

Insulation monitoring relay CM-IWS.2

For unearthed AC systems up to $U_n = 400$ V AC

The CM-IWS.2 serves to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems with a voltage up to 400 V AC. The CM-IWS.2 can be configured to the requirements of the applications and therefore used multi-functional.

The device is available with two different terminal versions. You can choose between the proven screw connection technology (double-chamber cage connection terminals) and the completely tool-free Easy Connect Technology (push-in terminals).



Characteristics

- For monitoring the insulation resistance of unearthed IT systems up to $U_n = 400$ V AC
- 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
- Measuring principle with superimposed DC voltage
- One measuring range 1-100 k Ω
- Precise adjustment of the threshold value in 1 k Ω steps
- Fault storage / latching configurable by control input
- Precise adjustment by front-face operating controls
- Screw connection technology or Easy Connect Technology available
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting on DIN rail as well as demounting
- 1 c/o (SPDT) contact, closed-circuit principle
- 22.5 mm (0.89 in) width
- 3 LEDs for the indication of operational states

Approvals / Marks



Classifications:

EN 50155, IEC 60571, NF F 16-101/102, EN 45545-2

EN 50155, IEC 60571

| Temp. class | Voltage supply | | | | Vibration and shock acc to IEC/EN 61373 | Coated pcb. |
|-------------|----------------|----|----|----|---|-------------|
| | S1 | S2 | C1 | G2 | | |
| T3 | ■ | ■ | ■ | ■ | Cat 1, Class B | no |

NF F 16-101/102

| Flammability index | Opticity and toxicity of smoke index | | EN 45545-2 Risk level achieved |
|--------------------|--------------------------------------|----|--------------------------------|
| | F2 | F2 | |
| I2 | F2 | F2 | HL3 |

Order data

Insulation monitoring relay

| Type | Nominal voltage U_n of the distribution system to be monitored | Rated control supply voltage | Connection technology | Order code |
|-----------|--|------------------------------|-----------------------|--------------------|
| CM-IWS.2P | 0-400 V AC | 24-240 V AC/DC | Push-in terminals | 1SVR 740 670 R0200 |
| CM-IWS.2S | | | Screw type terminals | 1SVR 730 670 R0200 |

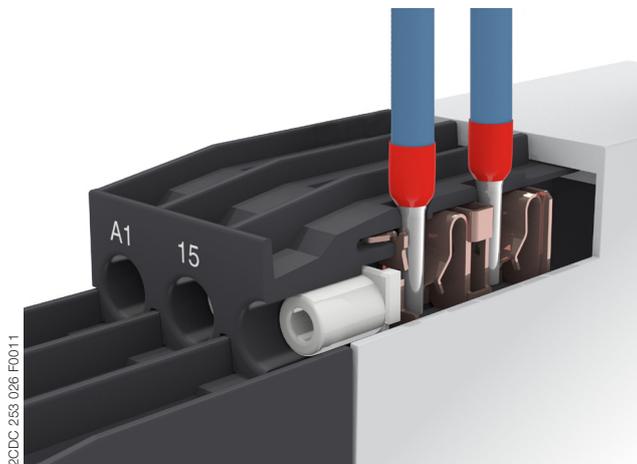
Accessories

| Type | Description | Order code |
|--------|---|--------------------|
| ADP.01 | Adapter for screw mounting | 1SVR 430 029 R0100 |
| MAR.01 | Marker label for devices without DIP switches | 1SVR 366 017 R0100 |
| COV.11 | Sealable transparent cover | 1SVR 730 005 R0100 |

Connection technology

Maintenance free Easy Connect Technology with push-in terminals

Type designation CM-xxS.yyP

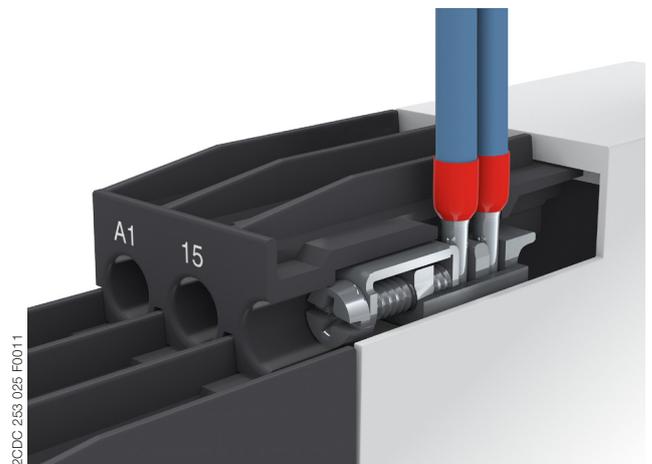


Push-in terminals

- Tool-free connection of rigid and flexible wires with wire end ferrule according to DIN 46228-1-A, DIN 46228-4-E
Wire size: 2 x 0.5-1.5 mm², (2 x 20 - 16 AWG)
- Easy connection of flexible wires without wire end ferrule by opening the terminals
- No retightening necessary
- One operation lever for opening both connection terminals
- For triggering the lever and disconnecting of wires you can use the same tool (Screwdriver according to DIN ISO 2380-1 Form A 0.8 x 4 mm (0.0315 x 0.157 in), DIN ISO 8764-1 PZ1 ø 4.5 mm (0.177 in))
- Constant spring force on terminal point independent of the applied wire type, wire size or ambient conditions (e. g. vibrations or temperature changes)
- Opening for testing the electrical contacting
- Gas-tight

Approved screw connection technology with double-chamber cage connection terminals

Type designation CM-xxS.yyS



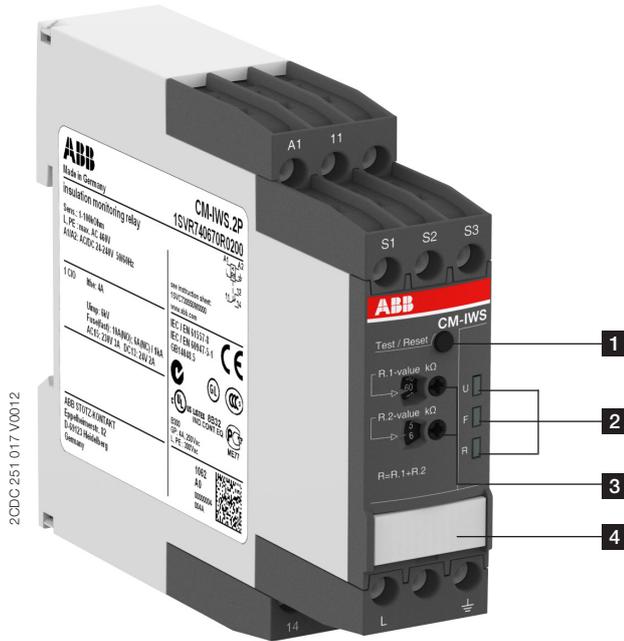
Double-chamber cage connection terminals

- Terminal spaces for different wire sizes:
fine-strand with/without wire end ferrule:
1 x 0.5-2.5 mm² (2 x 20 - 14 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)
- One screw for opening and closing of both cages
- Pozidrive screws for pan- or crosshead screwdrivers according to DIN ISO 2380-1 Form A 0.8 x 4 mm (0.0315 x 0.157 in), DIN ISO 8764-1 PZ1 ø 4.5 mm (0.177 in)

Both the Easy Connect Technology with push-in terminals and screw connection technology with double-chamber cage connection terminals have the same connection geometry as well as terminal position.

Functions

Operating controls



1 Test and reset button

2 Indication of operational states

U: green LED - control supply voltage

F: red LED - fault message

R: yellow LED - relay status

3 Configuration and setting

Front-face rotary switches for threshold value adjustment:

R.1 for R1 tens figures:

0, 10, 20, 30, 40, 50, 60, 70, 80, 90 kΩ in ten kΩ steps

R.2 for R1 units figures:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10 kΩ in one kΩ steps

4 Marker label for devices without DIP switches

Application / monitoring function

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.x with or without the coupling unit CM-IVN can be used.

Measuring principle

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.

Operating mode

The system to be monitored is connected to terminal L. The earth potential is connected to terminal \perp .

The device operates according to the closed-circuit principle (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 relay energizes.

If the measured value drops below the set threshold value, the output relay de-energizes. If the measured value exceeds the threshold value plus hysteresis, the output relay re-energizes.

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

Test function

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

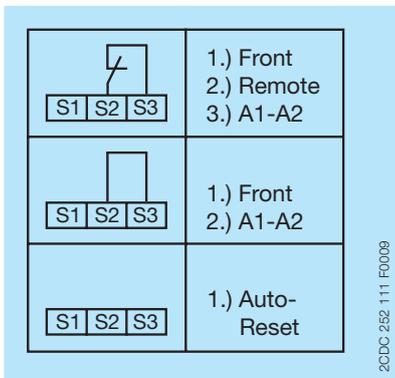
By pressing the front-face combined test/reset button a system test routine is executed. The output relay remains de-energized as long as the test/reset button is pressed, the control contact S1-S3 is closed or the test functions are processed.

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

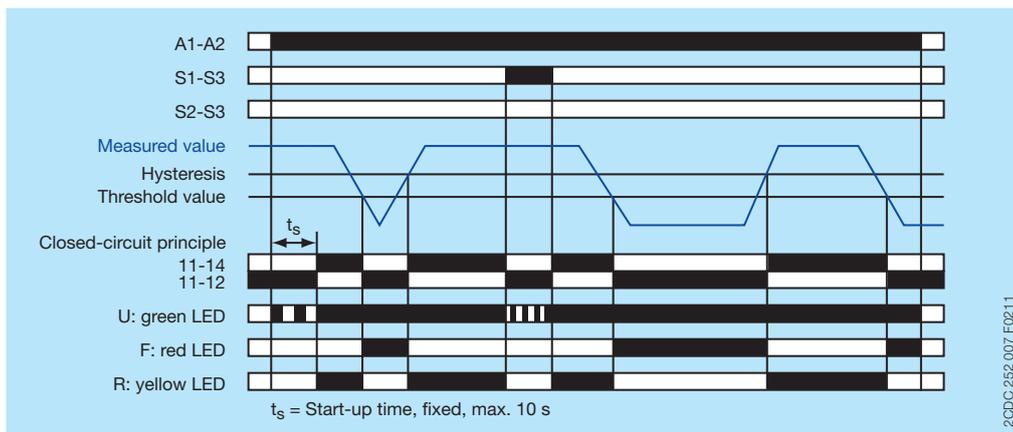
The output relay remains de-energized and only energizes after the combined test/reset button is pressed or after the remote reset (terminals S2-S3) is activated, and when the insulation resistance is higher than the set threshold value plus hysteresis.



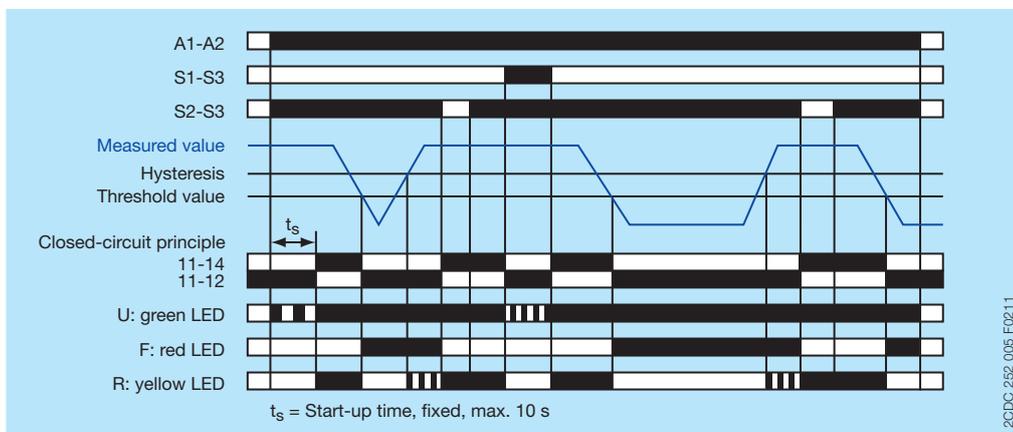
Function descriptions/diagrams

□ 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



Insulation resistance monitoring with fault storage, manual reset

Connection and wiring

Connection diagram

| | | |
|----|----|----|
| A1 | 11 | |
| S1 | S2 | S3 |

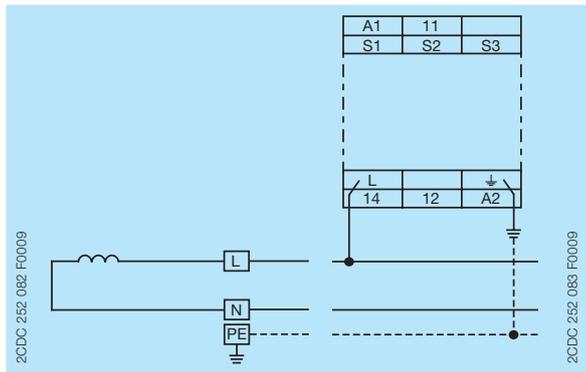
| | | |
|----|----|----|
| L | | |
| 14 | 12 | A2 |

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

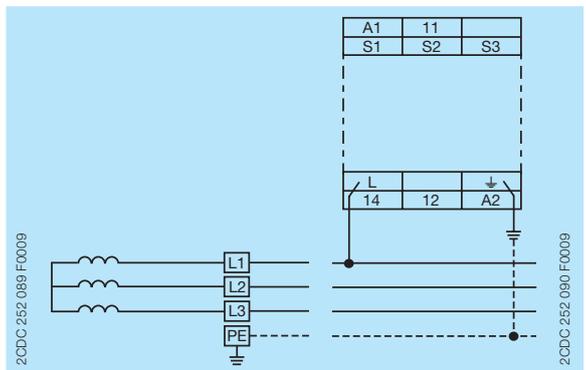
Wiring diagrams

L can be connected to any of the conductors.

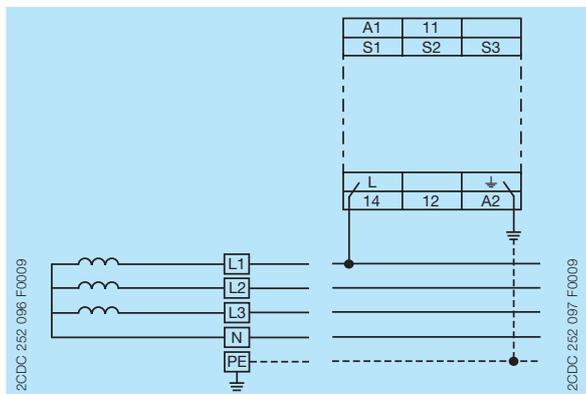
$U_n \leq 400$ V AC



2-wire AC system



3-wire AC system



4-wire AC system

Configuration and settings

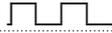
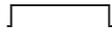
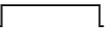
Rotary switches R.1 and R.2 (threshold value)

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

With the R.1 rotary switch the tens figure is set and with the R.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 k Ω .

Operating state indication

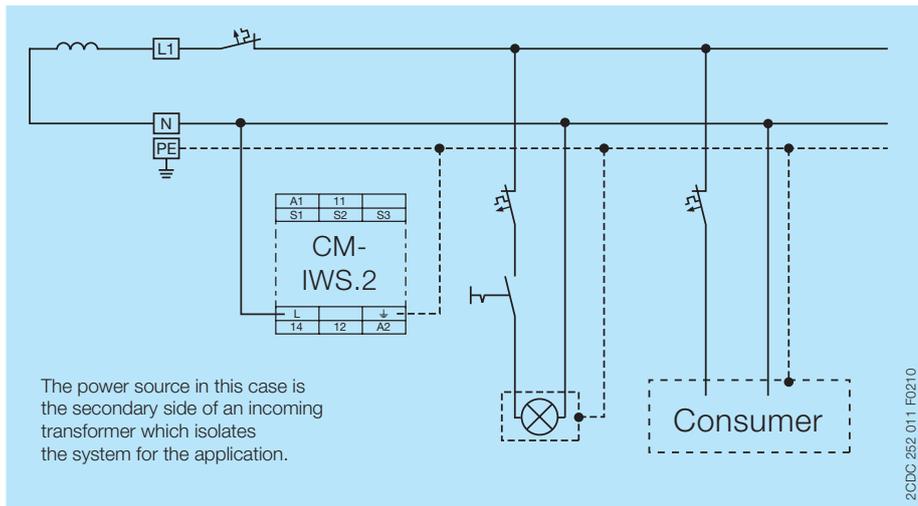
LEDs, status information and fault messages

| Operational state | LED U (green) | LED F (red) | LED R (yellow) |
|--|---|---|---|
| Start-up |  | OFF | OFF |
| No fault |  | OFF |  |
| Insulation fault (below threshold value) |  |  | OFF |
| System leakage capacitance during start-up too high ²⁾ |  |  | OFF |
| Invalid measuring result |  |  | OFF |
| Internal system fault | OFF |  | OFF |
| Test function |  | OFF | OFF |
| No fault after fault storage ¹⁾ |  | ²⁾ |  |

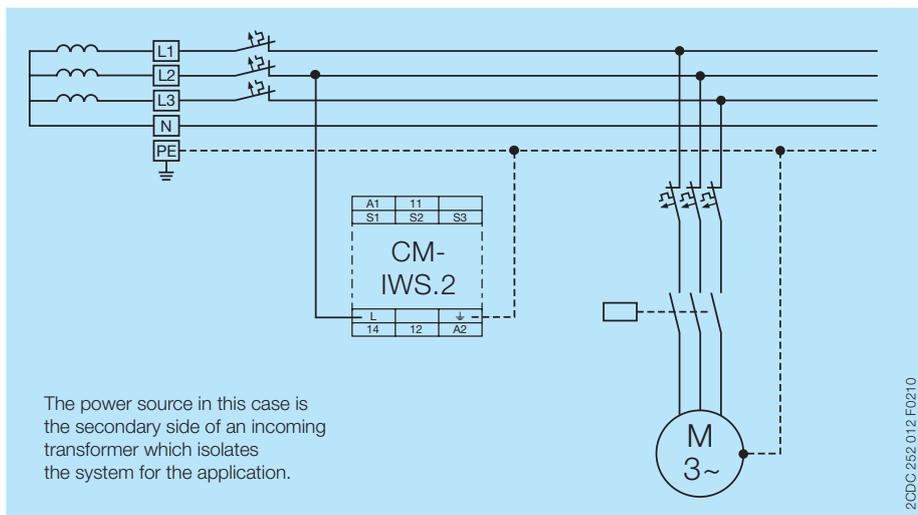
¹⁾ The device has triggered after an insulation fault. The fault has been stored and the insulation resistance has returned to a higher value than the threshold value plus hysteresis.

²⁾ Depending on the fault.

Application examples



Earth fault / insulation resistance monitoring of an unearthed 2-wire IT AC system



Earth fault / insulation resistance monitoring of a 4-wire IT AC system

Technical data

Data at $T_a = 25\text{ °C}$ 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 | 30 mA / 0.7 VA |
| | 115 V AC | 12 mA / 1.4 VA |
| | 230 V AC | 12 mA / 2.8 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 | max. | 10 s |

| Input circuit - Measuring circuit | L, \perp | |
|---|---|--|
| Monitoring function | insulation resistance monitoring of IT systems (IEC/EN 61557-8) | |
| Measuring principle | superimposed DC voltage | |
| Nominal voltage U_n of the distribution system to be monitored | 0-400 V AC | |
| Voltage range of the distribution system to be monitored | 0-460 V AC (tolerance +15 %) | |
| Rated frequency f_N of the distribution system to be monitored | 50-60 Hz | |
| Tolerance of the rated frequency f_N | 45-65 Hz | |
| System leakage capacitance C_e | max. | 10 μ F |
| Extraneous DC voltage U_{ig} (when connected to an AC system) | none | |
| Number of possible response / threshold values | 1 | |
| Adjustment range of the specified response value R_{an} (threshold) | min.-max. | 1-100 k Ω |
| Adjustment resolution | 1 k Ω | |
| Tolerance of the adjusted threshold value / Relative percentage uncertainty A | at 1-10 k Ω R_F (yellow marked scale) | $\geq 15\%$; max $\pm 0.5\text{ k}\Omega$ |
| | at 10-100 k Ω R_F | $\pm 6\%$ |
| at $-5...+45\text{ °C}$, $U_n = 0-115\%$, $U_s = 85-110\%$, $f_N, f_s, C_e = 1\mu\text{F}$ | | |
| Hysteresis related to the threshold value | 25 %; min. 2 k Ω | |
| Internal impedance Z_i | at 50 Hz | 135 k Ω |
| Internal DC resistance R_i | 185 k Ω | |
| Measuring voltage U_m | 15 V | |
| Tolerance of measuring voltage U_m | +10 % | |
| Measuring current I_m | max. | 0.1 mA |
| Response time t_{an} | $0.5 \times R_{an}$ and $C_e = 1\mu\text{F}$ | max. 10 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 k Ω R_F | 5 Ω / K |
| | at 10-100 k Ω R_F | 0.05 % / K |
| Transient overvoltage protection (\perp - terminal) | Z-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 \pm 5% |

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 6.

| Operating elements and controls | |
|--|--|
| Adjustment of threshold value R_{an} | R.1 rotary switch, 10 k Ω steps for the tens figure |
| | R.2 rotary switch, 1 k Ω steps for the units figure |

Output circuits

| | | |
|--|--|---|
| Kind of output | relay, 1 c/o (SPDT) contact | |
| Operating principle | closed-circuit principle ¹⁾ | |
| Contact material | AgNi alloy, Cd free | |
| Rated operational voltage | 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 11 | |
| Rated operational current I_e | AC-12 (resistive) at 230 V | 4 A |
| | AC-15 (inductive) at 230 V | 3 A |
| | DC-12 (resistive) at 24 V | 4 A |
| | DC-13 (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 phi 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 | AC-12, 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} | | 4 A |

¹⁾ Closed-circuit principle: Output relay(s) de-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) | product dimensions | 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) |
| Weight | | Screw connection technology |
| | | Easy Connect Technology (Push-in) |
| | net weight | 0,141 kg (0,311 lb) |
| | gross weight | 0,166 kg (0,366 lb) |
| Mounting | DIN rail (IEC/EN 60715), snap-on mounting without any tool | |
| Mounting position | any | |
| Minimum distance to other units | not necessary | |
| Material of housing | UL 94 V-0 | |
| Degree of protection | housing | IP50 |
| | terminals | IP20 |

Electrical connection

| | | Screw connection technology | Easy Connect Technology (Push-in) |
|---------------------|---|--|--|
| Connecting capacity | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm ² (1 x 18-14 AWG) | 2 x 0.5-1.5 mm ² (2 x 18-16 AWG) |
| | | 2 x 0.5-1.5 mm ² (2 x 18-16 AWG) | |
| | rigid | 1 x 0.5-4 mm ² (1 x 20-12 AWG) | 2 x 0.5-1.5 mm ² (2 x 20-16 AWG) |
| | | 2 x 0.5-2.5 mm ² (2 x 20-14 AWG) | |
| Stripping length | | 8 mm (0.32 in) | |
| Tightening torque | | 0.6 - 0.8 Nm (7.08 lb.in) | - |

Environmental data

| | | |
|----------------------------|-------------------|---|
| Ambient temperature ranges | operation | -25...+60 °C (-13...+140 °F) |
| | storage | -40...+85 °C (-40...+185 °F) |
| | transport | -40...+85 °C (-40...+185 °F) |
| Climatic class | 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 | | 25 Hz: 2.5 g |

Isolation data

| | | |
|---|------------------------------------|---------------------|
| Rated impulse withstand voltage U_{imp} | supply circuit / measuring circuit | 6 kV |
| | supply circuit / output circuit | 6 kV |
| | measuring circuit / output circuit | 6 kV |
| Rated insulation voltage U_i | supply circuit / measuring circuit | 400 V |
| | supply circuit / output circuit | 300 V |
| | measuring circuit / output circuit | 400 V |
| Basic insulation | supply circuit / measuring circuit | 400 V AC / 300 V DC |
| | supply circuit / output circuit | 250 V AC / 300 V DC |
| | measuring circuit / output circuit | 400 V AC / 300 V DC |
| Protective separation (IEC/EN 61140, EN 50178) | supply circuit / output circuit | 250 V AC / 250 V DC |
| | supply circuit / measuring circuit | 250 V AC / 250 V DC |
| | measuring circuit / output circuit | 250 V AC / 250 V DC |
| Pollution degree | | 3 |
| Overvoltage category | | III |

Standards / Directives

| | |
|-----------------------|--|
| Standards | IEC/EN 60947-5-1, IEC/EN 61557-1, IEC/EN 61557-8 |
| Low Voltage Directive | 2014/35/EU |
| EMC Directive | 2014/30/EU |
| RoHS Directive | 2011/65/EU |

Railway application standards

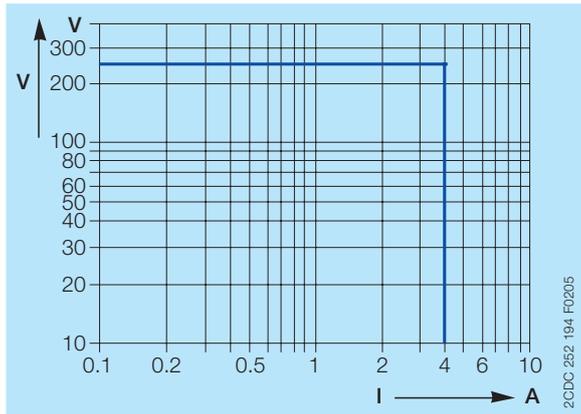
| | | |
|--|-------------------------|---------------------|
| EN 50155, IEC 60571 | temperature class | T3 |
| “Railway applications – Electronic equipment used on rolling stock” | supply voltage category | S1, S2, C1, C2 |
| IEC/EN 61373 | | Category 1, Class B |
| “Railway applications – Rolling stock equipment – Shock and vibration tests” | | |
| EN 45545-2 Railway applications – Fire protection on railway vehicles – part 2: Requirements for fire behavior of materials and components | | HL3 |
| | ISO 4589-2 | LOI 32.3 % |
| | NF X-70-100-1 | C.I.T. (T12) 0.45 |
| | EN ISO 5659-2 | Ds max (T10.03) 104 |
| NF F 16-101: Rolling stock. Fire behaviour. Materials choosing | | I2 / F2 |
| NF F 16-102: Railway rolling stock. Fire behaviour. Materials choosing, application for electric equipment | | |
| DIN 5510-2 Preventive fire protection in railway vehicles. Part 2: Fire behaviour and fire side effects of materials and parts | | fulfilled |

Electromagnetic compatibility

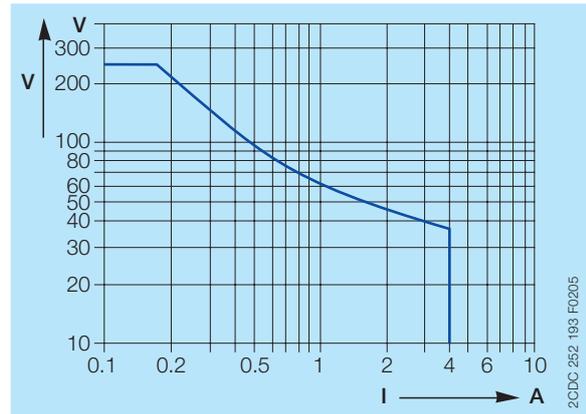
| | | |
|---|------------------------|--|
| Interference immunity to | | IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61326-2-4 |
| electrostatic discharge | IEC/EN 61000-4-2 | Level 3, 6 kV / 8 kV |
| radiated, radio-frequency, electromagnetic field | IEC/EN 61000-4-3 | Level 3, 10 V/m (1 GHz) / 3 V/m (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 | Class 3 |
| harmonics and interharmonics | IEC/EN 61000-4-13 | Class 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

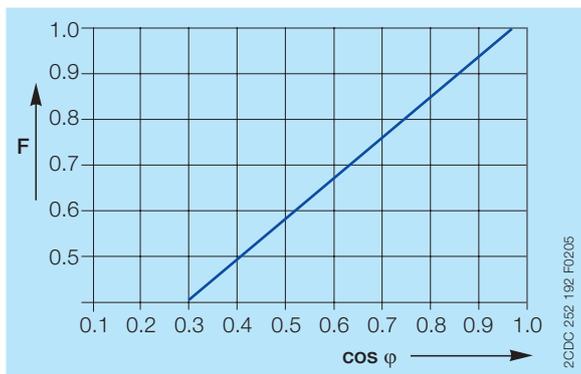
Load limits curves



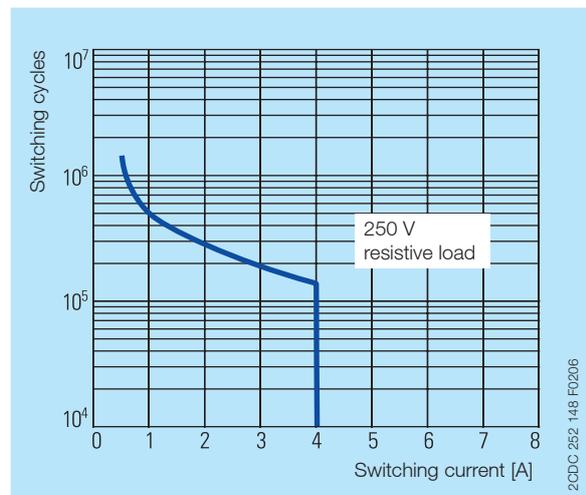
AC load (resistive)



DC load (resistive)



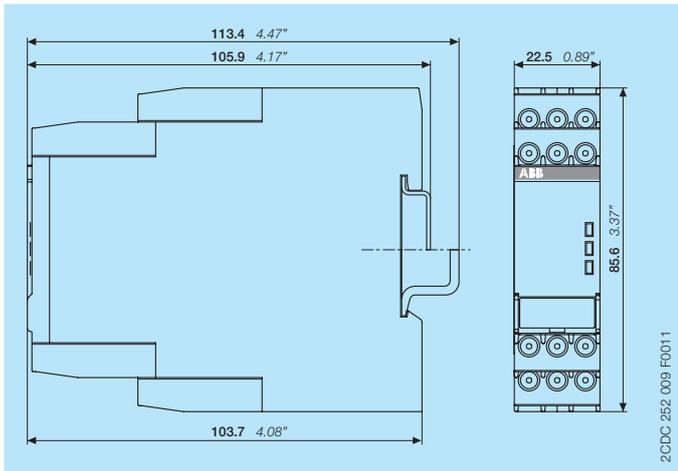
Derating factor F at inductive AC load



Contact lifetime

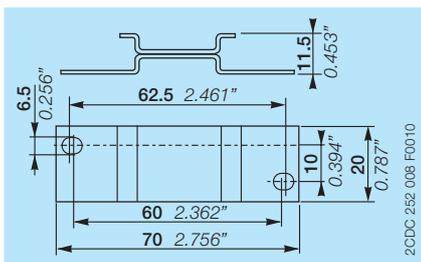
Dimensions

in mm and inches

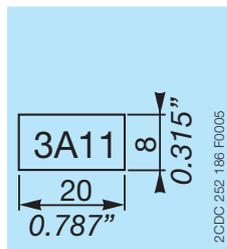


CM-IWS.2 - Insulation monitoring relay

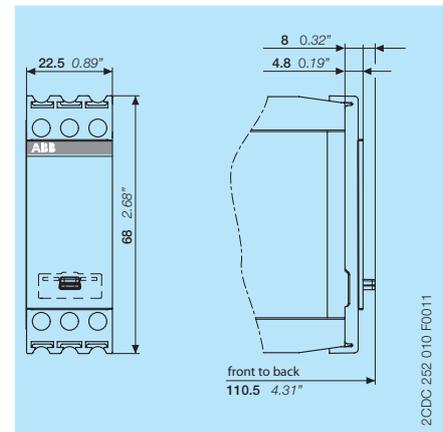
Accessories



ADP.01 - Adapter for screw mounting



MAR.01 - Marker label for devices without DIP switches



COV.11 - Sealable transparent cover

Further documentation

| Document title | Document type | Document number |
|--------------------------------|-------------------|--------------------|
| Electronic products and relays | Catalog | 2CDC 110 004 C02xx |
| CM-IWS.1, CM-IWS.2 | Instruction sheet | 1SVC 730 550 M0000 |

You can find the documentation on the internet at www.abb.com/lowvoltage -> Automation, control and protection -> Electronic relays and controls -> Measuring and monitoring relays

CAD system files

You can find the CAD files for CAD systems at <http://abb-control-products.partcommunity.com> -> Low Voltage Products & Systems -> Control Products -> Electronic Relays and Controls

Contact us

ABB STOTZ-KONTAKT GmbH

P. O. Box 10 16 80
69006 Heidelberg, Germany
Phone: +49 (0) 6221 7 01-0
Fax: +49 (0) 6221 7 01-13 25
E-mail: info.desto@de.abb.com

You can find the address of your
local sales organisation on the
ABB home page
<http://www.abb.com/contacts>
-> Low Voltage Products and Systems

Note:

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB AG does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB AG.

Copyright© 2016 ABB
All rights reserved