INSTALLATION & OPERATION

EarthGuard

Single-Channel Insulation Monitoring Device

Model · EG-600-SC

DOCUMENT	REVISION	FIRMWARE	MODELS
AER12-SC	2.0.0	v1.0.4 and above	EG-600-SC

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CHAPTER 01

About AERL

Australian Energy Research Laboratories (AERL) was established in 1985 by Stuart Watkinson to develop the AERL **MAXIMIZER™** — the world's first truly Universal Maximum Power Point Tracker (MPPT).

Today, AERL provides a wide range of renewable energy products serving critical energy infrastructure in oil & gas, mining, telecommunications and off-grid sectors.

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CHAPTER 02

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.

IMPORTANT — LOCAL STANDARDS & CERTIFIED INSTALLATION
Installation must comply with the electrical standards, codes, and wiring rules in force at the installation site, and only an installer accredited or licensed in your jurisdiction should perform the work. Where specific standards are cited elsewhere in this document, those citations reflect the design intent at time of publication. Always refer to your current local standards for the actual installation requirements.

About this manual

- This User Manual provides detailed installation and usage instructions for the EarthGuard. It is recommended that the 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.

Firmware

This user manual covers EarthGuard EG-600-SC Firmware Revisions **v1.0.4 and above**.

CHAPTER 03

Warranty conditions

WARRANTY DURATION FROM THE DATE OF PURCHASE

WARRANTY REQUIREMENTS	TOTAL DURATION
You are the original purchaser of the EarthGuard.	3 Years
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 1/75 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.

CHAPTER 04

Specifications

GENERAL

PARAMETER	TYPICAL
Weight	250 g
Dimensions (H × W × D)	155 × 100 × 35 mm
Enclosure type	Indoor Type 1 / IP20
Operating temperature	−25 to 60 °C
Storage temperature	−25 to 80 °C
Connection terminals (Test & Earth)	Lever push-in · 0.2 – 10 mm² (22 – 8 AWG)

LOW-VOLTAGE SIDE

PARAMETER	VALUE
Input power (DC input)	15 – 60 Vdc 11.5 – 15 Vdc with BATT/PSU jumper fitted
Input power (USB-C)	4.5 – 5.5 Vdc
Max power consumption	2 W
Alarm indication relay	1 × signal (dry contact)

HIGH-VOLTAGE SIDE

PARAMETER	VALUE
Voltage range	40 – 600 Vdc
Leakage trip thresholds (±10%)	30 kΩ → 100 kΩ
Isolation to LV side	4 kV (transient)

CERTIFICATIONS

DOMAIN	STANDARD
Electrical Safety	AS/NZS 3100:2017
EMC	AS/NZS 61000.6.3:2012

APPLICABLE INSTALLATION STANDARDS

(informative)

The EarthGuard EG-600-SC is intended for use in installations designed in accordance with the relevant installation standards in the jurisdiction of use, including (in Australia/New Zealand) **AS/NZS 3000**, **AS/NZS 5033**, and **AS/NZS 5139**.

CHAPTER 05

Introduction

Thank you for purchasing an AERL EarthGuard EG-600-SC.

Product description

The AERL EarthGuard EG-600-SC is a single-channel insulation monitoring device that continuously monitors system conductor insulation integrity on a single PV string or battery bus. It is designed to support compliance with earth fault and insulation monitoring requirements set out in AS/NZS 5033 (PV arrays), AS/NZS 5139 (battery systems), and other applicable local installation standards, when installed in accordance with this manual and those standards. The unit includes integrated audio and visual alarms, along with a relay output 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, 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.

Detection requirements

General guidance for non-galvanically-isolated systems (e.g., solar regulators with Common Positive or Common Negative designs): because the battery bank assumes the PV array's earth-fault potential, a single EarthGuard installed on the battery side can typically provide coverage for both the battery and the PV array circuits. Confirm this is acceptable under your applicable standard.

Galvanically isolated systems: detection requirements differ depending on the decisive voltage class of the battery side; refer to your applicable installation standard and PCE manufacturer documentation.

Product compatibility

The EarthGuard can be installed on DC buses from **40 Vdc to 600 Vdc**, so suitable for both 48 V battery systems and 600 V PV arrays.

While all AERL products have been thoroughly tested and verified as compatible with the EarthGuard EG-600-SC, 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

CHAPTER 06

Installation

Mounting the device

Installation must comply with all applicable national and local electrical standards and codes of practice. Professional installation is required.

> **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.

Use appropriate mounting hardware for your surface type. Once mounted, verify that the unit is level, and all mounting points are secure.

WIRE AND DISCONNECT SIZING

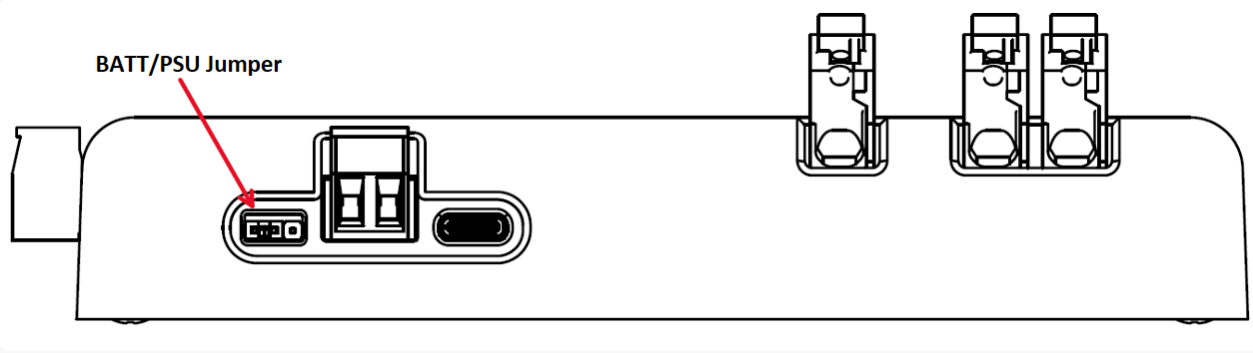
> **IMPORTANT**
> Use appropriate Personal Protective Equipment when handling live connections and disconnect all power sources prior to making any wiring configuration changes.

> **CAUTION — HAZARD**
> Do not connect the EG-600-SC's 15 – 60 Vdc 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.

- The Test Circuit and earth reference terminals are lever push-in, rated **0.2 mm² to 10 mm² (22 to 8 AWG)**.
  - **Cold push-in (lever closed):** rigid or stranded conductors at the lower end of the range can be pushed straight into the terminal.
  - **Open terminal point (lever opened):** required for flexible / fine-stranded conductors and for the upper end of the range. Lift the lever, insert the conductor, then close the lever.
- Appropriately rated in-line fusing, or a circuit breaker, must be installed between the EG-600-SC test-circuit terminals and the DC bus.
- The 5 Vdc (USB-C), the 15 – 60 Vdc Input Power, and the Signal Relay connections are internally fused.

BATT/PSU jumper (12 V operation)

For 12 V supplies, fit the **BATT/PSU** jumper.



BATT/PSU JUMPER LOCATION

BATT/PSU JUMPER	INPUT RANGE
Removed (default)	15 – 60 Vdc
Fitted	11.5 – 15 Vdc

DEFAULT
BATT/PSU jumper removed

BYPASS · 12 V
BATT/PSU jumper fitted

CAUTION — HAZARD
Do not fit the BATT/PSU jumper when supplying more than 15 Vdc. This will damage the unit or arc the supply contacts at connection.

Wiring diagram

Refer to Figure 1 below for an example wiring configuration.

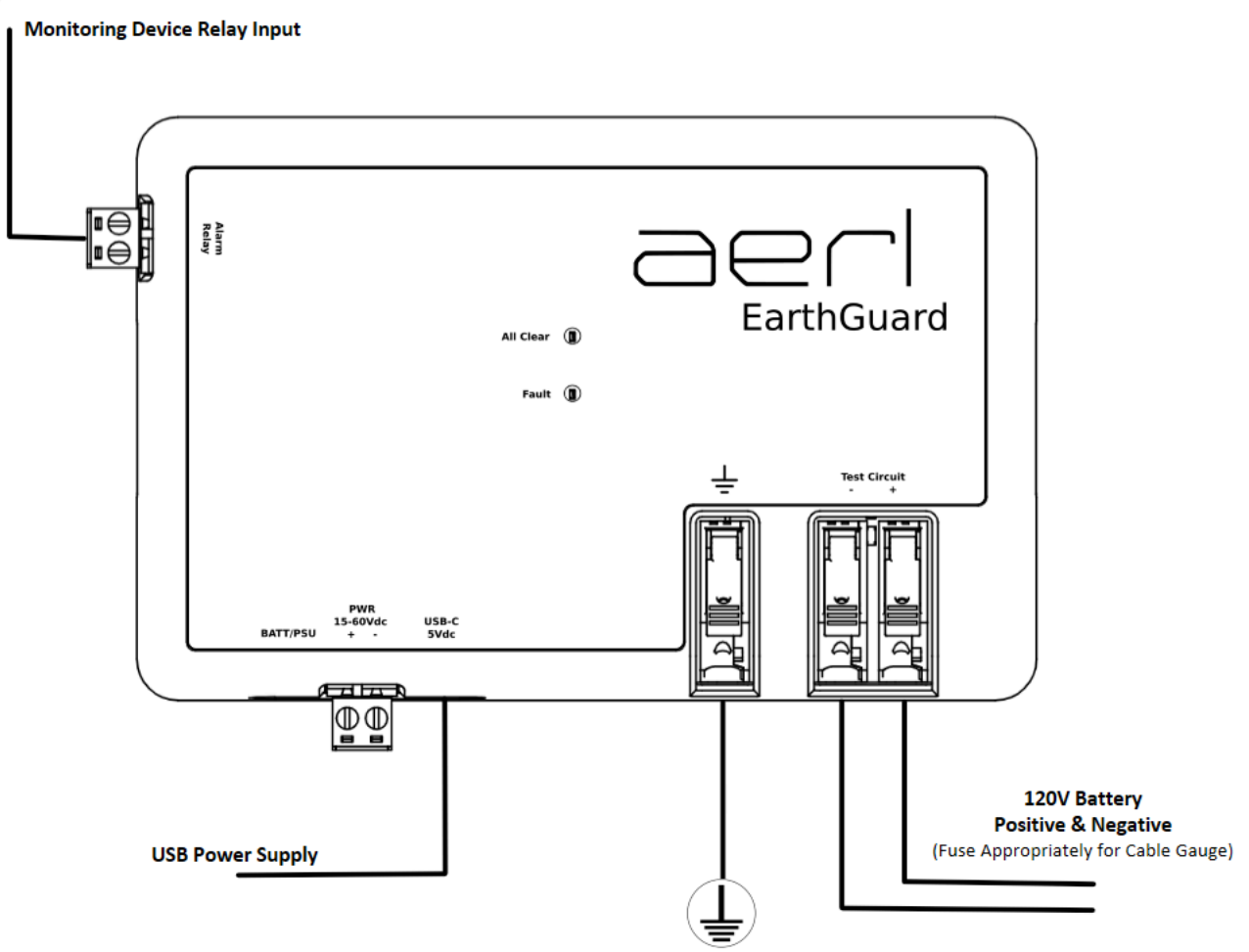


FIGURE 1 · EG-600-SC WIRING DIAGRAM — EXAMPLE CONNECTIONS

Front-panel terminal / indicator layout

LEFT EDGE

ALARM RELAY	Dry-contact pluggable terminal

BOTTOM EDGE — POWER

DC INPUT	15 – 60 Vdc
USB-C	5 Vdc

BOTTOM EDGE — JUMPER

BATT/PSU	12 Vdc power option (see above)

FACE LEDS

ALL CLEAR	Green status indicator
FAULT	Red fault indicator

BOTTOM EDGE — TERMINALS

⏚ EARTH	Earth / reference terminal
TEST (– / +)	Test circuit terminals

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.

`www.aerl.com.au/professionals`

AERL Link displays the device's insulation values (circuit voltage, Earth Resistance (+) and Earth Resistance (–) in MΩ) as well as device status and firmware version.

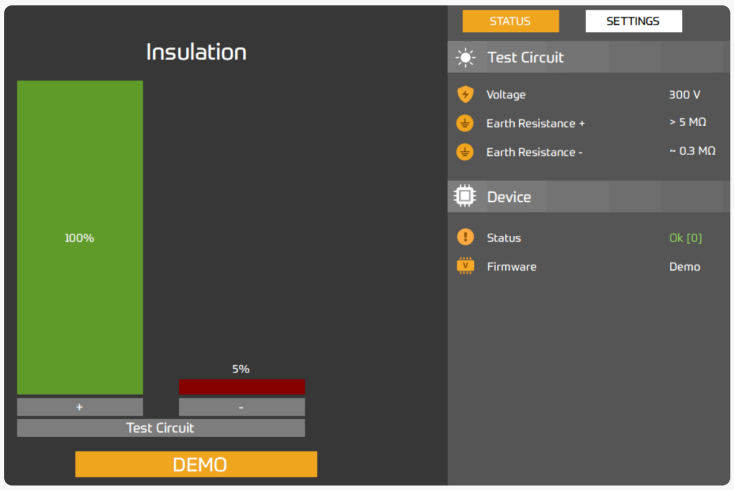


FIGURE 2 · AERL LINK — STATUS TAB

Trip sensitivity configuration

The EarthGuard provides three configurable trip sensitivity levels (accessible under "Settings" in AERL Link):

HIGH	MID	LOW
< 100 kΩ	< 50 kΩ	< 30 kΩ DEFAULT

The default configuration is set to **low sensitivity (30 kΩ)**. Sensitivity adjustments can be made via the USB-C port using AERL Link software.

Ground Fault Mode Configuration

The EarthGuard supports three ground-fault detection modes corresponding to how the DC bus is referenced to earth. Select the mode that matches your system configuration via the AERL Link software.

MODE	WHEN TO USE	DETECTION BEHAVIOUR
Floating (default)	The DC bus is **not** bonded to earth at any point	Both DC+ and DC− poles are monitored against earth
Positive Earth	DC+ is bonded to earth elsewhere in the system	Only DC− is monitored against earth
Negative Earth	DC− is bonded to earth elsewhere in the system	Only DC+ is monitored against earth

> **IMPORTANT**
> Selecting Positive Earth or Negative Earth disables monitoring on this pole. Incorrect selection will disable earth leakage detection.

FIGURE 3 · AERL LINK — SETTINGS TAB (EARTH FAULT SENSITIVITY & EARTH TYPE)

Remote Monitoring

The EarthGuard EG-600-SC incorporates a dry contact signal relay for remote fault monitoring. This relay is 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.

The contact is wired as **Normally Open (NO)** in an **energise-to-close, fail-safe** configuration: the coil is energised in normal operation, holding the contact closed. On either power loss or earth fault detection the coil de-energises and the contact opens, so loss of monitoring (fault, power, cable break) presents the same “open” state to the external system.

RELAY SPECIFICATIONS

- **Operation:** Contact closed in normal operation; opens on power loss or earth fault detection
- **Location:** Pluggable terminal positioned in the top left corner of the device
- **Configuration:** Normally Open (NO), energise-to-close (fail-safe)

CHAPTER 07

Operation

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

Upon fault detection, the system will:

- Activate the fault alarm LED.
- Trigger the audible alarm.
- Open the indication relay.

Face LED Indicators

The EG-600-SC has two face LEDs. Their states map to device status as follows:

ALL CLEAR (GREEN)	FAULT (RED)	MEANING
SOLID ON	OFF	Normal operation. Insulation resistance is above the configured trip threshold on both poles.
OFF	FLASHING (2 HZ)	Warning. A potential fault has been identified. The unit requires several more readings to confirm the fault. The relay and buzzer are not yet active.
OFF	SOLID ON	Confirmed ground fault. The buzzer sounds and the alarm relay opens (see Remote Monitoring). The fault state clears automatically once insulation resistance returns above the trip threshold.

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 damage.
   b. PV back sheet degradation.

4. **Segment and Test:**
   a. Measure Ohms between the battery positive conductor and Earth with a multimeter.
   b. Measure Ohms between the battery negative conductor and Earth with a multimeter.

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

CHAPTER 08

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-SC is correctly operating, the following method can be used with **extreme caution**.

1. **Isolation procedure:**
   a. Disconnect all PCE from EarthGuard.
   b. Remove chargers and inverters from the 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 **20 kΩ** resistance in-line.

3. **Testing sequence:**
   a. Apply battery voltage to DC+ & DC− sense wires.
   b. Restore power to EarthGuard.
   c. Confirm the EarthGuard reports a fault (Fault LED solid red, buzzer active, relay opened).

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.