

# EarthGuard

## Earth Leakage Detection

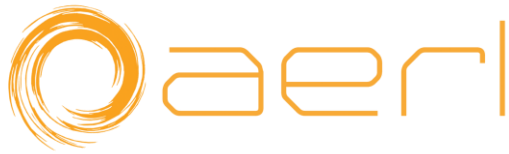
### Installation & Operation Manual



#### Models

---

EG-300



## 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.

Unlike many inventors, Stuart possessed not only a great idea, but also the entrepreneurial skill to turn it in to a commercially viable product. The “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 electronic controllers for use in Solar, Micro Hydro, Micro Wind and Cathodic Protection applications.

## Contact Information

Address: Unit 15, 1015 Nudgee Rd,  
Banyo, QLD, 4078, Australia

Phone: [+61 07 3129 0330](tel:+610731290330)  
Email: [sales@aerl.com.au](mailto:sales@aerl.com.au)  
Website: <https://www.aerl.com.au>

## Disclaimer

UNLESS SPECIFICALLY AGREED TO IN WRITING, AUSTRALIAN ENERGY RESEARCH LABORATORIES:

(a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.

(b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSS OR DAMAGE, WHETHER DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION.

THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER’S RISK.

## Notice of Copyright

EarthGuard Owner’s Manual © 2020 by Australian Energy Research Laboratories Pty. Ltd. All Rights Reserved.

## Trademark

AERL and the AERL logo are trademarks owned and used by Australian Energy Research Laboratories Pty. Ltd.

These trademarks may be registered in Australia and other countries.

## Effective Date

July 2020 (07/2020)



## Table of Contents

<b>Warranty Conditions .....</b>	<b>5</b>
<b>Specifications .....</b>	<b>6</b>
<b>Introduction .....</b>	<b>7</b>
<b>Product Description.....</b>	<b>7</b>
<b>Firmware.....</b>	<b>7</b>
<b>Supported System Components.....</b>	<b>7</b>
<b>Installation .....</b>	<b>8</b>
<b>Installation Standards .....</b>	<b>8</b>
<b>Detection Requirements.....</b>	<b>8</b>
<b>Mounting the Device.....</b>	<b>8</b>
<b>Wiring Information.....</b>	<b>9</b>
<b>Wire and Disconnect Sizing .....</b>	<b>9</b>
<b>EarthGuard EG-300.....</b>	<b>9</b>
<b>Wiring Compartment.....</b>	<b>9</b>
<b>Wiring Diagram .....</b>	<b>10</b>
<b>Adjusting the Trip Sensitivity .....</b>	<b>11</b>
<b>Alarm Indication Relay .....</b>	<b>11</b>
<b>Operation .....</b>	<b>12</b>
<b>Finding a Fault .....</b>	<b>12</b>
<b>Clearing a Fault.....</b>	<b>12</b>
<b>Simulating a Fault.....</b>	<b>12</b>

# 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 of 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

### <sup>1</sup> Warranty Duration from the Date of Purchase

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

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 Unit 15, 1015 Nudgee Road, Brisbane, 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 charge controller 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 charge controller, or damage caused by other system components will not be covered under warranty.

The degradation or failure of consumable components (cooling fans and power capacitors reaching end of life) is not covered under this 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 <https://core.aerl.com.au/register-product/> and fill out the associated form to activate your full AERL warranty.

## Specifications

General Specifications	
Parameter	Typical
Weight	1.2 kg
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	Screw Terminals (0.2 mm <sup>2</sup> -> 2.08 mm <sup>2</sup> )

Low Voltage Side	EG 300
Input Power (12V Input)	10 – 14 Vdc (12V Nominal)
Max Power Consumption (12V Input)	120mA
Input Power (5V Input – USB C)	4.5 – 5.5 Vdc (5V Nominal)
Max Power Consumption (5V Input)	290mA
Alarm Indication Relay	Signal (Dry Contact)

High Voltage Side	EG 300
PV Array Monitoring Range	60 – 300 Vdc
Supported Battery Voltages	48V   120V
Input Load Under Test	1Mohm
Input Load Not Under Test	300Mohm
Leakage Trip Current (+/- 10%)	> 35uA   > 100uA
Isolation to Low Voltage Side	1000V (Transient)

Standards	EG 300
Electrical Safety	AS/NZS 3100:2017
EMC (Domestic)	AS/NZS 61000.6.3:2012



## Introduction

---

Thanks for supporting local manufacturing with your purchase of an Australian designed and made product.

## Product Description

Utilizing proprietary detection techniques, the AERL EarthGuard Insulation Monitoring Device simultaneously monitors the unearthed PV Array (60 - 300V) and Battery Storage System (48/120V) for conductor insulation degradation.

Installed on the battery bus, the EarthGuard monitoring device satisfies the earth fault detection requirements of both AS/NZS 5033:2014 & AS/NZS 5139:2019 with onboard audio/visual alarms and an alarm relay output for external fault indication.

Featuring support for full integration with AERL's CoolMax SRX charge controller range, EarthGuard can be utilized in an integrated arrangement or as a standalone device for use with approved third-party controllers, power conversion equipment and battery systems.

## Firmware

This installation and operation manual covers EarthGuard Firmware Revision v1.1.

## Supported System Components

All **AERL** products have been tested for compatibility with the EarthGuard EG-300 but some third-party products may internally exceed the maximum allowed leakage tolerated by the EarthGuard, causing the device to immediately trigger.

Please refer to the list below for supported third-party Controllers, PCE and Battery Inverters.

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

Products listed below are **incompatible** with EarthGuard and cannot be installed in systems requiring compliance with AS/NZS 5033:2014 & AS/NZS 5139:2019.

- Victron EasySolar II GX

## Installation

---



### **IMPORTANT**

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

## Installation Standards

All installations must comply with national and local electrical standards and codes of practice. AERL always recommends professional installation.

The EarthGuard EG-300 can be used to fulfil the earth fault/leakage detection requirements of AS/NZS 5033:2014 and 5139:2019 for unearthed PV and Battery installations.

Please refer to the **Detection Requirements** section below to determine the configuration that is required for your application.

## Detection Requirements

If the PV Array **is not Galvanically Isolated** from the battery bank (AERL and Victron regulators are not isolated as they are Common Positive and Common Negative designs respectively), the battery bank's potential Earth Fault Voltage is considered to be that of the connected PV Array and thus requires earth fault/leakage detection on both the Battery and PV Array **if the array exceeds 60Vdc**.

That said, because the **AERL** and **Victron** regulators are not galvanically isolated, only a **single** EarthGuard is required to cover both the array and battery bank due to the common (positive & negative) electrical connections and the sensitivity of the EarthGuard device.

If the PCE **is Galvanically Isolated**, and the battery bank is **below DVC-C**, earth fault/leakage detection is only required on the PV Array (provided it is above 60Vdc).

## Mounting the Device

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

If the device is being used with an AERL CoolMax SRX Solar Charge Controller, the top plate can be removed from the EarthGuard and the device can be mounted seamlessly against the base of the CoolMax.

Seamless EarthGuard mounting requires that the CoolMax solar charge controller is installed using the reverse cable entry ports, and the base cable glands have been removed from the controller prior to installation of the EarthGuard device.



## Wiring Information

The EarthGuard can be installed on to either a **48V** or **120V** Nominal Battery Bus in systems with a connected PV array not exceeding **300V 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.

## EarthGuard EG-300

- The 5V Input (USB-C) and fault monitoring lines are internally fused. The 12V input is not fused and requires an appropriately sized disconnect when not being powered from the CoolMax SRX 12V line (which is fused internally on the SRX side).
- A jumper connection allows for the choice between 5V and 12V power. The EarthGuard ships with the jumper located on **JP2** for **5V (USB-C)** from factory and must be moved to **JP1** to power the device from a **12V** source.
- 14 to 24 AWG (0.2 mm<sup>2</sup> -> 2.08 mm<sup>2</sup>) may be used for all internal terminal connections.
- Use an insulated flat blade screwdriver to secure the connections.
- Torque all terminal connections to 0.6 Nm (5 in-lb).

## Wiring Compartment



### CAUTION – Hazard

All EarthGuard wiring must enter the unit through the cable glands in the base plate or through the top of the enclosure with the top plate removed when being installed in an integrated configuration with a CoolMax SRX charge controller.

Under absolutely **no circumstances** should holes be drilled anywhere into the unit to make other cable entry points. Doing so can cause metal swarf or fillings to enter the internal electronics and damage the unit once powered up.

**To install cabling and configure the device**, the 4 x M4 CSK Phillips Screws holding the lid in place must be removed. When removing the lid, gently disconnect the 10-way cable from the circuit board and re-fit the cable prior to powering up the device.



### IMPORTANT

- **DO NOT** remove the lower 2 x M4 CSK Screws from the USB-C panel as this may cause alignment issues with the USB connection port.

## Wiring Diagram

Please refer to **Figure 1** below for the recommended wiring configuration.

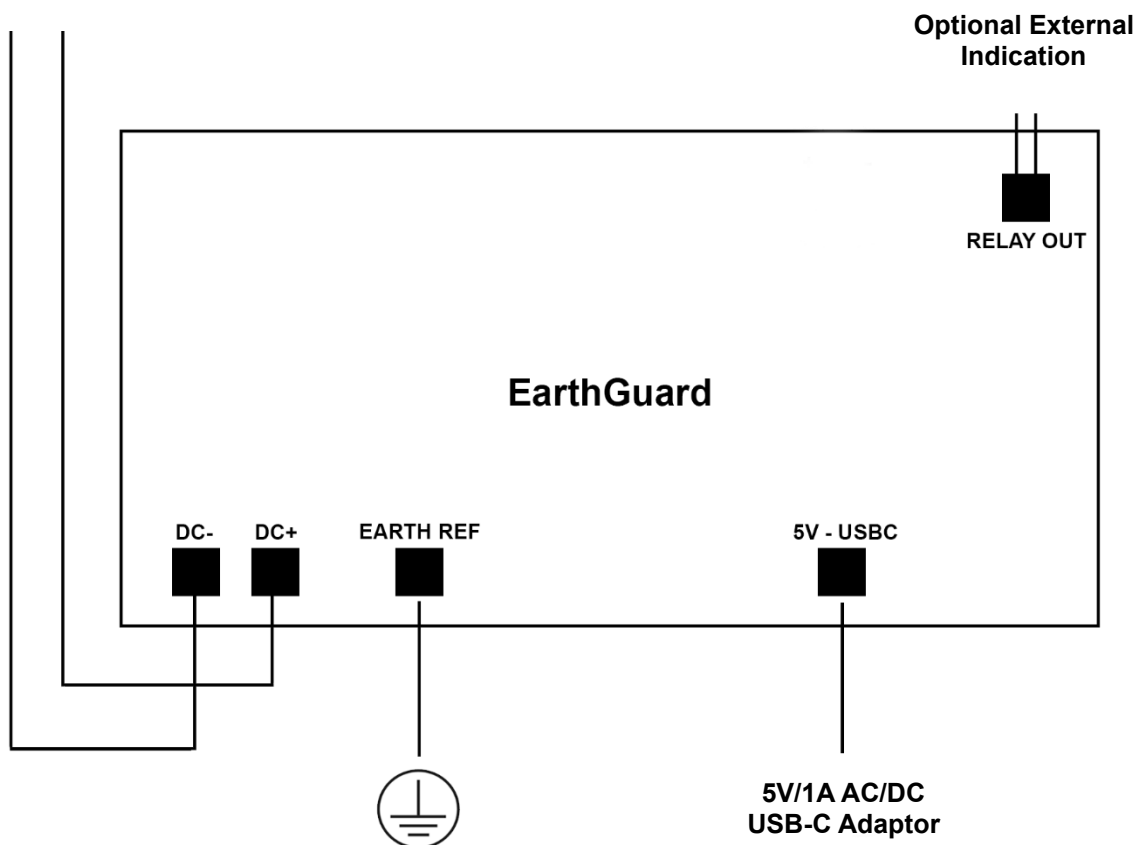


### CAUTION – Potential Hazard

If the DC+ and DC- sense wires are at risk of mechanical damage in their installed location, appropriately rated in-line fusing is **highly recommended** due to the potential fault currents available from the connected battery bank.

The EarthGuard is internally fused at **50mA**. As such, operational current on DC+ and DC- will never exceed 50mA even in the event of an internal failure. External in-line fusing is purely for protection from a short circuit occurring between the DC+/- sense wiring as high potential fault currents (Fire Hazard) are present.

### System Under Test



**Figure 1** – EarthGuard Wiring Diagram



## Adjusting the Trip Sensitivity

The EarthGuard device currently has two trip sensitivity levels, each tailored for the respective supported battery voltages (48V & 120V).

By default, the EG-300's are set to 48V, but this can be adjusted to 120V by removing the Jumper Connection located on the central two pins of the **CON2** header while the device is powered down.

## Alarm Indication Relay

The EarthGuard features a dry contact signal relay for use with the CoolMax SRX and other external devices (such as the Victron Venus GX) in order to alert the appropriate personal to the presence of a fault if the device is installed in a remote location where the audible buzzer will not be heard.

This alarm relay will **Open** when the device either loses power or an earth fault has been detected.

When the system is All Clear, the relay contact will be **Closed**.

The Relay Terminal (**J5**) is located on the top right-hand corner of the PCB and is visible with the access cover removed.

## Operation

---

When the EarthGuard is powered up, it will immediately check for insulation degradation between the connected DC Poles Under Test and Reference Earth, reverting to periodic tests thereafter.

If a fault is detected, the red alarm LED will flash, and the integrated buzzer will sound until silenced with the “Silence” button located on the front of the device.

### Finding a Fault

If the EarthGuard has detected a fault, the red LED’s flash pattern will indicate which pole the fault has been detected on.

**2 Flashes = Positive Pole**

**4 Flashes = Negative Pole**

This can be used to narrow down the potential location of the detected fault when troubleshooting.

### Clearing a Fault

If a fault has been rectified, the “Re-Test” button located on the front of the EarthGuard device can be used to immediately retest to the system to confirm the fault is no longer present.

After several seconds, the “All Clear” green LED should start blinking if the fault is no longer detected.

### 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 the instructions below.

If you would like to test the EG-300 has been correctly installed, the following method can be used with extreme caution.

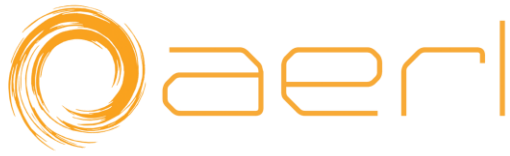
Firstly, isolate all power conversion equipment (PCE) from the EarthGuard, disconnecting any chargers, inverters, and generators from the battery bus.

**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 **100kOhm** Resistance in-line.

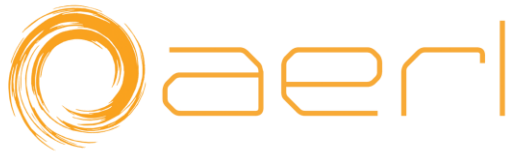
Upon reapplying battery voltage to the DC+ & DC- sense wires and either USB or 12V power to the EarthGuard, a fault alarm will occur within a few seconds, provided the device is correctly installed and configured for the relevant battery voltage.



**Note:** The EarthGuard documentation is being improved regularly. If the relevant situation is not documented, please contact AERL at either [support@aerl.com.au](mailto:support@aerl.com.au) or on **07 3129 0330**, we are happy to help assist with any queries you may have.



Page intentionally left blank.



Page intentionally left blank.