DRC61D7241KE

Insulation monitoring device for ungrounded DC circuits in EV charging stations

Description

DRC61 is an insulation monitoring device designed for unearthed DC (IT) systems up to 1000 V DC, typically used in Mode 4 EV charging stations.

It continuously monitors the insulation resistance between the DC lines and the ground, detecting both gradual degradation and sudden insulation faults.

Two independently configurable relay outputs provide pre-alarm and alarm signals, enabling early fault detection and preventive maintenance.

The device supports both CCS and CHAdeMO charging architectures and is compliant with IEC 61851-23, IEC 61557-8 and UL 2231-1/-2 standards. Configuration is performed via Modbus communication.

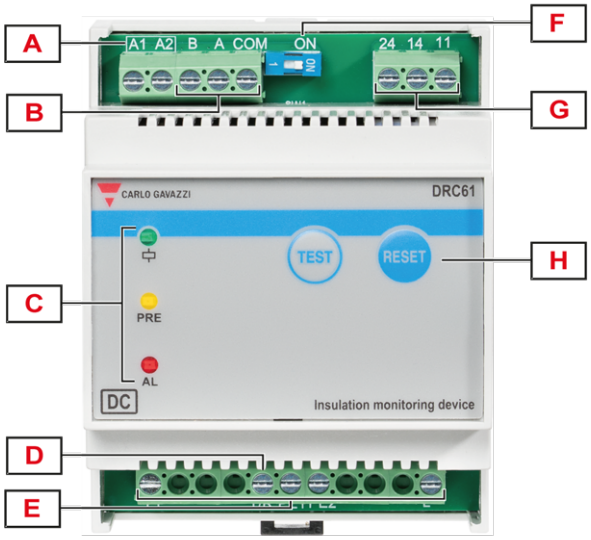
Benefits

- **Enhanced system safety and reliability**. Early detection of insulation degradation helps preventing unexpected shutdowns and costly downtime.
- **Optimised for EV fast charging integration**. Designed specifically for Mode 4 DC charging stations, ensuring seamless integration into high-voltage architectures.
- **Design flexibility**. Compatible with both CCS and CHAdeMO charging systems, simplifying platform standardisation.
- **Reduced maintenance costs**. Configurable pre-alarm and alarm setpoints allow preventive intervention before critical failures occur.
- **Fail-safe operation for higher operational security**. Default de-energise-on-fault logic ensures safe system behaviour in critical conditions.
- **Simplified commissioning and diagnostics**. Clear LED indications and local / remote Test & Reset functions support fast troubleshooting.
- **Adaptable to different system configurations**. Modbus configuration enables easy customisation of setpoints, relay logic and voltage range.
- **Fast and intuitive configuration via UCS software**. Guided setup reduces commissioning time and complexity. Software available free of charge.

Main features

- Continuous monitoring of insulation resistance between DC lines and ground.
- Detection of gradual insulation degradation and sudden failures.
- System voltage monitoring with undervoltage and overvoltage detection.
- Maximum system leakage capacitance: 25 µF.
- Local Test and Reset buttons with option for remote triggering.
- Configurable pre-alarm and alarm setpoints.
- Two SPST relay outputs.

Structure



Element	Component	Function
A	Power supply terminals	Auxiliary power supply (A1, A2)
B	RS485 port	Modbus RTU communication
C	Information LEDs	Green for device ON Yellow for signal pre-alarm status Red for signal alarm status
D	Remote R / T input	Input for remote R / T pushbutton (in conjunction with PE1)
E	Input terminals	Monitored DC supply voltage
F	RS485 termination dip-switch (120 Ω)	1: termination not active ON: termination active
G	Output terminals	2 x SPST relays
H	Front Test / Reset pushbutton	TEST: local test RESET: resetting Modbus parameters / resetting ALL user parameters

Principle of operation

DRC61 superimposes a voltage measuring signal across the terminals L+/L- and PE. In the event of an insulation fault such as a breakdown between a live conductor and PE protective earth, a measurable current will flow. DRC61 continuously monitors this signal and compares it to the setpoints. If the measured signal exceeds one of them, it indicates an insulation fault and triggers the respective alarm.

CHAdeMO

The insulation fault resistance can be calculated for DC systems with a voltage of 50 volts or higher. In CHAdeMO mode* (which can be enabled and mode selected via a Modbus register), the resistance fault is determined by the smaller between the double pole fault measurement and single pole fault measurement.

*There are two modes available:

CHAdeMO 1 monitors for 1-pole and 2-pole faults

CHAdeMO 2 monitors for 1-pole faults only, i.e. L+ to PE or L- to PE

Please also note that in CHAdeMO mode, the maximum capacitance of the network is limited to 1.6uF per conductor.

UCS software

- Free download from Carlo Gavazzi website
- Configuration through RS485 from PC
- Real time data view for testing and diagnostics

Features

Auxiliary power supply

Terminals	A1, A2
Voltage range (U_s)	12 to 24 V DC (± 15%)
Auxiliary supply is galvanically insulated from the monitored DC supply	
Overvoltage category	III (IEC 60664)
Consumption	2 W
1.25 A (T) rated fuse should be installed in line with terminal A1	

Inputs

Terminals	L+, L-, PE1, PE2
Monitoring principle	Insulation between L+ / L- and PE1 / PE2
Monitored DC supply voltage (U_n)	50 to 1000 V DC
Max. permanently admissible voltage (U_{fg})	1200 V DC
Maximum system leakage capacitance (C_e)	25 µF (1.6 µF per conductor in CHAdeMO mode)
Max. system leakage capacitance (C_e) according to UL 2231-1/-2	≤ 10 µF
Default insulation resistance setpoints	R_{an1} = 100 kΩ (Alarm) R_{an2} = 500 kΩ (Pre-alarm) Values based on a nominal charger output of 1000 V DC
Response level accuracy	± 15%, ± 2 kΩ
Alarm hysteresis level	125% of R_{an1} (125 kΩ) for default setpoint
Pre-alarm hysteresis level	125% of R_{an2} (625 kΩ) for default setpoint
Response time (t_{an})	≤ 10 s typ. (≤ 1 s in CHAdeMO 1 mode) *Response time measured with $C_e = 1_{uF}$*
Response value for break / dis-connection of PE1 / PE2 conductors	> 500 Ω
Measuring voltage (U_m)	± 15 V approx.
Internal DC resistance	Typ. > 376 kΩ
Measuring current	≤ 100 µA peak @ Rf = 0 Ω
Reset time	< 1 s (from supply interruption)

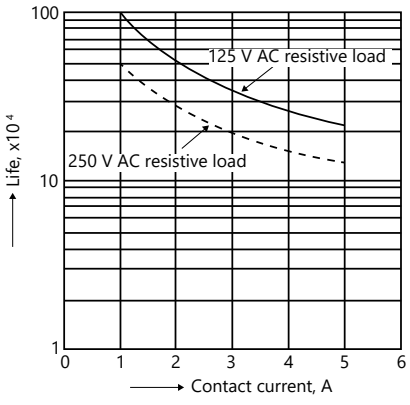
Test and Reset

Manual operation (front panel pushbuttons)	
Test	Press **TEST** once to initiate the test.
Reset	Press **RESET** once to clear the fault indication (only after the fault has been cleared).

Remote operation (N.O. pushbutton – terminals T/R, PE1)	
Test	Press and hold the button for 2.5 to 8 s, then release to initiate the test.
Reset	Press the button for less than 2.5 s to reset the device.

Auto-reset	
Auto-reset function	Enabled (factory default)
UL requirement	To comply with UL 2231 requirements, the **Auto-reset function must be disabled**.

Outputs

Terminals	Relay 1 (RLY1): 11, 14 (Pre-alarm)		
	Relay 2 (RLY2): 11, 24 (Alarm)		
Number of outputs	2		
Type	SPST relay		
Relay operational mode (using factory defaults)	**Status**	**RLY1 (Pre-alarm)**	**RLY2 (Alarm)**
	Normal	Energised	Energised
	Pre-alarm	De-energised	Energised
	Alarm	De-energised	De-energised
Contact rating	**AC1** (250 V): 5 A (1250 VA) **DC1** (25 V): 5 A (125 W)		
Electrical lifetime			

Modbus RTU

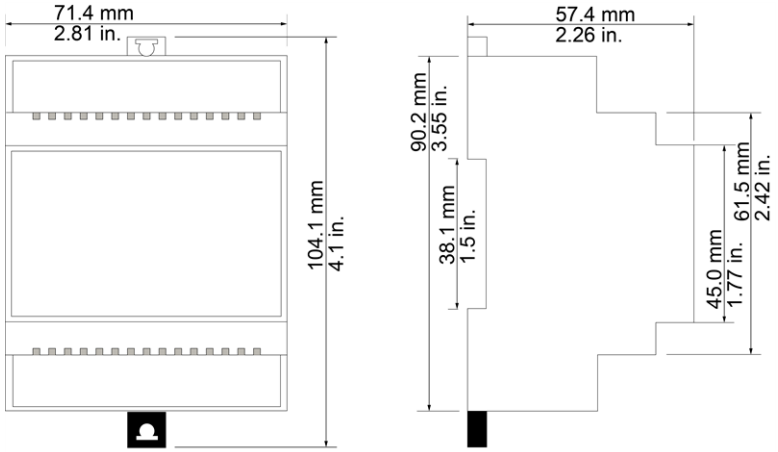
Terminals	A, B, COM
Connections	Tx+, Tx-, 0 V
Baud rate	Selectable (factory default: 9600)
Parity	Selectable (factory default: none)
Stop bit	Selectable (factory default: 1)
Device address	Selectable (factory default: 003)
Termination method	120 R resistor built in Set slide switch to “ON” to enable
Configuration mode	Via UCS software or using the Modbus map

Insulation

Terminals	**Rated impulse withstand voltage**
Supply to modbus	Galvanically insulated < 100 V
Output to supply / input (L+, L-)	8 kV
Output to input (T/R, PE1, PE2)	
Input (T/R, PE1, PE2) to supply / modbus	
Input (L+, L-) to supply / modbus	
Input (L+, L-) to output	

General

Material	Grey flame-retardant polycarbonate UL94 V0
Colour	RAL7035 (light grey)
Dimensions (W x H x D)	71.4 x 90.2 x 57.4 mm (2.81 x 3.55 x 2.26 in)
Weight	120 g (4.23 oz)
Terminals	Cable size from 0.2 to 2.5 mm^2 (AWG12 to AWG22/24), stranded or solid
Tightening torque	Max. 0.4 Nm (3.54 lbin)
Stripping length	7 mm ± 1 mm



Environmental

Operating temperature	-40 to 70 °C (-40 to 158 °F)
Storage temperature	-40 to 85 °C (-50 to 185 °F)
Relative humidity	95% max.
Protection degree	IP20
Pollution degree	2
Operating max altitude	2000 m amsl (6560 ft)

Compatibility and conformity

Marking	CE RoHS COMPLIANT
Directives	2014/35/EU (LVD - Low voltage) 2014/30/EU (EMC - Electromagnetic compatibility) 2011/65/EU, 2015/863/EU (RoHS)
Standards	IEC 61851-1:2017 / BS EN 61851-1:2019/AC:2023-12 – Electric vehicle conductive charging system – Part 1: General requirements IEC 61851-23:2023 – Electric vehicle conductive charging system – Part 23: DC electric vehicle supply equipment IEC 61557-8:2014 / BS EN 61557-8:2015 – Insulation monitoring devices IEC 61326-2-4:2020 / BS EN 61326-2-4:2021 – Electromagnetic compatibility (EMC) IEC 61000-4 series – EMC immunity tests UL 2231-1 and UL 2231-2
Approvals	c UL us

Operating description

The device is supplied with factory default settings and all parameters can be set via Modbus RTU.

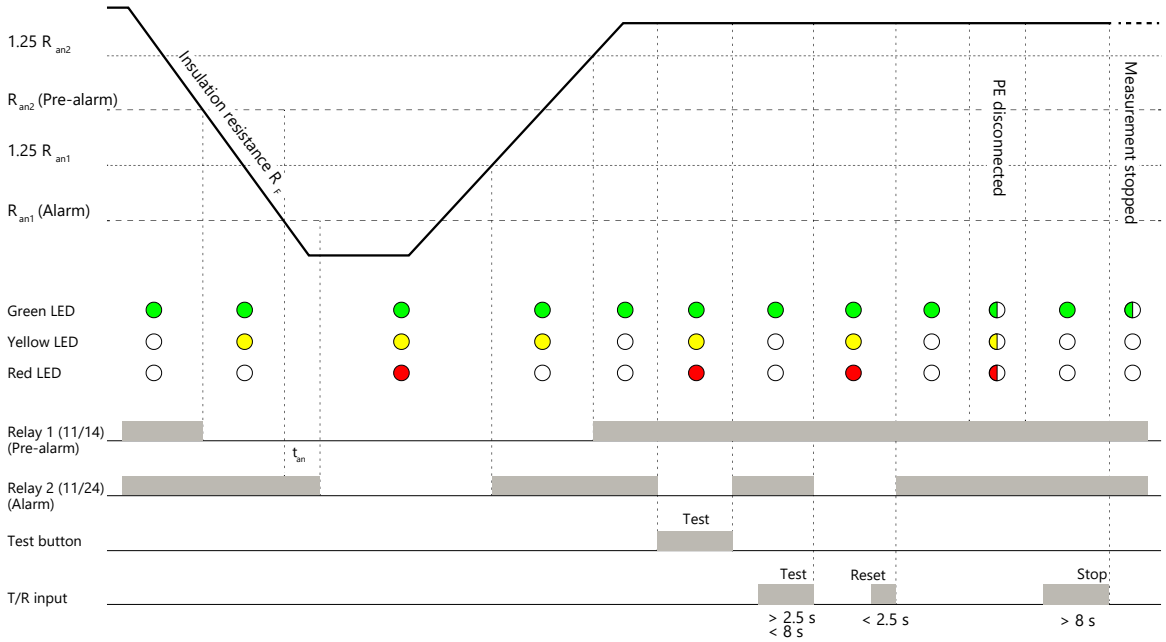
There are no user adjustments on the product itself.

Information LED

Colour	Status		Description
Green (⏚)	Power supply	ON steady	Power supply ON
		Flashing 2 Hz	If measurement stopped or PE disconnected
		OFF	Power supply OFF
Yellow (PRE)	Pre-alarm	ON steady	During pre-alarm condition
		Flashing 2 Hz	If PE disconnected or undervoltage detection
		OFF	No pre-alarm condition
Red (AL)	Alarm	ON steady	During alarm condition
		Flashing 2 Hz	If PE disconnected
		OFF	No alarm condition

System status	LED indication			Factory default	
	Green	Yellow	Red	Relay 1 (Pre- alarm)	Relay 2 (Alarm)
Normal operation ($R_F > R_{an2}$)	ON	OFF	OFF	Energised	Energised
Pre-alarm condition ($R_{an2} > R_F > R_{an1}$)	ON	ON	OFF	De-energised	Energised
Alarm condition ($R_F \leq R_{an1}$)	ON	ON	ON	De-energised	De-energised
Waiting for user to reset after fault ($R_F \geq 1.25\ R_{an1}$) *(auto-reset disabled)*	ON	OFF	ON	De-energised	De-energised
Under voltage *(detection disabled by default)*	ON	Flashing	OFF	Configurable via Modbus	
Over voltage *(detection disabled by default)*	ON	OFF	Flashing		
PE disconnected (relay response configurable)	Flashing simultaneously at 2 Hz			Energised	Energised
Measurement stopped	Flashing at 2 Hz	OFF	OFF	Energised	Energised
Test mode	ON	ON	ON	Energised	De-energised

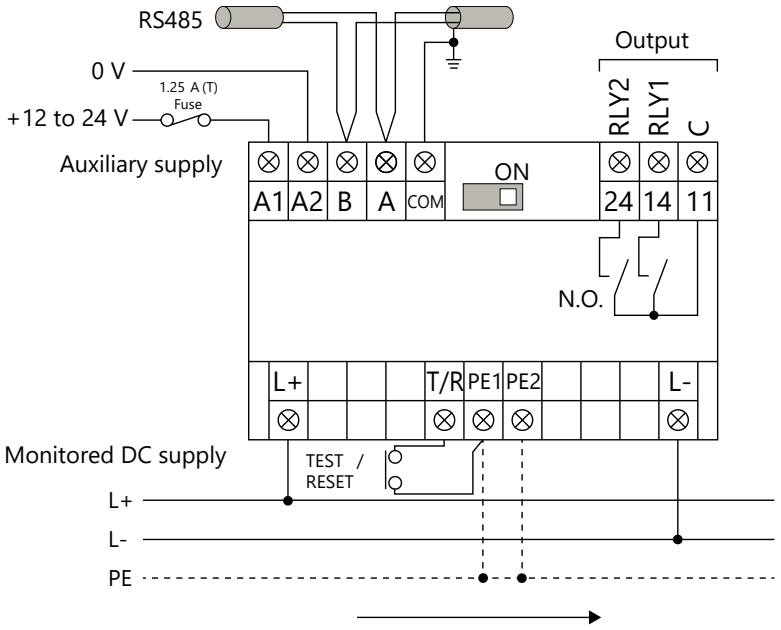
Operating diagram



Note 1: Factory default assignment of relays is shown in the diagram above.
Note 2: By default, the NO relay contacts are closed during normal operation and open in alarm condition.

Connection diagram

Note: 1.25 A (T) rated fuse should be installed in line with terminal A1.



References

Further reading

Information	Where to find it	QR code
Installation manual	https://carlogavazzi-pss.com/manuals/DRC61_IM_html	
Why is important insulation monitoring	https://www.youtube.com/watch?v=tY5XHq5Icr8	
How to configure the device via UCS software	https://www.youtube.com/watch?v=u08By-Q95xw	
PSS selection tool	https://carlogavazzi-pss.com/	

CARLO GAVAZZI compatible components

Purpose	Component name / code	Notes
Configure analyser via desktop application	**UCS software**	Available for free download at: www.gavazzi-automation.com

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