Data sheet

Insulation monitoring relay CM-IWN.1

For unearthed AC, DC and mixed AC/DC systems up to U_n = 400 V AC and 600 V DC

The CM-IWN.1 serves to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems, IT AC systems with galvanically connected DC circuits, or unearthed IT DC systems with a voltage up to 400 V AC and 600 V DC. The measuring range can be extended up to 690 V AC and 1000 V DC by using the coupling unit CM-IVN. It can be configured to the requirements of the applications and therefore used multi-functional.

2CDC 251 080 S0009

Characteristics

- For monitoring the insulation resistance of unearthed IT systems up to U_n = 400 V AC and 600 V DC
- According to IEC/EN 61557-8 “Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems"
- Rated control supply voltage 24-240 V AC/DC
- Prognostic measuring principle with superimposed square wave signal
- Two measuring ranges 1-100 kΩ and 2-200 kΩ
- One (1 x 2 c/o) or two (2 x 1 c/o) threshold values $R_{an}1$/R1[1] (final switch-off) and $R_{an}2$/R2[1] (prewarning) configurable[2]
- Precise adjustment of the threshold values in 1 kΩ steps (R1) and 2 kΩ steps (R2)
- Interrupted wire detection configurable
- Non-volatile fault storage configurable
- Open- or closed-circuit principle configurable
- 45 mm (1.77 in) width
- 3 LEDs for status indication

[1] term acc. to IEC/EN 61557-8
[2] R2 only active with 2 x 1 c/o configuration

Approvals

- UL 508, CAN/CSA C22.2 No.14
- GL
- IEC/EN 60947-5-1, CB scheme
- GB14048.5 - 2001, CCC
- GOST

Marks

- CE
- C-Tick

Order data

Insulation monitoring relay

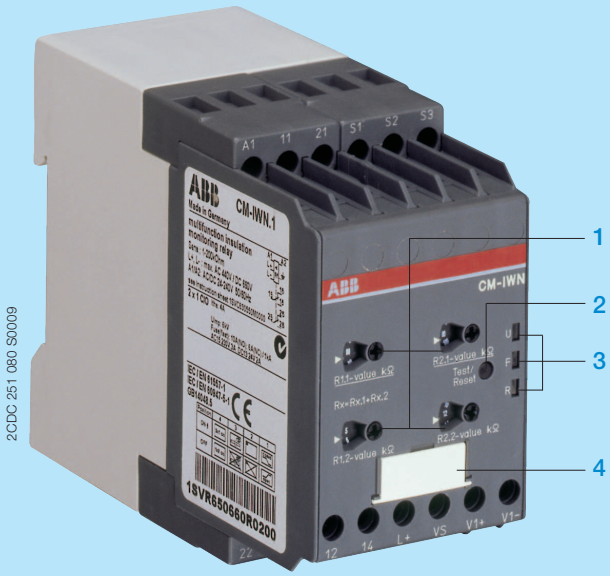
Type	Nominal voltage U_n of the distribution system to be monitored	Rated control supply voltage	System leakage capacitance, max.	Order code
CM-IWN.1	0-400 V AC / 0-600 V DC	24-240 V AC/DC	20 µF	1SVR 650 660 R0200

Accessories

Type	Description	Order code
CM-IVN	Coupling unit for connection of the CM-IWN.1 to systems with voltages U_n up to 690 V AC and 1000 V DC	1SVR 650 669 R9400
ADP.02	Adapter for screw mounting	1SVR 440 029 R0100
MAR.02	Marker label for devices with DIP switches	1SVR 430 043 R0000
COV.02	Sealable transparent cover	1SVR 440 005 R0100

Functions

Operating controls



1 Configuration and setting
Front-face rotary switches to adjust the threshold value:

R1.1 for R1 tens figure:
0, 10, 20, 30, 40, 50, 60, 70, 80, 90 kΩ in ten kΩ steps

R1.2 for R1 units figure:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 kΩ in one kΩ steps

R2.1 for R2 tens figure:
0, 20, 40, 60, 80, 100, 120, 140, 160, 180 kΩ in twenty kΩ steps

R2.2 for R2 units figure:
2, 4, 6, 8, 10, 12, 14, 16, 18, 20 kΩ in two kΩ steps

2 Test and reset button

3 Status indication
U: green LED - control supply voltage

F: red LED - fault message

R: yellow LED - relay status

4 Function selection and marker label
See "DIP switches" on page 7

Application / monitoring function

The CM-IWN.1 serves to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems, IT AC systems with galvanically connected DC circuits, or unearthed IT DC systems.

The insulation resistance between system lines and system earth is measured. If this falls below the adjustable threshold values, the output relays switch into the fault state.

The device can monitor control circuits (single-phase) and main circuits (3-phase).

Supply systems with voltages U_n = 0-400 V AC (15-400 Hz) or 0-600 V DC can be directly connected to the measuring inputs and their insulation resistance being monitored. For systems with voltages above 400 V AC and 600 V DC the coupling unit CM-IVN can be used for the expansion of the CM-IWN.1 voltage range.

Measuring principle

A pulsating measuring signal is fed into the system to be monitored and the insulation resistance calculated.

This pulsating measuring signal alters its form depending on the insulation resistance and system leakage capacitance. From this altered form the change in the insulation resistance is forecast.

When the forecast insulation resistance corresponds to the insulation resistance calculated in the next measurement cycle and is smaller than the set threshold value, the output relays are activated or deactivated, depending on the device configuration. This measuring principle is also suitable for the detection of symmetrical insulation faults.

Additional monitoring functions

When interrupted wire detection is activated, the CM-IWN.1 automatically controls the system/measuring circuit connections L+ and L- when the system starts up. This can be repeated at any time by activating the test function. The CM-IWN.1 cyclically monitors the measuring circuit connections ⏚ and KE for wire interruption. In case of a wire interruption in one of the connections, the output relays switch to the fault state.

In addition, the unearthed AC-, DC- or AC/DC system is monitored for inadmissible system leakage capacitance. If the system leakage capacitance is too high, the output relays switch to the fault state.

Also incorrect settings that could cause a faulty function of the device are monitored. When the device detects such an incorrect setting, the output relays switch to the fault state.

Operating mode

The system to be monitored is connected to terminals L+ and L-. The earth potential is connected to terminals ⏚ and KE.

Depending on the setting, the device operates according to the open-circuit principle [open] (fault state: relay energized) or closed-circuit principle [closed] (fault state: relay de-energized).

Once the control supply voltage has been applied the insulation monitoring relay runs through a system test routine. The system is diagnosed and the settings are tested. If no internal or external faults are found after this test routine is completed, the output relays switch into the operational state.

All operating states are signalled by the front-face LEDs. See table "LEDs, status information and fault messages" on page 8.

Configuration 1 x 2 c/o contacts [1x2 c/o] (final switch-off)

With this configuration the settings for the threshold value for prewarning (R2) have no influence on the operating function. If the measured value drops below the set threshold value, the output relays switch into the fault state. If the measured value exceeds the threshold value plus hysteresis, the output relays switch back into their original state.

Configuration 2 x 1 c/o contact [2x1 c/o] (prewarning and final switch-off)

If the measured value drops below the set threshold value for prewarning the second output relay 21-22/24 switches. If the measured value drops below the threshold value for final switch-off, the first output relay 11-12/14 switches.

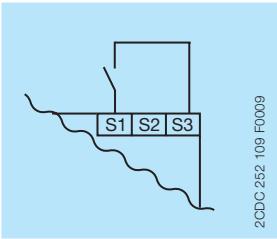
If the measured value exceeds the threshold value for final switch-off plus hysteresis, the first output relay 11-12/14 switches back into its original state. If the measured value exceeds the threshold value for prewarning plus hysteresis, also the second output relay 21-22/24 switches back to its original state.

Test function

The test function is only possible when there is no fault.

By pressing the front-face combined test/reset button a system test routine is executed. The output relays switch to the fault state as long as the test/reset button is pressed, the control contact S1-S3 is closed or the test functions are processed.

The test function can be activated either with the front-face combined test/reset button or with a remote test button connected as shown in the picture.

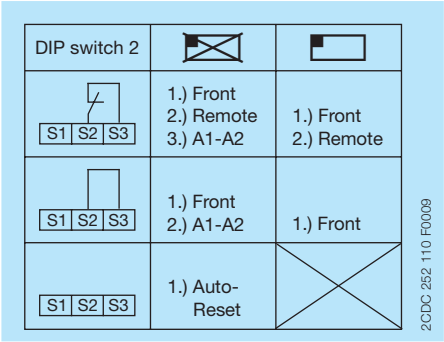


Fault storage, reset function and remote reset

When fault storage [▪] is active, the output relays remain in the fault state and only switch back to their original state after the combined test/reset button is pressed or after the remote reset (terminals S2-S3) is activated, and when the insulation resistance is higher than the set threshold value(s) plus hysteresis.

The fault storage is designed non-volatile (remanent). This means that after switch-off and return of the control supply voltage the device returns to the state it was prior to the switch-off until a reset is executed.

Depending on the configuration of DIP switch 2, there are several possibilities of resetting the device, as shown in the picture.



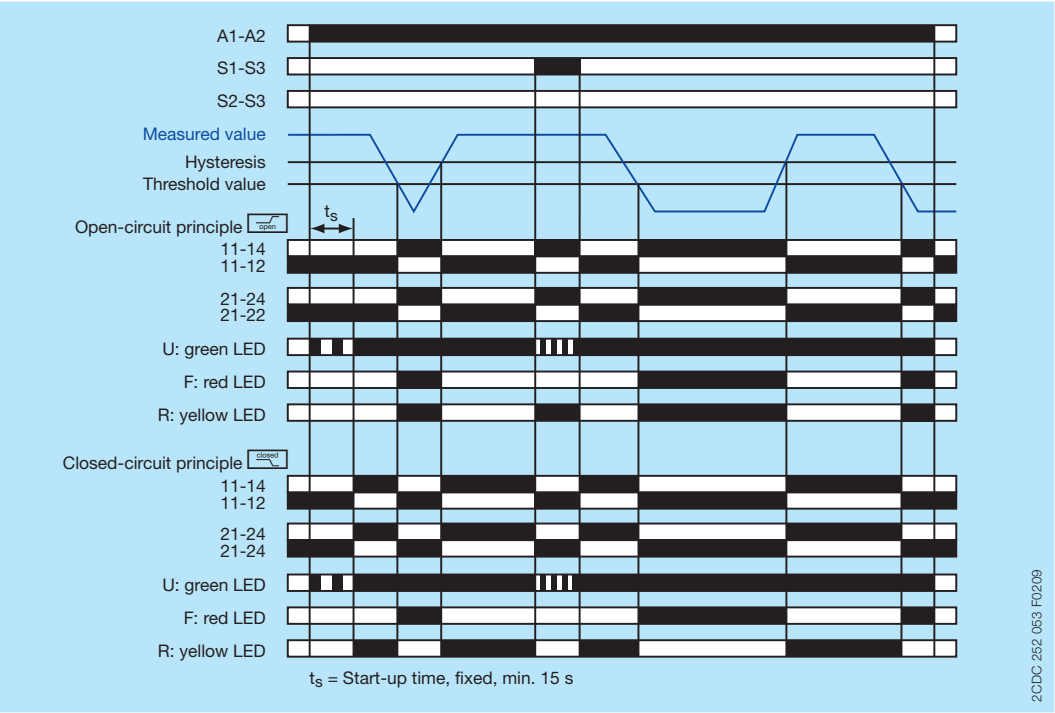
Measuring range expansion by using the coupling unit CM-IVN

The coupling unit CM-IVN serves to connect the CM-IWN.1 to systems up to 690 V AC and 1000 V DC. Terminals VS, V1+, V1- are connections for the coupling unit.

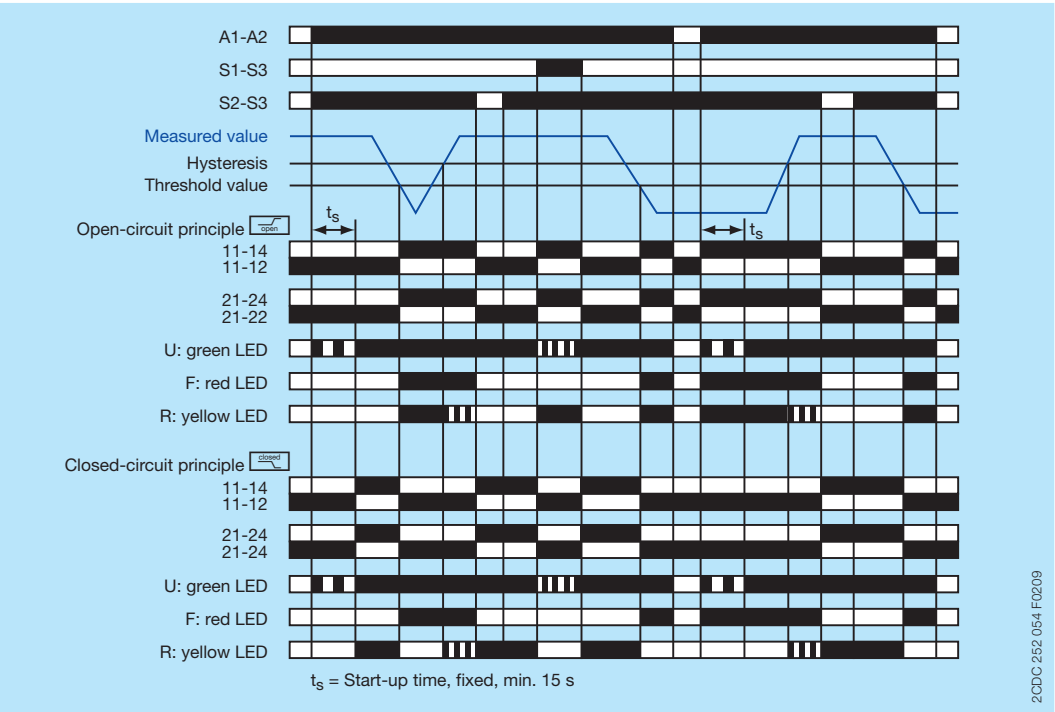
Function descriptions/diagrams

Control supply voltage not applied / Output contact open / LED OFF

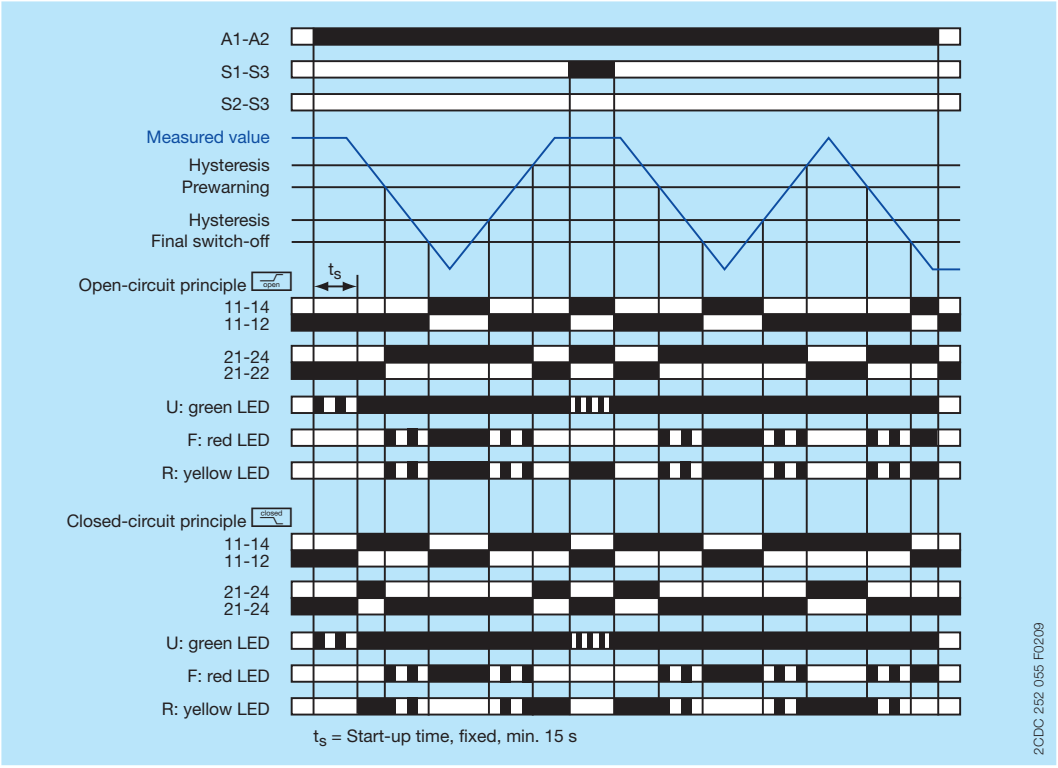
Control supply voltage applied / Output contact closed / LED ON



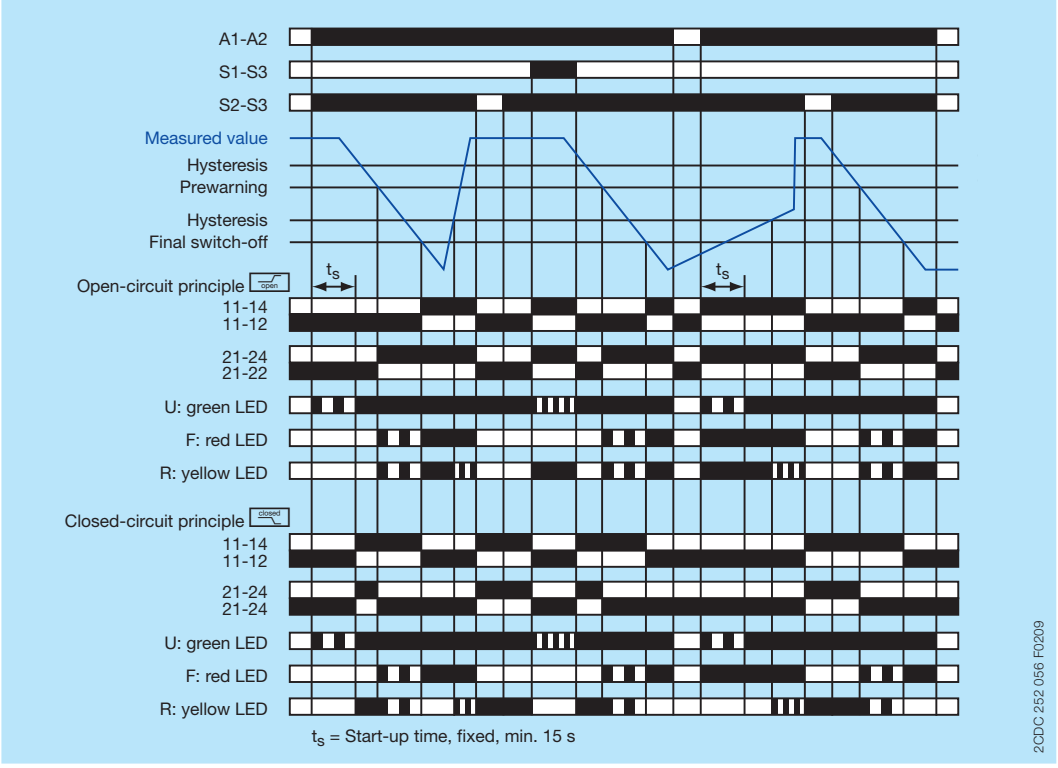
Insulation resistance monitoring w/o fault storage, auto reset, 1 x 2 c/o



Insulation resistance monitoring with fault storage, manual reset, 1 x 2 c/o



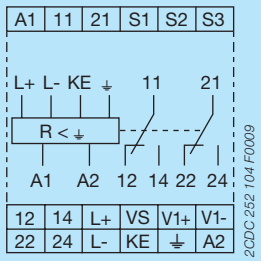
Insulation resistance monitoring w/o fault storage, auto reset, 2 x 1 c/o



Insulation resistance monitoring with fault storage, manual reset, 2 x 1 c/o

Connection and wiring

Connection diagram

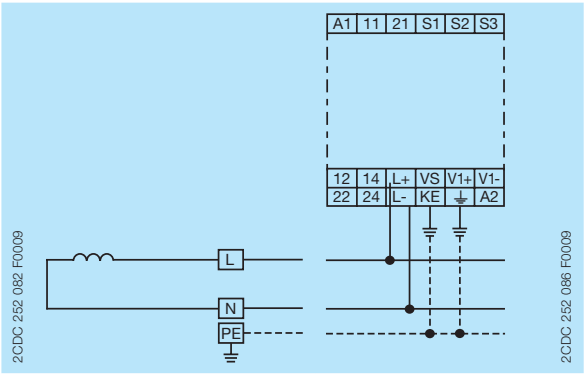


A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L+, L–	Measuring circuit/input, system connection
⏚, KE	Measuring circuit/input, earth connections
VS, V1+, V1-	Connections for the coupling unit (if used)
11-12/14	Output relay 1, open- or closed-circuit principle
21-22/24	Output relay 2, open- or closed-circuit principle

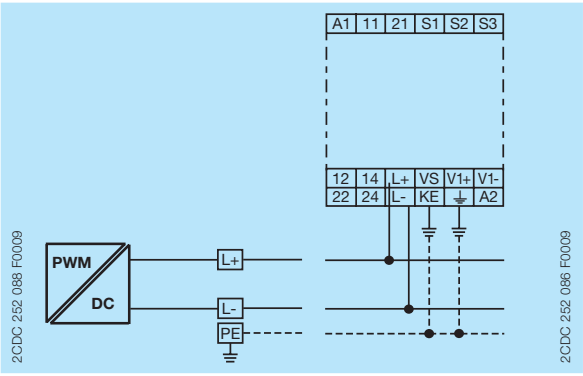
Wiring diagrams

Always connect L+ and L- to different conductors. L+ and L- can be connected to any of the conductors.

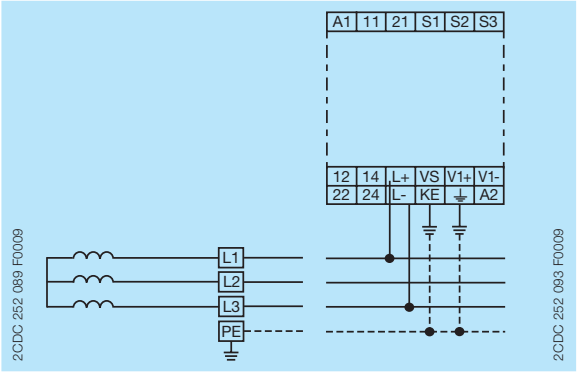
U_n ≤ 400 V AC; 600 V DC (For monitoring of systems with higher voltages, use coupling unit CM-IVN.)



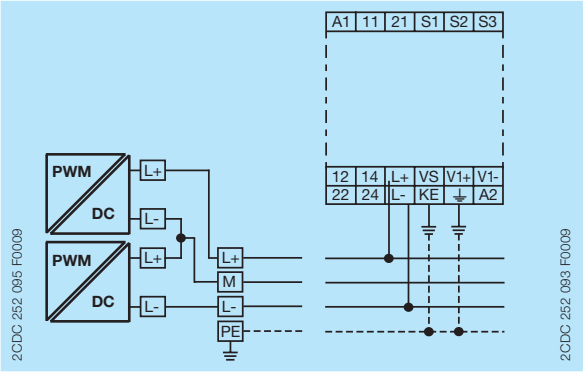
2-wire AC system



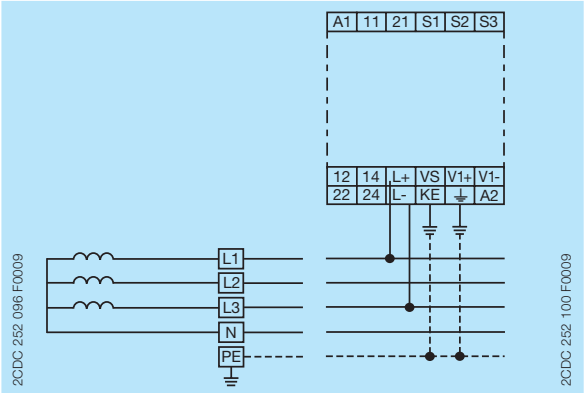
2-wire DC system



3-wire AC system



3-wire DC system



4-wire AC system

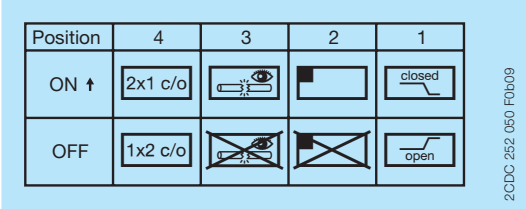
Configuration and settings

Rotary switches R1.1, R1.2, R2.1 and R2.2 (treshold values)

By means of four separate 10 position rotary switches with direct reading scales, the threshold values for the insulation resistance R_F of the systems to be monitored can be adjusted.

With the Rx.1 rotary switch the tens figure is set and with the Rx.2 rotary switch the units figure is set. The set threshold value is then the addition of the two values. For example, R1.1 set to 70 and R1.2 set to 8 leads to a threshold value for R1 of 78 kΩ.

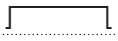
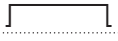
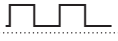
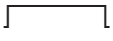
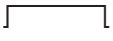
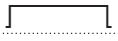
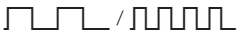
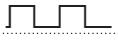
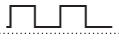
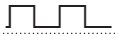
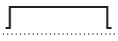
DIP switches



	ON	OFF (default)
DIP switch 1 Operating principle of the output relays	Closed-circuit principle If closed-circuit principle is selected, the output relays are energized. They de-energize if a fault is occuring.	Open-circuit principle If open-circuit principle is selected, the output relays are de-energized. The energize if a fault is occuring.
DIP switch 2 Non-volatile fault storage	Fault storage activated (latching) If the fault storage function is activated, the output relays remain in tripped position until a reset is done either by the front-face button or by the remote reset connection S2-S3. This function is non-volatile.	Fault storage de-activated (non latching) If the fault storage function is de-activated, the output relays switch back to their original position as soon as the insulation fault no longer exists.
DIP switch 3 Interrupted wire detection	Interrupted wire detection activated With this configuration, the CM-IWN.1 monitors the wires connected to L+ and L- for interruptions.	Interrupted wire detection de-activated With this configuration the interrupted wire detection is de-activated.
DIP switch 4 2 x 1 c/o, 1 x 2 c/o	2 x 1 c/o (SPDT) contact If operating principle 2 x 1 c/o contact is selected, the output relay R1 (11-12/14) reacts to threshold value R1 (final switch-off) and the output relay R2 (21-22/24) reacts to threshold value R2 (prewarning)	1 x 2 c/o (SPDT) contacts If operating principle 1 x 2 c/o contacts is selected, both output relays R1 (11-12/14) and R2 (21-22/24) react synchronously to threshold value R1. Settings of the threshold value R2 have no effect on the operation.

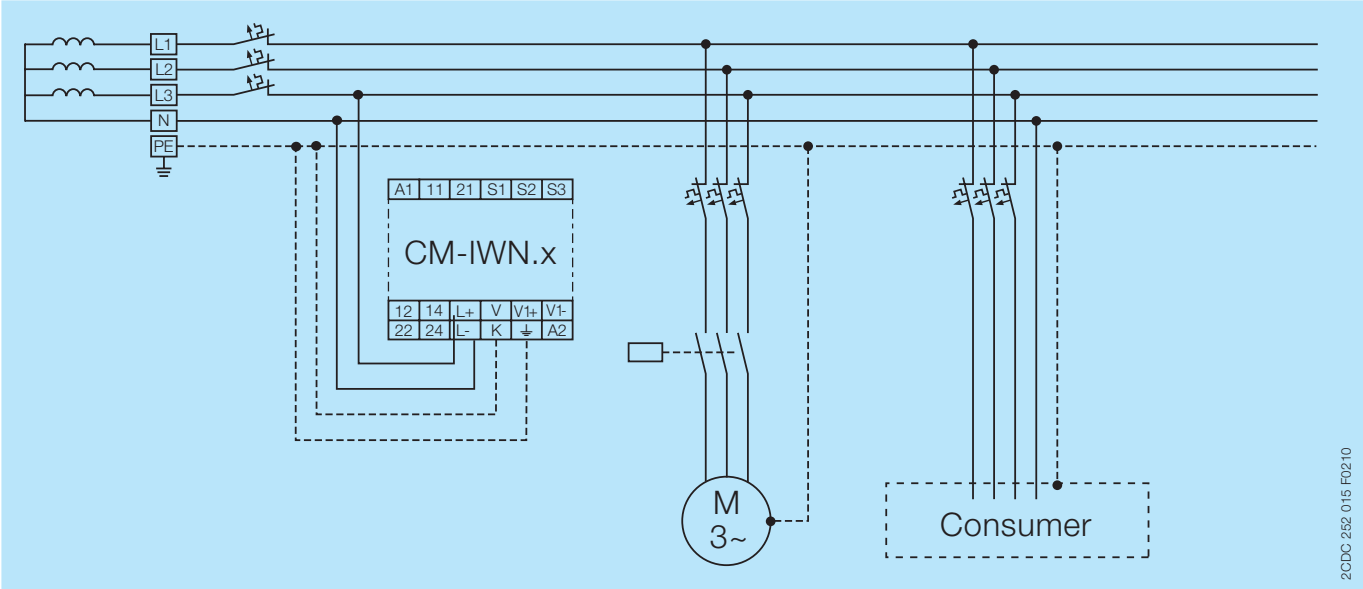
Operating state indication

LEDs, status information and fault messages

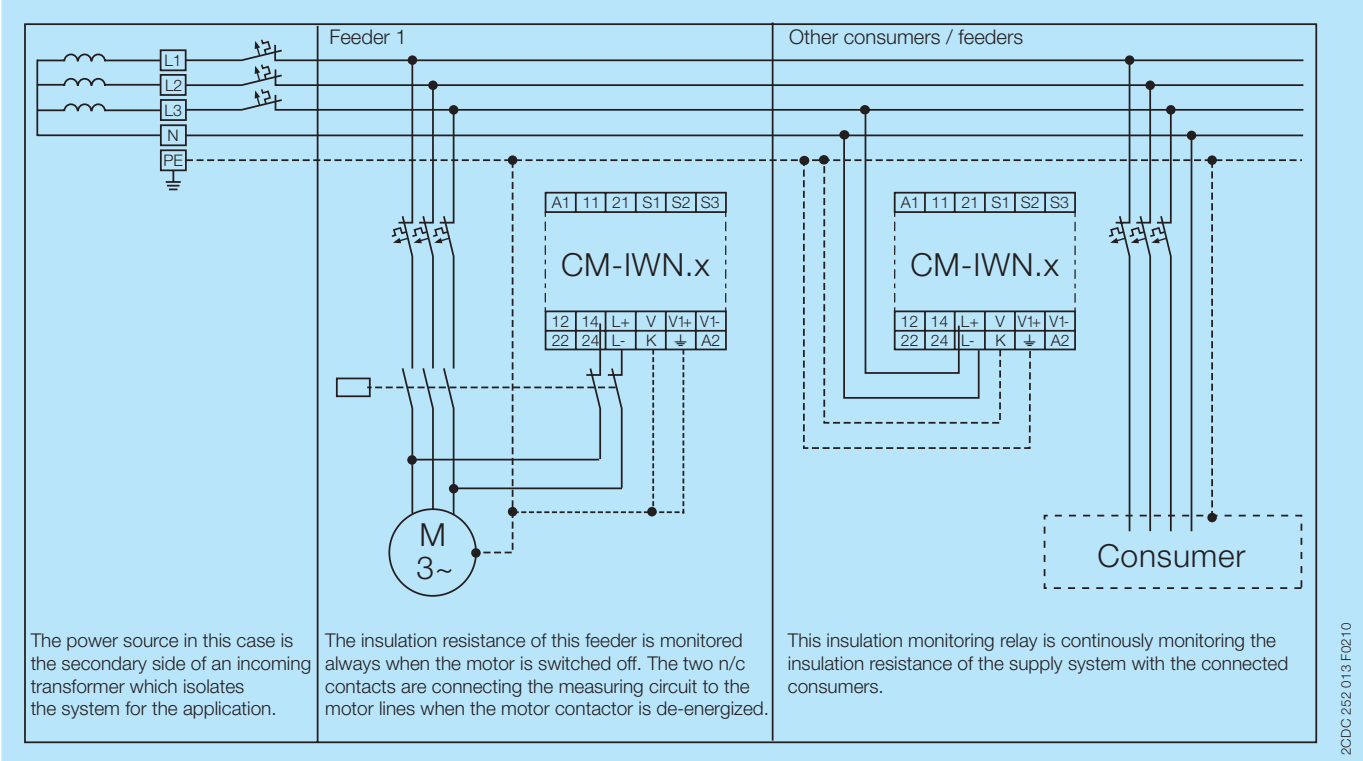
Operational state	LED U (green)	LED F (red)	LED R (yellow)
Start-up		OFF	OFF
No fault		OFF	1)
Prewarning			
Insulation fault (below threshold value)			1)
KE/⏚ wire interruption			1)
L+/L- wire interruption during system start-up / test function			1)
System leakage capacitance too high / invalid measurement result			1)
Internal system fault	1)		1)
Setting fault2)			
Test function		OFF	1)
No fault after fault storage3)		4)	

1) Depending on the configuration (see "Function descriptions/diagrams" on page 4)
2) Possible faulty setting: The threshold value for final switch-off is set at a higher value than the threshold value for prewarning.
3) The device has triggered after an insulation fault. The fault has been stored and the insulation resistance has returned to a higher value than the threshold value plus hysteresis.
4) Depending on the fault

Application examples



Earth fault / insulation resistance monitoring of an unearthed 4-wire AC system



Earth fault / insulation resistance monitoring of different feeder circuits with fault localization

Technical data

Data at T_a = 25 °C and rated values, unless otherwise indicated

Input circuits

Input circuit - Supply circuit		A1 - A2
Rated control supply voltage U_s		24-240 V AC/DC
Rated control supply voltage tolerance		-15...+10 %
Typical current / power consumption	24 V DC	55 mA / 1.3 VA
	115 V AC	20 mA / 2.3 VA
	230 V AC	15 mA / 3.5 VA
Rated frequency f_s		DC or 15-400 Hz
Frequency range AC		13.5-440 Hz
Power failure buffering time	min.	20 ms
Start-up time t_s, fixed	min.	15 s

Input circuit - Measuring circuit		L+, L-, ⏚, KE
Monitoring function		insulation resistance monitoring of IT systems (IEC/EN 61557-8)
Measuring principle		prognostic measuring principle with superimposed square wave signal
Nominal voltage U_n of the distribution system to be monitored		0-400 V AC / 0-600 V DC
Voltage range of the distribution system to be monitored		0-460 V AC / 0-690 V DC (tolerance +15 %)
Rated frequency f_N of the distribution system to be monitored		DC or 15-400 Hz
Tolerance of the rated frequency f_N		13.5-440 Hz
System leakage capacitance C_e	max.	20 µF
Extraneous DC voltage U_{fg} (when connected to an AC system)	max.	460 V DC
Voltage range expansion of the measuring input with coupling unit CM-IVN		use connection terminals V1+, V1-, VS max. length of connection cable 40 cm
Number of possible response / threshold values		2
Adjustment range of the specified response value R_{an} (threshold)	min.-max. R1	1-100 kΩ
	min.-max. R2	2-200 kΩ (activated/de-activated by DIP switch)
Adjustment resolution	R1	1 kΩ
	R2	2 kΩ
Tolerance of the adjusted threshold value / Relative percentage uncertainty A at -5...+45 °C, U_n = 0-115 %, U_s = 85-110 %, f_N, f_s, C_e = 1µF	at 1-15 kΩ R_F	±1 kΩ / in combination with CM-IVN ±1.5 kΩ
	at 15-200 kΩ R_F	±8 %
Hysteresis related to the threshold value		25 %; min. 2 kΩ
Internal impedance Z_i	at 50 Hz	155 kΩ
Internal DC resistance R_i		185 kΩ
Measuring voltage U_m		24 V
Tolerance of measuring voltage U_m		+10 %
Measuring current I_m		0.15 mA
Response time t_{an}		
pure AC system	0.5 x R_{an} and C_e = 1 µF	max. 10 s
DC system or AC system with connected rectifiers		max. 15 s
Repeat accuracy (constant parameters)		< 0.1 % of full scale
Accuracy of R_a (measured value) within the rated control supply voltage tolerance		< 0.05 % of full scale
Accuracy of R_a (measured value) within the operation temperature range	at 1-10 kΩ R_F	5 Ω / K
	at 10-200 kΩ R_F	0.05 % / K
Transient over voltage protection (⏚ - terminal)		avalanche diode

Input circuit - Control circuits		S1 - S2 - S3
Control inputs - volt free	S1-S3	remote test
	S2-S3	remote reset
Maximum switching current in the control circuit		1 mA
Maximum cable length to the control inputs		50 m - 100 pF/m (164 ft - 30.5 pF/ft)
Minimum control pulse length		150 ms
No-load voltage at the control input		≤ 24 V DC

User interface

Indication of operational states		
Control supply voltage	U	green LED
Fault message	F	red LED
Relay status	R	yellow LED

Details see table "LEDs, status information and fault messages" on page 8 and "Function descriptions/diagrams" on page 4

Operating elements and controls		
Adjustment of threshold value R1	R1.1	rotary switch, 10 kΩ steps for the tens figure
	R1.2	rotary switch, 1 kΩ steps for the units figure
Adjustment of threshold value R2	R2.1	rotary switch, 20 kΩ steps for the tens figure
	R2.2	rotary switch, 2 kΩ steps for the units figure
Configuration of	DIP switch 1	operating principle of the output relays
	DIP switch 2	non volatile fault storage
	DIP switch 3	interrupted wire detection
	DIP switch 4	2 x 1 c/o, 1 x 2 c/o

Output circuits

Kind of output	11-12/14	1st relay
	21-22/24	2nd relay
		2 x 1 or 1 x 2 c/o (SPDT) contacts configurable
Operating principle		open- or closed-circuit principle[1] configurable
Contact material		AgNi alloy, Cd free
Rated voltage (VDE 0110, IEC 60947-1)		250 V AC / 300 V DC
Min. switching voltage / Min. switching current		24 V / 10 mA
Max. switching voltage / Max. switching current		see "Load limits curves" on page 14
Rated operational current I_e	AC12 (resistive) at 230 V	4 A
(IEC/EN 60947-5-1)	AC15 (inductive) at 230 V	3 A
	DC12 (resistive) at 24 V	4 A
	DC13 (inductive) at 24 V	2 A
AC rating	Utilization category (Control Circuit Rating Code)	B 300, pilot duty
(UL 508)		general purpose (250 V, 4 A, cos φ 0,75)
	max. rated operational voltage	250 V AC
	max. continuous thermal current at B 300	4 A
	max. making/breaking apparent power at B 300	3600/360 VA
Mechanical lifetime		30 x 10^6 switching cycles
Electrical lifetime (AC12, 230 V, 4 A)		0.1 x 10^6 switching cycles
Max. fuse rating to achieve short-	n/c contact	6 A fast-acting
circuit protection	n/o contact	10 A fast-acting
Conventional thermal current I_{th} (IEC/EN 60947-1)		4 A

1) Closed-circuit principle: Output relay(s) de-energize(s) if measured value falls below the adjusted threshold value R_{an}

Open-circuit principle: Output relay(s) energize(s) if measured value falls below the adjusted threshold value R_{an}

General data

MTBF		on request
Duty time		100 %
Dimensions (W x H x D)		45 x 78 x 100 mm (1.78 x 3.07 x 3.94 in)
Weight	gross weight	0.258 kg (0.569 lb)
	net weight	0.231 kg (0.509 lb)
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool
Mounting position		any
Minimum distance to other units	vertical	not necessary
	horizontal	10 mm (0.39 in) at U_n > 400 V
Degree of protection	housing / terminal	IP50 / IP20

Electrical connection

Wire size	fine-strand with(out) wire end ferrule	2 x 0.75-2.5 mm² (2 x 18-14 AWG)
	rigid	2 x 0.5-4 mm² (2 x 20-12 AWG)
Stripping length		7 mm (0.28 in)
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)

Environmental data

Ambient temperature ranges	operation	-25...+60 °C
	storage	-40...+85 °C
	transport	-40...+85 °C
Climatic category	IEC/EN 60721-3-3	3K5 (no condensation, no ice formation)
Damp heat, cyclic	IEC/EN 60068-2-30	6 x 24 h cycle, 55 °C, 95 % RH
Vibration, sinusoidal	IEC/EN 60255-21-1	Class 2
Shock, half-sine	IEC/EN 60255-21-2	Class 2

Isolation data

Rated impulse withstand voltage U_{imp} between all isolated circuits (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply circuit / measuring circuit	6 kV
	supply circuit / output circuits	6 kV
	measuring circuit / output circuits	6 kV
	output circuit 1 / output circuit 2	4 kV
Pollution degree (IEC/EN 60664-1, VDE 0110-1)		3
Overvoltage category (IEC/EN 60664-1, VDE 0110-1)		III
Rated insulation voltage U_i (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply circuit / measuring circuit	600 V
	supply circuit / output circuits	300 V
	measuring circuit / output circuits	600 V
	output circuit 1 / output circuit 2	300 V
Basic insulation for rated control supply voltage (IEC/EN 60664-1, VDE 0110-1)	supply circuit / measuring circuit	400 V AC / 600 V DC
	supply circuit / output circuits	250 V AC / 300 V DC
	measuring circuit / output circuits	400 V AC / 600 V DC
	output circuit 1 / output circuit 2	250 V AC / 300 V DC
Protective separation (IEC/EN 61140, IEC/EN 50178)	supply circuit / output circuits	250 V AC / 250 V DC
	supply circuit / measuring circuit	250 V AC / 250 V DC
	measuring circuit / output circuits	250 V AC / 250 V DC
Test voltage between all isolated circuits, routine test (IEC/EN 60255-5, IEC/EN 61010-1)	supply circuit / output circuits	2.32 kV, 50 Hz, 2 s
	supply circuit / measuring circuit	2.32 kV, 50 Hz, 2 s
	measuring circuit / output circuits	2.53 kV, 50 Hz, 1 s

Standards

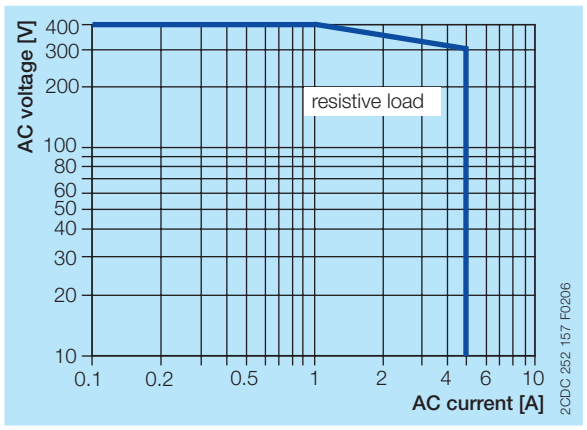
Product standard	IEC/EN 61557-8, IEC/EN 60255-6
Other standards	EN 50178
Low Voltage Directive	2006/95/EC
EMC Directive	2004/108/EC
RoHS Directive	2002/95/EC

Electromagnetic compatibility

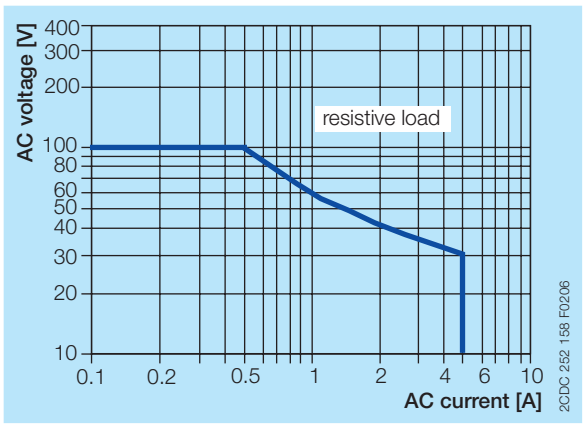
Interference immunity to		IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61326-2-4
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV / 8 kV
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3, 10 V/m (1 GHz) / 3 V/m (2 GHz) / 1 V/m (2.7 GHz)
electrical fast transient/burst	IEC/EN 61000-4-4	Level 3, 2 kV / 5 kHz
surge	IEC/EN 61000-4-5	Level 3, installation class 3, supply circuit and measuring circuit 1 kV L-L, 2 kV L-earth
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3, 10 V
voltage dips, short interruptions and voltage variations	IEC/EN 61000-4-11	Level 3
harmonics and interharmonics	IEC/EN 61000-4-13	Level 3
Interference emission		IEC/EN 61000-6-3, IEC/EN 61000-6-4
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B

Technical diagrams

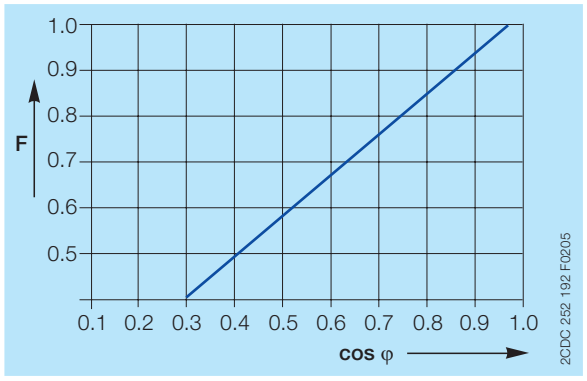
Load limits curves



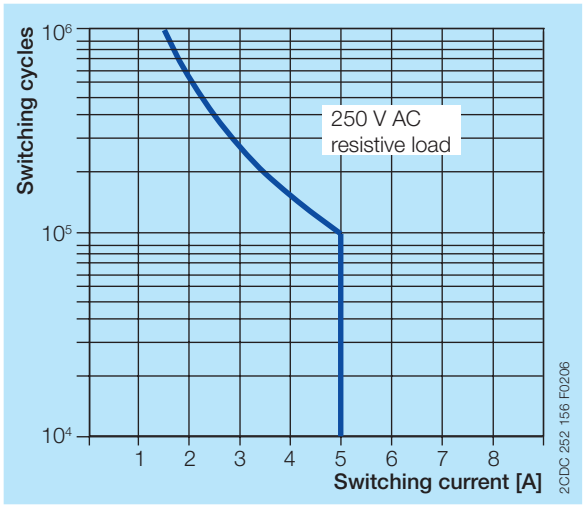
AC load (resistive)



DC load (resistive)



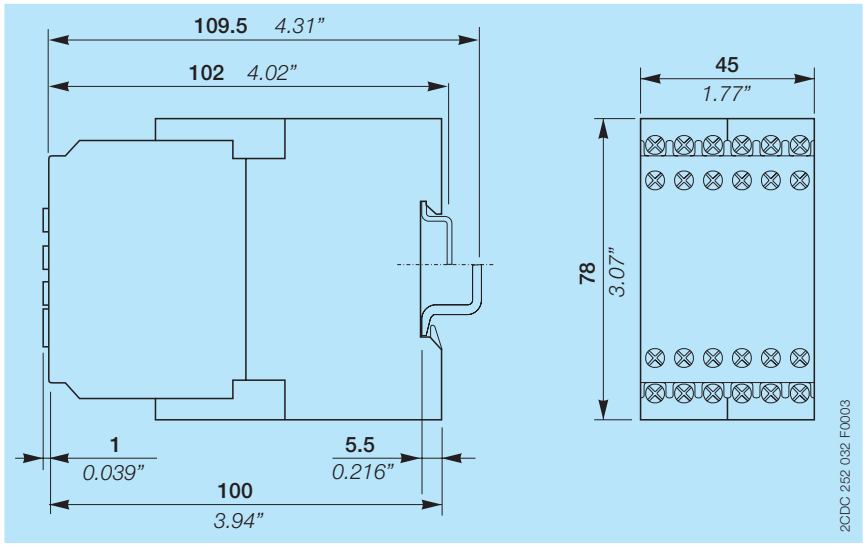
Derating factor F at inductive AC load



Contact lifetime

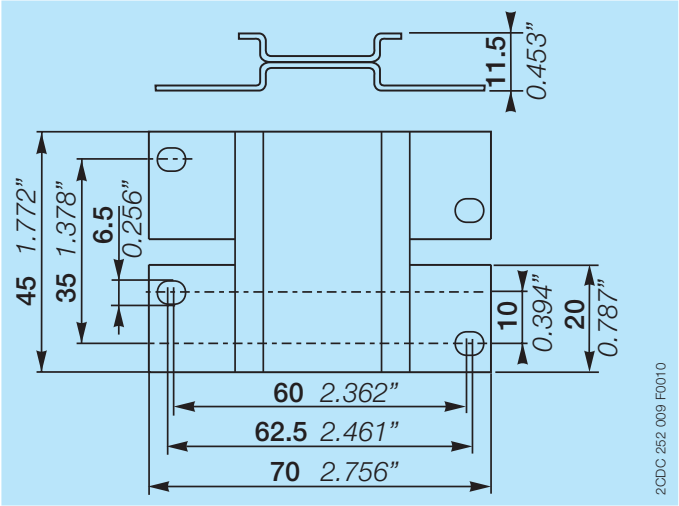
Dimensional drawings

in **mm** and *inches*

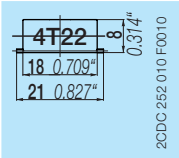


CM-IWN.1 - Insulation monitoring relay

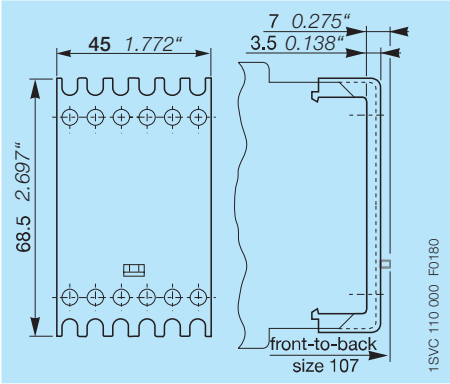
Accessories



ADP.02 - Adapter for screw mounting



MAR.02 - Marker label



COV.02 - Sealable transparent cover

Further documentation

Document title	Document type	Document number
Electronic products and relays	Technical catalogue	2CDC 110 004 C020x
CM-IWN.1, CM-IWN.5	Instruction sheet	1SVC 650 020 M0000

You can find the documentation on the internet at www.abb.com/lowvoltage -> Control Products -> Electronic Relays and Controls.

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