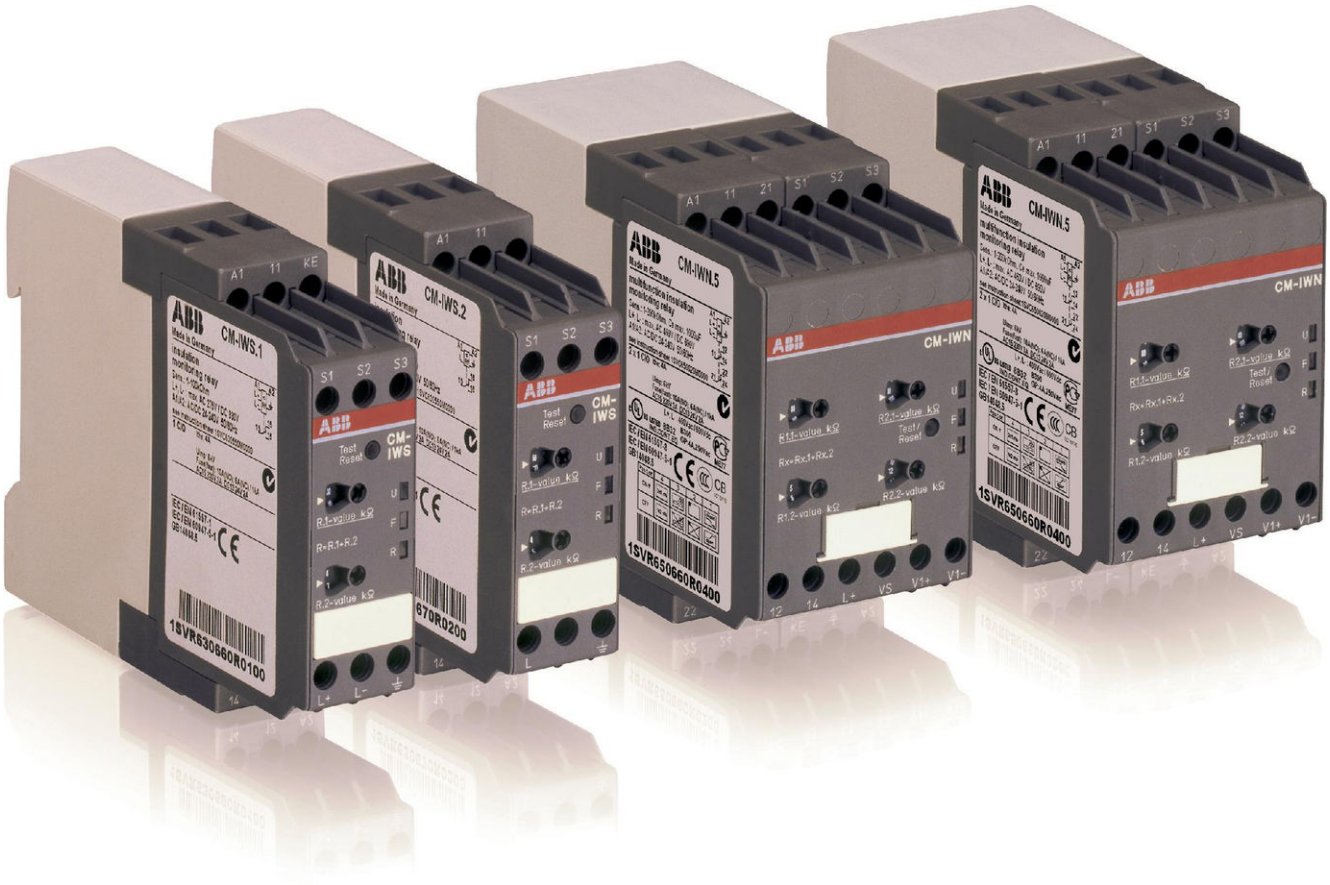
Insulation monitoring relays for unearthed supply systems
Product group picture

2



Insulation monitoring relays for unearthed supply systems
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Insulation monitoring relays for unearthed supply systems
Benefits and advantages







Insulation monitoring relays for unearthed pure AC systems: Characteristics

- For monitoring the insulation resistance of unearthed IT systems: up to U_n = 400 V AC
- According to IEC/EN 61227-8 "Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC – 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
- Superimposed DC signal
- One measuring range 1–100 kΩ
- Precise adjustment of the threshold value in 1 kΩ steps
- Interrupted wire detection
- Fault storage/latching configurable by control input
- 1 c/o contact, closed-circuit principle
- 22.5 mm [0.89 in] width
- 3 LEDs for status indication

A new generation of insulation monitoring relays of the CM range consolidates ABB's strengths in innovative control products.

The new products are in accordance to IEC/EN 61557-1 and to IEC/EN 61557-8. That means the monitoring relays can be used directly to measure the insulation resistance in unearthed AC and DC mains with a voltage up to 690 V AC and 1000 V DC!

With the new prognostic measuring principle the measuring and response time is reduced significantly.

Insulation monitoring relays for unearthed AC, DC or mixed AC/DC systems: Characteristics

- For monitoring the insulation resistance of unearthed IT systems up to U_n= 250 V AC and 300 V DC or U_n= 400 V AC and 600 V DC
- According to IEC/EN 61227-8 "Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC – 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
- 1 or 2 measuring ranges (1-100kΩ or 1-100 kΩ + 2-200 kΩ)[1)]
- 1 or 2 (configurable) c/o contacts[1)]
- Precise adjustmemt of the measuring value in 1 or 2 kΩ steps[1)]
- (non-volatile) fault storage, configurable latching, interrupted wire protection, open- or closed-circuit principle selectable[1)]
- 22.5 or 45 mm width
- 3 LEDs for status indication
- Solution for solar available

[1)] depending on device

Standardisation background:

- EC/EN 61557-1 "Electrical safety in low voltage distribution system up to 1000 V AC and 1500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements"
- IEC/EN 61557-8 "Electrical safety in low voltage distribution system up to 1000 V AC and 1500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 1: Insulation monitoring devices for IT systems"

Insulation monitoring relays for unearthed supply systems
Insulation monitoring in IT systems

In electricity supply systems, an earthing system defines the electrical potential of the conductors relative to that of the earth's conductive surface. The choice of earthing system has implications for the safety and electromagnetic compatibility of the power supply. Note that regulations for earthing (grounding) systems vary considerably among different countries.

The international standard IEC 60364 distinguishes three families of earthing arrangements, using the two-letter codes TN, TT and IT.

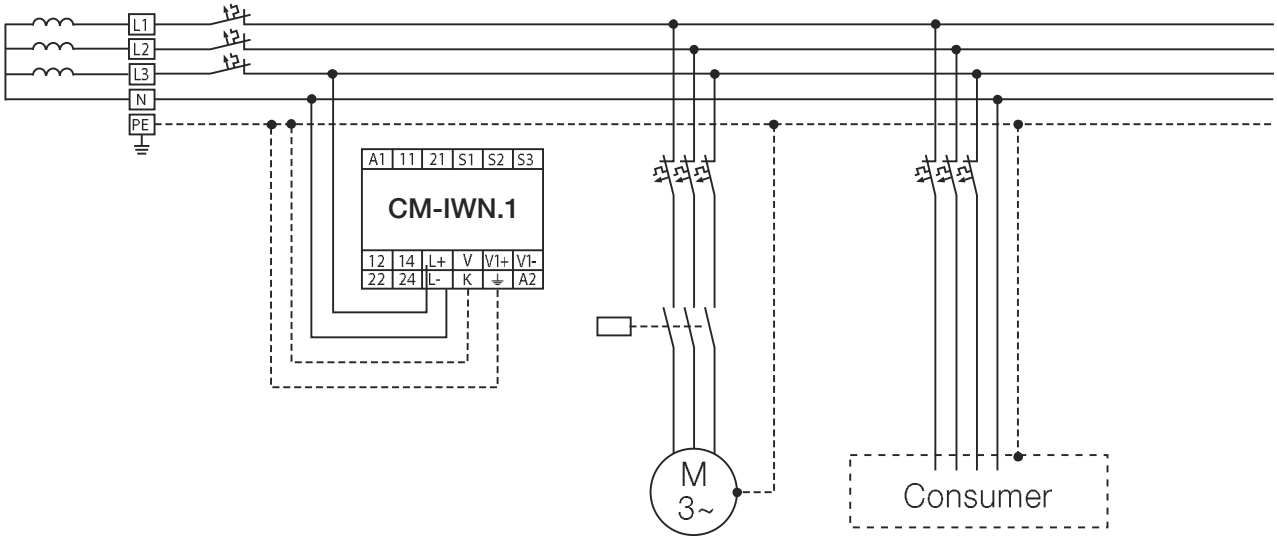
The first letter indicates the connection between earth and the power-supply equipment (generator or transformer):
T: direct connection of a point with earth (Latin: terra)
I: no point is connected with earth (insulation), except perhaps via a high impendance

The second letter indicates the connection between earth and the electrical device being supplied:
T: direct connection of a point with earth
N: direct connection to neutral at the origin of installation, which is connected to the earth

IT supply systems

The IT system is supplied either by an isolation transformer or a voltage source, such as battery or a generator.
In this system no active conductor is directly connected to earth potential. The advantage of this is that only a small fault current can flow in case of an insulation fault. This current is essentially caused by the leakage capacitance of the system.
The fuse of the system or MCB does not respond, thus maintaining the voltage supply and therefore operation even in case of a phase-to-earth fault.

The high reliability of an IT system is guaranteed thanks to continous insulation monitoring.
The insulation monitoring device recognizes insulation faults as they develop, and immediately reports that the value has fallen below the minimum. This prevents operational interruptions caused by a second more severe insulation fault.



Insulation monitoring relays for unearthed supply systems
Application / monitoring function, Measuring principle

Application / monitoring function CM-IWS.2

The CM-IWS.2 serves to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems. The insulation resistance between system lines and system earth is measured. If this falls below the adjustable threshold values, the output relay de-energizes. The device can monitor control circuits (single-phase) and main circuits (3-phase). Supply systems with voltages U_n = 0-400 V AC (45-65 Hz) can be directly connected to the measuring inputs and their insulation resistance being monitored. For systems with voltages above 400 V AC the insulation monitoring relay CM-IWN.1 with or without the coupling unit CM-IVN can be used.

Measuring principle CM-IWS.2

A superimposed DC measuring signal is used for measurement. From the superimposed DC measuring voltage and its resultant current the value of the insulation resistance of the system to be monitored is calculated.

Application / monitoring function CM-IWS.1

The CM-IWS.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 value, the output relay de-energizes. The device can monitor control circuits (single-phase) and main circuits (3-phase). Supply systems with voltages U_n = 0-250 V AC (15-400 Hz) or 0-300 V DC can be directly connected to the measuring inputs and their insulation resistance being monitored. For systems with voltages above 250 V AC and 300 V DC the insulation monitoring relay CM-IWN.x with or without the coupling unit CM-IVN can be used.

Measuring principle CM-IWS.1

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 relay de-energizes. This measuring principle is also suitable for the detection of symmetrical insulation faults.

Application / monitoring function CM-IWN.1 / CM-IWN.5

The CM-IWN.x 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.x voltage range.

Measuring principle CM-IWN.1 / CM-IWN.5

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.

Application / monitoring function CM-IVN

The coupling unit CM-IVN is designed to extend the nominal voltage range of the insulation monitoring relay CM-IWN.1 up to 690 V AC and 1000 V DC. The coupling unit can be connected to the system to be monitored by means of the terminals VL+ and VL-. The terminal V⏚ has to be connected to the earth potential. The terminals L+, V1+, L-, V1-, VS and VE have to be connected to the CM-IWN.1 as shown in the connection diagrams below. Supply systems with voltages U_n = 0-690 V AC (15-400 Hz) or 0-1000 V DC can be connected.

Measuring principle CM-IVN

With CM-IWN.1 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.

Insulation monitoring relays for unearthed supply systems
Characteristics

Characteristics CM-IWS.2

- For monitoring the insulation resistance of unearthed IT systems up to U_n = 400 V AC
- Rated control supply voltage 24-240 V AC/DC
- Measuring principle with superimposed DC voltage
- One measuring range 1-100 kΩ
- Precise adjustment of the threshold value in 1 kΩ steps
- Fault storage / latching configurable by control input
- 1 c/o contact, closed-circuit principle
- 22.5 mm [0.89 in] width
- 3 LEDs for status indication

Characteristics CM-IWS.1

- For monitoring the insulation resistance of unearthed IT systems up to U_n = 250 V AC and 300 V DC
- Rated control supply voltage 24-240 V AC/DC
- Prognostic measuring principle with superimposed square wave signal
- One measuring range 1-100 kΩ
- Precise adjustment of the threshold value in 1 kΩ steps
- Interrupted wire detection
- Fault storage / latching configurable by control input
- 1 c/o [SPDT] contact, closed-circuit principle
- 22.5 mm [0.89 in] width
- 3 LEDs for status indication

Characteristics CM-IWN.1, CM-IWN.4, CM-IWN.5, CM-IWN.6

- For monitoring the insulation resistance of unearthed IT systems up to U_n = 400 V AC and 600 V DC
- CM-IWN.4,5,6: 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 Ran1/R1[1] (final switch-off) and Ran2/R21) (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
- System leakage capacitance: 20 µF, 500 µF, 1000 µF or 2000 µF

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

Characteristics CM-IVN

- Expansion of the nominal voltage range of the insulation monitoring relay CM-IWN.1 for monitoring the insulation resistance of unearthed IT systems up to 690 V AC and 1000 V DC
- According to IEC/EN 61557-8 “Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems"
- Passive device, no supply voltage needed
- 45 mm [1.77 in] width

Insulation monitoring relays for unearthed supply systems
Selection and conversion table

2

	Existing range		New range [1]	
	Type	Order number	Type	Order number
	CM-IWS.2	**1SVR 630 670 R0200**	CM-IWS.2S	1SVR 730 670 R0200
			CM-IWS.2P	1SVR 740 670 R0200
	CM-IWS.1	**1SVR 630 660 R0100**	CM-IWS.1S	1SVR 730 660 R0100
			CM-IWS.1P	1SVR 740 660 R0100
	CM-IWN.1	**1SVR 650 660 R0200**	CM-IWN.1S	1SVR 750 660 R0200
			CM-IWN.1P	1SVR 760 660 R0200
			CM-IWN.4S	1SVR 750 660 R0300
			CM-IWN.4P	1SVR 760 660 R0300
			CM-IWN.5S	1SVR 750 660 R0400
			CM-IWN.5P	1SVR 760 660 R0400
			CM-IWN.6S	1SVR 750 660 R0500
			CM-IWN.6P	1SVR 760 660 R0500
Rated control supply voltage U_s				
24 - 240 VAC/DC	■	■	■	■	■	■	■	■	■	■	■	■
Measuring voltages												
250 V AC (L-PE)			■	■								
400 V AC (L-PE)	■	■			■	■	■	■	■	■	■	■
690 V AC (L-PE)					■ [2]	■ [2]	■ [2]	■ [2]	■ [2]	■ [2]	■ [2]	■ [2]
300 V DC (L-PE)			■	■								
600 V DC (L-PE)					■	■	■	■	■	■	■	■
1000 V DC (L-PE)					■ [2]	■ [2]	■ [2]	■ [2]	■ [2]	■ [2]	■ [2]	■ [2]
Measuring range												
1 - 100 kΩ	■	■	■	■	■	■	■	■	■	■	■	■
2 - 200 kΩ					■	■	■	■	■	■	■	■
System leakage capacitance, max.												
10 µF	■	■	■	■								
20 µF					■	■						
500 µF							■	■				
1000 µF									■	■		
2000 µF											■	■
1 c/o	■	■	■	■								
1 x 2 c/o or 2 x 1 c/o					■	■	■	■	■	■	■	■
Working principle												
open circuit principle	■	■	■	■								
open or closed principle adjustable					■	■	■	■	■	■	■	■
Test												
Front face button or control input	■	■	■	■	■	■	■	■	■	■	■	■
Reset												
Front face button or control input	■	■	■	■	■	■	■	■	■	■	■	■
Fault storage / latching configurable	■	■	■	■	■	■	■	■	■	■	■	■
Non voltage storage configurable	■	■	■	■	■	■	■	■	■	■	■	■
Interrupted wire detection					■	■	■	■	■	■	■	■
Threshold values configurable	1	1	1	1	2	2	2	2	2	2	2	2
[2] With coupling module CM-IVN	Existing range [3]				New range [1]							
screw version	**1SVR650669R9400**				CM-IVN.S: 1SVR750669R9400							
push-in version					CM-IVN.P: 1SVR760669R9400							

[1] available 4th quarter 2012

[2] with coupling module CM-IVN

[3] Existing range will be available until release of new generation

Insulation monitoring relays for unearthed supply systems
Ordering details



CM-IWS.2



CM-IWS.1



CM-IWN.1



CM-IVN

Description

The high reliability of an IT system is guaranteed thanks to continuous insulation monitoring. An insulation monitoring device recognizes insulation faults as they develop, and immediately reports that the value has fallen below the minimum. This prevents operational interruption caused by a second, more severe insulation fault.
ABB developed a totally new range of insulation monitors for AC, DC or mixed AC/DC IT Systems up to 690 V AC or 1000 V DC. With only 4 devices most standard applications can be served. Additionally a version for solar applications with increased earth leakage capacitance has been added.

Ordering details - Existing range

Rated control supply voltage = measuring voltage	Nominal voltage U_n of the distribution system to be monitored	System leakage capacitance, max.	Adjustment range of the specified response value R_{an} (threshold)	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC	0-250 V AC / 0-300 V DC	10 µF	1-100 kΩ	CM-IWS.1	1SVR630660R0100		0.133 (0.293)
24-240 V AC/DC	0-400 V AC	10 µF	1-100 kΩ	CM-IWS.2	1SVR630670R0200		0.127 (0.280)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	20 µF	1-100 kΩ 2-200 kΩ (activated / de-activated by DIP-switch)	CM-IWN.1	1SVR650660R0200		0.231 (0.509)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	1000 µF		CM-IWN.5	1SVR650660R0400		0.231 (0.509)
Passive device, no control supply voltage needed	0-690 V AC / 0-1000 V DC			CM-IVN	1SVR650669R9400		0.169 (0.373)

Ordering details - New range available at 4th quarter of 2012

Rated control supply voltage = measuring voltage	Nominal voltage U_n of the distribution system to be monitored	System leakage capacitance, max.	Adjustment range of the specified response value R_{an} (threshold)	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC	0-250 V AC / 0-300 V DC	10 µF	1-100 kΩ	CM-IWS.1S	1SVR730660R0100		0.148 (0.326)
				CM-IWS.1P	1SVR740660R0100		0.137 (0.302)
24-240 V AC/DC	0-400 V AC	10 µF	1-100 kΩ	CM-IWS.2S	1SVR730670R0200		0.141 (0.311)
				CM-IWS.2P	1SVR740670R0200		0.130 (0.287)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	20 µF	1-100 kΩ 2-200 kΩ (activated / de-activated by DIP-switch)	CM-IWN.1S	1SVR750660R0200		0.241 (0.531)
				CM-IWN.1P	1SVR760660R0200		0.217 (0.478)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	500 µF		CM-IWN.4S	1SVR750660R0300		0.241 (0.531)
				CM-IWN.4P	1SVR760660R0300		0.217 (0.478)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	1000 µF		CM-IWN.5S	1SVR750660R0400		0.241 (0.531)
				CM-IWN.5P	1SVR760660R0400		0.217 (0.478)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	2000 µF		CM-IWN.6S	1SVR760660R0500		0.241 (0.531)
				CM-IWN.6P	1SVR760660R0500		0.217 (0.478)

Insulation monitoring relays for unearthed supply systems
Operating state indication

LEDs, status information and fault messages CM-IWS.2

Operational state	LED U (green)	LED F (red)	LED R (yellow)
Start-up		OFF	OFF
No fault		OFF	
Insulation fault (below threshold value)			OFF
Invalid measuring result			OFF
Internal system fault	OFF		OFF
Test function		OFF	OFF
No fault after fault storage1)		2)	

1) 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.

2) Depending on the fault.

LEDs, status information and fault messages CM-IWS.1

Operational state	LED U (green)	LED F (red)	LED R (yellow)
Start-up		OFF	OFF
No fault		OFF	
Insulation fault (below threshold value)			OFF
KE/⏚ wire interruption			OFF
System leakage capacitance too high / invalid measurement result			OFF
Internal system fault	OFF		OFF
Test function		OFF	OFF
No fault after fault storage1)		2)	

1) 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.

2) Depending on the fault.

LEDs, status information and fault messages CM-IWN.1, CM-IWN.4, CM-IWN.5, CM-IWN.6

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

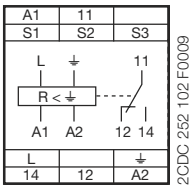
2) Possible faulty setting: The threshold value for final switch-off is set at a higher value than the threshold value for prewarning.

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

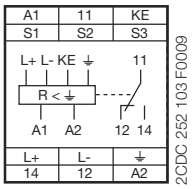
Insulation monitoring relays for unearthed supply systems
Connection diagrams, DIP switches

Connection diagram CM-IWS.2



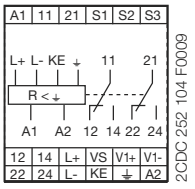
A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L	Measuring circuit/input, system connection
⏚	Measuring circuit/input, earth connections
11-12/14	Output relay, closed-circuit principle

Connection diagram CM-IWS.1



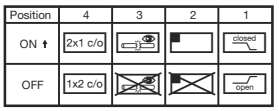
A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L+, L–	Measuring circuit/input, system connection
⏚, KE	Measuring circuit/input, earth connections
11-12/14	Output relay, closed-circuit principle

Connection diagram CM-IWN.1, 4, 5, 6



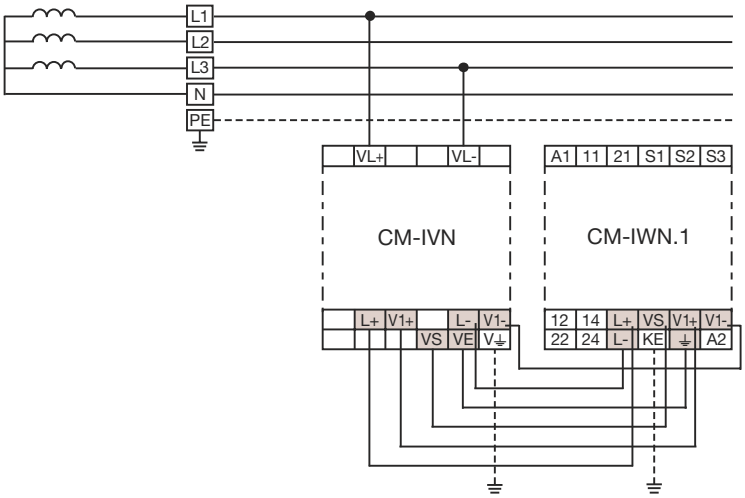
A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L+, L–	Measuring circuit/input, system connection
⏚, KE	Measuring circuit/input, earth connections
VS, V1+, V1-	Connections for the coupling unit (if used)
11-12/14	Output relay 1, open- or closed-circuit principle
21-22/24	Output relay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

DIP switches of CM-IWN.1, 4, 5, 6



	ON	OFF (default)
DIP switch 1 Operating principle of the output relays	Closed-circuit principle If closed-circuit principle is selected, the output relays de-energize in case a fault is occuring. In non-fault state the relays are energized.	Open-circuit principle If open-circuit principle is selected, the output relays energize in case a fault is occuring. In non-fault state the relays are de-energized.
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 monitoring relays the wires connected to + and KE for interruptions.	Interrupted wire detection de-activated With this configuration the inter-rupted 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.

Connection diagram CM-IVN



VE	Connection to CM-IWN.1 - ⏚
VS	Connection to CM-IWN.1 - VS
L+	Connection to CM-IWN.1 - L+
V1+	Connection to CM-IWN.1 - V1+
L-	Connection to CM-IWN.1 - L-
V1-	Connection to CM-IWN.1 - V1-
VL+, VL-	Measuring circuit / Measuring input Connection to the system
V⏚	Measuring circuit / Measuring input Connection to earth

Insulation monitoring relays for unearthed supply systems
Technical data

2

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

		CM-IWS.2	CM-IWS.1	CM-IWN.1, 4, 5, 6
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	30 mA / 0.7 VA	35 mA / 0.9 VA	55 mA / 1.3 VA
	115 V AC	12 mA / 1.4 VA	17 mA / 2.0 VA	20 mA / 2.3 VA
	230 V AC	12 mA / 2.8 VA	14 mA / 3.2 VA	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		
Input circuit - Measuring circuit		L, ⏚	L+, L-, ⏚, KE	L+, L-, ⏚, KE
Monitoring function		insulation resistance monitoring of IT systems (IEC/EN 61557-8)		
Measuring principle		superimposed DC voltage	prognostic measuring principle with superimposed square wave signal	
Nominal voltage U_n of the distribution system to be monitored		0-400 V AC	0-250 V AC / 0-300 V DC	400 V AC / 0-600 V DC
Voltage range of the distribution system to be monitored		0-460 V AC (tolerance +15 %)	0-287.5 V AC / 0-345 V DC (tolerance +15 %)	0-460 V AC / 0-690 V DC (tolerance +15 %)
Rated frequency f_N of the distribution system to be monitored		50-60 Hz	DC or 15-400 Hz	DC or 15-400 Hz
System leakage capacitance C_e	max.	10 µF		CM-IWN.1 20 µF CM-IWN.5 1000 µF
Tolerance of the rated frequency f_N		45-65 Hz	13.5-440 Hz	13.5-440 Hz
Extraneous DC voltage U_{fg} (when connected to an AC system)	max.	none	290 V DC	460 V DC
Number of possible response / threshold values		1		2
Adjustment range of the specified response value R_{an} (threshold)	min.-max.	1-100 kΩ		–
	min.-max. R1	–		1-100 kΩ
	min.-max. R2	–		2-200 kΩ (activated / de-activated by DIP-switch)
Adjustment resolution		1 kΩ		
	R1	1 kΩ		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 1-10 kΩ R_F	±0.5 kΩ		–
	at 10-100 kΩ R_F	±6 %		–
	at 1-15 kΩ R_F	–		±1 kΩ*
	at 15-200 kΩ R_F	–		±8 %
Hysteresis related to the threshold value		25 %; min. 2 kΩ		
Internal impedance Z	at 50 Hz	135 kΩ	100 kΩ	155 kΩ
Internal DC resistance R_i		185 kΩ	115 kΩ	185 kΩ
Measuring voltage U_m		15 V	22 V	24 V
Tolerance of measuring voltage U_m		+10 %		
Measuring current I_m	max.	0.1 mA	0.3 mA	0.15 mA
Response time t_{ae}				
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 W / K		
	at 10-100 kΩ R_F	0.05 % / K		–
	at 10-200 kΩ R_F	–		0.05 % / K
Transient over voltage protection (⏚ - terminal)		Z-diode	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 ± 5 %	≤ 24 V DC	
Indication of operational states				
Control supply voltage		LED U (green)*		
Fault message		LED F (red)*		
Relay status		LED R (yellow)*		
Output circuits				

*in combination with CM-IVN ±1.5 kΩ

Insulation monitoring relays for unearthed supply systems
Technical data

		CM-IWS.2	CM-IWS.1	CM-IWN.1, 4, 5, 6
Kind of output		relay, 1 c/o (SPDT) contact		2 x 1 or 1 x 2 c/o (SPDT) contacts configurable
Operating principle		closed-circuit principle[1]		open- or closed circuit principle[1] confi gurable
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 data sheet		
Rated operational current I_e (IEC/EN 60947-5-1)	AC12 (resistive) at 230 V	4 A		
	AC15 (inductive) at 230 V	3 A		
	DC12 (resistive) at 24 V	4 A		
	DC13 (inductive) at 24 V	2 A		
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300, pilot duty 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-circuit protection	n/c contact	6 A fast-acting		
	n/o contact	10 A fast-acting		
Conventional thermal current I_{th} (IEC/EN 60947-1)		4 A		
General data [1]				
Duty time		100 %		
Dimensions (W x H x D)		22.5 x 78 x 100 mm [0.89 x 3.07 x 3.94 in]		45 x 78 x 100 mm [1.78 x 3.07 x 3.94 in]
Weight	gross weight	0.149 kg [0.328 lb]	0.163 kg [0.359 lb]	0.258 kg [0.569 lb]
	net weight	0.127 kg [0.280 lb]	0.133 kg [0.293 lb]	0.231 kg [0.509 lb]
Mounting		DIN rail (EN 60715), snap-on mounting without any tool		
Mounting position		any		
Minimum distance to other units	vertical	not necessary		
	horizontal	10 mm [0.4 in] at U_n > 240 V	not necessary	10 mm [0.4 in] at U_n > 400 V
Degree of protection	housing / terminal	IP50 / IP20		
Electrical connection [1]				
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 [1]				
Ambient temperature ranges	operation / storage / transport	-25...+60 °C/-40...+85 °C/-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				

[1] The products with new order codes (1SVR 7x0 xxx xxx) vary in different technical data. Please refer to page: 2/66

Insulation monitoring relays for unearthed supply systems
Technical data

2

		CM-IWS.2	CM-IWS.1	CM-IWN.1, 4, 5, 6
Rated impulse withstand voltage U_{imp} between all isolated circuits (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply / measuring circuit	6 kV		
	supply / output circuit	6 kV		
	measuring / output circuit	6 kV		
	output 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 (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply / measuring circuit	400 V	300 V	600 V
	supply / output circuit	300 V		
	supply / measuring circuit	400 V	300 V	600 V
	output 1 / output circuit 2	-	-	300 V
Basis isolation for rated control supply voltage (IEC/EN 60664-1, VDE 0110-1)	supply / measuring circuit	400 V AC / 300 V DC	250 V AC / 300 V DC	400 V AC / 600 V DC
	supply / output circuit	250 V AC / 300 V DC		
	measuring / output circuit	400 V AC / 300 V DC	250 V AC / 300 V DC	400 V AC / 600 V DC
	output 1 / output 2	250 V AC / 300 V DC		
Protective separation (IEC/EN 61140)	supply / output circuit	250 V AC / 250 V DC		
	supply / measuring circuit	250 V AC / 250 V DC		
	measuring / output circuit	250 V AC / 250 V DC		
Test voltage between all isolated circuits, routine test (IEC/EN 60255-5, IEC/EN 61010-1)	supply / output circuit	2.32 kV, 50 Hz, 2 s		
	supply / measuring circuit	2.32 kV, 50 Hz, 2 s		
	measuring / output circuit	2.2 kV, 50 Hz, 1 s		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 compability				
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		
		IEC/EN 61000-6-3, IEC/EN 61000-6-4		
high-frequency radiated	IEC/CISPR 22, EN 50022	Class B		
high-frequency conducted	IEC/CISPR 22, EN 50022	Class B		

Insulation monitoring relays for unearthed supply systems
Technical data - New housing range

General data		CM-IWS.1, 2 S/P	CM-IWN.1, 4, 5, 6 S/P
Dimensions (W x H x D)	product dimensions	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)
	packaging dimensions	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)
Weight	CM-IWS.1P	0.137 (0.302)	
	CM-IWS.1S	0.148 (0.326)	
	CM-IWS.2P	0.130 (0.287)	
	CM-IWS.2S	0.141 (0.311)	
	CM-IWN.1S		0.241 (0.531)
	CM-IWN.1P		0.217 (0.478)
	CM-IWN.4S		0.241 (0.531)
	CM-IWN.4P		0.217 (0.478)
	CM-IWN.5S		0.241 (0.531)
	CM-IWN.5P		0.217 (0.478)
	CM-IWN.6S		0.241 (0.531)
	CM-IWN.6P		0.217 (0.478)
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool	
Mounting position		any	
Minimum distance to other units	vertical / horizontal	not necessary / not necessary	
Material of housing		UL 94 V-0	
Degree of protection	housing / terminals	IP50 / IP20	

Electrical connection		CM-IWS.1, CM-IWS.2, CM-IWN.1, 4, 5, 6 in new housing	
Wire size		Screw connection technology	Easy Connect Technology (Push-in)
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm² (1 x 20-14 AWG) 2 x 0.5-1.5 mm² (2 x 20-16 AWG)	2 x 0.5-1.5 mm² (2 x 20-16 AWG)
	rigid	1 x 0.5-4 mm² (1 x 20-12 AWG) 2 x 0.5-2.5 mm² (2 x 20-14 AWG)	2 x 0.5-1.5 mm² (2 x 20-16 AWG)
Stripping length		8 mm (0.32 in)	
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)	-

Insulation monitoring relays for unearthed supply systems
Technical data

Technical data - CM-IVN

Input circuit - Measuring circuit		VL+, VL-, V⏚
Function		expansion of the nominal voltage range of the insulation monitoring relay CM-IWN.1 to 690 V AC or 1000 V DC, max. length of connection cable 40 cm
Measuring principle		see CM-IWN.1
Nominal voltage U_n of the distribution system to be monitored		0-690 V AC / 0-1000 V DC
Voltage range of the distribution system to be monitored		0-793.5 V AC / 0-1150 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.	identical to that of the insulation monitoring relay used
Extraneous DC voltage U_{fg} (when connected to an AC system)	max.	793.5 V DC
Tolerance of the adjusted threshold value / Relative percentage uncertainty A at -5...+ 45 °C, U_s = 0-115 %, U_s = 85-110 %, f_N, f_s, C_e = 1µF	at 1-15 kΩ R_F	±1.5 kΩ
	at 15-200 kΩ R_F	±8 %
Internal impedance Z	at 50 Hz	195 kΩ
Internal DC resistance R_i		200 kΩ
Measuring voltage U_m		24 V
Tolerance of measuring voltage U_m		+10 %
Measuring current I_m		0.15 mA
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	0.200 kg [0.441 lb]
	net weight	0.169 kg [0.373 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 [0.4 in] at Un > 600 V
Degree of protection		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]
Max. length of connection cable to CM-IWN.1		40 cm
Environmental data		
Ambient temperature ranges	operation / storage / transport	-25...+60 °C / -40...+85 °C / -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)	input circuit / PE	8 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)	input circuit / PE	1000 V
Test voltage between all isolated circuits, routine test (IEC/EN 60255-5, IEC/EN 61010-1)	input circuit / PE	3.3 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 compability		
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 50022	Class B
high-frequency conducted	IEC/CISPR 22, EN 50022	Class B

Insulation monitoring relays for unearthed supply systems
Notes