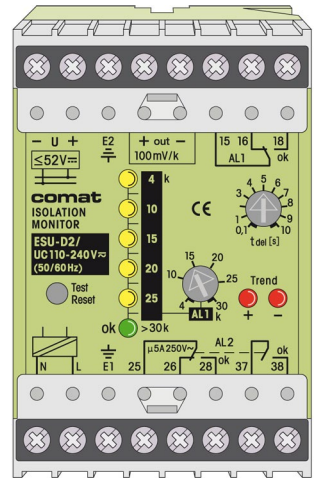


DC Isolation Monitor ESU-D2

1 Key Features

- Monitoring of non grounded DC mains
- Reporting of two alarm states by two different relay contacts
- Display of earth fault resistance by LED display and analogue output 0...5 V
- Periodical self check
- ESU-D2R version supports Railway approval EN 50155



2 Overview

The ground earth fault monitor ESU-D2x/...V is an universal monitoring relay specially designed to detect ground faults in isolated DC 12 - 48 V supplies to control systems. It is specially designed for DC supply there with unique features. The device detects all short-circuits to earth, including those related to voltage components. It is capable of detecting short-circuits or leakage-path resistances of less than 30 k Ω . The trend indicates whether the fault is related to the positive or negative line.

The unit is also capable to detect short-circuits to single side grounded AC mains to the DC supply without damage. The detection threshold value for Alarm 1 (pre alarm), and the Alarm delay time t_{del} can be set on the front of the device. The Alarm 2 (main alarm) is set permanently to 4 k Ω .

The LEDs indicate the resistance value as a graphic bar.

As long as there is no short circuit, the green LED indicates that the output relays are held in the 'on' state. If a fault occurs, the red LED indicates a fault. After the set time delay elapses at least one of the output relays drops out.

The case wide is 50mm with plug-in screw terminals. It is possible to mount the device on a DIN TS35 mounting rail, or by screw fixing.

Comprehensive self test functions and the robust design allow a reliable service also under rugged conditions.

The versions ESU-D2R and ESU-D2.C2354 are suitable to work with a high capacity between ground and supply lines. Due to that capability the fault detection time is longer than that of the standard version.

Technical specifications are subject to change without notice

3 Order Information

ComatReleco Ground Fault Monitor	ESU-D2/UC24-48V	(Standard)
ComatReleco Ground Fault Monitor	ESU-D2/UC110-240V	(Standard)
ComatReleco Ground Fault Monitor	ESU-D2R/UC24-48V	(Railway version, $C_{Erd} \dots 60 \mu F$)
ComatReleco Ground Fault Monitor	ESU-D2.C2354/UC24-48V	($C_{Erd} \dots 60 \mu F$)

5 Function Description

5.1 Operation

In normal operation, the green LED lights up. If a fault is detected, then a visual indication is given immediately. In principle, alarm 1 (AL 1) and alarm 2 (AL 2), with adjustable threshold values, are available in case of a fault.

Normally the AL1 value is set to a higher resistance value (early warning function), and the AL2 value to a lower resistance value (main alarm). If a short-circuit is detected, with a path resistance smaller than the detection value (30 k Ω) but higher than the alarm threshold value, then, as a warning indicator, the yellow LEDs in the fault-level bar display start to illuminate. The resistance is displayed in steps of 2,5 k Ω within the range from 4...30 k Ω . If the measured resistance falls below the set value of (AL 1), the alarm delay time (t_{del}) begins to run and the green LED flashes. If the fault is not corrected before the delay time (t_{del}) elapses, then the first alarm is triggered. The AL1 relay drops out, the green LED turns off, and the trend indicator starts flashing (red LED's). If the resistance of the path to earth falls below the threshold of the second alarm, then the time t_{del} starts again, the green LED flashes again, but significantly faster. After this delay time (t_{del}) has elapsed, the AL 2 relay also drops out, the trend indicator lights are illuminated continuously (red LED's), and the green LED is off.

If the measured value returns within the acceptable range, after the time t_R the visual fault indication disappears, the yellow LED's disappear and the green 'OK' LED illuminates and the two output relays pull in. It ensures that the alarm condition is maintained for at least 1s (reset time).

The trend evaluation (+;-) indicates if the fault is positive or negative and is referred to the half supply voltage U_B

5.2 Test Function

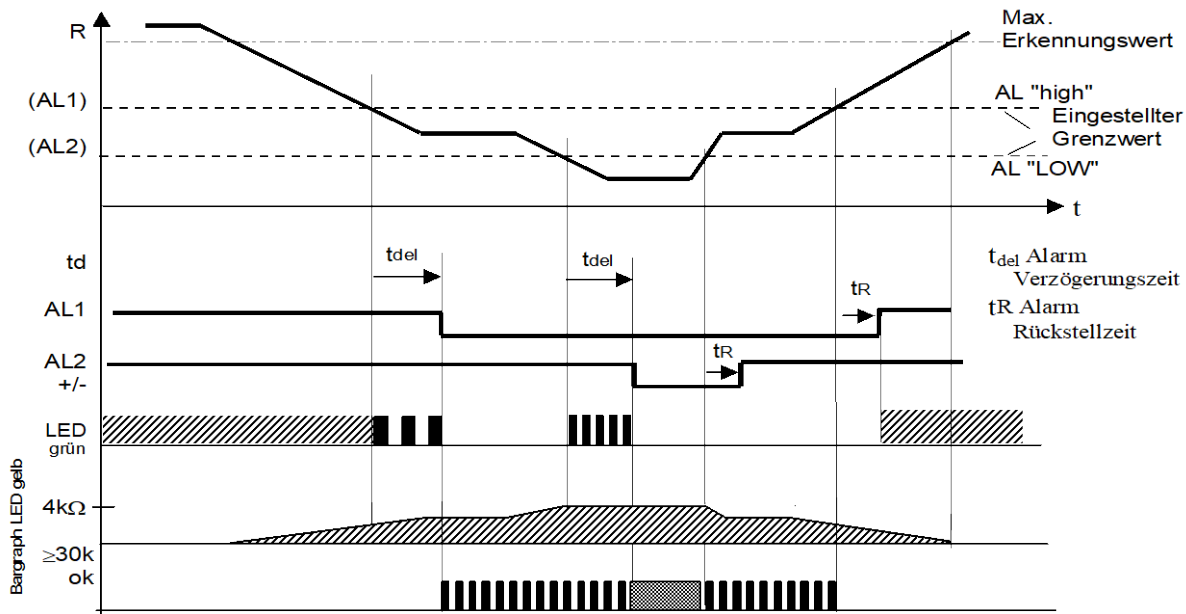
When the test function is pressed for >1 sec, a 3 k Ω resistance is connected from + and from - to earth. The unit recognises this as a symmetrical fault, indistinctly of the setting. The Test/Reset button is active only when no fault occurs, i.e. t_{del} is not running.

For advice on operation and display, see operation section.

5.3 Special features

- If a low-resistance path to earth is suddenly detected (AL2 value), then the higher-resistance alarm is triggered immediately (AL1), and t_{del} is then only effective to trigger the second alarm.
- There are cases in which detecting the trend (+;-) is not possible, e.g. if the DC supply has failed (< 8V), then both Trend LED's light and both relays drop out.
- Trend evaluation (+/-): the short-circuit is evaluated clearly + or -, if the earth potential lies in the range (-)+(20% supply voltage) or in the range (+)-(20% supply voltage), respectively.
- When an AC short circuit is detected, AL1 and AL2 are triggered immediately.
- The unit has comprehensive internal fault-monitoring facilities. If a fault occurs, the green LED and the trend LED's flash alternately.
- The unit has comprehensive fault analysis procedures, for both internal and external faults; see the **Failure condition** behaviour section, 3.1.1
- In the case when any voltage is applied (< 8 V) then the current between (+) and (-) will be limited to 1 k Ω by a linked diode. In this way it is also possible to measure the positive line (+).

5.4 Operation Diagramm



5.5 Failure Condition

Error	Indication	Cause	AL1	AL2	Trouble shooting
Ground failure pre alarm	LED ok is not lit One or more LEDs 4...25 kΩ lighting up Trend + or - flashing	Ground failure resistance smaller than threshold of pre alarm	Off	On	Auto reset after disappearing of the error.
Ground failure main alarm	LED ok is not lit One or more LEDs 4...25 kΩ lighting up Trend + or - lighting up	Ground failure resistance smaller than 4 kΩ	Off	Off	Auto reset after disappearing of the error.
Overtoltage	LED 4 and 10 kΩ lighting up Trend flashing alternately	Voltage of the monitored supply is > 52 VDC	Off	On	Manual reset by „Reset“ button or cut of alimentation.
Ground connection	LED 4 and 15 kΩ lighting up Trend flashing alternately	One of both ground connection terminals is not connected or interrupt of the connection between both ground terminals	Off	On	
AC error	LED 4 and 20 kΩ lighting up Trend flashing alternately	Detection of an AC short circuit in the monitored supply	Off	Off	
Processor error	LED 4 and 25 kΩ lighting up Trend flashing alternately	Error in RAM, Flash, Register or Watchdog detected.	Off	Off	Replacement of the device.

In case of an error apart from ground failure the isolation measurement is not longer displayed.

6 Technical Information

6.1 General Data

6.1.1 Mechanische Daten

Case	W x H x D 50 x 75 x 110 mm
Mounting	On support rail 35, DIN 60715 or screw fixing
Protection class	IP20
Case material	Lexan EXL9330
Weight	approx. 250 g
Connections	Pull-off screw terminals, 1 x 2.5 mm ² , or 2 x 1.5 mm ² ; unit replacement possible without disconnecting the wiring

6.1.2 Environment conditions

Storage temperature	-40 °C ... +85 °C
Operating temperature	-25 °C ... +60 °C (Railway version: -40 °C ... +70 °C)
Relative humidity	10% ... 95% (no condensing)

6.1.3 Life time

Expected life time (MTTF)	> 75'000 h / Tamb < 40 °C
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6.2 Electrical specification

6.2.1 Power supply

Type	ESU-D2x../UC24-48V	ESU-D2/UC110-240V
Nominal operating voltage (AC/DC)	24...48 V	110...240V
Operating voltage (AC/DC)	18...60 V	88...265 V
Frequency range	40...60 Hz	40...60 Hz
Input current max.	100 mA	40 mA
Power consumption	2 W	2 W
Power failure protection	(see 6.2.3)	

6.2.2 Measurement input

Type	ESU-D2	ESU-D2R	ESU-D2.C2354
Nominal voltage	24...48 V		
Operating voltage	0...60 V		
Voltage Trend detection min.	8 V		
AC voltage + or – terminal to earth max.	250 V		
Input current max.	5 mA		
Input current +/- to earth max.	0,2 mA		
Main capacity max. (+/-) to Earth (< 5% error)	1,5 uF	60 uF	60 uF
Detection value	4...30 kΩ		
Accuracy typ.	10% set value / circuit resistance to earth		
Hysteresis typ.	10% from set values AL1, AL2		
Ripple DC supply max.	5%		

6.2.3 Time Characteristics

Type	ESU-D2	ESU-D2R	ESU-D2.C2354
Fault detection time (typ.)	ca. 600 ms	ca. 30 s	ca. 30 s
Alarm delay t_{del}	0,1 s..10 s adjustable		
Accuracy t_{del}	20 ms		
Alarm reset time t_R	1 s		
Time response by AC short circuit (AC230V) max.	250 ms		
Supply failure protection min.	50 ms		
Start time max.	250 ms		

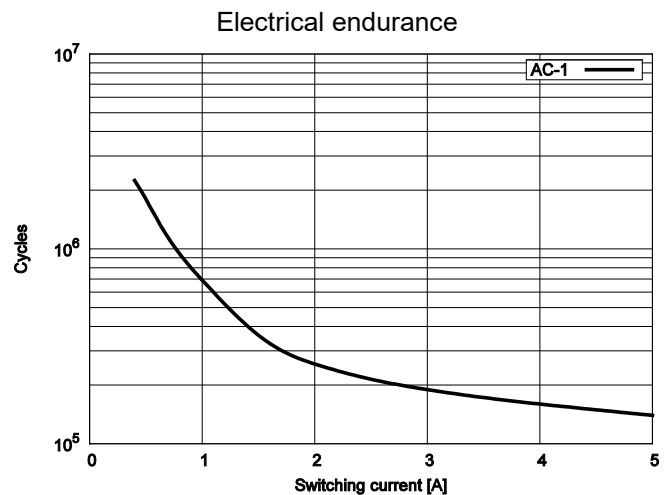
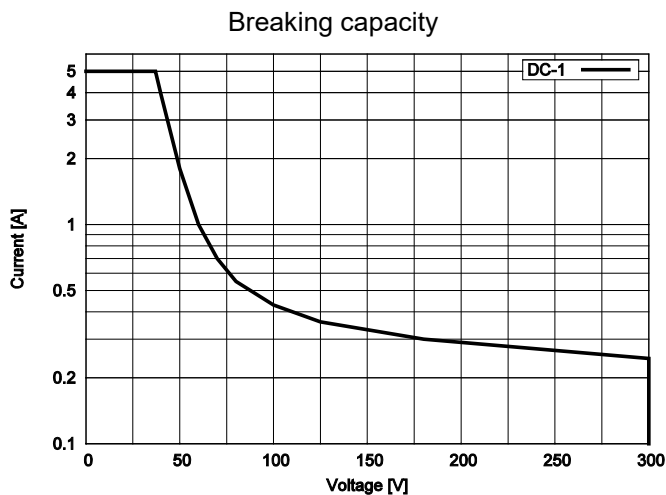
6.2.4 Alarm outputs

Contacts	2 C.O., 1 N.O.
Contact material	AgNi
Nominal voltage	250 V
Nominal current	5 A
Inrush current	15 A / 20 ms
Total current	6 A
Switching power AC-1	1250 VA
Life time of contacts	10^5
Mechanical life time	5×10^6

6.2.5 Analogue outputs

Nominal range	0...5 VDC
Value range	0...50 k Ω
Max. Current	1 mA

6.3 Typical performance characteristics



7 Operation

Alarm delay time

Ground error resistance bar

In normal state the green LED is lighting up.
Flashing during delay time.
The yellow LEDs showing ground error resistance or error out of table in point 5.5.

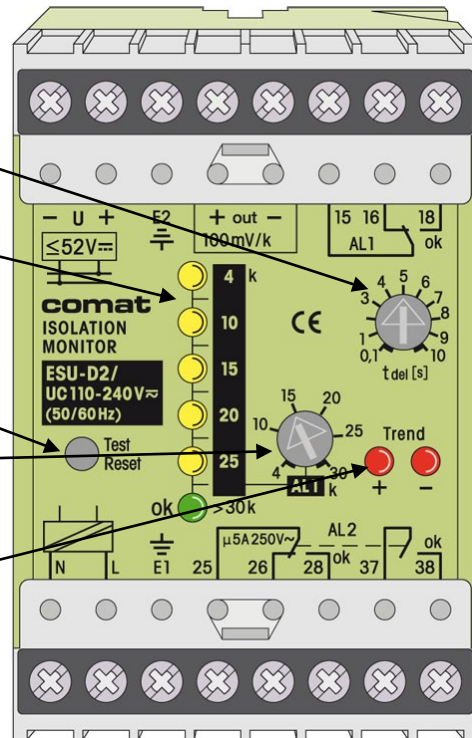
Test / Reset

Button for reset of error storage. Pressing for a longer time (> 1 s) to trigger self-test function.

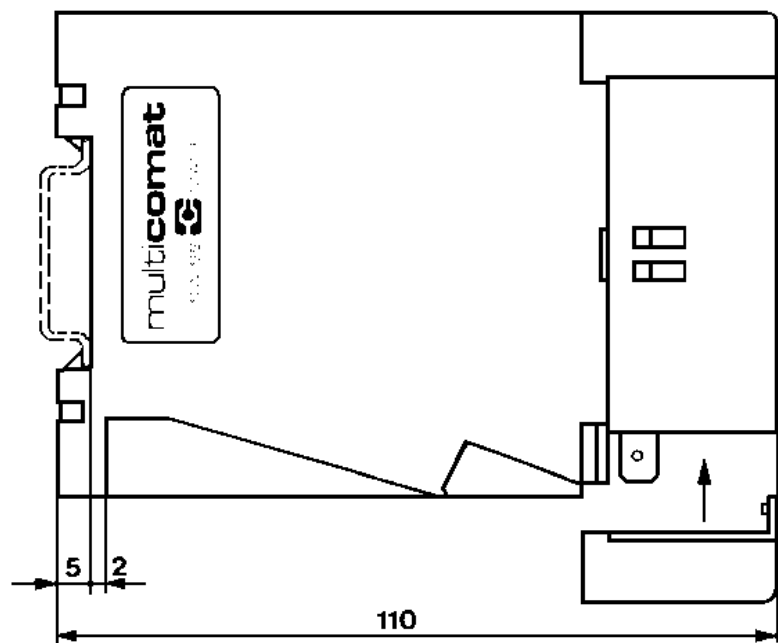
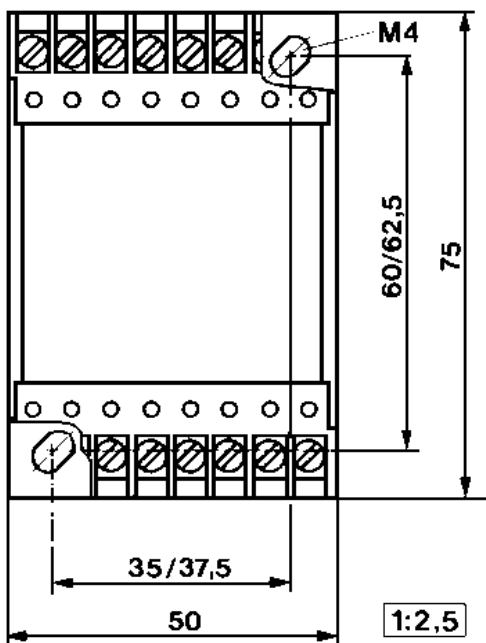
Alarm threshold pre-alarm AL1

Trend

Monitoring of smaller ground error resistance to + or -.
Alternately flashing means error of table in point 5.5.



8 Dimensions



9 Approvals, Standards

Low voltage directive	EN 60255-1:2010
Railway approval	EN 50155
Interference immunity	EN 61000-6-2:2005
Interference emission	EN 61000-6-3:2007
Conformities, Identification	CE

10 Releases

Version	Date	Responsible	Changes
55053-01-57-401	26.03.2001	Pd	Version 1
55053-01-57-403	30.11.2004	An, Cp	Version 2
55053-01-57-404	09.03.2005	Cp	Version 4
55053-002-57-005	22.02.2013	Mi, Cp	Version 5
55053-002-57-006	16.09.2013	Cp	Processor error added