or unsafe operation of the OTS-EL or the system into which it is installed.

Along with relevant competence, and an understanding of the target application, the following points should be considered:

4.1.1 Ensure that the information provided in this user manual is fully understood.

It is extremely important that the limitations and functionality of the OTS - EL are understood to prevent incorrect installation or use, creating a potentially dangerous risk. If in doubt as to the nature of the limitations or their implication, consult a competent authority such as a supervisor or Ampcontrol technical representative.

4.1.2 Ensure that the application into which the OTS-EL is being installed has been properly defined, designed and approved.

Any system intended to mitigate the risk of injury needs to be properly designed and implemented. Such a system must be the result of structured risk analysis with the outcomes used to define the system requirements. These requirements, in turn, will guide the choice of instrumentation, logic solvers and actuators needed to implement the system. Understanding the needs of the system will ensure proper selection of equipment.

4.1.3 Ensure that the OTS-EL will properly perform the required functions within the system design.

It is important to understand how the OTS-EL is intended to interact with other equipment within a system. For safe and reliable use, it is crucial that neither the OTS-EL logical operation nor its signalling be compromised by incompatibilities with connected equipment.

4.1.4 Modifications of any form to the Outlet Test System are prohibited.

If modifications of any form are made to the OTS-EL, the equipment may no longer be fit for use. If any modifications or damage to the OTS-EL is evident, do not use the equipment and contact Ampcontrol for advice.

4.2 Mandatory Installation Practices

The following information must be adhered to when installing the OTS-EL. Failure to adhere to this information may give rise to unsafe operation.

Using the OTS-EL in a manner that exceeds its electrical or functional specifications, or in a way that is contrary to its operating restrictions, may create risks to personnel and/or equipment resulting in injury or death.

- The OTS-EL must be supplied by a regulated voltage within the specified range.
- The installation of the OTS-EL must be carried out by suitably trained and qualified personnel.
- Identification labels fixed to the OTS-EL must not be damaged, removed or covered.
- The installation is to be in accordance with the relevant installation Standards/Codes of Practice.
- Modifications must not be made to any part of the OTS-EL. Modifications to its construction will render the unit non-compliant.
- Complete and accurate records of the installation must be retained for warranty purposes.

4.3 Mechanical Installation Information

The OTS-EL is comprised of an OTS-EL Test module and an OTS Comms Module.

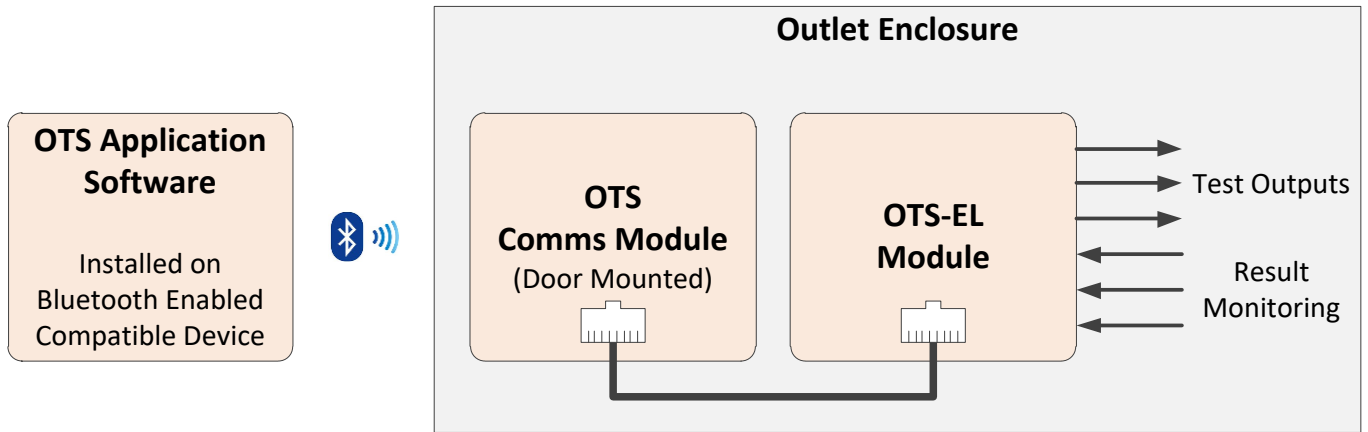


Figure 4.1 OTS-EL System Overview

4.3.1 OTS-EL Mechanical Installation Information

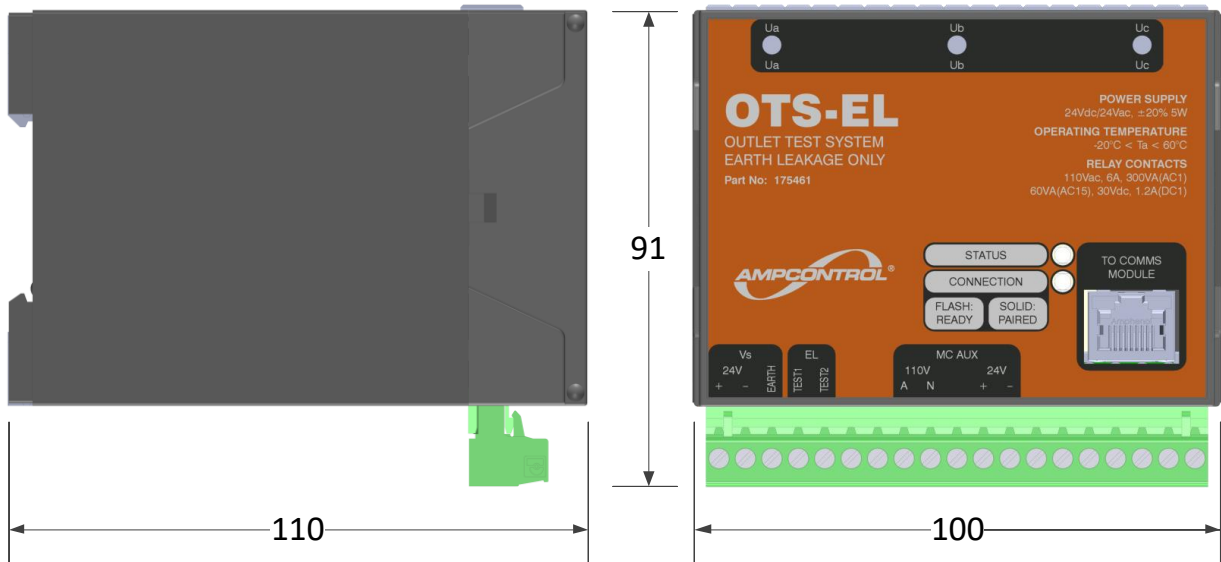


Figure 4.2 OTS-EL Dimensions

The OTS-EL Test module performs all the test actuation and measurements. It is a DIN Rail mounted unit that interfaces with the outlet electrics. The terminal layout and description is shown in Figure 4.3 and Table 1 respectively.



Figure 4.3 OTS-EL Terminal Layout

Table 1 OTS-EL Terminal Designators

Number	Designator	Number	Designator
1	Vs +	12	MC AUX -
2	Vs -	13	SPARE
3	Earth	14	SPARE
4	EL Test 1	15	SPARE
5	EL Test 2	16	SPARE
6	SPARE	17	SPARE
7	SPARE	18	SPARE
8	MC AUX 110V A	19	SPARE
9	MC AUX 110V N	Ua	Barrier Connection
10	SPARE	Ub	Barrier Connection
11	MC AUX +	Uc	Barrier Connection

4.3.2 OTS Comms Module Mechanical Installation Information

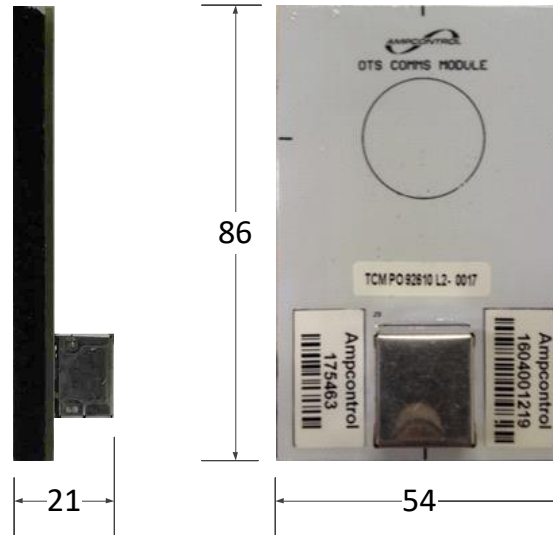


Figure 4.4 OTS Comms Module

The Comms module provides Bluetooth connectivity to the Tester. It is intended to be mounted onto the back of an outlet door or enclosure, covering a 22.5 mm OD hole. The hole needs to align with the PCB aerial on the Comms module. Without this hole, the steel of the enclosure would form a shield, preventing Bluetooth communications to the tester. To improve the connectivity of the Bluetooth device, the hole in the enclosure should be positioned such that it faces the location where the testing officer is most likely to stand when initiating the test procedure.

The Communications Module must be oriented with the RJ45 port pointing downwards to ensure both LEDs on the Comms Module align with their corresponding position on the external label.

To install the Comms Module, simply pull the plastic off of the high strength adhesive tape and stick it to the back of the door, aligning the circle on the PCB with the hole in the enclosure.

To maintain the IP rating of the enclosure the included label must be placed externally over the hole. The location of the two LEDs on the OTS Comms Module can be seen in Figure 4.5.

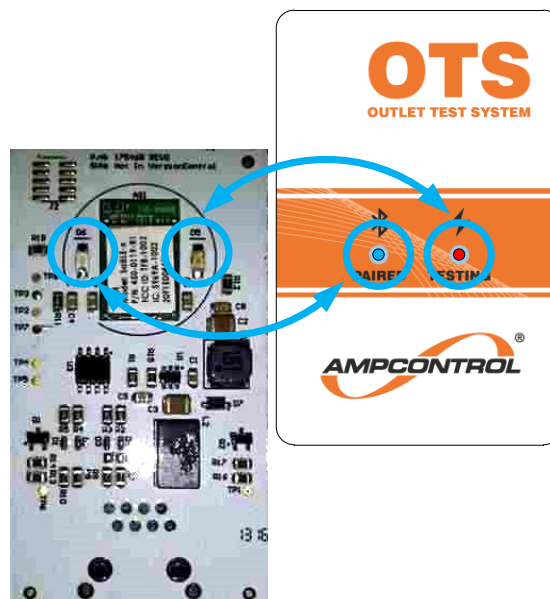


Figure 4.5 OTS Comms Module and External Label

4.4 Electrical Installation Information

A typical installation diagram of the OTS-EL is shown below, Figure 4.6. The following sub-sections provide a more detailed description of each of the individual circuit elements.

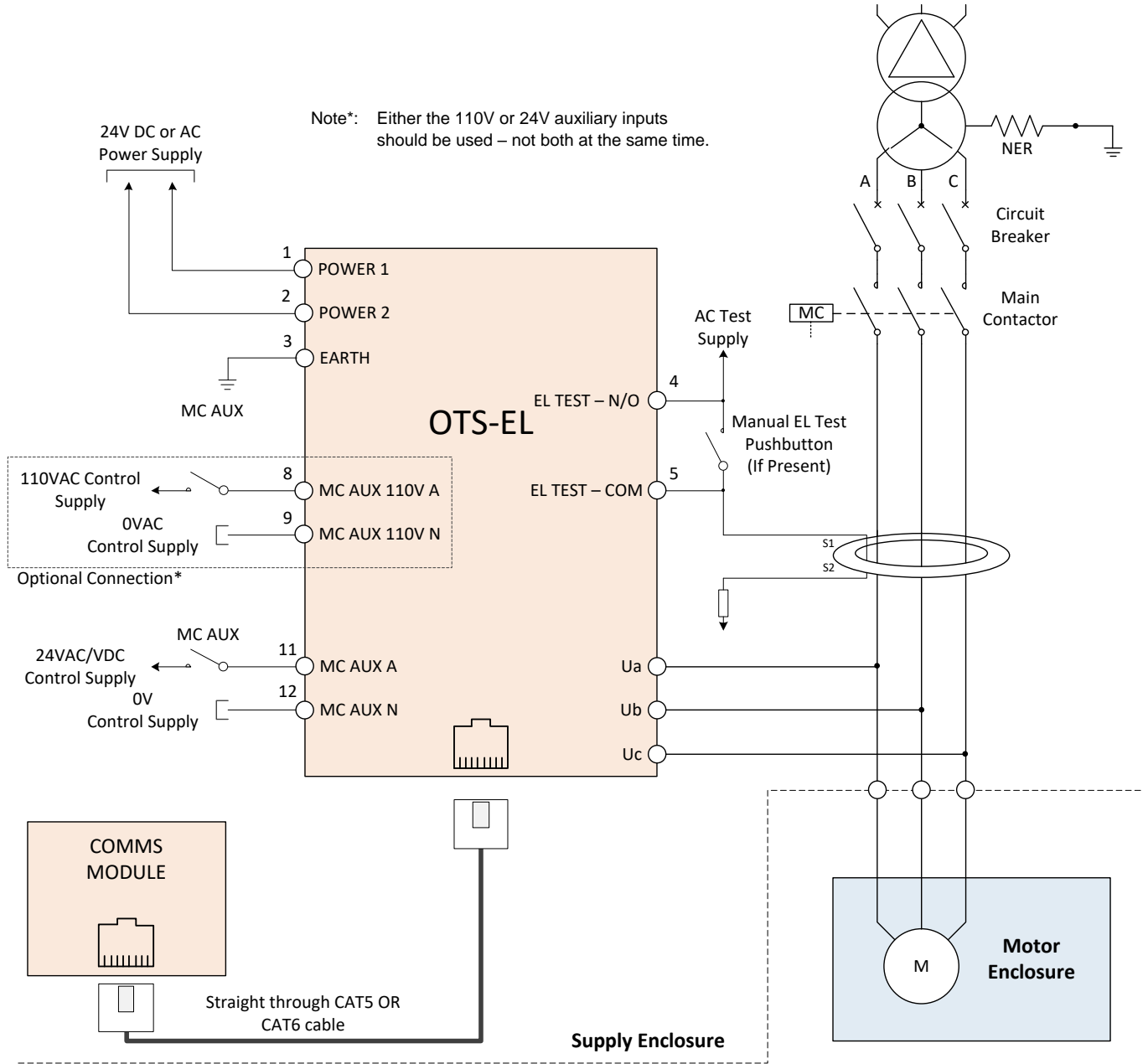


Figure 4.6 Electrical Connections - OTS-EL Circuit Diagram

4.4.1 Power Supply (Terminals 1, 2 & 3)

The OTS-EL requires a regulated 24 VDC or 24 VAC power supply.

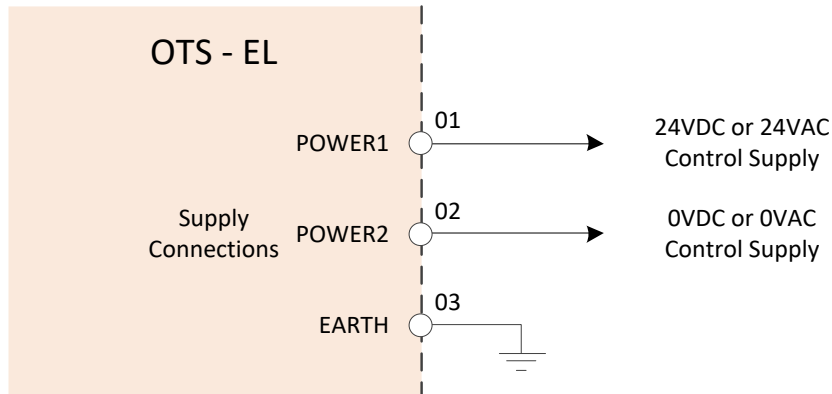


Figure 4.7 Electrical Connections – OTS-EL Power Supply

4.4.2 Line Connections (Terminals Ua, Ub & Uc)

The OTS-EL contains an internal high voltage barrier that allows the OTS-EL to directly interface with the phase conductors.

The high voltage connections from the OTS-EL must be made on the load side of the outlet's contactor / breaking device.

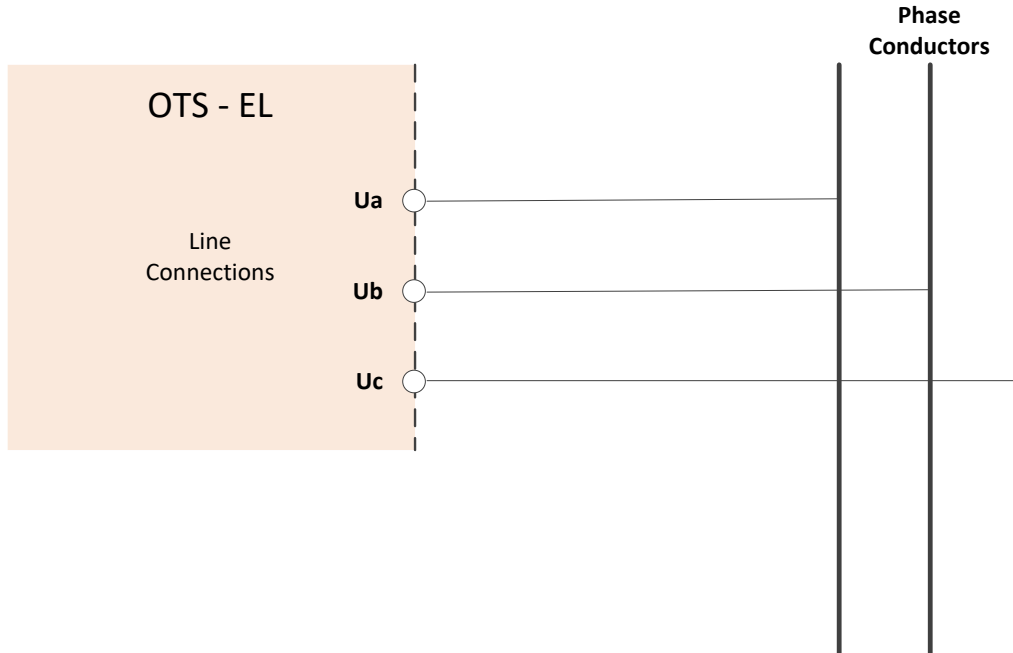


Figure 4.8 Electrical Connections - Internal HV Barrier

4.4.3 Comms Module Connections (RJ45 Port)

The OTS-EL interfaces with the user's compatible tablet via the OTS Comms Module. The Comms Module is connected to the OTS-EL via a standard CAT5 or CAT6 cable (straight-through RJ45 termination).

CAUTION!



This Comms Module Connection Ports **are not standard Ethernet ports**. These cores carry voltages that will damage an incompatible device if connected.

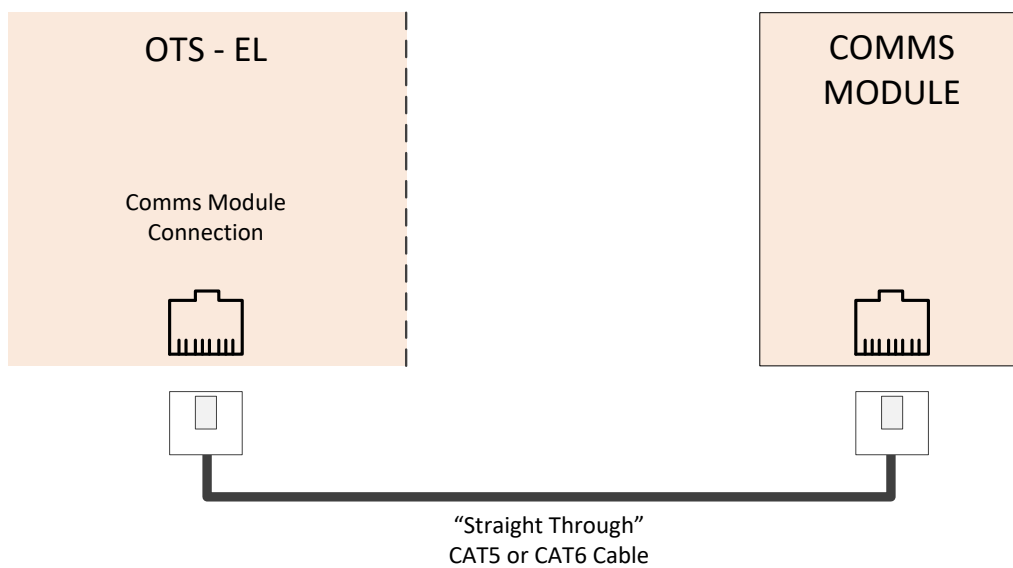


Figure 4.9 Electrical Connections - Comms Module

4.4.4 EL Test Connections (Terminals 4 & 5)

The Earth Leakage Test works by closing an internal normally open contact for the duration of the test. This contact is intended to be wired in parallel to an existing earth leakage test circuit that passes an AC current through the outlet's earth leakage toroid.

NOTE



The installer is responsible for ensuring that the test resistance is of a suitable magnitude to provide a meaningful test.

It is recommended that the resistance value is chosen such that the test current is between 110 % and 120 % of the trip level of the earth leakage protection relay (AS/NZS 2081 Appendix E4, AS/NZS 4871.1:2012 Clause 2.6.2.4).

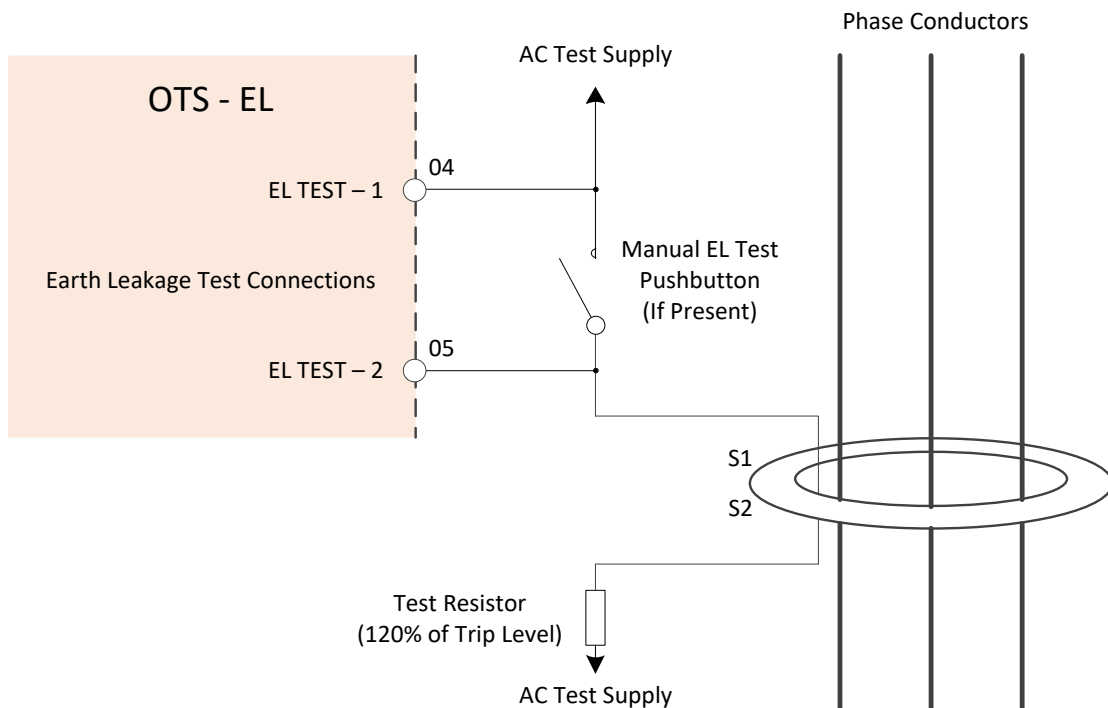


Figure 4.10 Electrical Connections – EL Test

4.4.5 MC Auxiliary Input Connections (Terminals 8 & 9 or 11 & 12)

The MC Auxiliary Input provides feedback to the OTS-EL on the current position of the outlet's contactor / breaking device. The OTS-EL provides two options for monitoring the MC Auxiliary. The first option is used in 110 VAC control circuits, as shown in Figure 4.11. The second option is to use the MC AUX 24 V input, as shown in Figure 4.12. This input is used with 24 VDC or 24 VAC control supplies. The MC AUX 110 V and the MC AUX 24 V input do not require a load to be present; the voltage input can connect directly to the input (via the contactor's auxiliary contact).

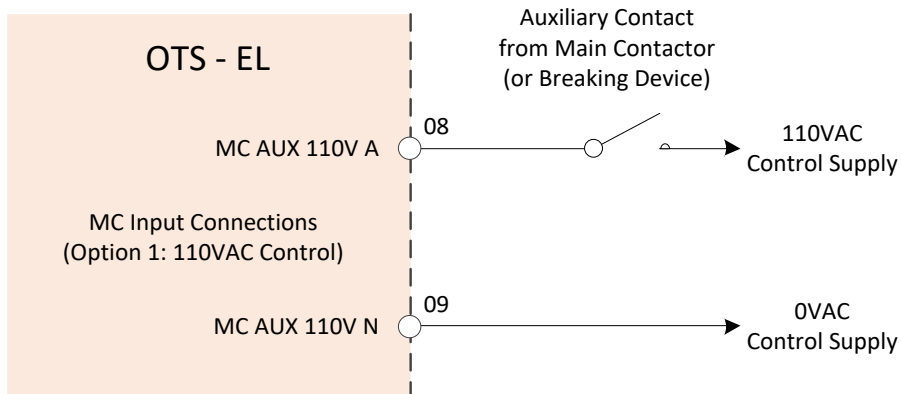


Figure 4.11 Electrical Connections – MC Auxiliary Input (Option 1)

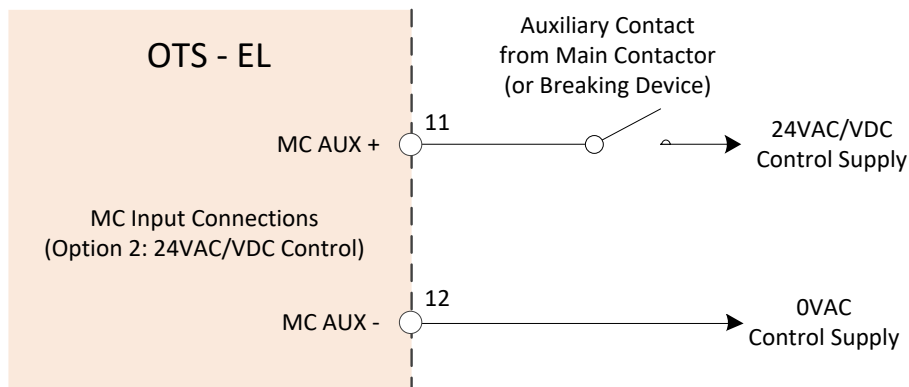


Figure 4.12 Electrical Connections – MC Auxiliary Input (Option 2)

NOTE



Either the 110 V or 24 V auxiliary inputs should be used – not both at the same time.

5 PRODUCT OPERATION

All tests are initiated wirelessly through Bluetooth from the AmpINTEL PowerSAFE OTS software. The AmpINTEL PowerSAFE OTS Application software is compatible with Android versions 4.3 and above. As the OTS application has been developed and tested on the Samsung Galaxy Tab A with Android version 6.0.1, Ampcontrol can only guarantee compatibility with this device.

CAUTION!



Ampcontrol cannot guarantee correct operation of the AmpINTEL PowerSAFE OTS application if a non-compatible smart device is utilised.

During a test, the results will be displayed on the tablet and a report will be generated upon completion. These test reports are stored on the tablet until the tablet gains network access. At this point the test reports are uploaded to the dashboard, a site-specific cloud-based storage platform.

Once these reports have been uploaded, all reports except for the most recent will be removed from the tablet. The most recent report is saved on the tablet because, at the beginning of each new connection, the OTS-EL will check to make sure there are no discrepancies between the results obtained from the last test and those stored on the tablet. If there are any differences the test report will be updated to those stored in the OTS-EL. If the reports are different (i.e. the last test was conducted on a different device) a new test report will be generated with the data stored on the OTS-EL. This is of particular use if there were any issues with the tablet or Bluetooth connection during testing.

For more information on the operation on the OTS-EL Android Application or the Dashboard please refer to the relevant user manual.

NOTE



The Bluetooth range is limited to a maximum of approximately three metres (3 m). This distance is an advised maximum, various factors will influence the connection distance.

5.1 Earth Leakage Protection Function Test

The Earth Leakage test can only be initiated with the outlet energised. When the EL test is initialised, the OTS-EL will energise the existing external EL test circuit. This simulates an EL current to be detected by the outlet's earth leakage toroid.

NOTE



The OTS itself does not generate the test current; it operates in parallel to the existing manual EL test circuit.

Once the earth leakage test is initiated, the OTS-EL will measure the time taken for the outlet to open its contactor or breaking device. In addition, the OTS-EL will also monitor the voltage on the load side of this breaking device to determine the time that it takes for the back EMF generated by the connected load to subside to extra low voltage (<50 VAC). This represents the true clearing time following an earth leakage fault.

The magnitude of the current that flows through the earth leakage toroid is determined by the design of the test circuit installed. It is the responsibility of the installer to ensure that this current is sized to provide meaningful results when the earth leakage test is conducted by the OTS.

NOTE



The installer is responsible for ensuring that the EL test current is of a suitable magnitude to provide a meaningful test.

It is recommended that the circuit design is chosen such that the test current is between 110 % and 120 % of the trip level of the earth leakage protection relay (AS/NZS 2081 Appendix E4, AS/NZS 4871.1:2012 Clause 2.6.2.4).

6 OPERATIONAL INTERFACE

This section will give an explanation of the physical location and the operational characteristics of the OTS-EL's interface elements.

6.1 OTS-EL Operational Interface

The OTS-EL has two LEDs and a RJ45 connection port (identified in Figure 6.1). The operation of the LED's is detailed in *Table 2*.

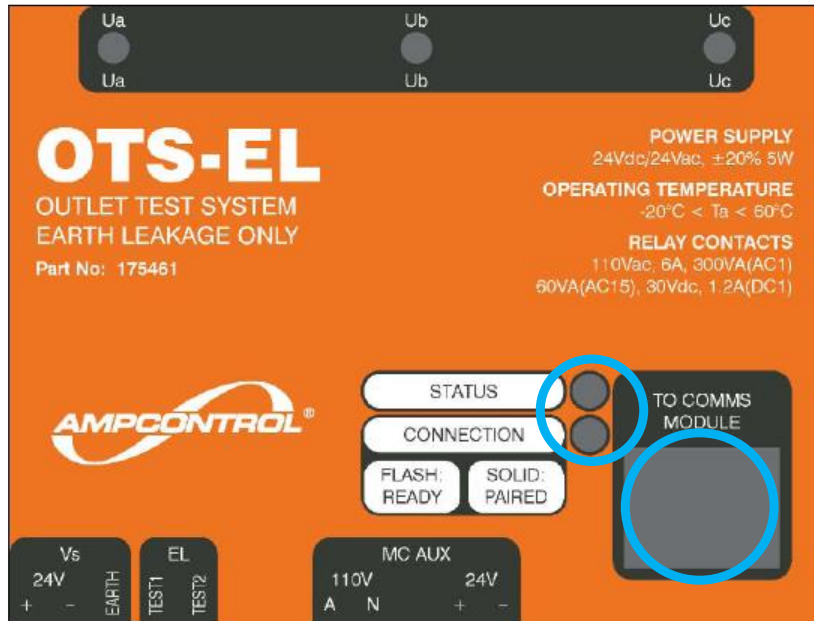


Figure 6.1 OTS-EL Operational Interface

Table 2 OTS-EL Fascia LED Operation

LED		Behaviour		
Name	Colour	Off	Flashing	On
Status	Green	Control Power Off	Healthy	Processor Error
Comms	Blue	Not Connected to Comms Module	Ready for Connection to Tablet	Connected to the Tablet

The RJ45 port is designed to connect the OTS-EL to the Comms Module via a straight through CAT5 or CAT6 cable.

CAUTION!



The Comms Module Connection Ports **are not standard Ethernet ports**. These cores carry voltages that will damage an incompatible device if connected.

6.2 OTS Comms Module Operational Interface

If the OTS Comms Module is installed correctly, the two LEDs identified on the left in Figure 6.2, will line up with the label that is installed over the hole on the outside of the enclosure. These LEDs are the Paired LED (left) and the Testing LED (right). The operation of the LEDs is detailed in *Table 3*.



Figure 6.2 Comms Module Operational Interface

Table 3 OTS-EL Comms Module LED Operation

LED		Behaviour		
Name	Colour	Off	Flashing	On
Paired	Blue	Not Connected to OTS-EL	Ready for Connection to Tablet	Connected to the Tablet
Testing	Red	No Testing in Progress	Testing in Progress	Testing Completed

7 SERVICE, MAINTENANCE & DISPOSAL

7.1 Equipment Service

A number of external system-based checks should be completed on a regular basis. These 'routine inspections' must be carried out by suitably trained people with knowledge of the Outlet Test System and the systems into which it is fitted. Routine inspections may take the form of either visual-only checks, or visual and 'hands-on' checks.

7.1.1 Visual Only Inspections

A basic visual inspection focuses on looking at the installation for signs of physical damage, water or dust ingress and the condition of cables and labels. This type of inspection may involve opening cabinets to gain access to the OTS-EL and other equipment. This level of inspection may also include cleaning display windows that have become obscured by dirt.

Observations would typically be:

- Check that equipment enclosures, cable trays, conduits, etc. are in good order with no physical damage
- Check that sealed wall boxes are free from water and dust ingress internally. Door seals are in good condition
- Check that connected cables are free from cuts, abrasions and obvious signs of damage. Cable restraints are in good order and correctly fitted
- Check that labels on equipment, wall boxes and cables are present and in good condition (especially certification labels)
- Check that no modifications have been carried out to installed equipment

7.1.2 Hands-On (Detailed) Inspections

A more detailed inspection would include all of the elements of a visual inspection, plus some checks that cover the integrity of connections, fixtures and fittings.

In addition to basic visual observations, more detailed integrity checks would involve:

- Verify that equipment housings, wall boxes and other mechanical fixtures are secured in place. This includes terminal box lids, tightness of cable glands, integrity of wall-box mountings, security of equipment fixing to walls/DIN rails etc
- Verify all electrical connections are secure with no loose screw terminals or DIN rail terminals not fitted to rails etc

7.2 Equipment Maintenance

WARNING!



The OTS-EL has no user-serviceable parts.

All repairs must be carried out by Ampcontrol only.

If a fault develops, return the unit to Ampcontrol for repair. It is essential that **no attempt be made to repair the unit** as any attempt to dismantle or repair the unit can **seriously compromise the safety of the unit and voids product warranty.**

7.3 Disposal

ENVIRO



The electronic equipment discussed in this manual **must not be treated as general waste**. By ensuring that this product is disposed of correctly you will be helping to prevent potentially negative consequences for the environment which could otherwise be caused by incorrect waste handling of this product.

8 SPECIFICATIONS

Specifications	
Supply	
<i>Regulated Voltage</i>	24 VDC or 24 VAC (50 Hz) ±20 %
<i>Power Supply Requirement</i>	5 VA
Dimensions and Environment	
<i>OTS-EL (H x W x D)</i>	91 x 100 x 110 mm
<i>Comms Module (H x W x D)</i>	86 x 54 x 21 mm
<i>IP Rating</i>	IPX6
Earth Leakage Test	
<i>Test Interface</i>	Current injected through the earth leakage toroid
<i>Measured Entities</i>	Elapsed time between trip initiation and outlet contactor opening and , Elapsed time between trip initiation and the back EMF falling below ELV (true clearing time).
Find Out More	
For more information on this product, contact Ampcontrol Customer Service on +61 1300 267 373 or customerservice@ampcontrolgroup.com or visit the Ampcontrol website: www.ampcontrolgroup.com	

9 EQUIPMENT LIST

<i>Part Number</i>	<i>Description</i>
175461	MODULE OTS TESTER
179019	MODULE OTS2 TESTER
175463	MODULE OTS COMMS
176536	MODULE OTS EL-ONLY TESTER
180264	MODULE OTS EL-ONLY TESTER Version 2
175462	MODULE OTS EXTERNAL EL/EC BARRIER
177451	OTS TESTERS TABLET NON-LTE 8IN OTS+CASE