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The Power in Electrical Safety™

RCM420 Series

Digital Ground Fault Monitor / Ground Fault Relay
Grounded and High-Resistance Grounded AC Systems

Technical Bulletin

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RCM420 Series

Digital Ground Fault Monitor / Relay for Grounded AC Systems

RCM420

Features

- Ground fault monitoring for AC grounded systems
- True RMS value measurement (AC)
- External measuring current transformer
- Two separately adjustable response values
- Frequency range 42 - 2000 Hz
- 3 seperately adjustable time delays: startup, response, and release
- Restart function
- LCD screen with real-time value display
- Latching or non-latching operating mode
- CT connection monitoring
- Power On LED, LED Alarm 1 / 2
- TEST / RESET button, internal / external
- Two separate voltage-free SPDT contacts
- Normally energized or de-energized operation (selectable)
- Password protection
- Device self monitoring
- Sealable transparent cover
- Small form factor
- Conforms to RoHS

Approvals

Description

The RCM420 monitors for ground faults in grounded and high-resistance grounded AC systems, both single- and three-phase. The RCM420 is specially designed to provide advanced warning of developing ground faults without the problems associated with high sensitivity nuisance tripping.

A digital LCD screen displays real-time measurements of the system's ground fault current. Two separately adjustable SPDT contacts allow for information transmission (such as to a PLC) or power interruption (such as through a contactor or shunt trip breaker).

Since the values are measured with measuring current transformers, the device is nearly independent of the load current and the nominal voltage of the system.

Applications

- Ground fault detection in single- or three-phase AC systems
- Motor and motor control systems
- Heat tracing systems
- Current monitoring of normally offline single conductors
- Alarm systems, safety devices
- HVAC systems
- Generators, portable and fixed
- Industrial controls

Function

Once the supply voltage U_S is applied,the starting delay ("t") activates. Alarms during this delay will not cause the RCM420 to switch over the contacts.

Measurements of the system's ground fault current are taken via an external current transformer. All phases (including the neutral if one exists) are placed through the current transformer. The measured value is indicated in real-time on the device's LCD display.

If the measured value exceeds one or both response values, the respective response delays $t_{on1\ /\ 2}$ activate. If the ground fault still exists after the response delays expire, the respective contacts switch over and the alarm LEDs activate. If the device is set to non-latching mode and the ground fault clears, the alarms will clear after the set release time "t_{off}" expires. If the device is set to latching mode, the alarms will not clear until the device is reset manually or the supply voltage is lost. The TEST function allows for an internal operation testing of the device. The device's easy-to-use onboard menu manages all settings via the detailed LCD screen. An optional password protection setting protects unauthorized users from changing settings.

Connection monitoring

The connections between the device and the external current transformer are continuously monitored. If the device detects a connection error, the CT connection monitoring alarm will activate, and the contacts will switch over without delay. After the connection error is cleared, the device will reset based on its latching/non-latching setting.

Restart function

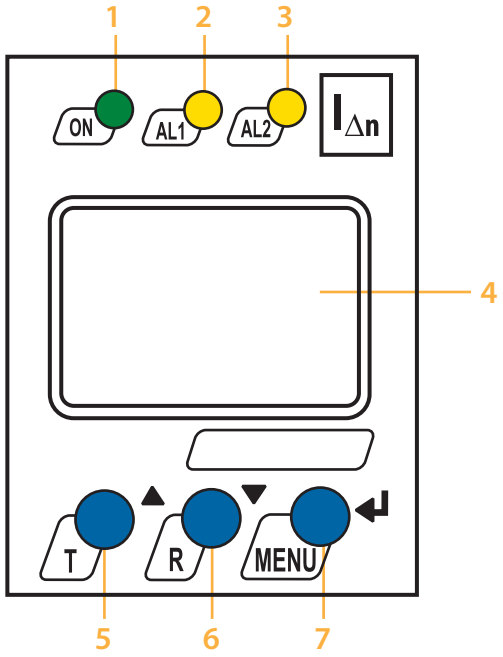
If an alarm is pending after resetting the alarm relay and restarting the system being monitored, this reset process is repeated until the preset number of restart cycles is completed.

As soon as the preset number of restart cycles is completed, the fault memory is set to ON (latching operation). A manual reset will be required.

Latching capability

The RCM420 has the capability to be set to latch on an alarm and require a manual reset, or automatically reset when the fault has been cleared. Additionally, the "con" setting allows for latching, and if a power loss to the RCM420 occurs, it will return to a latched state when power is restored.

Operating and display elements



1 - Power “ON” LED (green): Illuminates when power is received to the unit. Flashes when the current transformer connection alarm is active.

2 - Alarm LED “AL1” (yellow): Alarm 1, illuminates when the set response value $I_{\Delta n1}$ has been exceeded. Flashes when the current transformer connection alarm is active.

3 - Alarm LED “AL2” (yellow): Alarm 2, illuminates when the set response value $I_{\Delta n2}$ has been exceeded. Flashes when the current transformer connection alarm is active.

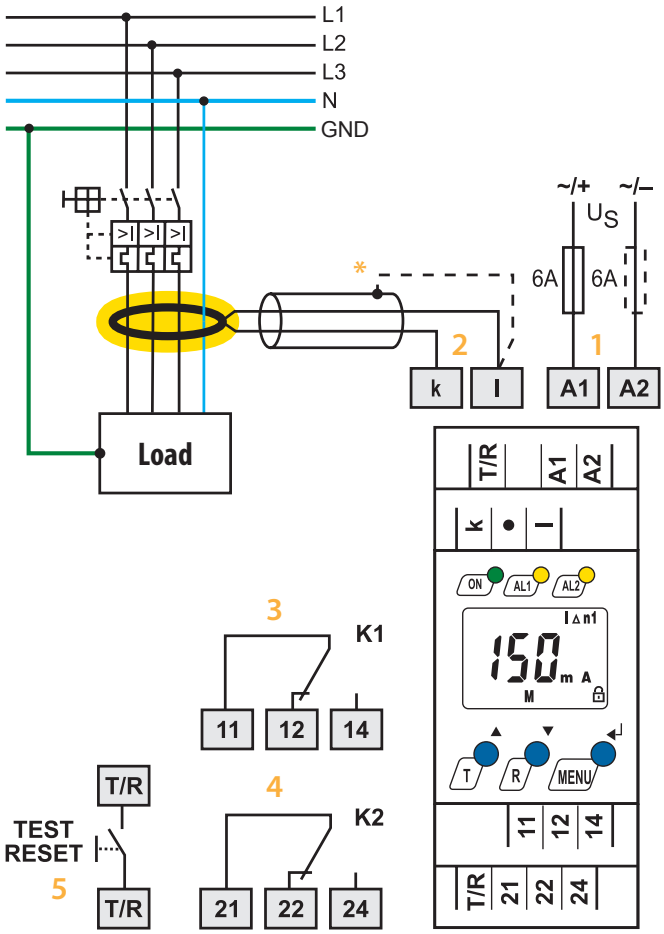
4 - Multi-functional LCD display

5 - TEST button: Activates self-test
Arrow up key: Scrolls up inside device's menu

6 - RESET button: Resets device
Arrow down key: Scrolls down inside device's menu

7 - MENU key: Activates device's internal menu
Enter key: Confirm change inside device's menu
Escape key (held > 1.5 s): Goes back a step inside menu

Wiring diagram



1 - External supply voltage used to power device
a 6 A fuse recommended for internal short circuit protection.

2 - Connection to external current transformer. All phases, including the neutral if one exists, are placed through the current transformer.

3 - Alarm relay K1: programmable for $I_{\Delta n1}$ / $I_{\Delta n2}$ / TEST / ERROR

4 - Alarm relay K2: programmable for $I_{\Delta n1}$ / $I_{\Delta n2}$ / TEST / ERROR

5 - Combined external TEST and RESET button

* - When shielded cabling is used.

Note: Do not route the ground conductor through the measuring current transformer when also routing the power conductors.

Technical data

Insulation coordination acc. to IEC 60664-1 / IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage / pollution degree	2.5 kV / III
Protective separation (reinforced insulation) between	
(A1, A2) - (k / l, T / R) – (11, 12, 14) – (21, 22, 24)	
Voltage test according to IEC 61010-1	2.21 kV

Supply voltage

Supply voltage U_S	see ordering details
Power consumption	≤ 3 VA

Measuring circuit

External measuring current transformer	W - , WR - , WS - series
Load	68 Ω
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristic acc. to IEC 62020	Type A
Rated frequency	42 - 2000 Hz
Measuring range	3 mA - 16 A
Relative percentage error	0 - - 20 %
Display accuracy	± 15 %

Response values

Rated residual operating current $I_{\Delta n1}$ (prewarning)	50 - 100 % x $I_{\Delta n2}$ (50 %)*
Rated resiudal operating current $I_{\Delta n2}$ (alarm)	10 mA - 10 A (30 mA)*
Hysteresis	10 - 25 % (15 %)*

Specified time

Starting delay t	0 - 10 s (0,5 s)*
Response delay t_{on2} (alarm)	0 - 10 s (0 s)*
Response delay t_{on1} (prewarning)	0 - 10 s (1 s)*
Delay on release t_{off}	0 - 99 s (1 s)*
Operating time t_{ae} at $I_{\Delta n} = 1 \times I_{\Delta n1 / 2}$	≤ 180 ms
Operating time t_{ae} at $I_{\Delta n} = 5 \times I_{\Delta n1 / 2}$	≤ 30 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1 / 2}$
Recovery time t_b	≤ 300 ms
Number of restart cycles	0 - 100 (0)*

Cable lengths for current transformers

Single wire ≥ AWG 20 (0.75 mm²)	0 . . . 3.2 ft (0 - 1 m)
Single wire, twisted ≥ AWG 20 (0.75 mm²)	0 . . . 32.8 ft (0 - 10 m)
Shielded cable ≥ AWG 22 (0.5 mm²)	0 . . . 131 ft (0 - 40 m)
Recommended cable (shielded, shield on one side connected to terminal l of the RCM420, not connected to earth)	J-Y(ST)Y min. 2 x 0.8
Connection	screw terminals

Displays, memory

Display range, measuring value	3 mA - 16 A
Relative percentage error	0 - - 30 % / ± 2 digit
Measured-value memory for alarm value	data record measured values
Password	off / 0 - 999 (off)*
Latching behavior	
ON / OFF / CON (Latching / Non-latching / Remains latched on return from power loss)	

Inputs / outputs

Cable length for external test / reset button	0 - 32 ft (0 - 10 m)

Switching elements

Number of switching elements					2 SPDT contacts
Operating principle					normally energized or normally deenergized(*)
Electrical service life under rated operating conditions					10.000 switching operations
Contact data acc. to IEC 60947-5-1					
Utilization category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	30 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact load					1 mA at AC / DC ≥ 10 V

Environment / EMC

EMC	IEC 62020: 2003-11
Operating temperature	- 25 °C - + 55 °C
Climatic class acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection	screw terminals
rigid / flexible	AWG 24 - 12 / 24 - 14
Multi-conductor connection (2 conductors with the same cross section)	
rigid / flexible	AWG 24 - 14 / 24 - 14
Stripping length	8 - 9 mm
Tightening torque	0.5 - 0.6 Nm

Other

Operating mode	continuous operation
Position of normal use	any
Degree of protection, internal components (IEC 60529)	IP30, NEMA 1
Degree of protection, terminals (IEC 60529)	IP20, NEMA 1
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Standards	IEC 62020
Instruction leaflet	TGH1410
Weight	≤ 150 g

( )* factory setting

Ordering Information

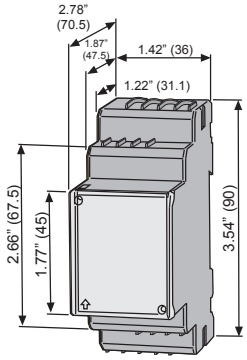
Supply voltage [1] U_S		Outputs	Type	Ordering No.
DC	AC			
9.6 - 94 V	16 - 72 V (15 - 460 Hz)	2 SPDT contacts	RCM420-D-1	B 9401 4001
70 - 300 V	70 - 300 V (15 - 460 Hz)	2 SPDT contacts	RCM420-D-2	B 9401 4002

Accessories

Description	Ordering No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Dimensions

Dimensions in inches (mm)



Compatible Current Transformers

CT Type	Opening Size in inches (mm)	Part No.	Ordering No.
circular, closed	1.35" (35)	W1-S35	B 911 731
	2.75" (70)	W2-S70	B 911 732
	4.1" (105)	W3-S105	B 911 733
	5.5" (140)	W4-S140	B 911 734
	8.25" (210)	W5-S210	B 911 735
rectangular, closed	2.75" X 6.9" (70 x 175)	WR70X175S	B 911 738
	4.5" x 12" (115 x 305)	WR115X305S	B 911 739
	5.9" x 13.8" (150 x 350)	WR150X350S	B 911 740
rectangular, split-core	2" x 3.1" (50 x 80)	WS50X80S	B 911 741
	3.1" x 3.1" (80 x 80)	WS80X80S	B 911 742
	3.1" x 4.7" (80 x 120)	WS80X120S	B 911 743
flexible, open type*	6.7" (170)*	WF170-2	B 9808 0201
	9.8" (250)*	WF250-2	B 9808 0203
	19.7" (500)*	WF500-2	B 9808 0205
	31.5" (800)*	WF800-2	B 9808 0207
	47.2" (1200)*	WF1200-2	B 9808 0209

Notes on WF series flexible current transformers:

- The listed dimension is the length of the flexible cable, not the opening size when closed. Closed circumference must be calculated appropriately.
- WF series current transformers additionally utilize the RCC420 signal converter, which requires supply voltage. See WF series datasheet for more information.
- When WF series current transformers are used with the RCM420, CT connection monitoring must be disabled. Refer to RCM420 manual for more information.