ESM1 Installation Guide
ESM1-A AC Power Supply
ESM1-B DC Power Supply

1. INTRODUCTION

There are two ESM1 variants, identical other than power supply needs

- ESM1-A AC Power Required (85-264 Volts AC, 50-60Hz)
- ESM1-B DC Power required (9.6-36 Volts)

This document provides basic information on the installation and connection of the EarthSense ESM1 Insulation Monitor to an IT system. Complete information on setup and specification is available from

www.mrd.com.au/dl/esm1-UM.pdf

The ESM1 features a daylight readable LCD, and all functions can be accessed and controlled using the two button interface. The current button function is identified using on-screen labels, and the menu system is simple to operate and provides guidance and feedback. Depending on experience and knowledge, it is possible to install the ESM1 without consulting the manual.

2. PRODUCT DESCRIPTION

The ESM1 monitors the Insulation Resistance (IR) of an attached circuit and alerts system operators if the IR falls below a user-selected trip value for longer than a pre-set period. Alert devices are:

- On-screen display and LED colour/flash
- Relay activated devices and External communication using RS485.

There are two User selectable trip values, R_{AN1} and R_{AN2}, referred to as Warning and Alarm. In the event of an alert, until Reset, the device will:

- Continue to monitor and display the current IR value
- Display the highest recorded alert State (Warning or Alarm)
- Display the lowest IR value recorded
- Count and Display the number of hours since alert started
- Change LED colour and Activate Relay(s) (If the alert state continues beyond the Trip Delay period)

Warning and Alarm have the following settable parameters:

- Trip (Response) Value (kΩ) and Trip Delay (seconds)
- Relay Activated (1 or 2) and Activated State (Normally Open or Closed)

Reset are done manually (on the device) or remotely (using RS485 or a connected reset switch), or the device can be configured to Auto-Reset if the IR increases above the Warning value.
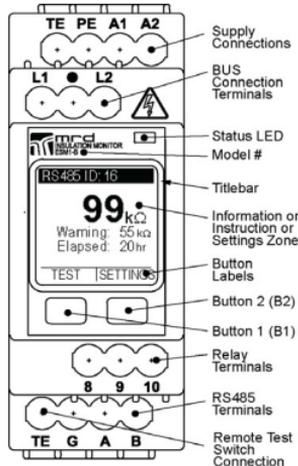
3. CE DECLARATION OF CONFORMITY

View the CE Declaration of Conformity at http://www.mrd.com.au/dl/esm1-DoC.pdf

4. INSTALLATION

4.1 INSTALLATION NOTES

⚠️
- Refer to Wiring Diagram ESM1-0001
- DO NOT connect devices in parallel
- Extra care is required when connecting Bus cables to the device. DO NOT allow Bus Connector wires to touch any terminal other than L1 and L2: the device will be damaged
- MRD recommends that device is connected to de-activated bus
- Use appropriate Personal Protective Equipment when handling live connections

4.2 MOUNTING TO DIN RAIL

- The device snap fits to a standard 35mm DIN Rail
- Hook the internal hook over one edge of the DIN rail ❶
- Rotate the unit toward the DIN Rail until the black clip snaps over the edge of the rail ❷
- To remove the ESM1 from the rail, use an insulated flat blade screwdriver to release the clip: Insert the screwdriver into the gap between clip and body and rotate until the clip releases the rail. ❸
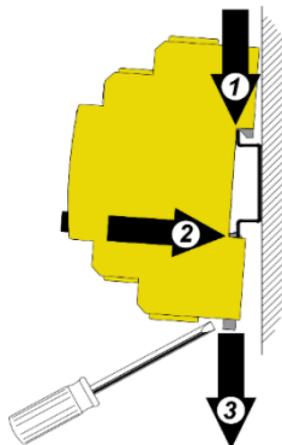
5. CONNECTIONS

All connections to the unit use screw terminals suitable for stripped cables up to 4mm2 or size 12 AWG. To connect a cable:

- Strip 8mm of insulation from the cable end
- Use an insulated, flat-blade screwdriver to tighten terminals to 0.5 - 0.6nm torque.
- Ensure all connections are tight before use

5.1 REQUIRED CONNECTIONS

| Installation type	AC Bus See diagram page 3	DC Bus See diagram page 3
Bus	• Connect AC Bus to L1 and L2	• Connect DC Bus to L1 and L2
Earth	• Connect Earth to PE & TE using separate cables • Test Earth Connections	
Power Supply	• Connect supply voltage to a1 & A2. DC supply must observe polarity. • Use an in-line 2A fuse	

5.2 OPTIONAL CONNECTIONS

|	
Test/Reset	• Connect an external Test/Reset switch to terminal TR & G, if required • Earth to terminal PE
Relays	Connect Relay Activated External devices
	• Relay 1- Connect device to terminals K1 & 10, if required (maximum rating 3A @ 240V) • Relay 2- Connect device to terminals K2 & 10, if required (maximum rating 3A @ 240V)
RS485 Comm's	Connect RS485 Communications
	(Recommended: RS485 Shielded Twisted Pair cable, size AWG22 or AWG24)
	• Connect RS485 Cable to Terminals A & B • Connect RS485 Shielding to terminal G • Connect RS485 120Ω Termination Resistor if required • See connection diagram on page 3

5.3 AC Bus Connection Diagram ESM1-0001
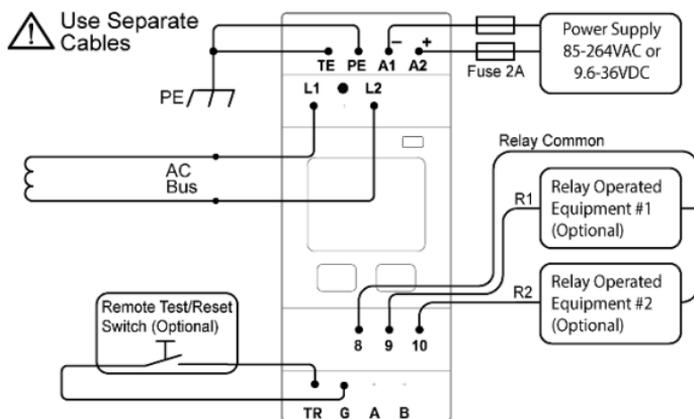
5.4 DC Bus Connection Diagram ESM1-0001
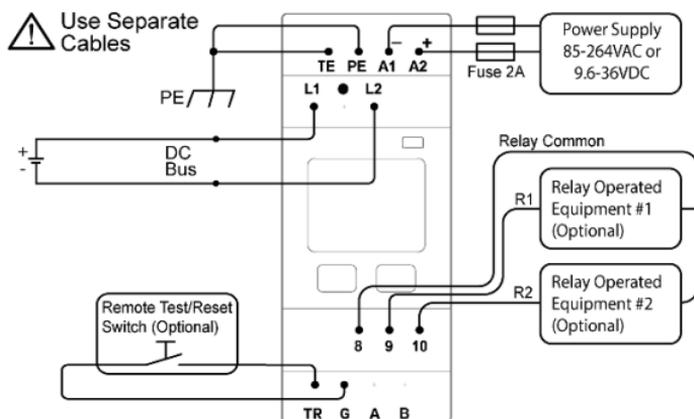
5.5 RS485 Connections
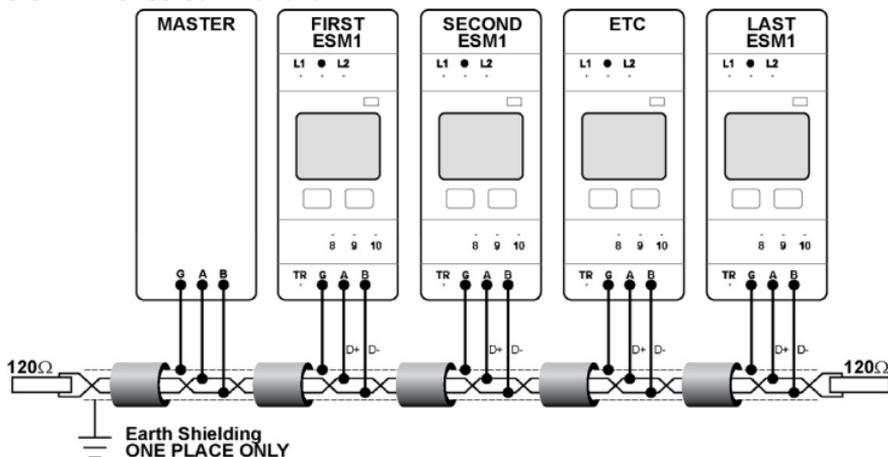
6. SETUP AND OPERATION

*Note: Refer to the User Manual for Detailed Instructions.*

6.1 INTERFACE

6.1.1 LCD Screen

Other than in Self-Test mode, the screen is divided into Title Bar zone; Settings zone; Button Label zones. The current button function is indicated on-screen.

The on-screen menus require single button presses. All menus, option lists, and value selectors are 'circular': repeated pressing of ▼ or ▲ will continuously scroll through the options.

Note: There are no "Back" or "Undo" options. If an error is made use

▶ *to advance through the menu until a Do-Not-Save or Exit opportunity appears. The device always requests confirmation before saving changes.*

- Status LED
- Model #
- Titlebar
- Information or Instruction or Settings Zone
- Button Labels
- Button 2 (B2)
- Button 1 (B1)
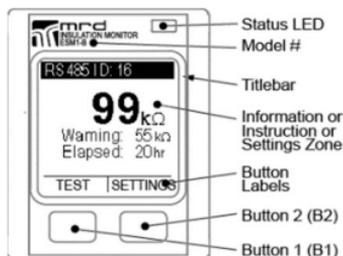
6.1.2 Buttons

B1 Label	Action
▼	Highlights the next item in the menu
▲	Changes the highlighted value by 1 or Scrolls through options
CHANGE	Opens the related Change Screen
YES	Answers "YES" to an on-screen question
TEST	Starts the device Self-Test
RESET	Clears error state records from memory

B2 Label	Action
▶	Select the highlighted item
SETTINGS	Opens the Device SETTINGS menu
SELECT	Saves the highlighted value
NO	Answers "NO" to an on-screen question
EXIT	Returns to the Parent Screen

6.1.3 Tri-Colour LED

Colour	Device Status
None	No Power Supply. The device is not working.
GREEN	OK. Device is monitoring Insulation Resistance properly
RED	Warning State: Insulation Resistance has fallen below the Warning Trip Value, R_{an1}
FLASHING	Alarm State: Insulation Resistance has fallen below the Alarm Trip Value, R_{an2}; or Device has failed Self-Test
BLUE	Self-Test in Progress, or Device is in SETTINGS mode
PURPLE	Firmware Upgrade in progress

6.1.4 Entering Numeric Values

Enter Trip Values and RS485 Identities as individual digits. Leading zeros must be used e.g. 06=6; 006 = 6; 067=67.

|		
Change a Numeric value	- Use ▲ to select a value for the highlighted digit - Use ▶ to highlight the next digit to the right, or go to the confirmation page - Confirmation page displays numeric value to be saved, and requests permission to save the value	

6.2 SELF-TEST

The Self-Test function checks the Earth Continuity, Bus Connections, and the Device Hardware.

- The Self-Test occurs automatically when Power Supply is connected, and every 24 hrs thereafter
- A manual Self-Test can run only when the device is in Standby mode
- The device displays the Hardware and Software versions during the Self-Test
- Self-Test does not clear records or settings from memory

A Self-Test takes less than 30 seconds. The Self-Test displays a message if a failure occurs, while continuing background self-testing until the error state is removed.

All configured relays latch following self-test completion, enabling time to inspect relay operated equipment. Press RESET to release latching. The latching test does not occur at initial power connection.

Note: Insulation Monitoring does not occur or continue if the device fails the Self-Test.
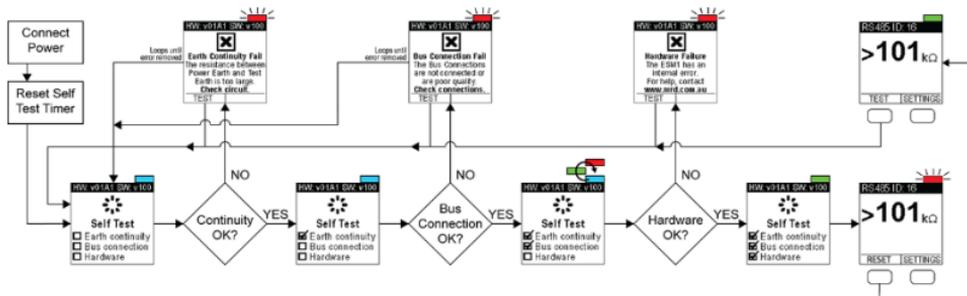
6.3 PASSWORDS (AUTHENTICATION)

If enabled, a password authenticates users and enables them to change any device setting. Without a password, user access is limited to viewing the device settings.

6.3.1 Factory Password

The Factory Password is set to **674**; it cannot be changed, and is required to change the User Password.

6.3.2 Authentication (User Password ON/OFF)

Authentication may be turned ON or OFF as required. This typically occurs if the operator is repeatedly accessing the device settings during testing, or if the System Operator has reduced security requirements. The Factory Default Setting is Authentication OFF, and no User Password exists.

6.3.3 User Password

The User Password can be changed only if the existing User Password is known; otherwise, the User Password Recovery feature must be used.

6.3.4 Recovery from Lost User Password

The device can recover from a lost User Password using the Factory Password. To replace a lost User Password: go to the Pwd Recovery page. The device will provide instructions and feedback.

6.3.5 Entering or Changing Password Values

Passwords are stored as three-digit codes, not numbers. If a mistake is made or if you accidently enter the Change page, use ▲ and ▶ to advance to the "Try Again?" page.

Function	Comments	Sample Pages
Enter or Change a Password value	- Instructions are on-screen - All Enter Password pages initially display ✱** - Use ▲ to select a value for the highlighted digit (mandatory) - Use ▶ to highlight the next digit to the right, or go to the next page - If the operator attempts to save an invalid or non-matching value, the device will offer the opportunity to Try Again - A message confirms successful completion of a change	

6.4 WARNING SETTINGS R_{AN1}

The Warning response has three user settable parameters, noting that the Trip Value must be higher than the Alarm value. If you wish to set the Trip Value *lower* than the current Alarm Trip Value, reduce the Alarm value first.

Recommended Setting (IEC60364-5-53)

Set the Warning value to about 100Ω/V (Bus). For example, if the Bus Voltage is 600V, initially set the Warning to 100x600= 60000 =60kΩ

Parameter	Options/Comments	Sample Pages
Activate Warning Settings	*SETTINGS>Warnings>Warning>CHANGE* • Enter Password if requested • The screen displays all current settings • Parameters become selectable.	
Warning Trip Value, R_{an1}	Range: 001 – 999 kΩ • Must be <u>greater than</u> the Alarm Trip Value • Set individual digits • Use ▲ to cycle through individual digits. • Use ▶ to select the next digit. • For reference, the current Alarm Trip Value appears on the WARNING TRIP page • If the operator attempts to save an invalid value, the device will offer the choice to Try Again.	
Warning Trip Delay	Range: 0 - 20 seconds • The Trip Delay is the continuous length of time that the IR must remain below the Warning Trip Value, prior to Relay and LED activation. • To change the setting, press ▲ to cycle through the available values.	
Warning Activated Relay	Options: Relay 1 or Relay 2 • The device contains two relays: 1 & 2. • The default Warning Relay is Relay 1. • The Relay activates when the IR remains continuously below the Warning Trip Value for greater than the Warning Trip Delay period. • Press ▲to toggle the Relay choice. • The Warning may activate the same relay as the Alarm.	

6.5 ALARM SETTINGS R_{AN2}

The Alarm response has three user settable parameters, similar to Warning, noting that the Alarm Trip Value must be lower than the Warning value. If you wish to set the Trip Value *higher* than the current Warning Trip Value, increase the Warning value first. The setup is a similar process to Warning setup.

Recommended Setting (IEC60364-5-53)

Set the Alarm value to about 50Ω/V (Bus). For example, if the Bus Voltage is 600V, initially set the Warning to 50x600= 30000 =30kΩ.
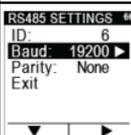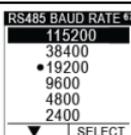
6.6 RELAY STATES

Relay 1 and Relay 2 can be set to Normally Open or Normally Closed, as required by connected equipment.

Note: The Relays fitted to this device Open when the power supply is disconnected. When power is connected, the device reads the stored Relay State setting from memory, and restores this state. This process takes ~300ms i.e. both Relays will be in the Open State for the first ~300ms following supply power connection. Equipment connected to a Normally Closed relay must be configured to compensate for this temporary Open Relay state. The device Self-Test and Reset functions do not affect the Relay States.

Parameter	Options/Comments	Sample Pages

Activate Relay States	*SETTINGS>Warnings>Relay States>CHANGE*
	• Enter Password if requested
	• Parameters become selectable
	• The screen displays all current settings
	   ○ N/O = Normally Open
	   ○ N/C = Normally Closed	

Change Relay States	• Use ▼ to highlight Relay to change, or Exit • Press ▶ to Select • Use ▲ to toggle between Relay States • Press ▶ to Select	

6.7 RS485 COMMUNICATION

The device can communicate with, and be controlled by external devices, using the RS485 Connection. The connection has three user settable parameters: Identification number, Communication speed (Baud rate), and Parity.

Parameter	Options/Comments	Sample Pages
	SETTINGS>RS485>CHANGE> • Enter Password if requested • Parameters become selectable • The screen displays all current settings	
RS485 Identity	01 – 99 (Set individual digits)	
Baud rate	2400; 4800; 9600; 19200; 38400; 115200 (Select from list)	
Parity	Odd; Even; None (Select from list)	
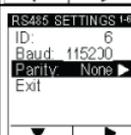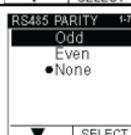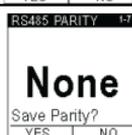
Warranty

Congratulations on choosing an MRD EarthSense ESM1. MRD Products are designed and manufactured to the highest standards, and backed with a TWO YEAR Warranty covering materials or manufacturing defects, commencing on the date of customer receipt.

Please record your product details below.

Model	Serial Number	Date of Purchase	F.PWD	Supplier
ESM1- _____	__ __ __ __ __ __	__ __ /__ __/20__ __	674	

Conditions

MRD warrants your new ESM1 Insulation Monitor shall be free of material or manufacturing defects and shall operate as designed, when installed, used, and maintained according to the ESM1 Installation Guide, Technical Data Sheet, and User Manual.

This warranty does not cover:
- Normal wear and tear
- Problems not caused by materials or manufacturing defects
- Damage caused in-transit, by fluid ingress, by accident, or intentionally
- Damage resulting from installations or applications not expressly approved by MRD
- Devices that are altered in any way, including software or removal of the serial number
- Any other event, act, default or omission beyond MRD's control.

In the event of a possible warranty claim, immediately **stop using the device and contact your supplier for assistance.** It may be possible to solve the problem without returning the device.

Returns

Do not return the device unless authorised by your supplier. If a return is required, it is your responsibility to pack the device for safe shipping, and to ship the device as instructed by your supplier. Return shipping is at your expense.

MRD will inspect returned devices. We will repair or replace devices or parts of devices that are found defective due to material or manufacturing faults. We will quote to repair other problems, if requested. We will return devices determined to be No Fault Found, at your expense.

Limited Liability

The benefits provided by this warranty are in addition to other rights and remedies available to the consumer under the law. In no instance shall MRD be liable for consequential damages.

For Australia Only

MRD Rail Technologies Pty Ltd 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.

This warranty is offered by:
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