

aerl

EarthGuard

Insulation Monitoring

User Manual



Models

EG-600

About Australian Energy Research Laboratories

Australian Energy Research Laboratories (AERL) was founded by Stuart Watkinson (BE Elec. Eng., Grad. M.I.E.A) in 1985 to commercialize the “Power Optimizer”, a revolutionary solution to a complex problem, developed while studying at the University of Queensland in Brisbane, Australia.

Stuart possessed not only a great idea, but also the entrepreneurial skill to turn it in to a commercially viable product and his “Power Optimizer” would eventually come to be known as the AERL MAXIMIZER™, the world’s first truly Universal Maximum Power Point Tracker (MPPT).

Today, AERL manufactures a range of highly reliable and efficient specialised power products for use in Solar, Micro Hydro, Micro Wind and Cathodic Protection applications.

Contact Information

Address: 2/75 Bluestone Circuit
Seventeen Mile Rocks, QLD,
4073, Australia

Phone: [+61 1800 950 865](tel:+611800950865)
Email: support@aerl.com.au
Website: <https://www.aerl.com.au>

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Effective Date

October 2024 (10/2024)

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Important Safety Information

This installation manual contains important safety information and installation instructions for the EarthGuard Earth Leakage Detection device.

The following symbols are used throughout this user manual to indicate ideal installation methods, potentially dangerous conditions, and important operational information.



IMPORTANT

Indicates information that must be followed to ensure proper operation of the EarthGuard device.



CAUTION

Indicates a critical procedure for the safe installation of the EarthGuard. Use extreme caution when performing this task.

About this Manual



IMPORTANT

- This User Manual provides detailed installation and usage instructions for the EarthGuard. It is recommended that all the Instructions and Cautions in this User Manual be read before beginning installation.
- Only qualified electricians and technicians should install the EarthGuard. This manual is intended for all installation technicians and the system owner.
- Do not disassemble or attempt to repair the EarthGuard unless you are a qualified technician and have authority in writing from AERL to do so.
- AERL will not be held responsible in any way for the mishandling of this product or for installation of the product in a manner that does not follow the instructions in this manual or as advised by an AERL technician.

Warranty Conditions

¹ Warranty Duration from the Date of Purchase

Warranty Requirements	Total Warranty Duration ¹
1. You are the original purchaser of the EarthGuard.	3 Years
2. You are the original purchaser and registered your warranty online within 60 days of installation.	5 Years

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law.

You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

AERL will bear the cost of parts and labour to repair any manufacturing faults found within the terms and period of this warranty. For claims under warranty, the faulty product(s) must be returned to AERL's facility at 2/75 Bluestone Circuit, Seventeen Mile Rocks, 4073, QLD, Australia, after contacting AERL and receiving the appropriate RMA documentation from AERL.

No allowance is made for labour or travelling time required to disconnect or reinstall faulty parts. AERL will pay the cost of freight to return the repaired device to the customer within Australia or New Zealand only. The method of freight will be determined by AERL.

All installation and user conditions as set down in the instruction manual must be strictly adhered to as failure to do so may void your warranty. Any faults or like faults caused by lightning, water or moisture ingress, vermin infestation, improper voltage, faulty installation, use of the product in a manner for which it is not intended, alterations which affect the reliability or performance of the unit but are not attributable to faulty manufacture, failure to act on service warning from the AERL product, or damage caused by other system components will not be covered under warranty.

In the event of the product being out of service, AERL shall bear no responsibility for any consequential loss or expense. AERL will not be held responsible for any misleading or incorrect information conveyed by anyone not directly employed by AERL.

Visit www.aerl.com.au/activate-warranty and fill out the associated form to activate your full AERL warranty.

Specifications

General Specifications	
Parameter	Typical
Weight	250g
Dimensions (L x W x H)	140 x 230 x 110 mm
Enclosure Type	Indoor Type 1 / IP20
Operating Temperature	-25 to 60°C
Storage Temperature	-25 to 80°C
Connection Terminals	Screwless Terminals (0.25 mm ² -> 5.25 mm ²)

Low Voltage Side	EG 600
Input Power (DC Input)	12 – 60 Vdc
Max Current Draw (DC Input)	100mA
Input Power (USB-C)	4.5 – 5.5 Vdc
Max Current Draw (USB-C)	250mA
Alarm Indication Relay	2 x Signal (Dry Contact)

High Voltage Side	EG 600
PV Array Monitoring Range	60 – 600 Vdc
Supported Battery Voltages	48V 120V
Leakage Trip Thresholds (+/- 10%)	30kOhm -> 100kOhm
Isolation to Low Voltage Side	4kV (Transient)

Standards	EG 600
Electrical Safety	AS/NZS 3100:2017
EMC (Domestic)	AS/NZS 61000.6.3:2012

Introduction

Thank you for purchasing an AERL EarthGuard EG-600.

Product Description

The AERL EarthGuard is an insulation monitoring device that continuously monitors system conductor insulation integrity. It meets earth fault detection requirements specified in AS/NZS 5033:2014 and AS/NZS 5139:2019 standards when installed on the battery bus. The unit includes integrated audio and visual alarms, along with relay outputs for external fault notification.

Product Methodology

The EarthGuard employs resistive earth fault detection strategy to monitor insulation integrity in solar and battery systems. When installed on the battery bus (central point), it provides comprehensive fault detection coverage for both the battery bank and PV array in systems using common positive or common negative regulators.

The device works by injecting a small test current between the system conductors and earth ground. In normal operation, with proper insulation integrity, this test current encounters high resistance due to the isolation between system conductors and ground. However, if insulation deteriorates or a fault occurs, the resistance between the system and ground decreases, allowing increased current flow. The EarthGuard continuously monitors this resistance value and triggers an alarm when it falls below the configured threshold.

This central point installation strategy is particularly effective because the battery bus serves as the electrical nexus in systems with common positive or common negative regulators. Since these configurations share electrical connections between the PV array and battery bank, a single EarthGuard unit at this location can detect insulation faults throughout the entire system, including both the battery and PV array circuits.

Product Compatibility

While all AERL products have been thoroughly tested and verified as compatible with the EarthGuard EG-600, certain third-party devices may exceed maximum permissible leakage thresholds, potentially triggering immediate fault detection.

Compatible Equipment:

- Selectronic SP Pro Series 1, 2 & 2i
- Victron SmartSolar & BlueSolar MPPT Series
- Victron MultiPlus & Quattro Series
- Morningstar TriStar Series

Non-Compatible Equipment:

- Victron EasySolar II GX

Detection Requirements

The earth fault detection requirements depend on your specific system configuration:

For non-galvanically isolated systems (including solar regulators with Common Positive or Common Negative designs):

- The battery bank assumes the PV Array's potential Earth Fault Voltage.
- Earth fault/leakage detection is required for both Battery and PV Array if the array exceeds 60V DC.
- A single EarthGuard unit installed on the battery side provides sufficient coverage for both array and battery bank due to common electrical connections.

For galvanically isolated systems:

Earth fault/leakage detection is only required on the PV Array side when the battery bank operates below DVC-C

Please refer to your system specifications to determine the appropriate configuration for your application.

Installation

Installation must comply with all applicable national and local electrical standards and codes of practice and professional installation is strongly recommended.

Mounting the Device



IMPORTANT

The EarthGuard must be installed in a clean, dry location away from direct sunlight and moisture.

The EarthGuard should be fixed to a vertical surface using the mounting holes in the chassis flanges.

Use appropriate mounting hardware for your surface type - expansion anchors for concrete, toggle bolts for drywall, or machine screws for metal surfaces. Once mounted, verify that the unit is level, and all mounting points are secure.

Wiring Information

The EarthGuard can be installed with battery systems operating at either **48V** or **120V** nominal voltage with a connected **solar PV array up to a maximum of 600V DC**.

Wire and Disconnect Sizing



IMPORTANT

Use appropriate Personal Protective Equipment when handling live connections and disconnect all power sources prior to making any wiring configuration changes.



CAUTION

Do not connect the EG-600's 12-60Vdc input port to any current source not intrinsically current limited. This port is intended for use with AC-DC/DC-DC power supplies, not for direct connection to a battery.

- Use 10 to 25 AWG (0.25 mm² -> 5.25 mm²) for the battery sense and earth reference terminal connections.
 - Appropriately rated in-line fusing, or a circuit breaker must be installed between the EG-600 and the DC bus.
- The 5Vdc (USB-C), the 12-60Vdc Input Power, and the Signal Relay connections are internally fused.

Wiring Diagram

Please refer to **Figure 1** below for an example wiring configuration.

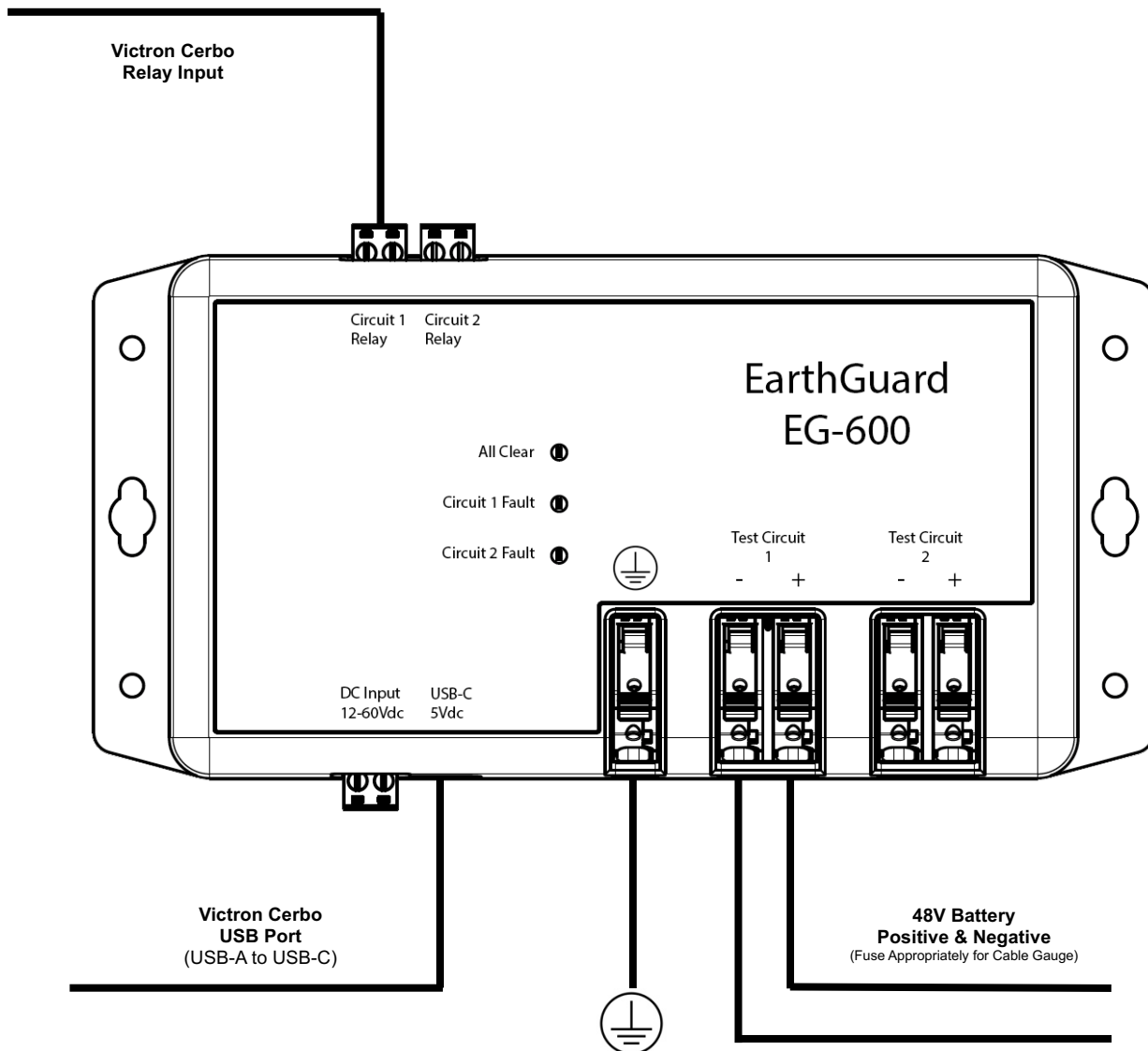


Figure 1 – EarthGuard Wiring Diagram

Connecting with AERL Link

The EarthGuard measurements can be viewed, sensitivity adjusted, and firmware updated via USB-C with the AERL Link software.



IMPORTANT

AERL Link is available for Windows 10/11 and available to download at the URL below.

aerl.com.au/aerl-link.

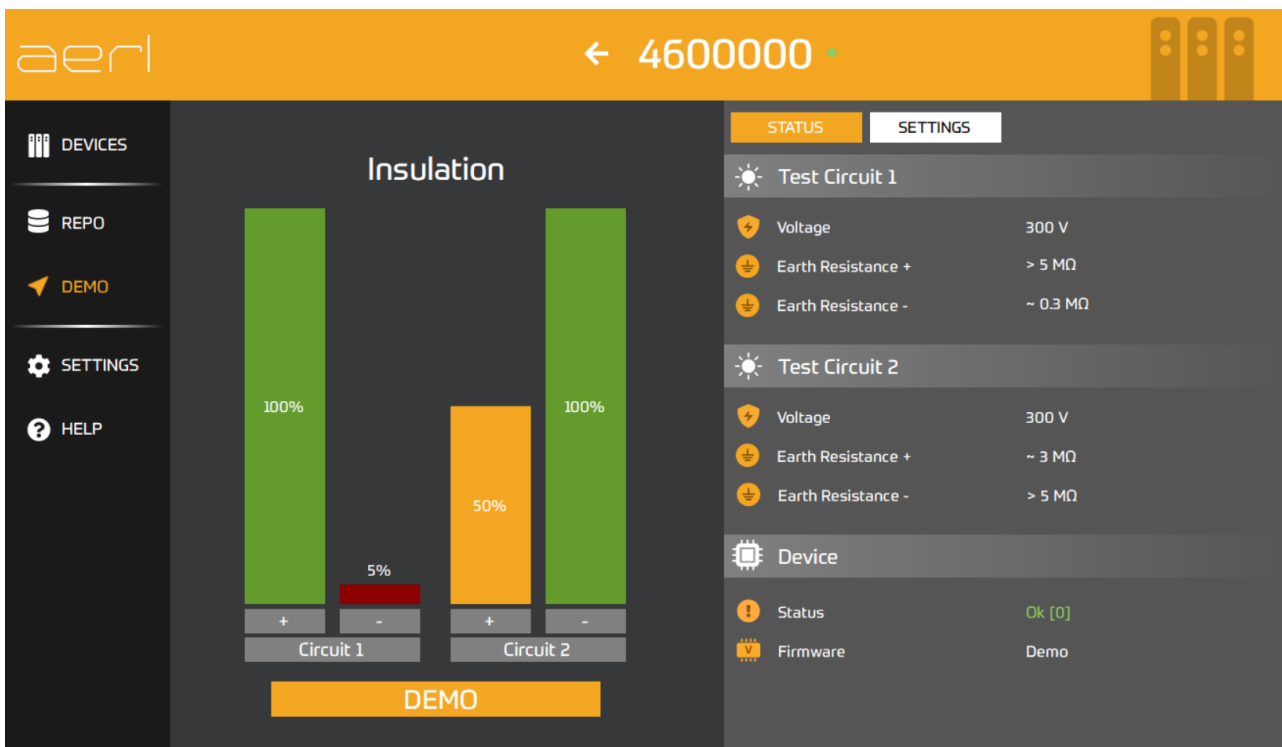


Figure 2 – AERL Link

Trip Sensitivity Configuration

The EarthGuard provides three configurable trip sensitivity levels:

Setting	Trip Threshold
High	< 100kOhm
Medium	< 50kOhm
Low	< 30kOhm

The default configuration is set to medium sensitivity (50kΩ). Sensitivity adjustments can be made via the USB-C port using AERL Link software.

Remote Monitoring

The EarthGuard incorporates normally closed (NC) dry contact signal relays for remote fault monitoring. These relays are designed to interface with external monitoring systems, such as the Victron Venus GX, enabling fault notification in remote installations where the local audible alarm may not be sufficient.

Relay Specifications

- **Operation:** Relays open upon either power loss or earth fault detection
- **Location:** Pluggable terminals positioned in the top right corner of the device
- **Configuration:** Normally closed (NC) contacts

Operation

The EarthGuard EG-600 continuously monitors insulation integrity between each pole of the test circuits and the reference earth.

Upon fault detection, the system will:

- Activate the corresponding alarm LED.
- Trigger the audible alarm.
- Engage the indication relay.

Troubleshooting a Fault

1. Safety preparations:
 - a. Wear appropriate PPE (insulated gloves, safety glasses).
 - b. Follow electrical isolation procedures.
 - c. Use properly rated test equipment.
2. System shutdown sequence:
 - a. Disable inverter/charge controllers.
 - b. Open battery circuit breakers.
 - c. Open PV array isolation switches.
 - d. Power down EarthGuard.
 - e. Verify zero voltage using multimeter.
3. Visually inspect for:
 - a. Cable/ Rodent damage.
 - b. PV back sheet degradation.
4. Segment and Test:
 - a. Measure Ohms between Battery Conductors and Earth with a multimeter.
 - b. Megger between PV Conductors and Earth.

Once the fault has been identified and rectified, the EG-600 will revert to an “All Clear” state.

Simulating a Fault



CAUTION – Potential Hazard

Earth Faults can damage PCE and connected components. Please consult the manufacturer of the PCE in use prior to simulating an Earth Fault. AERL takes no responsibility for any damage caused as a result of simulating an earth fault.

If you would like to test the EG-600 is correctly operating, the following method can be used with extreme caution.

1. Isolation procedure:
 - a. Disconnect all PCE from EarthGuard.
 - b. Remove chargers, inverters, and generators from battery bus.
 - c. Verify complete system power-down.
 - d. Confirm all equipment is isolated.
2. **With both the EarthGuard and the system completely powered down, and all equipment isolated from the device**, a simulated fault can be introduced by wiring a path from either the DC+ or DC- to Reference Earth with a **20kOhm** Resistance in-line.
3. Testing sequence:
 - a. Apply battery voltage to DC+ & DC- sense wires.
 - b. Restore power to EarthGuard.
 - c. Fault alarm should trigger within a few seconds.



Note: The EarthGuard documentation is being improved regularly. If the relevant scenario is not documented, please contact AERL at either support@aerl.com.au or on **+61 1800 950 865**, we are happy to help assist with any queries you may have.