

# Measuring and monitoring relays

## Product group picture



# Measuring and monitoring relays

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### Measuring and monitoring relays

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# Measuring and monitoring relays

## Benefits and advantages

### CM-N range: Multifunctional



- 45 mm wide housing
- Output contacts: 2 c/o (SPDT) contacts
- Continuous voltage range (24-240 V AC/DC) or single-supply
- Setting and operation via front-face operating controls
- Adjustment of threshold values and switching hysteresis via direct reading scale
- Adjustable time delays
- Integrated and snap-fitted front-face marker label
- Sealable transparent cover (accessory)

### CM-S range: Universal and multifunctional



- Only 22.5 mm wide housing
- Output contacts: 1 or 2 c/o (SPDT) contacts
- One supply voltage range or supplied by measuring circuit
- Setting and operation via front-face operating controls
- Adjustment of threshold values and switching hysteresis via direct reading scale
- Integrated and snap-fitted front-face marker
- Snap-on housing: The relays can be placed on a DIN rail tool-free - just snap it on or remove it tool-free
- Sealable transparent cover (accessory)

### CM-E range: Economy



- Only 22.5 mm wide housing
- Output contacts: 1 c/o contact or 1 n/o contact
- One supply voltage range
- One monitoring function
- Cost-efficient solution for OEM applications
- Preset monitoring ranges

### Certifications / Approvals

For certifications and approvals we kindly advise to go the documentation/download section on the product web pages that are referenced on the order pages.

### ABB's measuring and monitoring relays in a new housing

#### Benefits at a glance

##### Easy Connect Technology

###### New options:

Additionally to the existing well established screw connections a new innovative connection technology can be offered: Easy Connect Technology with push-in terminals.

###### Tool-free wiring:

The push-in terminals can be wired with rigid or fine stranded wires with wire end ferrules totally tool-free. The connection direction is exactly the same as the screw version.

###### Higher utility class:

The Easy Connect Technology provides excellent vibration resistance with gas tight push-in terminals – the right solution for harsh environment.

##### Extended features

###### Flammability:

The plastic housing material used meets the requirements for the highest flammability class. (UL94 V-0 rated)

###### Look and feel:

The new housing fits perfectly with ABB's control products offer.

# Measuring and monitoring relays

## Benefits and advantages

### Higher utility class ①

The Easy Connect Technology provides excellent vibration resistance with gas tight push-in terminals – the right solution for harsh environment. Selected products of the electronic timers and measuring and monitoring relays comply to the latest rail standards NF F 16-101/102, EN 45545, EN 50155 and more standards which are relevant for railway applications. Find more information in the rail brochure 2CDC110084B0201.

### Safety ②

The “real distance” is hidden. The clearance and the creepage distances of our products exceed international standards and substantially increase the safety of our products.

### Easy Connect Technology ③

Tool-free wiring and excellent vibration resistance. Push-in terminals provide connection of wires up to 2 x 0.5 - 1.5 mm<sup>2</sup> (2 x 20 -16 AWG), rigid or fine-strand with or without wire end ferrules. The extended type designators for products with push-in terminals are indicated by a **P** following the extended type designator e.g. CM-xxS.xx**P**.

### Double-chamber cage connection terminals ④

Double-chamber cage connection terminals provide connection of wires up to 2 x 0.5-2.5 mm<sup>2</sup> (2 x 20-14 AWG) rigid or fine-strand, with or without wire end ferrules. Potential distribution does not require additional terminals. The extended type designators for products with double-chamber cage connection terminals are indicated by a **S** following the extended type designator e.g. CM-xxS.xx**S**.

### LEDs for status indication ⑤

All actual operational states are displayed by front-face LEDs, thus simplifying commissioning and troubleshooting.

### Integrated marker label ⑥

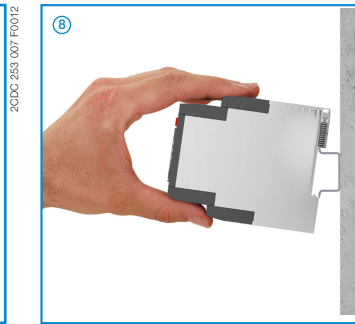
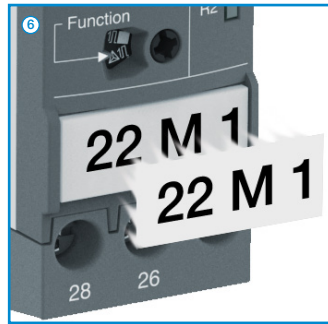
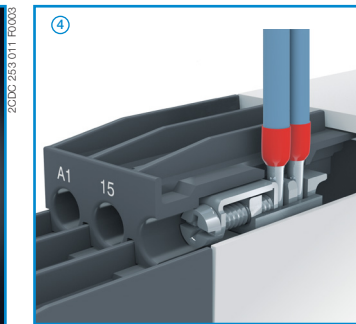
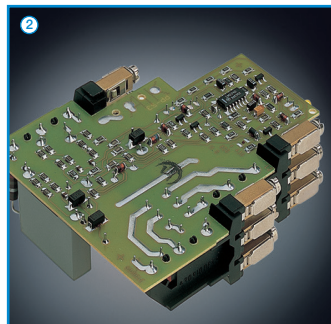
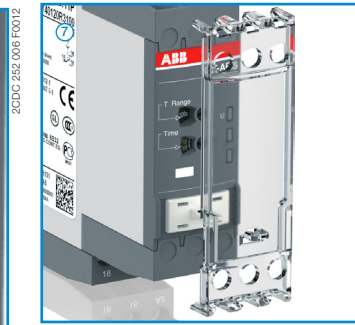
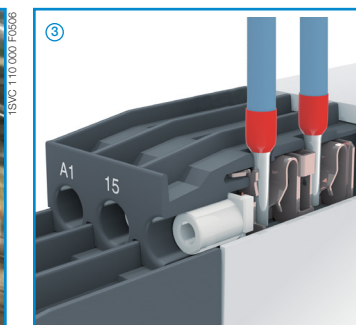
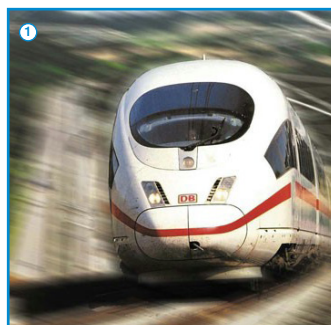
Integrated marker labels allow the product to be marked quickly and simply. No additional marker labels are required.

### Sealable transparent cover ⑦

Protection against unauthorized changes of time and threshold values. Available as an accessory.

### Snap-On housing ⑧

Tool-free DIN rail installation and deinstallation of the monitoring relay.



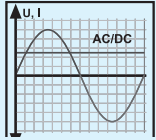


# Measuring and monitoring relays

## Assortment overview

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### Single-phase current and voltage monitoring



#### Current monitoring

- Monitoring of motor current consumption
- Monitoring of lighting installations and heating circuits
- Monitoring of transportation equipment overload
- Monitoring of locking devices, electromechanical brake gear and locked rotors

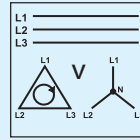
See “Ordering details - Current monitoring relays” on page 2/12.

#### Voltage monitoring

- Speed monitoring of DC motors
- Monitoring of battery voltages and other supply networks

See “Ordering details - Voltage monitoring relays” on page 2/14.

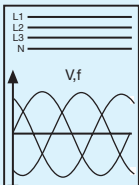
### Three-phase monitoring



- Voltage monitoring of mobile three-phase equipment
- Protection of personnel and installations against phase reversal
- Monitoring of the supply voltage of machines and installations
- Protection of equipment against damage caused by unstable supply voltage
- Switching to emergency or auxiliary supply
- Protection of motors against damage caused by unbalanced phase voltages and phase loss

See “Ordering details - Singlefunctional” on page 2/30 or “Ordering details - Multifunctional” on page 2/32.

### Grid feeding monitoring relays

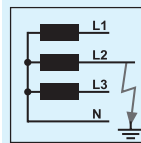


The CM-UFD.M\* range monitors all voltage and frequency parameters in a grid and ensures the safe feeding of decentral produced electrical energy into the grid.

- Monitoring of the voltage with up to 2 thresholds for over- and undervoltage
- Monitoring of the frequency with up to 2 thresholds for over- and underfrequency
- ROCOF (rate of change of frequency) and vector shift detection
- In compliance with several local standards
- CM-UFD.M\*M with Modbus RTU

See „Ordering details“ on page 50.

### Insulation monitoring



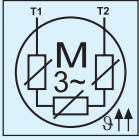
- Monitoring of electrically isolated supply mains for insulation resistance failure
- Detection of initial faults
- Protection against earth faults

See “Ordering details” on page 2/55.

# Measuring and monitoring relays

## Assortment overview

### Thermistor motor protection

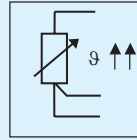


CM-MSE and CM-MSS provide full protection of motors with integrated PTC resistor sensors.

- Protection of motors against thermal overload, e. g. caused by insufficient cooling, heavy load starting conditions, undersized motors, etc.

See "Ordering details" on page 2/74.

### Temperature monitoring

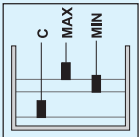


Acquisition, messaging and regulation of temperatures of solid, liquid and gaseous media in processes and machines

- Motor and system protection
- Control panel temperature monitoring
- Frost monitoring
- Temperature limits for process variables, e.g. in the packing or electroplating industry
- Control of systems and machines like heating, air-conditioning and ventilation systems, solar collectors, heat pumps or hot water supply systems
- Monitoring of servomotors with KTY sensors
- Bearing and gear oil monitoring
- Coolant monitoring

See "Ordering details" on page 2/87.

### Liquid level monitoring and control



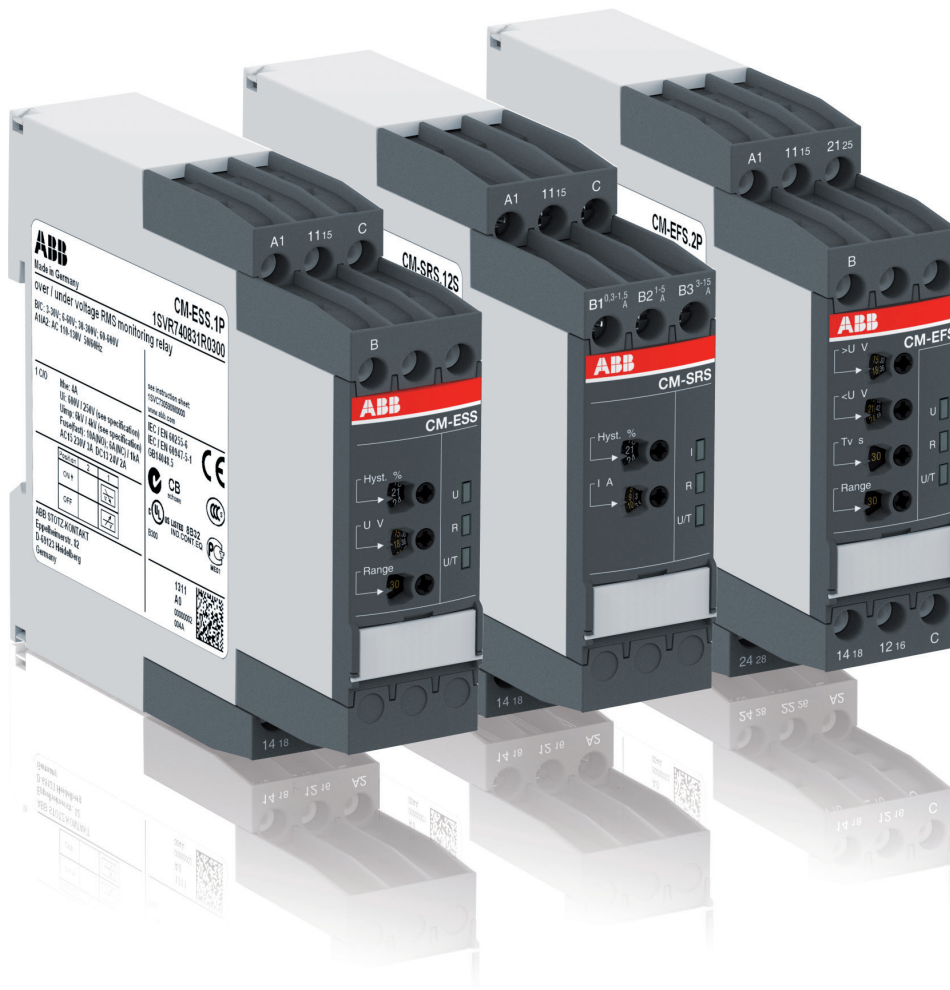
- Protection of pumps against dry running
- Protection against container overflow
- Control of liquid levels
- Detection of leaks
- Control of mixing ratios

See "Ordering details" on page 2/98.

# Current and voltage monitoring relays, single-phase

## Product group picture

2



# Current and voltage monitoring relays, single-phase

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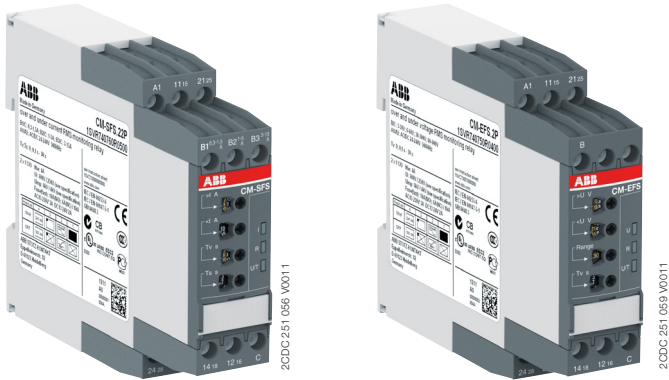
### Current and voltage monitoring relays, single-phase

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# Current and voltage monitoring relays, single-phase

## Benefits and advantages

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### Characteristics current and voltage monitoring relays <sup>1)</sup>

- Monitoring of DC and AC currents: 3 mA to 15 A
- Monitoring of DC and AC voltages from 3-600 V
- Suitable for railway applications
- TRMS measuring principle
- Device with 3 or 3 measuring ranges
- Over- and undercurrent monitoring
- Over- and undervoltage monitoring
- ON or OFF-delay configurable
- Open- or closed-circuit principle configurable
- Threshold values for >U and/or <U adjustable
- Latching function configurable
- Thresholds for >I and/or <I adjustable
- Fixed hysteresis of 5 %
- Start-up delay  $T_v$  adjustable 0; 0.1-30 s
- Tripping delay  $T_v$  adjustable 0; 0.1-30 s
- 1 x 2 c/o contacts (common signal) or 2 x 1 c/o contact (separate signals for >I and <I) configurable
- 1 x 2 c/o contacts (common signal) or 2 x 1 c/o contact (separate signals for >U and <U) configurable
- 22.5 mm width
- 3 LEDs for the indication of operational states
- Various approvals and marks

<sup>1)</sup> depending on device

### Current monitoring, single-phase

The ABB current monitoring relays CM-SRS.xx reliably monitor the occurrence of currents that exceed or fall below the selected threshold value. The functions overcurrent or undercurrent monitoring can be preselected. Single- and multifunction devices for the monitoring of direct or alternating currents from 3 mA to 15 A are available.

### Current window monitoring ( $I_{min}$ , $I_{max}$ )

The window monitoring relay CM-SFS.2x is available if the application requires the simultaneous monitoring of over- and undercurrents.

### Voltage monitoring, single-phase

The ABB voltage monitoring relays CM-SRS.xx are used to monitor direct and alternating voltages within a range of 3-600 V. Over- or undervoltage detection can be preselected.

### Voltage window monitoring ( $U_{min}$ , $U_{max}$ )

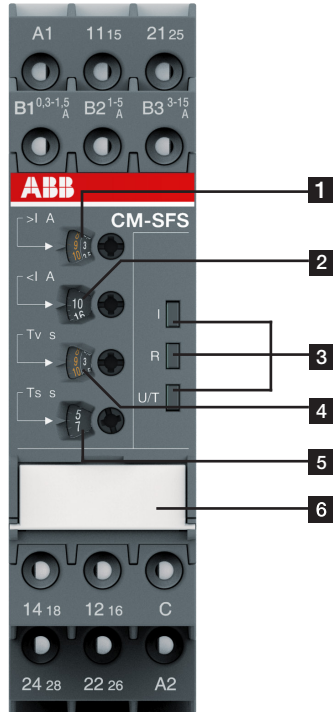
For the simultaneous detection of over- and undervoltages, the window monitoring relay CM-EFS.2 can be used.



# Current and voltage monitoring relays, single-phase

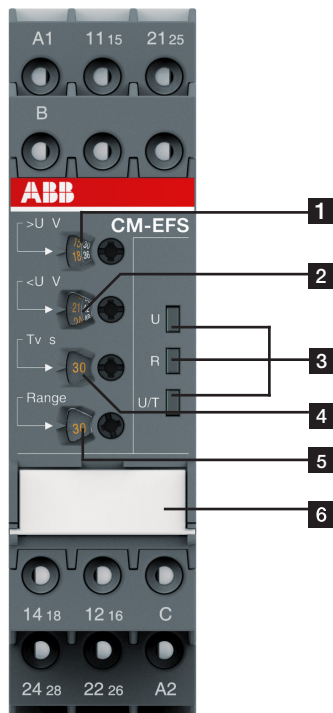
## Operating controls

### Current monitoring relays



- 1** Adjustment of the threshold value  $>I$  for overcurrent
- 2** Adjustment of the threshold value  $<I$  for undercurrent
- 3** Indication of operational states  
U/T: green LED – control supply voltage/timing  
R: yellow LED – relay status  
I: red LED – over- / undercurrent
- 4** Adjustment of the tripping delay  $T_v$
- 5** Adjustment of the start-up delay  $T_s$
- 6** DIP switches (see DIP switch functions on page 2/20)
  - ON-delay
  - OFF-delay
  - Closed-circuit principle
  - Open-circuit principle
  - Latching function activated
  - Latching function not activated
  - 2x1 c/o (SPDT) contact
  - 1x2 c/o (SPDT) contacts

### Voltage monitoring relays



- 1** Adjustment of the threshold value  $>U$  for overvoltage
- 2** Adjustment of the threshold value  $<U$  for undervoltage
- 3** Indication of operational states  
U/T: green LED – control supply voltage/timing  
R: yellow LED – relay status  
U: red LED – over- / undervoltage
- 4** Adjustment of the tripping delay  $T_v$
- 5** Adjustment of the measuring range
- 6** DIP switches (see DIP switch functions on page 2/20)
  - ON-delay
  - OFF-delay
  - Closed-circuit principle
  - Open-circuit principle
  - Latching function activated
  - Latching function not activated
  - 2x1 c/o (SPDT) contact
  - 1x2 c/o (SPDT) contacts

# Current and voltage monitoring relays, single-phase

## Selection table - Current monitoring relays

| Type       | Order number    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|------------|-----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| CM-SFS.11S | 1SVR730840R0200 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.11P | 1SVR740840R0200 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.11S | 1SVR730841R0200 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.11P | 1SVR740841R0200 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.11S | 1SVR730841R1200 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.11P | 1SVR740841R1200 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.12S | 1SVR730840R0300 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.12S | 1SVR730841R0300 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.12S | 1SVR730841R1300 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21S | 1SVR730840R0400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21P | 1SVR740840R0400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21S | 1SVR730841R0400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21P | 1SVR740841R0400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21S | 1SVR730841R1400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21P | 1SVR740841R1400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.22S | 1SVR730840R0500 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.22S | 1SVR730841R0500 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.22S | 1SVR730841R1500 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.M1S | 1SVR730840R0600 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.M1P | 1SVR740840R0600 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.M2S | 1SVR730840R0700 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21S | 1SVR730760R0400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.21P | 1SVR740760R0400 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CM-SFS.22S | 1SVR730760R0500 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| Rated control supply voltage U <sub>s</sub> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |  |
|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 24 - 240 V AC/DC                            | ■ | ■ |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 110 - 130 V AC                              |   |   | ■ | ■ |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 220 - 240 V AC                              |   |   |   |   | ■ | ■ |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |

| Measuring ranges AC/DC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |  |
|------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 3 - 30 mA              | ■ | ■ | ■ | ■ | ■ | ■ |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 10 - 100 mA            | ■ | ■ | ■ | ■ | ■ | ■ |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 0.1 - 1 A              | ■ | ■ | ■ | ■ | ■ | ■ |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 0.3 - 1.5 A            |   |   |   |   |   |   | ■ | ■ | ■ |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 1 - 5 A                |   |   |   |   |   |   | ■ | ■ | ■ |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| 3 - 15 A               |   |   |   |   |   |   | ■ | ■ | ■ |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |

| Monitoring function                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |   |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
| Over- or undercurrent                    | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■  | ■ |
| Window current monitoring                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Latching                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Open-circuit or closed-circuit principle |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |

| Timing functions for tripping delay | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |  |
|-------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| ON-delay, 0.1 - 30 s                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| ON- or OFF-delay, 0.1 - 30 s        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |

| Output      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|-------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| c/o contact | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  |

| Connection type                          | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Push-in terminals                        |   | ■ |   | ■ |   | ■ |   | ■ |   | ■  |    | ■  |    | ■  |    | ■  |    | ■  |    | ■  |    | ■  |    | ■  |
| Double-chamber cage connection terminals | ■ |   | ■ |   | ■ |   | ■ |   | ■ |    | ■  |    | ■  |    | ■  |    | ■  |    | ■  |    | ■  |    | ■  |    |

adj: adjustable  
 sel: selectable

# Current and voltage monitoring relays, single-phase

## Ordering details - Current monitoring relays



CM-SRS.22S

2C3DC 251 054 V0011



CM-SFS.22P

2C3DC 251 056 V0011

### Description

The CM range current monitoring relays protect single-phase mains (DC or AC) from over- and undercurrent from 3 mA to 15 A.

### Ordering details

| Description | Type       | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|-------------|------------|-----------------|---------------|-----------------------------|
|             |            | 1SVR730840R0200 |               | 0.145 (0.320)               |
|             | CM-SRS.11S | 1SVR730841R0200 |               | 0.161 (0.355)               |
|             |            | 1SVR730841R1200 |               | 0.161 (0.355)               |
|             | CM-SRS.11P | 1SVR740840R0200 |               | 0.137 (0.302)               |
|             |            | 1SVR740841R0200 |               | 0.153 (0.337)               |
|             |            | 1SVR740841R1200 |               | 0.153 (0.337)               |
|             | CM-SRS.12S | 1SVR730840R0300 |               | 0.137 (0.302)               |
|             |            | 1SVR730841R0300 |               | 0.168 (0.370)               |
|             |            | 1SVR730841R1300 |               | 0.168 (0.370)               |
|             | CM-SRS.21S | 1SVR730840R0400 |               | 0.152 (0.335)               |
|             |            | 1SVR730841R0400 |               | 0.179 (0.395)               |
|             |            | 1SVR730841R1400 |               | 0.179 (0.395)               |
|             | CM-SRS.21P | 1SVR740840R0400 |               | 0.141 (0.311)               |
|             |            | 1SVR740841R0400 |               | 0.168 (0.370)               |
|             |            | 1SVR740841R1400 |               | 0.168 (0.370)               |
|             | CM-SRS.22S | 1SVR730840R0500 |               | 0.144 (0.399)               |
|             |            | 1SVR730841R0500 |               | 0.181 (0.399)               |
|             |            | 1SVR730841R1500 |               | 0.181 (0.399)               |
|             | CM-SRS.M1S | 1SVR730840R0600 |               | 0.153 (0.337)               |
|             | CM-SRS.M1P | 1SVR740840R0600 |               | 0.142 (0.313)               |
|             | CM-SRS.M2S | 1SVR730840R0700 |               | 0.155 (0.342)               |
|             | CM-SFS.21S | 1SVR730760R0400 |               | 0.150 (0.331)               |
|             | CM-SFS.21P | 1SVR740760R0400 |               | 0.139 (0.306)               |
|             | CM-SFS.22S | 1SVR730760R0500 |               | 0.158 (0.348)               |

See "Selection table - Current monitoring relays" on page 2/11.

**S:** screw connection  
**P:** push-in connection



Further documentation single-phase monitoring relays on [www.abb.com](http://www.abb.com)

# Current and voltage monitoring relays, single-phase

## Selection table - Voltage monitoring relays

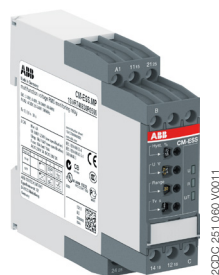
2

| Type  | Order number | 1SVR730830R0300 | 1SVR740830R0300 | 1SVR730831R0300 | 1SVR740831R0300 | 1SVR730831R1300 | 1SVR740831R1300 | 1SVR730830R0400 | 1SVR740830R0400 | 1SVR730831R0400 | 1SVR740831R0400 | 1SVR730831R1400 | 1SVR740831R1400 | 1SVR730830R0500 | 1SVR740830R0500 | 1SVR730750R0400 | 1SVR740750R0400 |
|---|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Rated control supply voltage U<sub>s</sub></b> |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 24 - 240 V AC/DC                                  |              | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               | ■               | ■               |
| 110 - 130 V AC                                    |              |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |
| 220 - 240 V AC                                    |              |                 |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |
| <b>Measuring ranges AC/DC</b>                     |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 3 - 30 V  |              | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| 6 - 60 V  |              | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| 30 - 300 V  |              | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| 60 - 600 V  |              | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| <b>Monitoring function</b>                        |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Over- or undervoltage                             |              | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Windows voltage monitoring                        |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |
| Latching  |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | sel             | sel             | sel             | sel             |
| Open-circuit or closed-circuit principle          |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | sel             | sel             | sel             | sel             |
| <b>Timing functions for tripping delay</b>        |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| ON-delay, 0.1 - 30 s                              |              |                 |                 |                 |                 |                 |                 | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             |                 |                 |
| ON- or OFF-delay, 0.1 - 30 s                      |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | sel             | sel             |
| <b>Output</b>                                     |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| c/o contact                                       |              | 1               | 1               | 1               | 1               | 1               | 1               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               |
| <b>Connection type</b>                            |              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Push-in terminals                                 |              |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |
| Double-chamber cage connection terminals          |              | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 |

adj: adjustable  
sel: selectable

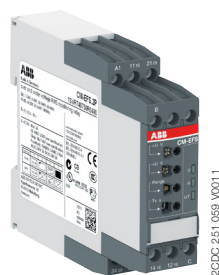
# Current and voltage monitoring relays, single-phase

## Ordering details - Voltage monitoring relays



CM-ESS.MP

2C3DC 251 059 V0011



CM-EFS.2

2C3DC 251 059 V0011

### Description

The CM range voltage monitoring relays provide reliable monitoring of voltages as well as detection of phase loss in single-phase mains.

### Ordering details

| Description   | Type      | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|---|-----------|-----------------|---------------|-----------------------------|
| See "Selection table - Voltage monitoring relays" on page 2/13. | CM-ESS.1S | 1SVR730830R0300 |               | 0.135 (0.298)               |
|   |           | 1SVR730831R0300 |               | 0.164 (0.362)               |
|   | CM-ESS.1P | 1SVR730831R1300 |               | 0.164 (0.362)               |
|   |           | 1SVR740830R0300 |               | 0.126 (0.278)               |
|   | CM-ESS.1P | 1SVR740831R0300 |               | 0.155 (0.342)               |
|   |           | 1SVR740831R1300 |               | 0.155 (0.342)               |
|   | CM-ESS.2S | 1SVR730830R0400 |               | 0.153 (0.337)               |
|   |           | 1SVR730831R0400 |               | 0.181 (0.399)               |
|   | CM-ESS.2S | 1SVR730831R1400 |               | 0.181 (0.399)               |
|   |           | 1SVR740830R0400 |               | 0.142 (0.313)               |
|   | CM-ESS.2P | 1SVR740831R0400 |               | 0.170 (0.375)               |
|   |           | 1SVR740831R1400 |               | 0.170 (0.375)               |
|   | CM-ESS.MS | 1SVR730830R0500 |               | 0.154 (0.340)               |
|   | CM-ESS.MP | 1SVR740830R0500 |               | 0.143 (0.320)               |
|   | CM-EFS.2S | 1SVR730750R0400 |               | 0.157 (0.346)               |
|   | CM-EFS.2P | 1SVR740750R0400 |               | 0.146 (0.322)               |

**S:** screw connection  
**P:** push-in connection



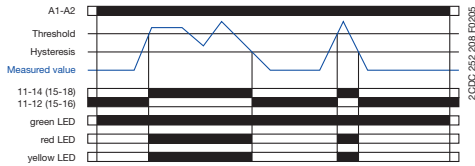
Further documentation single-phase monitoring relays on [www.abb.com](http://www.abb.com)



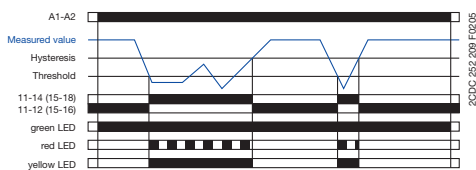
# Current and voltage monitoring relays, single-phase Function diagrams

## Function diagrams - CM-SRS.1

### Overcurrent monitoring

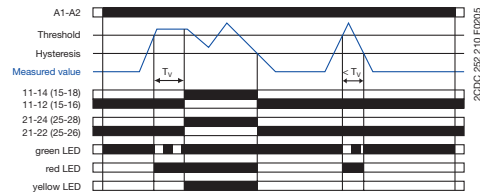


### Undercurrent monitoring

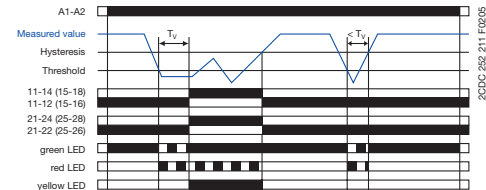


## Function diagrams - CM-SRS.2

### Overcurrent monitoring



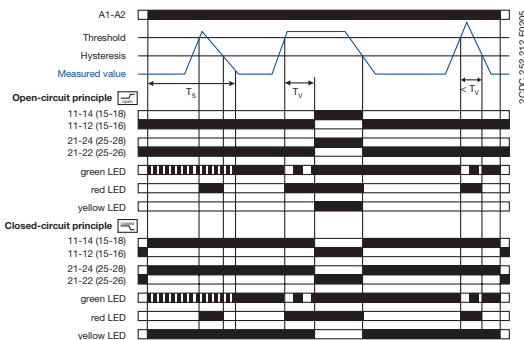
### Undercurrent monitoring



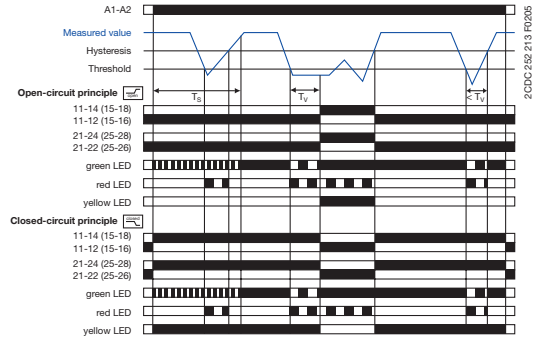
If the measured value exceeds resp. drops below the adjusted threshold value, the output relay(s) energize(s): on the CM-SRS.1 immediately, on the CM-SRS.2 after the set tripping delay  $T_V$ . If the measured value exceeds resp. drops below the threshold value plus resp. minus the adjusted hysteresis, the output relay(s) de-energize(s). The hysteresis is adjustable within a range of 3-30 % of the threshold value.

## Function diagrams - CM-SRS.M

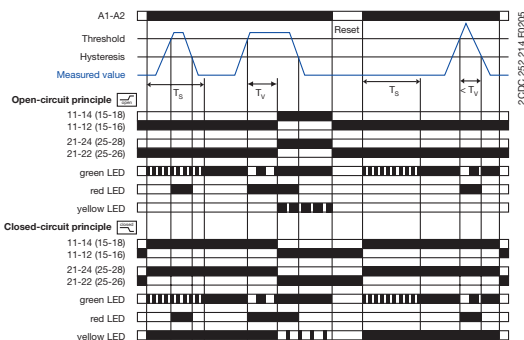
### Overcurrent monitoring without latching



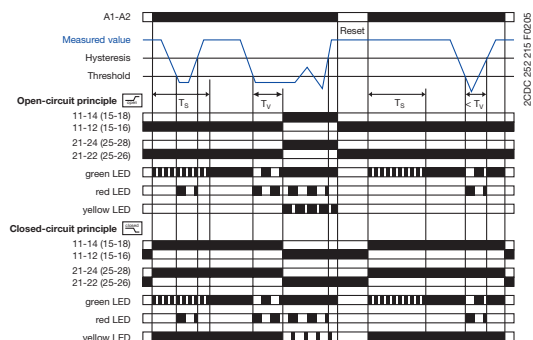
### Undercurrent monitoring without latching



### Overcurrent monitoring with latching



### Undercurrent monitoring with latching



If the measured value exceeds resp. drops below the adjusted threshold value before the set start-up delay  $T_S$  is complete, the output relays do not change their actual state. If the measured value exceeds resp. drops below the adjusted threshold value when  $T_S$  is complete, the tripping delay  $T_V$  starts. If  $T_V$  is complete and the measured value is still exceeding resp. below the threshold value plus resp. minus the set hysteresis, the output relays energize  / de-energize .

If the measured value exceeds resp. drops below the threshold value minus resp. plus the set hysteresis and the latching function is not activated , the output relays de-energize  / energize . With activated latching function  the output relays remain energized  and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized  and energize only, when the supply voltage is switched off and then again switched on = Reset.

The hysteresis is adjustable within a range of 3-30 % of the threshold value.

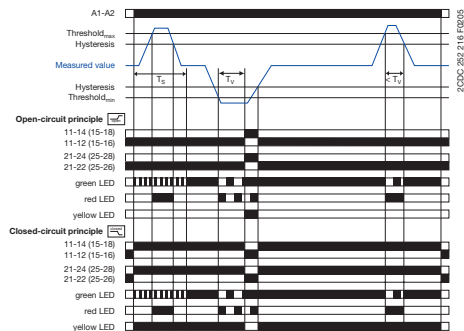
# Current and voltage monitoring relays, single-phase

## Function diagrams

### Function diagrams - CM-SFS.2

Current window monitoring 1x2 c/o contact  1x2 c/o

ON-delayed  without latching



Further function diagrams see data sheet.

ON-delayed  current window monitoring with parallel switching c/o contacts  1x2 c/o:

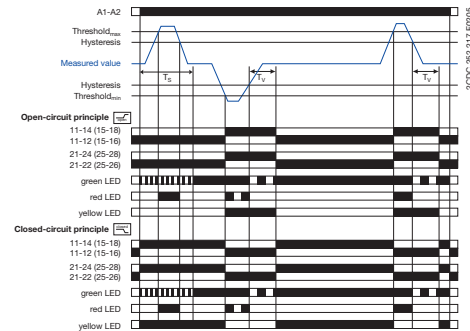
If the measured value exceeds resp. drops below the adjusted threshold value before the set start-up delay  $T_s$  is complete, the output relays do not change their actual state.

If the measured value exceeds resp. drops below the adjusted threshold value when  $T_s$  is complete, the tripping delay  $T_v$  starts, when  is configured. If  $T_v$  is complete and the measured value is still exceeding resp. below the threshold value minus resp. plus the fixed hysteresis (5%), the output relays energize  /de-energize .

If the measured value exceeds resp. drops below the threshold value plus resp. minus the hysteresis and the latching function is not activated , the output relays de-energize  / energize . With activated latching function  the output relays remain energized  and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized  and energize only, when the supply voltage is switched off and then again switched on = Reset.

Current window monitoring 1x2 c/o contact  1x2 c/o

OFF-delayed  without latching



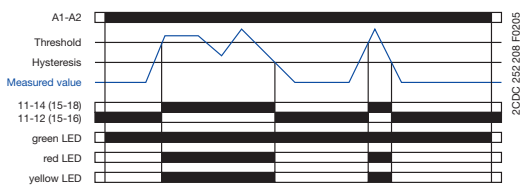
OFF-delayed  current window monitoring with parallel switching c/o contacts  1x2 c/o:

If the measured value exceeds resp. drops below the adjusted threshold value when the set start-up delay  $T_s$  is complete, the output relays energize  / de-energize , when  is configured, and remain in this position during the set tripping delay  $T_v$ . If the measured value exceeds resp. drops below the threshold value plus resp. minus the fixed hysteresis (5%) and the latching function is not activated , the tripping delay  $T_v$  starts. After completion of  $T_v$  the output relays de-energize  / energize , provided that the latching function is not activated . With activated latching function  the output relays remain energized  and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized  and energize only, when the supply voltage is switched off and then again switched on = Reset. When  is adjusted on the device, the functionality is equivalent to the one described above. There is only to consider that in this case, instead of both output relays, only one output relay each will be switched.

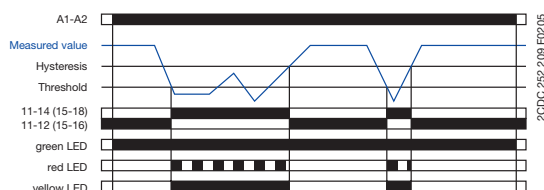
$$">I" = 11_{15}-12_{16}/14_{18}; "<I" = 21_{25}-22_{26}/24_{28}$$

### Function diagrams - CM-ESS.1

Overvoltage monitoring

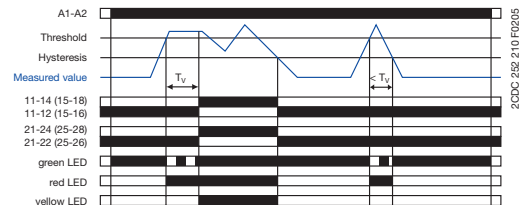


Undervoltage monitoring

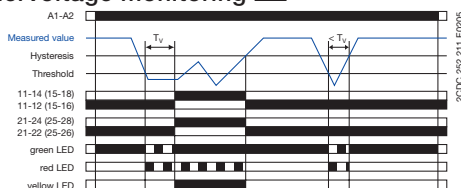


### Function diagrams - CM-ESS.2

Overvoltage monitoring



Undervoltage monitoring



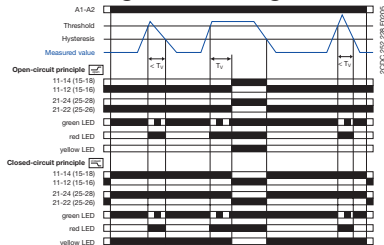
Depending on the configuration, the voltage monitoring relays CM-ESS.1 and CM-ESS.2 can be used for over-  or undervoltage monitoring  in single-phase AC and/or DC systems. The voltage to be monitored (measured value) is applied to terminals B-C. The devices work according the open-circuit principle. If the measured value exceeds resp. drops below the adjusted threshold value, the output relay(s) energize(s): on the CM-ESS.1 immediately, on the CM-ESS.2 after the set tripping delay  $T_v$ . If the measured value exceeds resp. drops below the threshold value plus resp. minus the adjusted hysteresis, the output relay(s) de-energize(s). The hysteresis is adjustable within a range of 3-30 % of the threshold value.

# Current and voltage monitoring relays, single-phase

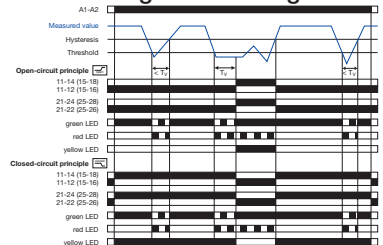
## Function diagrams

### Function diagrams - CM-ESS.M

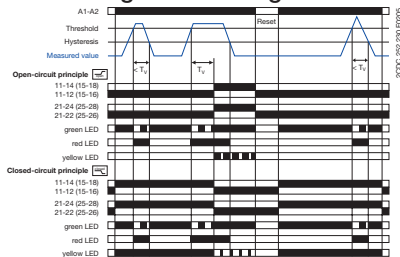
#### Overvoltage monitoring without latching



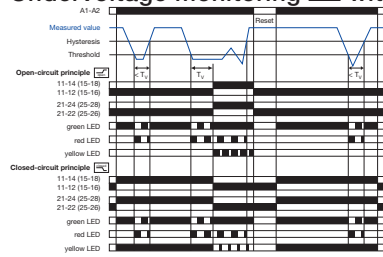
#### Undervoltage monitoring without latching











#### Overvoltage monitoring with latching



#### Undervoltage monitoring without latching



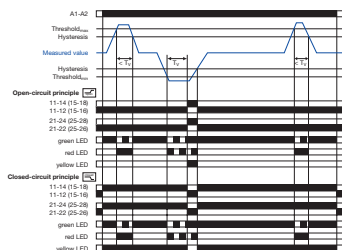
If the measured value exceeds resp. drops below the adjusted threshold value, the tripping delay  $T_V$  starts. If  $T_V$  is complete and the measured value is still exceeding resp. below the threshold value plus resp. minus the set hysteresis, the output relays energize  / de-energize .

If the measured value exceeds resp. drops below the threshold value plus resp. minus the set hysteresis and the latching function is not activated , the output relays de-energize  / energize . With activated latching function  the output relays remain energized  and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized  and energize only, when the supply voltage is switched off and then again switched on = Reset. The hysteresis is adjustable within a range of 3-30 % of the threshold value.




Further function diagrams see data sheet.







### Voltage window monitoring 1x2 c/o contact

#### ON-delayed without latching



#### ON-delayed voltage window monitoring with parallel switching c/o contacts

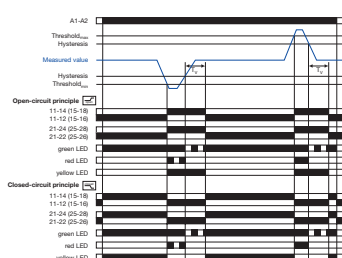
If the measured value exceeds resp. drops below the adjusted threshold value, the tripping delay  $T_V$  starts, when  is configured. If  $T_V$  is complete and the measured value is still exceeding resp. below the threshold value minus resp. plus the fixed hysteresis (5%), the output relays energize  /de-energize .




If the measured value exceeds resp. drops below the threshold value plus resp. minus the hysteresis and the latching function is not activated , the output relays de-energize  / energize . With activated latching function  the output relays remain energized  and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized  and energize only, when the supply voltage is switched off and then again switched on = Reset.








#### OFF-delayed voltage window monitoring with parallel switching c/o contacts


### Voltage window monitoring 1x2 c/o contact

#### OFF-delayed without latching



If the measured value exceeds resp. drops below the adjusted threshold value, the output relays energize  / de-energize , when  is configured, and remain in this position during the set tripping delay  $T_V$ .

If the measured value exceeds resp. drops below the threshold value plus resp. minus the fixed hysteresis (5%) and the latching function is not activated , the tripping delay  $T_V$  starts. After completion of  $T_V$ , the output relays de-energize  / energize , provided that the latching function is not activated . With activated latching function  the output relays remain energized  and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized  and energize only, when the supply voltage is switched off and then again switched on = Reset.

When  is adjusted on the device, the functionality is equivalent to the one described above. There is only to consider that in this case, instead of both output relays, only one output relay each will be switched.

$$">U" = 11_{15}-12_{16}/14_{18}; "<U" = 21_{25}-22_{26}/24_{28}$$

# Current and voltage monitoring relays, single-phase

## Connection diagrams, DIP switches

### Connection diagram CM-SRS.1, CM-SRS.2

|    |                  |    |
|----|------------------|----|
| A1 | 11 <sub>15</sub> | C  |
| B1 | B2               | B3 |

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B1 | B2               | B3               |

2CDC 252 204 F0005      2CDC 252 205 F0005

A1-A2      Control supply voltage  
 B1-C      Measuring range 1: 3-30 mA or 0.3-1.5 A  
 B2-C      Measuring range 2: 10-100 mA or 1-5 A  
 B3-C      Measuring range 3: 0.1-1 A or 3-15 A  
 11<sub>15</sub>-12<sub>16</sub>/14<sub>18</sub>      Output contacts - open-circuit principle  
 21<sub>25</sub>-22<sub>26</sub>/24<sub>28</sub>

### DIP switch functions CM-SRS.1, CM-SRS.2

| Position | 2 | 1 |
|----------|---|---|
| ON ↑     |   |   |
| OFF      |   |   |

2CDC 252 272 F0005

1 ON      Undercurrent monitoring  
 OFF      Overcurrent monitoring

OFF = Default

### Connection diagram CM-SRS.M

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B1 | B2               | B3               |

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B1 | B2               | B3               |

2CDC 252 205 F0005

A1-A2      Control supply voltage  
 B1-C      Measuring range 1: 3-30 mA or 0.3-1.5 A  
 B2-C      Measuring range 2: 10-100 mA or 1-5 A  
 B3-C      Measuring range 3: 0.1-1 A or 3-15 A  
 11<sub>15</sub>-12<sub>16</sub>/14<sub>18</sub>      Output contacts - open- or  
 21<sub>25</sub>-22<sub>26</sub>/24<sub>28</sub>      closed circuit principle

### DIP switch functions CM-SRS.M

| Position | 4 | 3 | 2 | 1 |
|----------|---|---|---|---|
| ON ↑     |   |   |   |   |
| OFF      |   |   |   |   |

2CDC 252 273 F0005

1 ON      Undercurrent monitoring  
 OFF      Overcurrent monitoring  
 2 ON      Closed-circuit principle  
 OFF      Open-circuit principle  
 3 ON      Latching function activated  
 OFF      Latching function not activated  
 OFF = Default

### Connection diagram CM-SFS.2

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B1 | B2               | B3               |

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B1 | B2               | B3               |

2CDC 252 205 F0005

A1-A2      Control supply voltage  
 B1-C      Measuring range 1: 3-30 mA or 0.3-1.5 A  
 B2-C      Measuring range 2: 10-100 mA or 1-5 A  
 B3-C      Measuring range 3: 0.1-1 A or 3-15 A  
 11<sub>15</sub>-12<sub>16</sub>/14<sub>18</sub>      Output contacts - open- or  
 21<sub>25</sub>-22<sub>26</sub>/24<sub>28</sub>      closed circuit principle

### DIP switch function CM-SFS.2

| Position | 4 | 3 | 2 | 1 |
|----------|---|---|---|---|
| ON ↑     |   |   |   |   |
| OFF      |   |   |   |   |

2CDC 252 274 F0005

1 ON      OFF-delay  
 OFF      ON-delay  
 2 ON      Closed-circuit principle  
 OFF      Open-circuit principle  
 3 ON      Latching function activated  
 OFF      Latching function not activated  
 4 ON      2x1 c/o contact  
 OFF      1x2 c/o contacts  
 OFF = Default

### Connection diagram CM-ESS.M

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B  |                  |                  |

|    |                  |                  |
|----|------------------|------------------|
| A1 | 11 <sub>15</sub> | 21 <sub>25</sub> |
| B  |                  |                  |

2CDC 252 207 F0005

A1-A2      Control supply voltage  
 B-C      Measuring ranges AC/DC:  
 3-30 V; 6-60 V  
 30-300 V; 60-600 V  
 11<sub>15</sub>-12<sub>16</sub>/14<sub>18</sub>      Output contacts - open- or  
 21<sub>25</sub>-22<sub>26</sub>/24<sub>28</sub>      closed circuit principle

### DIP switch functions CM-ESS.M

| Position | 4 | 3 | 2 | 1 |
|----------|---|---|---|---|
| ON ↑     |   |   |   |   |
| OFF      |   |   |   |   |

2CDC 252 276 F0005

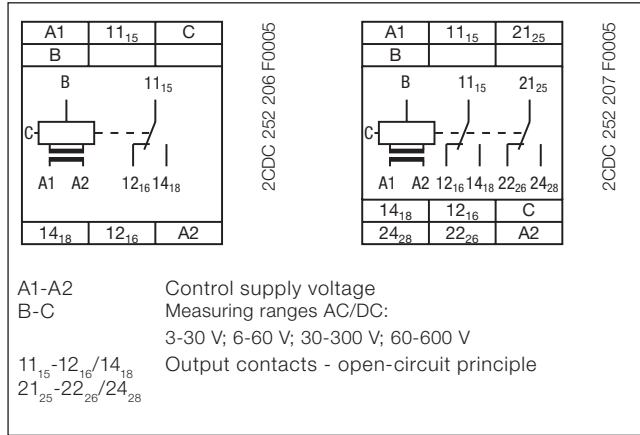
1 ON      Undervoltage monitoring  
 OFF      Overvoltage monitoring  
 2 ON      Closed-circuit principle  
 OFF      Open-circuit principle  
 3 ON      Latching function activated  
 OFF      Latching function not activated  
 OFF = Default

# Current and voltage monitoring relays, single-phase

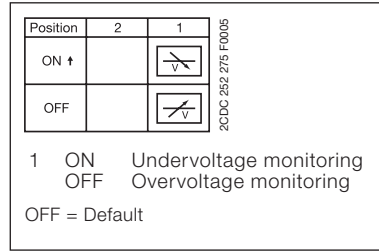
## Connection diagrams, DIP switches

2

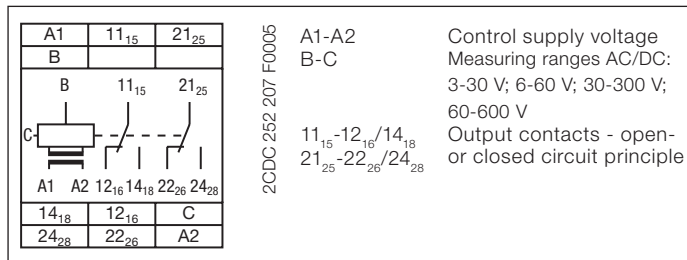
### Connection diagram CM-ESS.1, CM-ESS.2



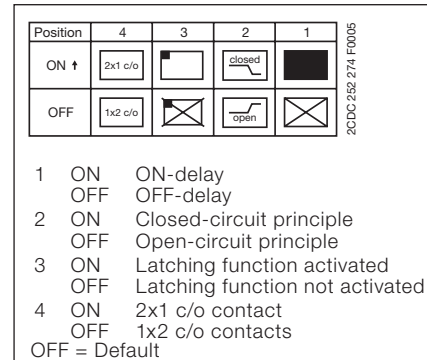
### DIP switch functions CM-ESS.1, CM-ESS.2



### Connection diagram CM-EFS.2











### DIP switch functions CM-EFS.2









# Current monitoring relays, single-phase

## Technical data - Current monitoring relays

| Type  |   | CM-SRS.1   | CM-SRS.2                                    | CM-SRS.M   | CM-SFS.2                               |               |
|---|---|--|---|--|--|---------------|
| <b>Input circuit - Supply circuit</b>                 |   | <b>A1-A2</b>   |   |  |  |               |
| Rated control supply voltage $U_s$                    | A1-A2   | 110-130 V AC   |   |  |  |               |
|   | A1-A2   | 220-240 V AC   |   |  |  |               |
|   | A1-A2   | 24-240 V AC/DC   |   |  |  |               |
| Rated control supply voltage $U_s$ tolerance          |   | -15...+10 %  |   |  |  |               |
| Rated frequency                                       | AC versions   | 50/60 Hz   |   |  |  |               |
|   | AC/DC versions  | 50/60 Hz or DC   |   |  |  |               |
| Current / power consumption                           |   | see data sheets  |   |  |  |               |
| Power failure buffering time                          |   | 20 ms  |   |  |  |               |
| Transient overvoltage protection                      |   | Varistors  |   |  |  |               |
| <b>Input circuit - Measuring circuit</b>              |   | <b>B1/B2/B3-C</b>  |   |  |  |               |
| Monitoring function                                   |   | over- or undercurrent monitoring<br>configurable   |   |  | over- and under-<br>current monitoring |               |
| Measuring method                                      |   | true RMS measuring principle   |   |  |  |               |
| Measuring inputs                                      |   | <b>CM-SxS.x1</b>   |   |  | <b>CM-SxS.x2</b>                       |               |
|   | terminal connection                                       | <b>B1-C</b>  | <b>B2-C</b>                                 | <b>B3-C</b>  | <b>B1-C</b>                            | <b>B2-C</b>   |
|   | measuring ranges AC/DC                                    | 3-30 mA  | 10-100 mA                                   | 0.1-1 A  | 0.3-1.5 A                              | 1-5 A         |
|   | input resistance  | 3.3 $\Omega$   | 1 $\Omega$                                  | 0.1 $\Omega$   | 0.05 $\Omega$                          | 0.01 $\Omega$ |
|   | pulse overload capacity $t < 1$ s                         | 500 mA   | 1 A   | 10 A   | 15 A                                   | 50 A          |
|   | continuous capacity                                       | 50 mA  | 150 mA                                      | 1.5 A  | 2 A                                    | 7 A           |
| Threshold value(s)                                    |   | adjustable within the indicated measuring range  |   |  |  |               |
| Tolerance of the adjusted threshold value             |   | 10 % of full-scale value   |   |  |  |               |
| Hysteresis related to the threshold value             |   | 3-30 % adjustable  |   |  |  |               |
| Measuring signal frequency range                      |   | DC / 15 Hz - 2 kHz   |   |  |  |               |
| Rated measuring signal frequency range                |   | DC / 50-60 Hz  |   |  |  |               |
| Maximum response time                                 |   | AC: 80 ms / DC: 120 ms   |   |  |  |               |
| Accuracy within the control supply voltage tolerance  |   | $\Delta U \leq 0.5$ %  |   |  |  |               |
| Accuracy within the temperature range                 |   | $\Delta U \leq 0.06$ % / $^{\circ}\text{C}$  |   |  |  |               |
| <b>Timing circuit</b>                                 |   |  |   |  |  |               |
| Start-up delay $T_s$                                  |   | none   | 0 or 0.1-30 s adjustable                    |  |  |               |
| Tripping delay $T_v$                                  |   | none   | 0 or 0.1-30 s adjustable                    |  |  |               |
| Repeat accuracy (constant parameters)                 |   | $\pm 0.07$ % of full-scale value   |   |  |  |               |
| Accuracy within the control supply voltage tolerance  |   | -  | $\Delta t \leq 0.5$ %                       |  |  |               |
| Accuracy within the temperature range                 |   | -  | $\Delta t \leq 0.06$ % / $^{\circ}\text{C}$ |  |  |               |
| <b>Indication of operational states</b>               |   |  |   |  |  |               |
| Control supply voltage                                | U/T: green LED  |  : control supply voltage applied,<br> : start-up delay $T_s$ active,<br> : tripping delay $T_v$ active                                     |   |  |  |               |
| Measured value  | I: red LED  |  : overcurrent,<br> : undercurrent   |   |  |  |               |
| Relay status  | R: yellow LED   |  : relay energized, no latching function<br> : relay energized, active latching function<br> : relay de-energized, active latching function |   |  |  |               |
| <b>Output circuits</b>                                |   | <b>11(15)-12(16)/14(18), 21(25)-22(26)/24(28) - Relays</b>   |   |  |  |               |
| Kind of output  |   | 1 c/o contact  | 2 c/o contacts                              | 1x2 c/o contacts<br>or 2x1 c/o contact<br>configurable       |  |               |
| Operating principle                                   |   | open-circuit principle <sup>a)</sup>   |   | open- or closed-circuit principle configurable <sup>a)</sup> |  |               |
| Contact material                                      |   | AgNi   |   |  |  |               |
| Minimum switching voltage / minimum switching current |   | 24 V / 10 mA   |   |  |  |               |
| Maximum switching voltage / maximum switching current |   | 250 V AC / 4 A AC  |   |  |  |               |
| Rated operational voltage $U_e$                       | AC-12 (resistive) at 230 V                                | 4 A  |   |  |  |               |
| and rated operational current $I_e$                   | 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  |   |  |  |               |
|   | max. rated operational voltage                            | 300 V AC   |   |  |  |               |
|   | max. continuous thermal current at B 300                  | 5 A  |   |  |  |               |
|   | max. making/breaking apparent power (make/break) at B 300 | 3600/360 VA  |   |  |  |               |
| Mechanical lifetime                                   |   | 30x10 <sup>6</sup> switching cycles  |   |  |  |               |
| Electrical lifetime (AC-12, 230 V, 4 A)               |   | 0.1x10 <sup>6</sup> switching cycles   |   |  |  |               |
| Max. fuse rating to achieve short-circuit protection  | n/c contact   | 6 A fast-acting  | 10 A fast-acting                            | 6 A fast-acting  |  |               |
|   | n/o contact   | 10 A fast-acting   |   |  |  |               |

<sup>1)</sup> In case of measured currents > 10 A, lateral spacing has to be min. 10 mm

<sup>2)</sup> Open-circuit principle: output relay energizes if the measured value exceeds  / falls below  the adjusted threshold value  
Closed-circuit principle: output relay de-energizes if measured value exceeds  / falls below  the adjusted threshold value

# Current monitoring relays, single-phase

## Technical data - Current monitoring relays








2





| Type  | CM-SRS.1   | CM-SRS.2       | CM-SRS.M                                    | CM-SFS.2 |
|---|--|----------------|---|----------|
| <b>General data</b>                                       |  |                |   |          |
| MTBF  | on request   |                |   |          |
| Duty cycle  | 100%   |                |   |          |
| Dimensions  | see 'Dimensional drawings'   |                |   |          |
| Mounting  | DIN rail (IEC/EN 60715), snap-on mounting without any tool                                 |                |   |          |
| Mounting position   | any  |                |   |          |
| Minimum distance to other units                           | 10 mm (0.39 in) at measured current > 10 A   |                |   |          |
| Material of housing                                       | UL 94 V-0  |                |   |          |
| Degree of protection                                      | housing / terminals  | IP50 / IP20    |   |          |
| <b>Electrical connection</b>                              |  |                |   |          |
| Connecting capacity                                       | <b>Screw connection technology</b>   |                | <b>Easy Connect Technology (Push-in)</b>    |          |
| fine-strand with(out) wire end ferrule                    | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)<br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |                | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |          |
| rigid   | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)   |                | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG) |          |
| Stripping length  | 8 mm (0.32 in)   |                |   |          |
| Tightening torque   | 0.6-0.8 Nm (7.08 lb.in)  |                | -   |          |
| <b>Environmental data</b>                                 |  |                |   |          |
| Ambient temperature range                                 | operation  | -20...+60 °C   |   |          |
|   | storage  | 40...+85 °C    |   |          |
| Damp heat (IEC/EN 60068-2-30)                             | 55 °C, 6 cycles  |                |   |          |
| Vibration, sinusoidal                                     | class 2  |                |   |          |
| Shock   | class 2  |                |   |          |
| <b>Isolation data</b>                                     |  |                |   |          |
| Rated insulation voltage                                  | input / measuring circuit / output   | 600 V          |   |          |
|   | output 1 / output 2  | 250 V          |   |          |
| Rated impulse withstand voltage U <sub>imp</sub>          | input / measuring circuit / output   | 6 kV 1.2/50 μs |   |          |
|   | output 1 / output 2  | 4 kV 1.2/50 μs |   |          |
| Pollution degree  | 3  |                |   |          |
| Overvoltage category                                      | III  |                |   |          |
| <b>Standards / Directives</b>                             |  |                |   |          |
| Standards   | IEC/EN 60255-27, IEC/EN 60947-5-1, EN 50178  |                |   |          |
| Low Voltage Directive                                     | 2014/35/EU   |                |   |          |
| EMC Directive   | 2014/30/EU   |                |   |          |
| RoHS Directive  | 2011/65/EU   |                |   |          |
| <b>Electromagnetic compatibility</b>                      |  |                |   |          |
| Interference immunity to                                  | IEC/EN 61000-6-2   |                |   |          |
| electrostatic discharge                                   | IEC/EN 61000-4-2   | level 3        |   |          |
| radiated, radio-frequency, electromagnetic field          | IEC/EN 61000-4-3   | level 3        |   |          |
| electrical fast transient / burst                         | IEC/EN 61000-4-4   | level 3        |   |          |
| surge   | IEC/EN 61000-4-5   | level 3        |   |          |
| conducted disturbances, induced by radio-frequency fields | IEC/EN 61000-4-6   | level 3        |   |          |
| Interference emission                                     | IEC/EN 61000-6-3   |                |   |          |
| high-frequency radiated                                   | IEC/CISPR 22; EN 55022   | class B        |   |          |
| high-frequency conducted                                  | IEC/CISPR 22; EN 55022   | class B        |   |          |

# Voltage monitoring relays, single-phase

## Technical data - Voltage monitoring relays

2

| Type  |   | CM-ESS.1   | CM-ESS.2                    | CM-ESS.M  | CM-EFS.2       |
|---|---|--|-----------------------------|---|----------------|
| <b>Input circuit - Supply circuit</b>                               |   | <b>A1-A2</b>   |                             |   |                |
| Rated control supply voltage $U_s$                                  | A1-A2   | 110-130 V AC   |                             |   |                |
|   | A1-A2   | 220-240 V AC   |                             |   |                |
|   | A1-A2   | 24-240 V AC/DC   |                             |   |                |
| Rated control supply voltage $U_s$ tolerance                        |   | -15...+10 %  |                             |   |                |
| Rated frequency   | AC versions   | 50/60 Hz   |                             |   |                |
|   | AC/DC versions  | 50/60 Hz or DC   |                             |   |                |
| Current / power consumption   |   | see data sheet   |                             |   |                |
| Power failure buffering time  |   | 20 ms  |                             |   |                |
| Transient overvoltage protection                                    |   | varistors  |                             |   |                |
| <b>Input circuit - Measuring circuit</b>                            |   | <b>B-C</b>   |                             |   |                |
| Monitoring function   |   | over- or undervoltage monitoring<br>configurable   |                             | over- and undervoltage<br>monitoring<br>configurable            |                |
| Measuring method  |   | true RMS measuring principle   |                             |   |                |
| Measuring inputs  |   | <b>CM-ExS</b>  |                             |   |                |
|   | terminal connection                                       | <b>B-C</b>   | <b>B-C</b>                  | <b>B-C</b>  | <b>B-C</b>     |
|   | measuring range AC/DC                                     | 3-30 V   | 6-60 V                      | 30-300 V  | 60-600 V       |
|   | input resistance  | 600 k $\Omega$   | 600 k $\Omega$              | 600 k $\Omega$  | 600 k $\Omega$ |
|   | pulse overload capacity $t < 1$ s                         | 800 V  | 800 V                       | 800 V   | 800 V          |
|   | continuous capacity                                       | 660 V  | 660 V                       | 660 V   | 660 V          |
| Threshold value(s)  |   | adjustable within the indicated measuring range  |                             |   |                |
| Tolerance of the adjusted threshold value                           |   | 10 % of full-scale value   |                             |   |                |
| Hysteresis related to the threshold value                           |   | 3-30 % adjustable  |                             |   | 5 % fixed      |
| Measuring signal frequency range                                    |   | DC / 15 Hz - 2 kHz   |                             |   |                |
| Rated measuring signal frequency range                              |   | DC / 50-60 Hz  |                             |   |                |
| Maximum response time   |   | AC: 80 ms / DC: 120 ms   |                             |   |                |
| Accuracy within the control supply voltage tolerance                |   | $\Delta U \leq 0.5$ %  |                             |   |                |
| Accuracy within the temperature range                               |   | $\Delta U \leq 0.06$ % / °C  |                             |   |                |
| Transient overvoltage protection                                    |   | Varistors  |                             |   |                |
| <b>Timing circuit</b>   |   |  |                             |   |                |
| Delay time $T_V$  |   | none   | 0 or 0.1-30 s adjustable    |   |                |
| Repeat accuracy (constant parameters)                               |   | $\pm 0.07$ % of full-scale value   |                             |   |                |
| Accuracy within the control supply voltage tolerance                |   | -  | $\Delta t \leq 0.5$ %       |   |                |
| Accuracy within the temperature range                               |   | -  | $\Delta t \leq 0.06$ % / °C |   |                |
| <b>Indication of operational states</b>                             |   |  |                             |   |                |
| Control supply voltage  | U/T: green LED  |  : control supply voltage applied<br> : tripping delay $T_V$ active  |                             |   |                |
| Measured value  | U: red LED  |  : overvoltage,<br> : undervoltage   |                             |   |                |
| Relay status  | R: yellow LED   |  : relay energized, no latching function<br> : relay energized, active latching function<br> : relay de-energized, active latching function |                             |   |                |
| <b>Output circuits</b>  |   |  |                             |   |                |
| Kind of output  |   | 1 c/o contact  | 2 c/o contacts              | 1x2 c/o contacts or<br>2x1 c/o contact<br>configurable          |                |
| Operating principle   |   | open-circuit principle <sup>1)</sup>   |                             | open- or closed-circuit principle<br>configurable <sup>1)</sup> |                |
| Contact material  |   | AgNi   |                             |   |                |
| Minimum switching voltage / minimum switching current               |   | 24 V / 10 mA   |                             |   |                |
| Maximum switching voltage / maximum switching current               |   | 250 V AC / 4 A AC  |                             |   |                |
| Rated operational voltage $U_o$ and rated operational current $I_o$ | 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  |                             |   |                |
|   | max. rated operational voltage                            | 300 V AC   |                             |   |                |
|   | max. continuous thermal current at B 300                  | 5 A  |                             |   |                |
|   | max. making/breaking apparent power (make/break) at B 300 | 3600/360 VA  |                             |   |                |
| Mechanical lifetime   |   | 30x10 <sup>6</sup> switching cycles  |                             |   |                |
| Electrical lifetime   | AC-12, 230 V, 4 A   | 0.1x10 <sup>6</sup> switching cycles   |                             |   |                |
| Max. fuse rating to achieve short-circuit protection                | n/c contact   | 6 A fast-acting  | 10 A fast-acting            | 6 A fast-acting   |                |
|   | n/o contact   | 10 A fast-acting   |                             |   |                |

<sup>1)</sup> Open-circuit principle: output relay energizes if the measured value exceeds  / falls below  the adjusted threshold value  
 Closed-circuit principle: output relay de-energizes if measured value exceeds  / falls below  the adjusted threshold value

# Voltage monitoring relays, single-phase

## Technical data - Voltage monitoring relays

2

| Type  | CM-ESS.1   | CM-ESS.2   | CM-ESS.M                                    | CM-EFS.2 |
|---|--|--|---|----------|
| <b>General data</b>                                       |  |  |   |          |
| MTBF  | on request   |  |   |          |
| Duty cycle  | 100%   |  |   |          |
| Dimensions  | see 'Dimensional drawings'                                 |  |   |          |
| 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  |   |          |
| <b>Environmental data</b>                                 |  |  |   |          |
| Ambient temperature ranges                                | operation  | -20...+60 °C   |   |          |
|   | storage  | -40...+85 °C   |   |          |
| Damp heat, cyclic (IEC/EN 60068-2-30)                     | 55 °C, 6 cycle   |  |   |          |
| Vibration, sinusoidal                                     | Class 2  |  |   |          |
| Shock   | Class 2  |  |   |          |
| <b>Electrical connection</b>                              |  |  |   |          |
| Wire size   |  | <b>Screw connection technology</b>   | <b>Easy Connect Technology (Push-in)</b>    |          |
|   | fine-strand with(out) wire end ferrule                     | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)<br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |          |
|   | rigid  | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)   | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG) |          |
| Stripping length  | 8 mm (0.32 in)   |  |   |          |
| Tightening torque   | 0.6-0.8 Nm (7.08 lb.in)                                    |  | -   |          |
| <b>Isolation data</b>                                     |  |  |   |          |
| Rated insulation voltage                                  | input / measuring circuit / output                         | 600 V  |   |          |
|   | output 1 / output 2  | 250 V  |   |          |
| Rated impulse withstand voltage U <sub>imp</sub>          | input / measuring circuit / output                         | 6 kV 1.2/50 μs   |   |          |
|   | output 1 / output 2  | 4 kV 1.2/50 μs   |   |          |
| Pollution degree  | 3  |  |   |          |
| Overvoltage category                                      | III  |  |   |          |
| <b>Standards / Directives</b>                             |  |  |   |          |
| Standards   | IEC/EN 60255-27, IEC/EN 60947-5-1, EN 50178                |  |   |          |
| Low Voltage Directive                                     | 2014/35/EU   |  |   |          |
| EMC Directive   | 2014/30/EU   |  |   |          |
| RoHS Directive  | 2011/65/EU   |  |   |          |
| <b>Electromagnetic compatibility</b>                      |  |  |   |          |
| Interference immunity to electrostatic discharge          | IEC/EN 61000-4-2   | IEC/EN 61000-6-2 level 3   |   |          |
| radiated, radio-frequency, electromagnetic field          | IEC/EN 61000-4-3   | level 3  |   |          |
| electrical fast transient / burst                         | IEC/EN 61000-4-4   | level 3  |   |          |
| surge   | IEC/EN 61000-4-5   | level 3  |   |          |
| conducted disturbances, induced by radio-frequency fields | IEC/EN 61000-4-6   | level 3  |   |          |
| Interference emission                                     | IEC/EN 61000-6-3   |  |   |          |
| high-frequency radiated                                   | IEC/CISPR 22; EN 55022                                     | class B  |   |          |
| high-frequency conducted                                  | IEC/CISPR 22; EN 55022                                     | class B  |   |          |

# Current and voltage monitoring relays, single-phase

## Notes



# Three-phase monitoring relays

## Product group picture

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# Three-phase monitoring relays

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### Three-phase monitoring relays

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# Three-phase monitoring relays

## Benefits and advantages, Applications

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### Characteristics of the CM range three-phase monitors <sup>1)</sup>

- Suitable for railway applications
- Adjustable phase unbalance threshold value
- Adjustable ON-delay/OFF-delay time
- Dual frequency measuring 50/60 Hz
- Powered by the measuring circuit
- 1 n/o contact, 1 or 2 c/o contacts
- LEDs for the indication of operational states
- Multifunctional and single-functional devices
- Phase failure detection
- Phase sequence monitoring
- Over- and undervoltage monitoring (fixed or adjustable)
- Wide-range operating voltage guarantees world-wide operation
- Various approvals and marks

<sup>1)</sup> depending on device type

### Phase unbalance monitoring

If the supply by the three-phase system is unbalanced due to uneven distribution of the load, the motor will convert a part of the energy into reactive power. This energy gets lost unexploited; also the motor is exposed to higher thermal stress. Other thermal protection devices fail to detect continuing unbalances which can lead to damage or destruction of the motor. The CM range three-phase monitors with phase unbalance monitoring can reliably detect this critical situation.

### Phase sequence

Changing the phase sequence during operation or a wrong phase sequence prior to startup causes a change of the rotational direction of the connected device. Generators, pumps or fans rotate in the wrong direction and the installation is no longer working properly. Especially for moveable equipment, such as construction machinery, phase sequence detection prior to the startup process is highly reasonable.

### Phase loss

In case of phase loss, undefined states of the installation are likely to occur. E.g. the startup process of motors is disturbed. All three-phase monitors of the ABB CM range detect a phase loss as soon as the voltage of one phase drops below 60% of its nominal value.

### Voltage monitoring

All electric devices can be damaged when operated continuously in a network with out-of-range voltages. For example, safe starting is not ensured in case of undervoltage. Also, the switching state of a contactor is not clearly defined when operated in a „forbidden“ voltage range. This can lead to undefined states of the installation and cause damage or destruction of valuable parts.

### Extended functionality

ABB's new generation of three-phase monitoring relays feature additional functions making the application field for the devices considerably larger.

### Selectable phase sequence monitoring

The phase sequence monitoring can be switched off by means of a rotary switch or a DIP switch. This enables monitoring of three-phase mains where phase sequence is not relevant for the application, for example in case of motors with forward and reverse rotation, heating applications, etc.

### Automatic phase sequence correction

The automatic phase sequence correction is activated by means of a DIP switch. With activated phase sequence correction, it is ensured that for any non-fixed or portable equipment, e.g. construction machinery, the correct phase sequence is always applied to the input terminals of the load. For details regarding the wiring, please see function description / diagrams.

### Structure of the type designation

CM-\_\_ x.yz

x: width of enclosure

y: Control supply voltage / measuring range

|   |  |
|---|--|
| 1 | 110, 115, 120, 127 V supply systems (phase-neutral)              |
| 2 | 220, 230, 240 V supply systems (phase-neutral)                   |
| 3 | 200, 208, 220, 230, 240, 257, 260 V supply systems (phase-phase) |
| 4 | 440, 460 V supply systems (phase-phase)                          |
| 5 | 480, 500 V supply systems (phase-phase)                          |
| 6 | 575, 600 V supply systems (phase-phase)                          |
| 7 | 660, 690 V supply systems (phase-phase)                          |
| 8 | 200, 400 V supply systems (phase-phase)                          |

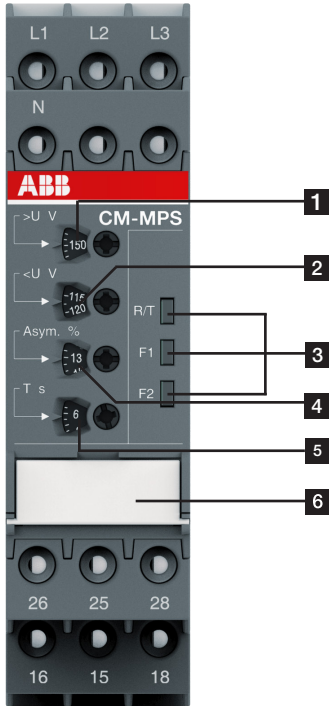
z: Rated frequency / output circuit

|   |                               |
|---|-------------------------------|
| 1 | 50/60 Hz – 1x2 c/o            |
| 2 | 50/60 Hz – 1x2 or 2x1 c/o     |
| 3 | 50/60/400 Hz – 1x2 or 2x1 c/o |

# Three-phase monitoring relays

## Operating controls

### S-Range Housing



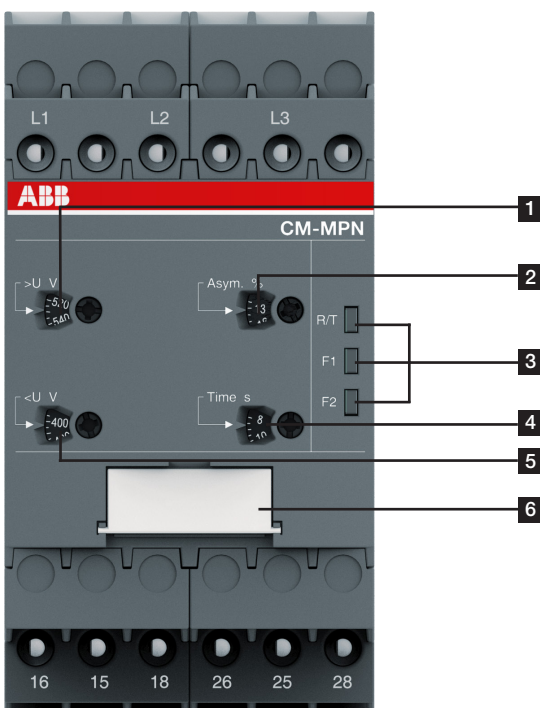
2CDC 253 017 F0013

- 1** Adjustment of the threshold value  $>U$  for overvoltage
- 2** Adjustment of the threshold value  $<U$  for undervoltage
- 3** Indication of operational states
  - R/T: yellow LED – Relay status / timing
  - F1: red LED – Fault message
  - F2: red LED – Fault message

- 4** Adjustment of the threshold value Asym. for phase unbalance
- 5** Adjustment of the tripping delay  $T_v$
- 6** DIP switches (see DIP switch functions on page 2/40)
  - ON-delay
  - OFF-delay
  - Phase sequence monitoring deactivated
  - Phase sequence monitoring activated
  - Phase sequence correction activated
  - Phase sequence correction deactivated
  - 2x1 c/o (SPDT) contact
  - 1x2 c/o (SPDT) contacts

2

### N-Range Housing



2CDC 253 016 F0013

- 1** Adjustment of the threshold value  $>U$  for overvoltage
- 2** Adjustment of the threshold value Asym. for phase unbalance
- 3** Indication of operational states
  - R/T: yellow LED – Relay status / timing
  - F1: red LED – Fault message
  - F2: red LED – Fault message

- 4** Adjustment of the tripping delay  $T_v$
- 5** Adjustment of the threshold value  $<U$  for undervoltage
- 6** DIP switches (see DIP switch functions on page 2/40)
  - ON-delay
  - OFF-delay
  - Phase sequence monitoring deactivated
  - Phase sequence monitoring activated
  - Phase sequence correction activated
  - Phase sequence correction deactivated
  - 2x1 c/o (SPDT) contact
  - 1x2 c/o (SPDT) contacts

# Three-phase monitoring relays

## Selection table - Singlefunctional

|  | Type       | Order number    |
|--|------------|-----------------|
|  | CM-PBE     | 1SVR550881R9400 |
|  | CM-PBE     | 1SVR550882R9500 |
|  | CM-PVE     | 1SVR550870R9400 |
|  | CM-PVE     | 1SVR550871R9500 |
|  | CM-PFE     | 1SVR550824R9100 |
|  | CM-PFE.2   | 1SVR550826R9100 |
|  | CM-PFS.S   | 1SVR730824R9300 |
|  | CM-PFS.P   | 1SVR740824R9300 |
|  | CM-PSS.31S | 1SVR730784R2300 |
|  | CM-PSS.31P | 1SVR740784R2300 |
|  | CM-PSS.41S | 1SVR730784R3300 |
|  | CM-PSS.41P | 1SVR740784R3300 |
|  | CM-PVS.31S | 1SVR730794R1300 |
|  | CM-PVS.31P | 1SVR730794R1300 |
|  | CM-PVS.41S | 1SVR730794R3300 |
|  | CM-PVS.41P | 1SVR740794R3300 |
|  | CM-PVS.81S | 1SVR730794R2300 |
|  | CM-PVS.81P | 1SVR740794R2300 |
|  | CM-PAS.31S | 1SVR730774R1300 |
|  | CM-PAS.31P | 1SVR740774R1300 |
|  | CM-PAS.41S | 1SVR730774R3300 |
|  | CM-PAS.41P | 1SVR740774R3300 |

| Rated control supply voltage U <sub>c</sub> |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Phase to phase                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 160-300 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 200-400 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 200-500 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 208-440 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 300-500 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 320-460 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 380 V AC                                    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 380-440 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 400 V AC                                    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Phase to Neutral                            |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 185-265 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 220-240 V AC                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Rated frequency                             |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 50/60 Hz                                    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Suitable for monitoring                     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Single-phase mains                          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Three-phase mains                           |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Monitoring function                         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Phase failure                               |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Phase sequence                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Automatic phase sequence correction         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Overtoltage                                 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Undervoltage                                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Unbalance                                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Neutral <sup>1)</sup>                       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Thresholds                                  | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | adj | adj | adj | adj | adj | adj |
| Timing functions for tripping delay         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| ON delay                                    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| On and OFF delay                            | fix | fix | fix | fix | fix | fix |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Connection type                             |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Push-in terminals                           |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Double-chamber cage connection terminals    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

<sup>1)</sup> The external conductor voltage towards the neutral conductor is measured.

adj: adjustable  
 sel: selectable  
 fix: fixed

# Three-phase monitoring relays

## Ordering details - Singlefunctional



2CDC 251 064 V0011

CM-PBE



2CDC 251 064 V0011

CM-PSS.41P



2CDC 251 063 V0011

CM-PAS.31P

### Description

The three-phase monitoring relays are designed for use in three-phase mains for monitoring the phase parameters like phase sequence, phase failure, over- and undervoltage as well as phase unbalance.

### Ordering details

| Characteristics  | Type     | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|--|----------|-----------------|---------------|-----------------------------|
| See "Selection table - Singlefunctional" on page 2/29. | CM-PBE   | 1SVR550881R9400 |               | 0.08 (0.17)                 |
|  | CM-PBE   | 1SVR550882R9500 |               | 0.08 (0.17)                 |
|  | CM-PVE   | 1SVR550870R9400 |               | 0.08 (0.17)                 |
|  | CM-PVE   | 1SVR550871R9500 |               | 0.08 (0.17)                 |
|  | CM-PFE   | 1SVR550824R9100 |               | 0.08 (0.17)                 |
|  | CM-PFE.2 | 1SVR550826R9100 |               | 0.067 (0.147)               |

### Ordering details

| Characteristics  | Type       | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|--|------------|-----------------|---------------|-----------------------------|
| See "Selection table - Singlefunctional" on page 2/29. | CM-PFS.S   | 1SVR730824R9300 |               | 0.127 (0.280)               |
|  | CM-PFS.P   | 1SVR740824R9300 |               | 0.119 (0.262)               |
|  | CM-PSS.31S | 1SVR730784R2300 |               | 0.132 (0.291)               |
|  | CM-PSS.31P | 1SVR740784R2300 |               | 0.123 (0.271)               |
|  | CM-PSS.41S | 1SVR730784R3300 |               | 0.132 (0.291)               |
|  | CM-PSS.41P | 1SVR740784R3300 |               | 0.123 (0.271)               |
|  | CM-PVS.31S | 1SVR730794R1300 |               | 0.141 (0.311)               |
|  | CM-PVS.31P | 1SVR740794R1300 |               | 0.132 (0.291)               |
|  | CM-PVS.41S | 1SVR730794R3300 |               | 0.139 (0.306)               |
|  | CM-PVS.41P | 1SVR740794R3300 |               | 0.131 (0.289)               |
|  | CM-PVS.81S | 1SVR730794R2300 |               | 0.136 (0.300)               |
|  | CM-PVS.81P | 1SVR740794R2300 |               | 0.128 (0.282)               |
|  | CM-PAS.31S | 1SVR730774R1300 |               | 0.133 (0.293)               |
|  | CM-PAS.31P | 1SVR740774R1300 |               | 0.124 (0.273)               |
|  | CM-PAS.41S | 1SVR730774R3300 |               | 0.132 (0.291)               |
|  | CM-PAS.41P | 1SVR740774R3300 |               | 0.123 (0.271)               |

S: screw connection  
P: push-in connection



Further documentation three-phase monitoring relays on [www.abb.com](http://www.abb.com)



# Three-phase monitoring relays

## Selection table - Multifunctional

2

|   | Order number    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Type  | 1SVR730885R1300 | 1SVR740885R1300 | 1SVR730885R3300 | 1SVR740885R3300 | 1SVR730884R1300 | 1SVR740884R1300 | 1SVR730884R3300 | 1SVR740884R3300 | 1SVR730885R4300 | 1SVR740885R4300 | 1SVR730884R4300 | 1SVR740884R4300 | 1SVR750487R8300 | 1SVR760487R8300 | 1SVR750488R8300 | 1SVR760488R8300 | 1SVR750489R8300 | 1SVR760489R8300 |
| <b>Rated control supply voltage U<sub>s</sub></b> |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| <b>Phase to Phase</b>                             |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 160-300 V AC                                      |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 300-500 V AC                                      |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 350-580 V AC                                      |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |
| 450-720 V AC                                      |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |
| 530-820 V AC                                      |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |
| <b>Phase to Neutral</b>                           |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 90-170 V AC                                       | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 180-280 V AC                                      |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |
| <b>Rated frequency</b>                            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 50/60 Hz  | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |                 |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               |
| 50/60/400 Hz                                      |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               |                 |                 |                 |                 |                 |                 |
| <b>Suitable for monitoring</b>                    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Single-phase mains                                | ■               | ■               | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |
| Three-phase mains                                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| <b>Monitoring function</b>                        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Phase failure                                     | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Phase sequence                                    | sel             | sel             | sel             | sel             | sel             | sel             | sel             | sel             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             |                 |
| Automatic phase sequence correction               |                 |                 |                 |                 |                 |                 |                 |                 | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             |                 |
| Overvoltage                                       | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Undervoltage                                      | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Unbalance   | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Interrupted neutral monitoring <sup>1)</sup>      | ■               | ■               | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |
| <b>Thresholds</b>                                 | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             |
| <b>Timing functions for tripping delay</b>        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| On and OFF delay                                  | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             | adj             |
| <b>Connection type</b>                            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Push-in terminals                                 |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |
| Double-chamber cage connection terminals          | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 |

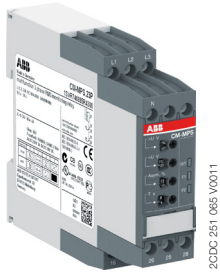
1) The external conductor voltage towards the neutral conductor is measured too

adj: adjustable  
sel: selectable



# Three-phase monitoring relays

## Ordering details - Multifunctional



CM-MPS.23P

2CDC 251 065 V0011



CM-MPN.52P

2CDC 251 062 V0011

### Ordering details

| Characteristics | Type       | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|-----------------|------------|-----------------|---------------|-----------------------------|
|                 | CM-MPS.11S | 1SVR730885R1300 |               | 0.148 (0.326)               |
|                 | CM-MPS.11P | 1SVR740885R1300 |               | 0.137 (0.302)               |
|                 | CM-MPS.21S | 1SVR730885R3300 |               | 0.146 (0.322)               |
|                 | CM-MPS.21P | 1SVR740885R3300 |               | 0.135 (0.298)               |
|                 | CM-MPS.31S | 1SVR730884R1300 |               | 0.142 (0.313)               |
|                 | CM-MPS.31P | 1SVR740884R1300 |               | 0.133 (0.293)               |
|                 | CM-MPS.41S | 1SVR730884R3300 |               | 0.140 (0.309)               |
|                 | CM-MPS.41P | 1SVR740884R3300 |               | 0.132 (0.291)               |
|                 | CM-MPS.23S | 1SVR730885R4300 |               | 0.149 (0.328)               |
|                 | CM-MPS.23P | 1SVR740885R4300 |               | 0.138 (0.304)               |
|                 | CM-MPS.43S | 1SVR730884R4300 |               | 0.148 (0.327)               |
|                 | CM-MPS.43P | 1SVR740884R4300 |               | 0.137 (0.302)               |
|                 | CM-MPN.52S | 1SVR750487R8300 |               | 0.230 (0.507)               |
|                 | CM-MPN.52P | 1SVR760487R8300 |               | 0.226 (0.498)               |
|                 | CM-MPN.62S | 1SVR750488R8300 |               | 0.229 (0.505)               |
|                 | CM-MPN.62P | 1SVR760488R8300 |               | 0.225 (0.496)               |
|                 | CM-MPN.72S | 1SVR750489R8300 |               | 0.224 (0.494)               |
|                 | CM-MPN.72P | 1SVR760489R8300 |               | 0.220 (0.485)               |

See "Selection table - Multifunctional" on page 2/31.

S: screw connection  
P: push-in connection



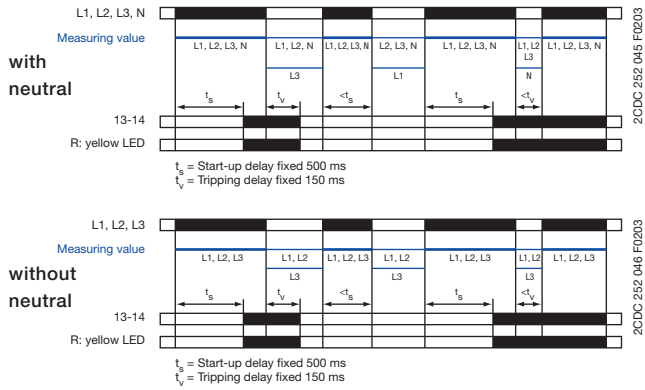
Further documentation three-phase monitoring relays on [www.abb.com](http://www.abb.com)

# Three-phase monitoring relays

## Function diagrams

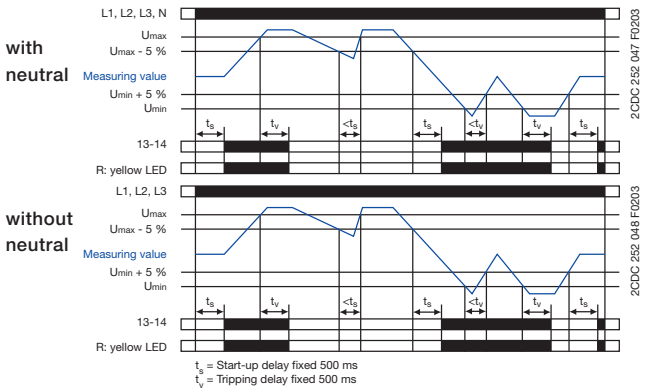
2

### Function diagrams - Phase failure detection CM-PBE



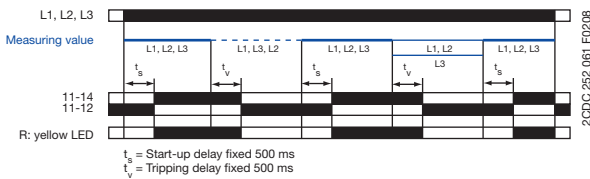
If all phases (and the neutral) are present, the output relay energizes after the start-up delay  $t_s$  is complete. If a phase failure occurs, the tripping delay  $t_v$  starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of  $t_s$  starts. When timing is complete, the output relay re-energizes automatically. The yellow LED glows when the output relay is energized.

### Function diagrams - Phase failure, under- / overvoltage detection CM-PVE



If all phases (and the neutral) are present with correct voltage, the output relay energizes after the start-up delay  $t_s$  is complete. If the voltage exceeds or falls below the fixed threshold value or if a phase failure occurs, the tripping delay  $t_v$  starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of  $t_s$  starts. When timing is complete, the output relay re-energizes automatically. The yellow LED glows when the output relay is energized.

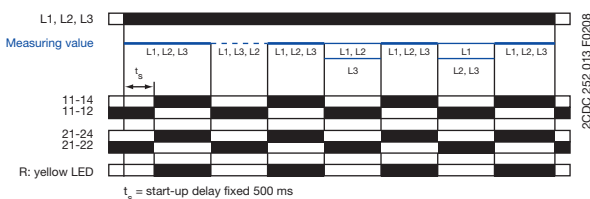
### Function diagram - Phase failure detection, phase sequence monitoring CM-PFE, CM-PFE.2



If all phases are present with the correct phase sequence, the output relay energizes after the start-up delay  $t_s$  is complete. If a phase failure or a phase sequence error occurs, the tripping delay  $t_v$  starts. When timing is complete, the output relay de-energizes. The yellow LED glows when the output relay is energized.

In case of motors which continue running with only two phases, the CM-PFE detects phase failure if the reverse fed voltage is less than 60 % of the originally applied voltage.

### Function diagram - Phase failure detection, phase sequence monitoring CM-PFS



If all phases are present with the correct phase sequence, the output relay energizes after the start-up delay  $t_s$  is complete. If a phase failure or a phase sequence error occurs, the output relay de-energizes instantaneous. The yellow LED glows when the output relay is energized.

In case of motors which continue running with only two phases, the CM-PFS detects phase failure if the reverse fed voltage is less than 60 % of the originally applied voltage.

#### ATTENTION

If several CM-PFS units are placed side by side and the control supply voltage is higher than 415 V, spacing of at least 10 mm has to be kept between the individual units.

# Three-phase monitoring relays

## Function diagrams

### CM-PSS.xx, CM-PVS.xx, CM.PAS.xx, CM-MPS.xx, CM-MPN.xx

#### Phase sequence monitoring and phase failure detection

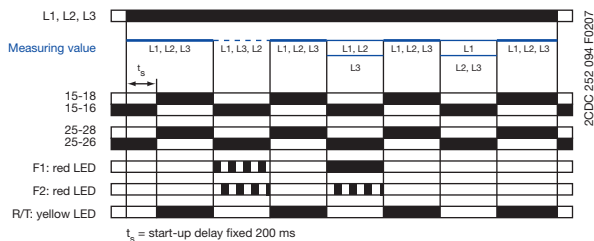
Applying control supply voltage begins the fixed start-up delay  $t_{s1}$ . When  $t_{s1}$  is complete and all phases are present with correct voltage, the output relays energize and the yellow LED R/T glows.

#### Phase sequence monitoring

If phase sequence monitoring is activated, the output relays de-energize as soon as a phase sequence error occurs. The fault is displayed by alternated flashing of the LEDs F1 and F2. The output relays re-energize automatically as soon as the phase sequence is correct again.

#### Phase failure detection

The output relays de-energize instantaneous if a phase failure occurs. The fault is indicated by lighting of LED F1 and flashing of LED F2. The output relays re-energize automatically as soon as the voltage returns to the tolerance range.

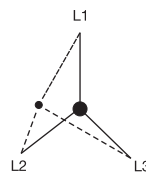


### CM-MPS.11, CM-MPS.21, CM-MPS.23

#### Interrupted neutral monitoring

The interruption of the neutral in the main to be monitored is detected by means of phase unbalance evaluation. Determined by the system, in case of unloaded neutral, i.e. symmetrical load between all three phases, it may happen that an interruption of the neutral will not be detected. If the star point is displaced by asymmetrical load in the three-phase main, an interrupted neutral will be detected.

#### Displacement of the star point



### CM-MPS.x3, CM-MPN.x2

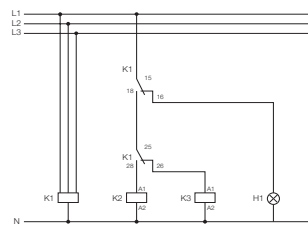
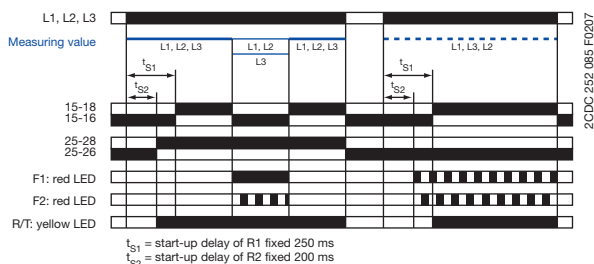
#### Automatic phase sequence correction

This function can be selected only if phase sequence monitoring is activated  and operating mode 2x1 c/o (SPDT) contact  is selected.

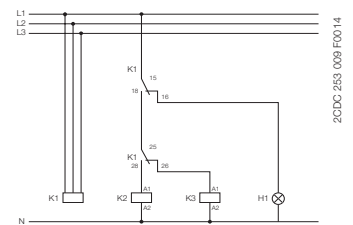
Applying control supply voltage begins the fixed start-up delay  $t_{s1}$ . When  $t_{s1}$  is complete and all phases are present with correct voltage, output relay R1 energizes. Output relay R2 energizes when the fixed start-up delay  $t_{s2}$  is complete and all phases are present with correct phase sequence. Output relay R2 remains de-energized if the phase sequence is incorrect.

If the voltage to be monitored exceeds or falls below the set threshold values for phase unbalance, over- or undervoltage or if a phase failure occurs, output relay R1 de-energizes and the LEDs F1 and F2 indicate the fault.

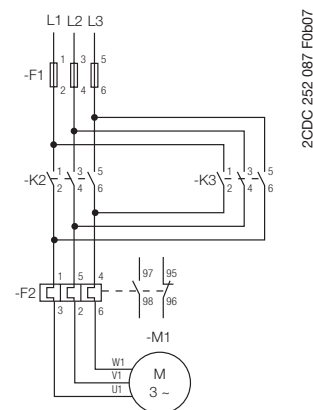
Output relay R2 is responsive only to a false phase sequence. In conjunction with a reversing contactor combination, this enables an automatic correction of the rotation direction. See circuit diagrams on the right.



Control circuit diagram  
(K1 = CM-MPS.23)



Control circuit diagram  
(K1 = CM-MPS.43 or CM-MPN.xx)



Power circuit diagram

# Three-phase monitoring relays

## Function diagrams

CM-PSS.xx<sup>1)</sup>, CM-PVS.xx<sup>2)</sup>, CM-MPS.xx<sup>2)</sup>, CM-MPN.xx<sup>2)</sup>

### Over- and undervoltage monitoring 1x2 c/o

Applying control supply voltage begins the fixed start-up delay  $t_s$ . When  $t_s$  is complete and all phases are present with correct voltage and with correct phase sequence, the output relays energize and the yellow LED R/T glows.

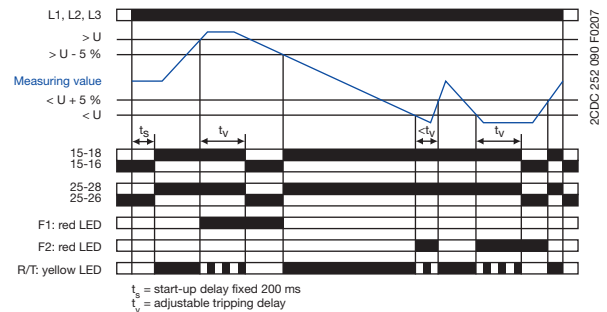
#### Type of tripping delay = ON-delay

If the voltage to be monitored exceeds or falls below the fixed<sup>1)</sup> or set<sup>2)</sup> threshold value, the output relays de-energize after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize. The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 % and the LED R/T glows.

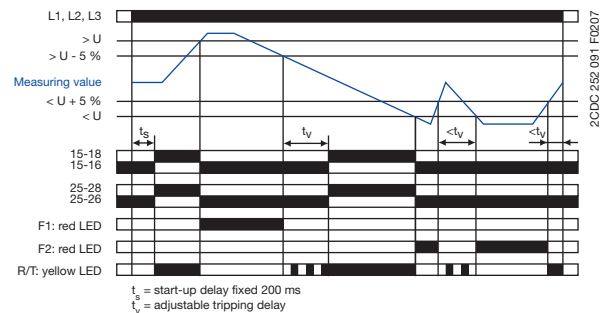
#### Type of tripping delay = OFF-delay

If the voltage to be monitored exceeds or falls below the fixed<sup>1)</sup> or set<sup>2)</sup> threshold value, the output relays de-energize instantaneously and the LED R/T turns off. As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize automatically after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns steady when timing is complete.

### ON-delay 1x2 c/o contacts 1x2 c/o



### OFF-delay 1x2 c/o contacts 1x2 c/o



CM-MPS.x3, CM-MPN.x2

### Over- and undervoltage monitoring 2x1 c/o

Applying control supply voltage begins the fixed start-up delay  $t_s$ . When  $t_s$  is complete and all phases are present with correct voltage and with correct phase sequence, the output relays energize. The yellow LED R/T glows as long as at least one output relay is energized.

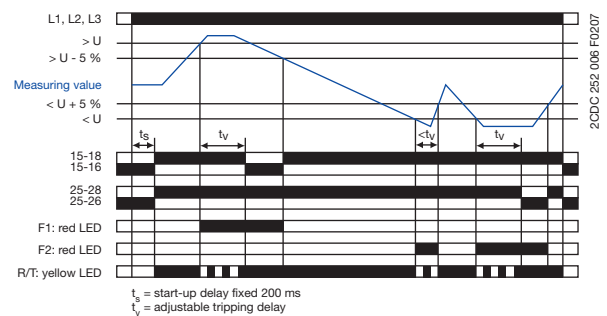
#### Type of tripping delay = ON-delay

If the voltage to be monitored exceeds or falls below the set threshold value, output relay R1 (overvoltage) or output relay R2 (undervoltage) de-energizes after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing. The corresponding output relay re-energizes automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %.

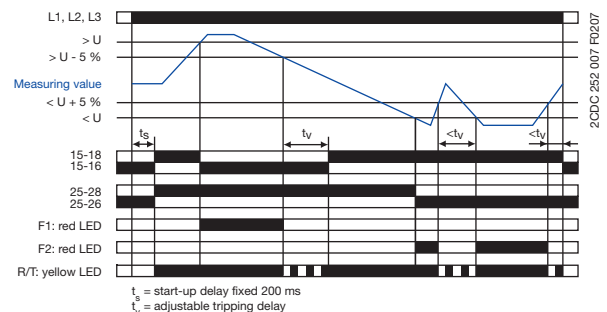
#### Type of tripping delay = OFF-delay

If the voltage to be monitored exceeds or falls below the set threshold value, output relay R1 (overvoltage) or output relay R2 (undervoltage) de-energizes instantaneously. As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the corresponding output relay re-energizes automatically after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing.

### ON-delay 2x1 c/o contact 2x1 c/o



### OFF-delay 2x1 c/o contact 2x1 c/o



# Three-phase monitoring relays

## Function diagrams

### CM-PAS.xx, CM-MPS.xx, CM-MPN.xx

#### Phase unbalance monitoring

Applying control supply voltage begins the fixed start-up delay  $t_s$ . When  $t_s$  is complete and all phases are present with correct voltage and with correct phase sequence, the output relays energize and the yellow LED R/T glows.

#### Type of tripping delay = ON-delay

If the voltage to be monitored exceeds or falls below the set phase unbalance threshold value, the output relays de-energize after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize.

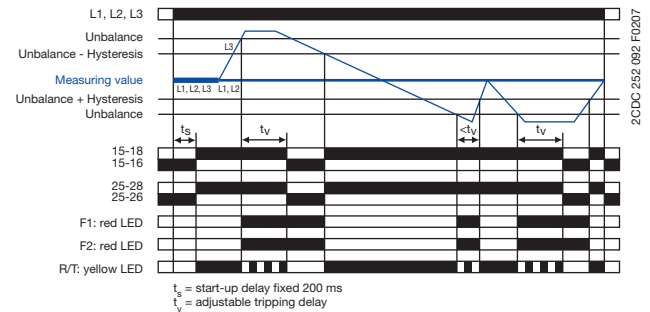
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 20 % and the LED R/T glows.

#### Type of tripping delay = OFF-delay

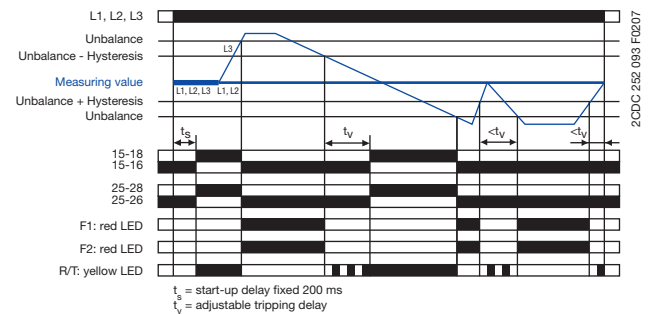
If the voltage to be monitored exceeds or falls below the set phase unbalance threshold value, the output relays de-energize instantaneously and the LED R/T turns off.

As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 20 %, the output relays re-energize automatically after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns steady when timing is complete.

#### ON-delay ☒



#### OFF-delay ■



### CM-PSS.xx, CM-PSV.xx, CM-PAS.xx, CM-MPS.xx, CM-MPN.xx

#### LED functions

| Function   | R/T:<br>yellow LED | F1:<br>red LED | F2:<br>red LED |
|--|--------------------|----------------|----------------|
| Control supply voltage applied, output relay energized | [Pulse]            | -              | -              |
| Tripping delay $t_v$ active                            | [Pulse]            | -              | -              |
| Phase failure  | -                  | [Pulse]        | [Pulse]        |
| Phase sequence   | -                  | [Alternating]  | [Alternating]  |
| Overtvoltage   | -                  | [Pulse]        | -              |
| Undervoltage   | -                  | -              | [Pulse]        |
| Phase unbalance  | -                  | [Pulse]        | [Pulse]        |
| Interruption of the neutral                            | -                  | [Pulse]        | [Pulse]        |
| Adjustment error <sup>1)</sup>                         | [Pulse]            | [Pulse]        | [Pulse]        |

1) Possible misadjustments of the front-face operating controls:  
 Overlapping of the threshold values: An overlapping of the threshold values is given, if the threshold value for overvoltage is set to a smaller value than the threshold value for undervoltage.  
 DIP switch 3 = OFF and DIP switch 4 = ON: Automatic phase sequence correction is activated and selected operating mode is 1x2 c/o contacts  
 DIP switch 2 and 4 = ON: Phase sequence detection is deactivated and the automatic phase sequence correction is activated

#### Type of tripping delay

The type of tripping delay ☒ / ■ can be adjusted via a rotary (CM-PxS.xx) or a DIP switch (CM-MPx.xx).

#### Switch position ON-delay ☒:

In case of a fault, the de-energizing of the output relays and the respective fault message are suppressed for the adjusted tripping delay  $t_v$ .

#### Switch position OFF-delay ■:

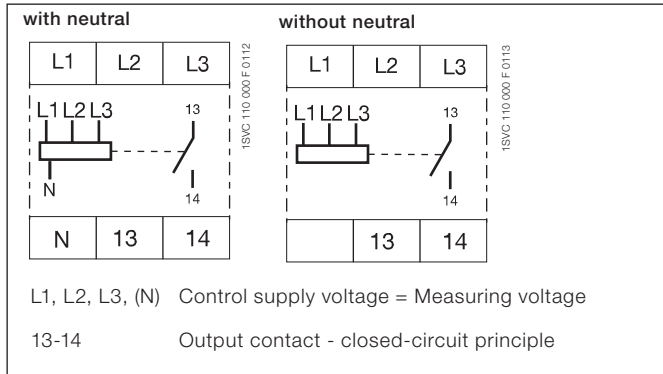
In case of a fault, the output relays de-energize instantaneously and a fault message is displayed and stored for the length of the adjusted tripping delay  $t_v$ . Thereby, also momentary undervoltage conditions are recognized.

# Three-phase monitoring relays

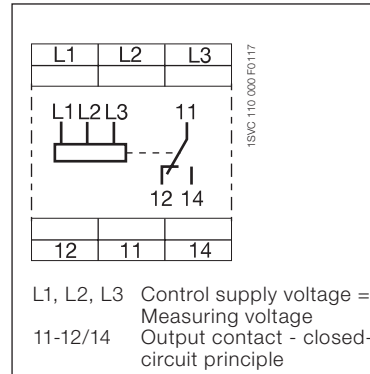
## Connection diagrams

2

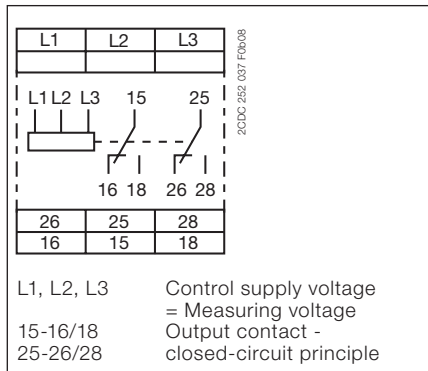
### Connection diagrams CM-PBE, CM-PVE



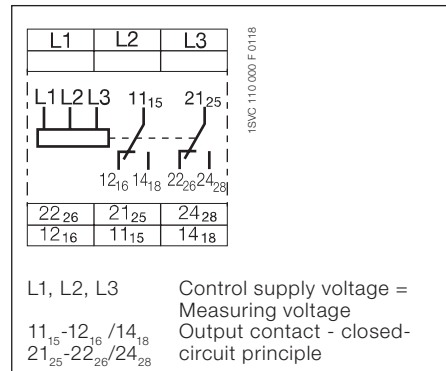
### Connection diagram CM-PFE



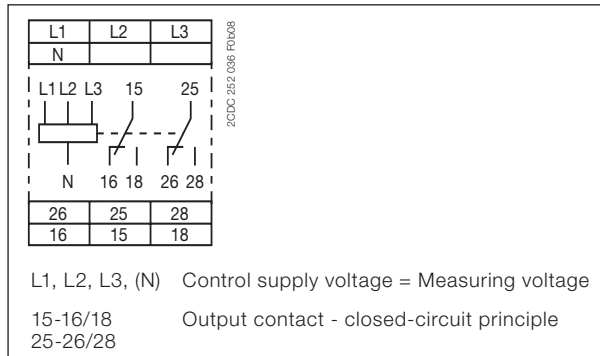
### Connection diagram CM-PVS.x1, CM-PSS.x1, CM-PAS.x1



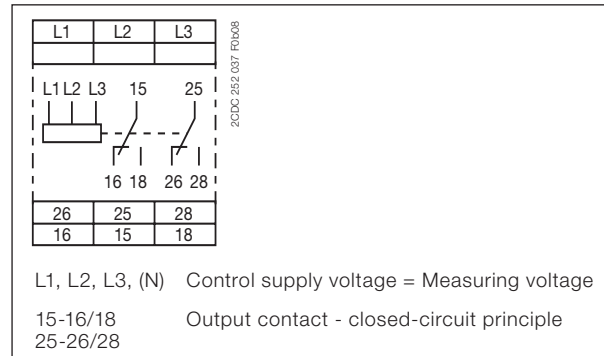
### Connection diagram CM-PFS



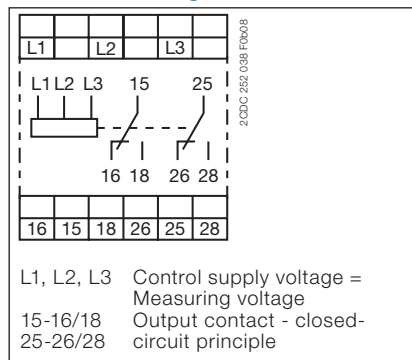
### Connection diagram CM-MPS.11, CM-MPS.21, CM-MPS.23



### Connection diagram CM-MPS.31, CM-MPS.41, CM-MPS.43



### Connection diagram CM-MPN.x2



# Three-phase monitoring relays DIP switches, Rotary switches

## Rotary switch "Function" CM-PSS, CM-PVS

|  |  |
|--|--|
|  | ON-delay<br>with phase sequence monitoring     |
|  | OFF-delay<br>with phase sequence monitoring    |
|  | ON-delay<br>without phase sequence monitoring  |
|  | OFF-delay<br>without phase sequence monitoring |

## DIP switch functions CM-MPS.x3 and CM-MPN.x2

|          |   |   |   |   |                     |
|----------|---|---|---|---|---------------------|
| Position | 4 | 3 | 2 | 1 | 2C01C 252 041 FEN05 |
| ON †     |   |   |   |   |                     |
| OFF      |   |   |   |   |                     |

**1 Timing function**  
ON ON-delayed  
OFF OFF-delayed

**2 Phase sequence monitoring**  
ON deactivated  
OFF activated

**3 Operating principle of output**  
ON 2x1 c/o contact  
OFF 1x2 c/o contact

**4 Phase sequence correction**  
ON activated  
OFF deactivated

Output relay R1 is responsive to overvoltage, output relay R2 is responsive to undervoltage. In case of other faults, both output relays react synchronously.

## DIP switch functions CM-MPS.x1

|          |   |   |                     |
|----------|---|---|---------------------|
| Position | 2 | 1 | 2C01C 252 040 FEN05 |
| ON †     |   |   |                     |
| OFF      |   |   |                     |

**1 Timing function**  
ON ON-delayed  
OFF OFF-delayed

**2 Phase sequence monitoring**  
ON deactivated  
OFF activated



# Three-phase monitoring relays

## Technical data - CM-PBE, CM-PVE, CM-PFE, CM-PFS

2

| Type  | CM-PBE <sup>1)</sup>                               | CM-PBE   | CM-PVE <sup>1)</sup>                                | CM-PVE           | CM-PFE           | CM-PFE.2         | CM-PFS   |
|---|--|--|---|------------------|------------------|------------------|--|
| <b>Input circuit - Supply circuit</b>                               | <b>L1-L2-L3-N</b>                                  | <b>L1-L2-L3</b>  | <b>L1-L2-L3-N</b>                                   |                  | <b>L1-L2-L3</b>  |                  |  |
| Rated control supply voltage $U_s$ = measuring voltage              | 3x380-440 V AC, 220-240 V AC                       | 3x380-440 V AC   | 3x320-460 V AC, 185-265 V AC                        | 3x320-460 V AC   | 3x208-440 V AC   | 3x200-500 V AC   |  |
| Power consumption   |  |  |   |                  | 13 mA / 9 VA     |                  | approx. 15 VA  |
| Rated control supply voltage $U_s$ tolerance                        | -15...+15 %  |  | -15...+10 %   |                  |                  |                  |  |
| Rated frequency   | 50/60 Hz   |  | 50/60 Hz (-10...+10 %)                              |                  | 50/60 Hz         |                  |  |
| <b>Input circuit - Measuring circuit</b>                            | <b>L1-L2-L3-N</b>                                  | <b>L1-L2-L3</b>  | <b>L1-L2-L3-N</b>                                   |                  | <b>L1-L2-L3</b>  |                  |  |
| Monitoring functions  |  |  |   |                  |                  |                  |  |
| phase failure   | ■  | ■  | ■   | ■                | ■                | ■                | ■  |
| phase sequence  | -  | -  | -   | -                | ■                | ■                | ■  |
| over- / undervoltage  | -  | -  | ■   | ■                | -                | -                | -  |
| neutral   | ■  | -  | ■   | -                | -                | -                | -  |
| Measuring ranges  | 3 x 380-440 V AC, 220-240 V AC                     | 3 x 380-440 V AC   | 3 x 320-460 V AC, 185-265 V AC                      | 3 x 320-460 V AC | 3 x 208-440 V AC | 3 x 200-500 V AC |  |
| Thresholds  | $U_{min}$  | 0.6 x $U_N$  | fixed 185 V / 320 V                                 | fixed 320 V      | 0.6 x $U_N$      |                  |  |
|   | $U_{max}$  | -  | fixed 265 V / 460 V                                 | fixed 460 V      | -                |                  |  |
| Hysteresis related to the threshold value                           |  | fixed 5 % (release value = 0.65 x $U_N$ )                    | fixed 5 %   |                  | -                |                  |  |
| Response time   |  | 40 ms  | 80 ms   |                  | 500 ms           |                  |  |
| Accuracy within the temperature range                               |  | -  | $\Delta U \leq 0.06 \% / ^\circ C$                  |                  | -                |                  |  |
| <b>Timing circuit</b>   |  |  |   |                  |                  |                  |  |
| Start-up delay $t_s$  |  | fixed 500 ms ( $\pm 20\%$ )                                  |   |                  | fixed 500 ms     |                  |  |
| Tripping $t_v$  |  | fixed 150 ms ( $\pm 20\%$ )                                  | at over- / undervoltage fixed 500 ms ( $\pm 20\%$ ) |                  | fixed 500 ms     |                  | -  |
| <b>Indication of operational states</b>                             |  |  |   |                  |                  |                  |  |
| Relay status  | R: yellow LED                                      | ┌───┐ output relay energized                                 |   |                  |                  |                  |  |
| Fault message   | F: red LED   | only CM-PFS: ┌───┐ phase failure / ┌──┐ phase sequence error |   |                  |                  |                  |  |
| <b>Output circuits</b>  |  | <b>13-14</b>   |   |                  | <b>11-12/14</b>  |                  | <b>11<sub>15</sub>-12<sub>16</sub> / 14<sub>18</sub><sup>*</sup><br/>21<sub>25</sub>-22<sub>26</sub> / 24<sub>28</sub></b> |
| Kind of output  |  | 1 n/o contact  |   |                  | 1 c/o contact    |                  | 2 c/o contacts   |
| Operating principle   |  | closed-circuit principle <sup>2)</sup>                       |   |                  |                  |                  |  |
| Min. switching voltage / Min. switching current                     |  | 24 V / 10 mA   |   |                  |                  |                  |  |
| Max. switching voltage / Max. switching current                     |  | see data sheets  |   |                  |                  |                  |  |
| Rated operational voltage $U_s$ and rated operational current $I_s$ |  | AC-12 (resistive) 230 V                                      | 4 A   |                  |                  |                  |  |
|   |  | AC-15 (inductive) 230 V                                      | 3 A   |                  |                  |                  |  |
|   |  | DC-12 (resistive) 24 V                                       | 4 A   |                  |                  |                  |  |
|   |  | DC-13 (inductive) 24 V                                       | 2 A   |                  |                  |                  |  |
| AC rating (UL 508)  | utilization category (Control Circuit Rating Code) | B300 pilot duty; general purpose 250 V, 4 A, cos phi 0.75    |   |                  |                  |                  |  |
|   | max. rated operational voltage                     | 300 V AC   |   |                  |                  |                  |  |
|   | max. continuous thermal current at B 300           | 5 A  |   |                  |                  |                  |  |
|   | max. making/breaking apparent power at B 300       | 3600/360 VA  |   |                  |                  |                  |  |
| Mechanical lifetime   |  | 30 x 10 <sup>6</sup> switching cycles                        |   |                  |                  |                  |  |
| Electrical lifetime (AC-12, 230 V, 4 A)                             |  | 0.1 x 10 <sup>6</sup> switching cycles                       |   |                  |                  |                  |  |
| Max. fuse rating to achieve short-circuit protection                | n/c contact  | 10 A fast-acting   |   |                  | 6 A fast-acting  |                  |  |
|   | n/o contact  | 10 A fast-acting   |   |                  |                  |                  |  |
| Conventional thermal current $I_{th}$                               |  | 4 A  |   |                  |                  |                  |  |

<sup>1)</sup> Device with neutral monitoring: The external conductor voltage towards the neutral conductor is measured.

<sup>2)</sup> Closed-circuit principle: Output relay is de-energized if the measured value exceeds/drops below the adjusted threshold.

# Three-phase monitoring relays

## Technical data - CM-PBE, CM-PVE, CM-PFE, CM-PFS

| Type  | CM-PBE <sup>1)</sup>                         | CM-PBE                                       | CM-PVE <sup>1)</sup> | CM-PVE | CM-PFE  | CM-PFE.2                       | CM-PFS  |
|---|--|--|----------------------|--------|---|--------------------------------|---|
| <b>General data</b>                                       |  |  |                      |        |   |                                |   |
| Duty cycle  | 100 %  |  |                      |        |   |                                |   |
| Dimensions  | see 'Dimensional drawings'                   |  |                      |        |   |                                |   |
| Mounting  | DIN rail (IEC/EN 60715)                      |  |                      |        |   |                                |   |
| Mounting position   | any  |  |                      |        |   |                                |   |
| Minimum distance to other units                           | horizontal                                   | not necessary                                |                      |        | ≥ 10 mm if ambient temperature > 50 °C and rated operational currents > 2 A |                                | ≥ 10 mm in case of continuous measuring voltage > 440 V         |
| Degree of protection                                      | housing / terminals                          | IP50 / IP20                                  |                      |        |   |                                |   |
| <b>Electrical connection</b>                              |  |  |                      |        |   |                                |   |
| Connecting capacity                                       | fine-strand with wire end ferrule            | 2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |                      |        |   |                                | same as CM-PSS.31   |
|   | fine-strand without wire end ferrule         | 2 x 1-1.5 mm <sup>2</sup> (2 x 18-16 AWG)    |                      |        |   |                                |   |
| Stripping length  | rigid  | 2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |                      |        |   |                                | same as CM-PSS.31   |
|   |  | 10 mm (0.39 in)                              |                      |        |   |                                |   |
| Tightening torque   | 0.6-0.8 Nm                                   |  |                      |        |   |                                |   |
| <b>Environmental data</b>                                 |  |  |                      |        |   |                                |   |
| Ambient temperature range                                 | operation / storage                          | -20...+60 °C / -40...+85 °C                  |                      |        |   |                                |   |
| Climatic class  |  |  |                      |        |   | 3K3                            |   |
| Damp heat   | IEC/EN 60068-2-30                            | 40 °C, 93 % RH, 4 days                       |                      |        |   | -                              |   |
| Damp heat, cyclic   | IEC/EN 60068-2-30                            |  |                      |        |   | 6 x 24 h cycle, 55 °C, 95 % RH |   |
| Vibration withstand                                       | IEC/EN 60068-2-6                             | 10-57 Hz: 0.075 mm; 57-150 Hz: 1 g           |                      |        |   | -                              |   |
| Vibration, sinusoidal                                     |  |  |                      |        |   | class 2                        |   |
| Shock   |  |  |                      |        |   | class 2                        |   |
| <b>Isolation data</b>                                     |  |  |                      |        |   |                                |   |
| Rated insulation voltage U <sub>i</sub>                   | between input, measuring and output circuits | 400 V  |                      |        |   | -                              |   |
|   | input circuit / output circuit               | -  |                      |        |   | 600 V                          |   |
|   | output circuit 1 / output circuit 2          | -  |                      |        |   | 300 V                          |   |
| Rated impulse withstand voltage U <sub>imp</sub>          | between input, measuring and output circuits | 4 kV / 1.2 - 50 μs                           |                      |        |   | -                              |   |
|   | input circuit / output circuit               | -  |                      |        |   | 6 kV                           |   |
|   | output circuit 1 / output circuit 2          | -  |                      |        |   | 4 kV                           |   |
| Basic insulation  | input circuit / output circuit               | -  |                      |        |   | 600 V AC                       |   |
| Pollution degree  |  | 3  |                      |        |   |                                |   |
| Overvoltage category                                      |  | III  |                      |        |   |                                |   |
| <b>Standards / Directives</b>                             |  |  |                      |        |   |                                |   |
| Standards   |  | IEC/EN 60947-5-1, EN 50178                   |                      |        | IEC/EN 60255-27, IEC/EN 60947-5-1, EN 50178                                 |                                |   |
| Low Voltage Directive                                     |  | 2014/35/EU                                   |                      |        |   |                                |   |
| EMC Directive   |  | 2014/30/EU                                   |                      |        |   |                                |   |
| RoHS Directive  |  | 2011/65/EU                                   |                      |        |   |                                |   |
| <b>Electromagnetic compatibility</b>                      |  |  |                      |        |   |                                |   |
| Interference immunity to electrostatic discharge          | IEC/EN 61000-4-2                             | level 3 - 6 kV/ 8 kV                         |                      |        |   |                                | level 3 -<br>10 V/m (1 GHz)<br>3 V/m (2 GHz)<br>1 V/m (2.7 GHz) |
| radiated, radio-frequency, electromagnetic field          | IEC/EN 61000-4-3                             | level 3 - 10 V/m                             |                      |        |   |                                |   |
| electrical fast transient / burst                         | IEC/EN 61000-4-4                             | level 3 - 2 kV / 5 kHz                       |                      |        |   |                                |   |
| surge   | IEC/EN 61000-4-5                             | level 4 - 2 kV L-L                           |                      |        |   |                                |   |
| 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   |
| <b>Interference emission</b>                              |  |  |                      |        |   |                                |   |
| high-frequency radiated                                   | IEC/CISPR 22, EN 55022                       | class B                                      |                      |        |   |                                |   |
| high-frequency conducted                                  | IEC/CISPR 22, EN 55022                       | class B                                      |                      |        |   |                                |   |

<sup>1)</sup> Device with neutral monitoring: The external conductor voltage towards the neutral conductor is measured.

# Three-phase monitoring relays

## Technical data - CM-PAS, CM-PSS, CM-PVS

2

| Type   | CM-PSS.31                                    | CM-PSS.41                | CM-PVS.31                | CM-PVS.41   | CM-PVS.81                         | CM-PAS.31                                    | CM-PAS.41                           |   |
|--|--|--------------------------|--------------------------|---|-----------------------------------|--|-------------------------------------|---|
| <b>Input circuit = Measuring circuit</b>                   |  |                          |                          | <b>L1, L2, L3</b>   |                                   |  |                                     |   |
| Rated control supply voltage $U_s$ = measuring voltage     | 3x380 V AC                                   | 3x400 V AC               | 3x160-300 V AC           | 3x300-500 V AC  | 3x200-400 V AC                    | 3x160-300 V AC                               | 3x300-500 V AC                      |   |
| Rated control supply voltage $U_s$ tolerance               | -15...+10 %                                  |                          |                          |   |                                   |  |                                     |   |
| Rated frequency  | 50/60 Hz                                     |                          |                          |   |                                   |  |                                     |   |
| Frequency range  | 45-65 Hz                                     |                          |                          |   |                                   |  |                                     |   |
| Typical current / power consumption                        | 25 mA / 18 VA (380 V AC)                     | 25 mA / 18 VA (400 V AC) | 25 mA / 10 VA (230 V AC) | 25 mA / 18 VA (400 V AC)  | 19 mA / 10 VA (300 V AC)          | 25 mA / 10 VA (230 V AC)                     | 25 mA / 18 VA (400 V AC)            |   |
| <b>Measuring circuit</b>                                   |  |                          |                          | <b>L1, L2, L3</b>   |                                   |  |                                     |   |
| Monitoring functions                                       | phase failure                                | ■                        | ■                        | ■   | ■                                 | ■  | ■                                   |   |
|  | phase sequence                               | can be switched off      |                          |   |                                   |  | ■                                   | ■ |
|  | automatic phase sequence correction          | -                        | -                        | -   | -                                 | -  | -                                   |   |
|  | over- / undervoltage                         | ■                        | ■                        | ■   | ■                                 | ■  | -                                   |   |
|  | phase unbalance                              | -                        | -                        | -   | -                                 | -  | ■                                   |   |
|  | neutral                                      | -                        | -                        | -   | -                                 | -  | -                                   |   |
| Measuring range  | overvoltage                                  | 3x418 V AC               | 3x440 V AC               | 3x220-300 V AC  | 3x420-500 V AC                    | 3x300-400 V AC                               | -                                   |   |
|  | undervoltage                                 | 3x342 V AC               | 3x360 V AC               | 3x160-230 V AC  | 3x300-380 V AC                    | 3x210-300 V AC                               | -                                   |   |
|  | phase unbalance                              | -                        | -                        | -   | -                                 | -  | 2-25 % of average of phase voltages |   |
| Thresholds   | overvoltage                                  | fixed                    | -                        | -   | adjustable within measuring range | -  | -                                   |   |
|  | undervoltage                                 | fixed                    | -                        | -   | adjustable within measuring range | -  | -                                   |   |
|  | phase unbalance (switch-off value)           | -                        | -                        | -   | -                                 | -  | adjust. within meas. range          |   |
| Tolerance of the adjusted threshold value                  | 6 % of full-scale value                      |                          |                          |   |                                   |  |                                     |   |
| Hysteresis related to the threshold value                  | over- / undervoltage                         | fixed 5 %                | -                        | -   | -                                 | -  | -                                   |   |
|  | phase unbalance                              | -                        | -                        | -   | -                                 | -  | fixed 20 %                          |   |
| Maximum measuring cycle time                               | 100 ms                                       |                          |                          |   |                                   |  |                                     |   |
| Accuracy within the temperature range                      | $\Delta U \leq 0.06 \% / ^\circ\text{C}$     |                          |                          |   |                                   |  |                                     |   |
| Measuring method   | true RMS                                     |                          |                          |   |                                   |  |                                     |   |
| <b>Timing circuit</b>                                      |  |                          |                          |   |                                   |  |                                     |   |
| Start-up delay $t_s$                                       | fixed 200 ms                                 |                          |                          |   |                                   |  |                                     |   |
| Tripping delay $t_v$                                       | ON- or OFF-delay 0; 0.1-30 s adjustable      |                          |                          |   |                                   | ON- delay 0; 0.1-30 s adjustable             |                                     |   |
| Repeat accuracy (constant parameters)                      | -  | -                        | -                        | -   | < $\pm 0.2 \%$                    | -  | -                                   |   |
| Accuracy within the rated control supply voltage tolerance | $\Delta t \leq 0.5 \%$                       |                          |                          |   |                                   |  |                                     |   |
| Accuracy within the temperature range                      | $\Delta t \leq 0.06 \% / ^\circ\text{C}$     |                          |                          |   |                                   |  |                                     |   |
| <b>Indication of operational states</b>                    |  |                          |                          |   |                                   |  |                                     |   |
|  | details see function description / -diagrams |                          |                          | 1 yellow LED, 2 red LEDs<br>details see operating mode and function description / -diagrams |                                   | details see function description / -diagrams |                                     |   |
| <b>Output circuits</b>                                     |  |                          |                          |   |                                   |  |                                     |   |
| <b>15-16/18, 25-26/28</b>                                  |  |                          |                          |   |                                   |  |                                     |   |
| Kind of output   | relay, 2 x 1 c/o contact                     |                          |                          |   |                                   |  |                                     |   |
| Operating principle  | closed-circuit principle <sup>1)</sup>       |                          |                          |   |                                   |  |                                     |   |
| Contact material   | AgNi alloy, Cd free                          |                          |                          |   |                                   |  |                                     |   |
| Minimum switching power                                    | 24 V / 10 mA                                 |                          |                          |   |                                   |  |                                     |   |
| Maximum switching voltage                                  | see "Load limit curves" on page 2/105        |                          |                          |   |                                   |  |                                     |   |

<sup>1)</sup> Closed-circuit principle: Output relay(s) de-energize(s) if measured value exceeds or falls below the adjusted threshold value

# Three-phase monitoring relays

## Technical data - CM-PAS, CM-PSS, CM-PVS

| Type  | CM-PSS.31                                    | CM-PSS.41  | CM-PVS.31 | CM-PVS.41 | CM-PVS.81                                   | CM-PAS.31 | CM-PAS.41       |
|---|--|--|-----------|-----------|---|-----------|-----------------|
| Rated operational voltage U <sub>e</sub> and rated operational current I <sub>e</sub> | AC-12 (resistive) 230 V                      | 4 A  |           |           |   |           |                 |
|   | AC-15 (inductive) 230 V                      | 3 A  |           |           |   |           |                 |
|   | DC-12 (resistive) 24 V                       | 4 A  |           |           |   |           |                 |
|   | DC-13 (inductive) 24 V                       | 2 A  |           |           |   |           |                 |
| AC rating (UL 508) utilization category (Control Circuit Rating Code)                 |  | B 300  |           |           |   |           |                 |
|   | max. rated operational voltage               | 300 V AC   |           |           |   |           |                 |
|   | max. continuous thermal current at B 300     | 5 A  |           |           |   |           |                 |
|   | max. making/breaking apparent power at B 300 | 3600/360 VA  |           |           |   |           |                 |
| Mechanical lifetime   |  | 30 x 10 <sup>6</sup> switching cycles                      |           |           |   |           |                 |
| Electrical lifetime (AC-12, 230 V, 4 A)   |  | 0.1 x 10 <sup>6</sup> switching cycles                     |           |           |   |           |                 |
| Max. fuse rating to achieve short-circuit protection                                  |  | n/c contact<br>10 A fast-acting                            |           |           |   |           |                 |
|   |  | n/o contact<br>10 A fast-acting                            |           |           |   |           |                 |
| <b>General data</b>   |  |  |           |           |   |           |                 |
| MTBF  |  | on request   |           |           |   |           |                 |
| Duty cycle  |  | 100%   |           |           |   |           |                 |
| Dimensions  |  | see "Dimensional drawings"                                 |           |           |   |           |                 |
| Mounting  |  | DIN rail (IEC/EN 60715), snap-on mounting without any tool |           |           |   |           |                 |
| Mounting position   |  | any  |           |           |   |           |                 |
| Minimum distance to other units   | horizontal                                   | 10 mm (0.39 in) in case of continuous measuring voltages   |           |           |   |           |                 |
|   |  | > 400 V  | > 400 V   | > 220 V   | > 400 V                                     | -         | > 220 V > 400 V |
| Material of housing   |  | UL 94 V-0  |           |           |   |           |                 |
| Degree of protection  | housing / terminals                          | IP50 / IP20  |           |           |   |           |                 |
| <b>Electrical connection</b>  |  |  |           |           |   |           |                 |
| Connecting capacity   |  | <b>Screw connection technology</b>                         |           |           | <b>Easy Connect Technology (Push-in)</b>    |           |                 |
|   | fine-strand with(out) wire end ferrule       | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)                |           |           | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |           |                 |
|   |  | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)                |           |           |   |           |                 |
|   | rigid  | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)                  |           |           | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG) |           |                 |
|   |  | 2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)                |           |           |   |           |                 |
| Stripping length  |  | 8 mm (0.32 in)   |           |           |   |           |                 |
| Tightening torque   |  | 0.6-0.8 Nm (7.08 lb.in)                                    |           |           |   |           |                 |
| <b>Environmental data</b>   |  |  |           |           |   |           |                 |
| Ambient temperature ranges  | operation / storage                          | -25...+60 °C / -40...+85 °C                                |           |           |   |           |                 |
| Damp heat, cyclic (IEC/EN 60068-2-30)   |  | 6 x 24 h cycle, 55 °C, 95 % RH                             |           |           |   |           |                 |
| Climatic class  |  | 3K3  |           |           |   |           |                 |
| Vibration, sinusoidal   |  | class 2  |           |           |   |           |                 |
| Shock   |  | class 2  |           |           |   |           |                 |
| <b>Isolation data</b>   |  |  |           |           |   |           |                 |
| Rated insulation voltage U  | input circuit / output circuit               | 600 V  |           |           |   |           |                 |
|   | output circuit 1 / output circuit 2          | 300 V  |           |           |   |           |                 |
| Rated impulse withstand voltage U <sub>imp</sub>                                      | input circuit / output circuit               | 6 kV; 1.2/50 µs  |           |           |   |           |                 |
|   | output circuit 1 / output circuit 2          | 4 kV; 1.2/50 µs  |           |           |   |           |                 |
| Basic insulation  | input circuit / output circuit               | 600 V  |           |           |   |           |                 |
| Protective separation (IEC/EN 61140, EN 50178)  | input circuit / output circuit               | -  |           |           |   |           |                 |
| Pollution degree  |  | 3  |           |           |   |           |                 |
| Overvoltage category  |  | III  |           |           |   |           |                 |
| <b>Standards / Directives</b>   |  |  |           |           |   |           |                 |
| Standards   |  | IEC/EN 60255-27, IEC/EN 60947-5-1, EN 50178                |           |           |   |           |                 |
| Low Voltage Directive   |  | 2014/35/EU   |           |           |   |           |                 |
| EMC directive   |  | 2014/30/EU   |           |           |   |           |                 |
| RoHS directive  |  | 2011/65/EU   |           |           |   |           |                 |
| <b>Electromagnetic compatibility</b>  |  |  |           |           |   |           |                 |
| Interference immunity to  |  | IEC/EN 61000-6-2   |           |           |   |           |                 |
| 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)   |           |           |   |           |                 |
| electrical fast transient / burst   | IEC/EN 61000-4-4                             | level 3 (2 kV / 2 kHz)                                     |           |           |   |           |                 |
| surge   | IEC/EN 61000-4-5                             | level 4 (2 kV L-L)   |           |           |   |           |                 |
| conducted disturbances, induced by radio-frequency fields                             | IEC/EN 61000-4-6                             | level 3 (10 V)   |           |           |   |           |                 |
| Interference emission   |  | IEC/EN 61000-6-3   |           |           |   |           |                 |
| high-frequency radiated   | IEC/CISPR 22, EN 55022                       | class B  |           |           |   |           |                 |
| high-frequency conducted  | IEC/CISPR 22, EN 55022                       | class B  |           |           |   |           |                 |

# Three-phase monitoring relays

## Technical data - CM-MPS

2

| Type  | CM-MPS.11                                    | CM-MPS.21                           | CM-MPS.31                   | CM-MPS.41                   |
|---|--|-------------------------------------|-----------------------------|-----------------------------|
| <b>Input circuit = Measuring circuit</b>                            | <b>L1, L2, L3, N</b>                         |                                     | <b>L1, L2, L3</b>           |                             |
| Rated control supply voltage $U_s$ = measuring voltage              | 3x90-170 V AC                                | 3x180-280 V AC                      | 3x160-300 V AC              | 3x300-500 V AC              |
| Rated control supply voltage $U_s$ tolerance                        | -15...+10 %                                  |                                     |                             |                             |
| Rated frequency   | 50/60 Hz                                     |                                     |                             |                             |
| Frequency range   | 45-65 Hz                                     |                                     |                             |                             |
| Typical current / power consumption                                 | 25 mA / 10 VA<br>(115 V AC)                  | 25 mA / 18 VA<br>(230 V AC)         | 25 mA / 10 VA<br>(230 V AC) | 25 mA / 18 VA<br>(400 V AC) |
| <b>Measuring circuit</b>  | <b>L1, L2, L3, N</b>                         |                                     | <b>L1, L2, L3</b>           |                             |
| Monitoring functions  | phase failure                                | ■                                   | ■                           | ■                           |
|   | phase sequence                               | can be switched off                 |                             |                             |
|   | automatic phase sequence correction          | -                                   | -                           | -                           |
|   | over- / undervoltage                         | ■                                   | ■                           | ■                           |
|   | phase unbalance                              | ■                                   | ■                           | ■                           |
|   | interrupted neutral                          | ■                                   | ■                           | -                           |
| Measuring range   | overvoltage                                  | 3x120-170 V AC                      | 3x240-280 V AC              | 3x220-300 V AC              |
|   | undervoltage                                 | 3x90-130 V AC                       | 3x180-220 V AC              | 3x160-230 V AC              |
|   | phase unbalance                              | 2-25 % of average of phase voltages |                             |                             |
| Thresholds  | overvoltage                                  | adjustable within measuring range   |                             |                             |
|   | undervoltage                                 | adjustable within measuring range   |                             |                             |
|   | phase unbalance (switch-off value)           | adjustable within measuring range   |                             |                             |
| Tolerance of the adjusted threshold value                           | 6 % of full-scale value                      |                                     |                             |                             |
| Hysteresis related to the threshold value                           | over- / undervoltage                         | fixed 5 %                           |                             |                             |
|   | phase unbalance                              | fixed 20 %                          |                             |                             |
| Maximum measuring cycle time  | 100 ms                                       |                                     |                             |                             |
| Accuracy within the temperature range                               | $\Delta U \leq 0.06 \% / ^\circ\text{C}$     |                                     |                             |                             |
| Measuring method  | true RMS                                     |                                     |                             |                             |
| <b>Timing circuit</b>   |  |                                     |                             |                             |
| Start-up delay $t_s$  | fixed 200 ms                                 |                                     |                             |                             |
| Tripping delay $t_v$  | ON- or OFF-delay 0; 0.1-30 s adjustable      |                                     |                             |                             |
| Accuracy within the rated control supply voltage tolerance          | $\Delta t \leq 0.5 \%$                       |                                     |                             |                             |
| Accuracy within the temperature range                               | $\Delta t \leq 0.06 \% / ^\circ\text{C}$     |                                     |                             |                             |
| Indication of operational states                                    | details see function description / -diagrams |                                     |                             |                             |
| <b>Output circuits</b>  | 15-16/18, 25-26/28                           |                                     |                             |                             |
| Kind of output  | relay, 1 x 2 c/o contacts                    |                                     |                             |                             |
| Operating principle   | closed-circuit principle <sup>1)</sup>       |                                     |                             |                             |
| Contact material  | AgNi alloy, Cd free                          |                                     |                             |                             |
| Minimum switching power   | 24 V / 10 mA                                 |                                     |                             |                             |
| Maximum switching voltage   | see "Load limit curves" on page 2/105        |                                     |                             |                             |
| Rated operational voltage $U_o$ and rated operational current $I_o$ | AC-12 (resistive) 230 V                      | 4 A                                 |                             |                             |
|   | AC-15 (inductive) 230 V                      | 3 A                                 |                             |                             |
|   | DC-12 (resistive) 24 V                       | 4 A                                 |                             |                             |
|   | DC-13 (inductive) 24 V                       | 2 A                                 |                             |                             |
| AC rating (UL 508)  | utilization category                         | B 300                               |                             |                             |
|   | (Control Circuit Rating Code)                |                                     |                             |                             |
|   | max. rated operational voltage               | 300 V AC                            |                             |                             |
|   | max. continuous thermal current at B 300     | 5 A                                 |                             |                             |
|   | max. making/breaking apparent power at B 300 | 3600/360 VA                         |                             |                             |
| Mechanical lifetime   | 30 x 10 <sup>6</sup> switching cycles        |                                     |                             |                             |
| Electrical lifetime (AC-12, 230 V, 4 A)                             | 0.1 x 10 <sup>6</sup> switching cycles       |                                     |                             |                             |
| Max. fuse rating to achieve short-circuit protection                | n/c contact                                  | 6 A fast-acting                     |                             |                             |
|   | n/o contact                                  | 10 A fast-acting                    |                             |                             |

<sup>1)</sup> Closed-circuit principle: Output relay(s) de-energize(s) if measured value exceeds or falls below the adjusted threshold value

# Three-phase monitoring relays

## Technical data - CM-MPS

2

| Type  | CM-MPS.11  | CM-MPS.21  | CM-MPS.31                                   | CM-MPS.41       |
|---|--|--|---|-----------------|
| <b>General data</b>                                       |  |  |   |                 |
| MTBF  | on request   |  |   |                 |
| Duty cycle  | 100%   |  |   |                 |
| Dimensions  | see 'Dimensional drawings'                                 |  |   |                 |
| Mounting  | DIN rail (IEC/EN 60715), snap-on mounting without any tool |  |   |                 |
| Mounting position   | any  |  |   |                 |
| Minimum distance to other units                           | horizontal   | 10 mm (0.39 in) in case of continuous measuring voltages                                   |   |                 |
|   |  | > 120 V  | > 240 V                                     | > 220 V > 400 V |
| Material of housing                                       | UL 94 V-0  |  |   |                 |
| Degree of protection                                      | housing / terminals  | IP50 / IP20  |   |                 |
| <b>Electrical connection</b>                              |  |  |   |                 |
| Connecting capacity                                       |  | <b>Screw connection technology</b>   | <b>Easy Connect Technology (Push-in)</b>    |                 |
|   | fine-strand with(out) wire end ferrule                     | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)<br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |                 |
|   | rigid  | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)   | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG) |                 |
| Stripping length  | 8 mm (0.32 in)   |  |   |                 |
| Tightening torque   | 0.6-0.8 Nm (7.08 lb.in)                                    |  |   | -               |
| <b>Environmental data</b>                                 |  |  |   |                 |
| Ambient temperature ranges                                | operation / storage  | -25...+60 °C / -40...+85 °C  |   |                 |
| Damp heat, cyclic (IEC/EN 60068-2-30)                     |  | 6 x 24 h cycle, 55 °C, 95 % RH   |   |                 |
| Climatic class  |  | 3K3  |   |                 |
| Vibration   |  | class 2  |   |                 |
| Shock   |  | class 2  |   |                 |
| <b>Isolation data</b>                                     |  |  |   |                 |
| Rated insulation voltage U <sub>i</sub>                   | input circuit / output circuit                             | 600 V  |   |                 |
|   | output circuit 1 / output circuit 2                        | 300 V  |   |                 |
| Rated impulse with-stand voltage U <sub>imp</sub>         | input circuit / output circuit                             | 6 kV; 1.2/50 μs  |   |                 |
|   | output circuit 1 / output circuit 2                        | 4 kV; 1.2/50 μs  |   |                 |
| Basic insulation  | input circuit / output circuit                             | 600 V  |   |                 |
| Protective separation (IEC/EN 61140, EN 50178)            | input circuit / output circuit                             | yes  | -   |                 |
| Pollution degree  |  | 3  |   |                 |
| Overvoltage category                                      |  | III  |   |                 |
| <b>Standards / Directives</b>                             |  |  |   |                 |
| Standards   | IEC/EN 60255-27, IEC/EN 60947-5-1 EN 50178                 |  |   |                 |
| Low Voltage Directive                                     | 2014/35/EU   |  |   |                 |
| EMC directive   | 2014/30/EU   |  |   |                 |
| RoHS directive  | 2011/65/EU   |  |   |                 |
| <b>Electromagnetic compatibility</b>                      |  |  |   |                 |
| Interference immunity to                                  |  | IEC/EN 61000-6-2   |   |                 |
| 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)   |   |                 |
| electrical fast transient / burst                         | IEC/EN 61000-4-4   | level 3 (2 kV / 2 kHz)   |   |                 |
| surge   | IEC/EN 61000-4-5   | level 4 (2 kV L-N)   | level 4 (2 kV L-L)                          |                 |
| conducted disturbances, induced by radio-frequency fields | IEC/EN 61000-4-6   | level 3 (10 V)   |   |                 |
| harmonics and interharmonics                              | IEC/EN 61000-4-13  | class 3  |   |                 |
| Interference emission                                     |  | IEC/EN 61000-6-3   |   |                 |
| high-frequency radiated                                   | IEC/CISPR 22, EN 55022                                     | class B  |   |                 |
| high-frequency conducted                                  | IEC/CISPR 22, EN 55022                                     | class B  |   |                 |



# Three-phase monitoring relays

## Technical data - CM-MPS, CM-MPN

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| Type  | CM-MPS.23  | CM-MPS.43                                       | CM-MPN.52                | CM-MPN.62                | CM-MPN.72                |
|---|--|---|--------------------------|--------------------------|--------------------------|
| <b>Input circuit = Measuring circuit</b>                            | <b>L1, L2, L3, N</b>                               | <b>L1, L2, L3</b>                               |                          |                          |                          |
| Rated control supply voltage $U_s$ = measuring voltage              | 3x180-280 V AC                                     | 3x300-500 V AC                                  | 3x350-580 V AC           | 3x450-720 V AC           | 3x530-820 V AC           |
| Rated control supply voltage $U_s$ tolerance                        | -15...+10 %  |   |                          |                          |                          |
| Rated frequency   | 50/60/400 Hz                                       |   | 50/60 Hz                 |                          |                          |
| Frequency range   | 45-440 Hz  |   | 45-65 Hz                 |                          |                          |
| Typical current / power consumption                                 | 5 mA / 4 VA (230 V AC)                             | 5 mA / 4 VA (400 V AC)                          | 29 mA / 41 VA (480 V AC) | 29 mA / 52 VA (600 V AC) | 29 mA / 59 VA (690 V AC) |
| <b>Measuring circuit</b>  | <b>L1, L2, L3, N</b>                               | <b>L1, L2, L3</b>                               |                          |                          |                          |
| Monitoring functions  | phase failure                                      | ■   | ■                        | ■                        | ■                        |
|   | phase sequence                                     | can be switched off                             |                          |                          |                          |
|   | automatic phase sequence correction                | configurable                                    |                          |                          |                          |
|   | over- / undervoltage                               | ■   | ■                        | ■                        | ■                        |
|   | phase unbalance                                    | ■   | ■                        | ■                        | ■                        |
|   | interrupted neutral                                | ■   | ■                        | ■                        | ■                        |
| Measuring range   | overvoltage  | 3x240-280 V AC                                  | 3x420-500 V AC           | 3x480-580 V AC           | 3x600-720 V AC           |
|   | undervoltage                                       | 3x180-220 V AC                                  | 3x300-380 V AC           | 3x350-460 V AC           | 3x450-570 V AC           |
|   | phase unbalance                                    | 2-25 % of average of phase voltages             |                          |                          |                          |
| Thresholds  | overvoltage  | adjustable within measuring range               |                          |                          |                          |
|   | undervoltage                                       | adjustable within measuring range               |                          |                          |                          |
|   | phase unbalance (switch-off value)                 | adjustable within measuring range               |                          |                          |                          |
| Tolerance of the adjusted threshold value                           |  | 6 % of full-scale value                         |                          |                          |                          |
| Hysteresis related to the threshold value                           | over- / undervoltage                               | fixed 5 %                                       |                          |                          |                          |
|   | phase unbalance                                    | fixed 20 %                                      |                          |                          |                          |
| Maximum measuring cycle time  |  | 100 ms  |                          |                          |                          |
| Accuracy within the temperature range                               |  | $\Delta U \leq 0.06 \% / ^\circ\text{C}$        |                          |                          |                          |
| Measuring method  |  | true RMS  |                          |                          |                          |
| <b>Timing circuit</b>   |  | <b>15-16/18, 25-26/28</b>                       |                          |                          |                          |
| Start-up delay $t_s$ and $t_{s2}$                                   |  | fixed 200 ms                                    |                          |                          |                          |
| Start-up delay $t_{s1}$   |  | fixed 250 ms                                    |                          |                          |                          |
| Tripping delay $t_v$  |  | ON- or OFF-delay 0; 0.1-30 s adjustable         |                          |                          |                          |
| Accuracy within the rated control supply voltage tolerance          |  | $\Delta t \leq 0.5 \%$                          |                          |                          |                          |
| Accuracy within the temperature range                               |  | $\Delta t \leq 0.06 \% / ^\circ\text{C}$        |                          |                          |                          |
| Indication of operational states                                    |  | Details see function description / -diagrams    |                          |                          |                          |
| <b>Output circuits</b>  |  | <b>15-16/18, 25-26/28</b>                       |                          |                          |                          |
| Kind of output  |  | relay, 2 x 1 or 1 x 2 c/o contacts configurable |                          |                          |                          |
| Operating principle   |  | closed-circuit principle <sup>1)</sup>          |                          |                          |                          |
| Contact material  |  | AgNi alloy, Cd free                             |                          |                          |                          |
| Minimum switching power   |  | 24 V / 10 mA                                    |                          |                          |                          |
| Maximum switching voltage   |  | see "Load limit curves" on page 2/105           |                          |                          |                          |
| Rated operational voltage $U_e$ and rated operational current $I_e$ | AC-12 (resistive) 230 V                            | 4 A   |                          |                          |                          |
|   | AC-15 (inductive) 230 V                            | 3 A   |                          |                          |                          |
|   | DC-12 (resistive) 24 V                             | 4 A   |                          |                          |                          |
|   | DC-13 (inductive) 24 V                             | 2 A   |                          |                          |                          |
| AC rating (UL 508)  | utilization category (Control Circuit Rating Code) | B 300   |                          |                          |                          |
|   | max. rated operational voltage                     | 300 V AC  |                          |                          |                          |
|   | max. continuous thermal current at B 300           | 5 A   |                          |                          |                          |
|   | max. making/breaking apparent power at B 300       | 3600/360 VA                                     |                          |                          |                          |
| Mechanical lifetime   |  | 30 x 10 <sup>6</sup> switching cycles           |                          |                          |                          |
| Electrical lifetime (AC-12, 230 V, 4 A)                             |  | 0,1 x 10 <sup>6</sup> switching cycles          |                          |                          |                          |
| Max. fuse rating to achieve short-circuit protection                | n/c contact  | 6 A fast-acting                                 |                          | 10 A fast-acting         |                          |
|   | n/o contact  | 10 A fast-acting                                |                          |                          |                          |

<sup>1)</sup> Closed-circuit principle: Output relay(s) de-energize(s) if measured value exceeds or falls below the adjusted threshold value



# Three-phase monitoring relays

## Technical data - CM-MPS, CM-MPN

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| Type  | CM-MPS.23  | CM-MPS.43                                   | CM-MPN.52                                   | CM-MPN.62                                   | CM-MPN.72 |
|---|--|---|---|---|-----------|
| <b>General data</b>                                       |  |   |   |   |           |
| MTBF  | on request   |   |   |   |           |
| Duty cycle  | 100%   |   |   |   |           |
| Dimensions  | see 'Dimensional drawings'                                 |   |   |   |           |
| Mounting  | DIN rail (IEC/EN 60715), snap-on mounting without any tool |   |   |   |           |
| Mounting position   | any  |   |   |   |           |
| Minimum distance to other units                           | horizontal   | 10 mm (0.39 in)                             | not necessary                               |   |           |
| Material of housing                                       | UL 94 V-0  |   |   |   |           |
| Degree of protection                                      | housing / terminals  | IP50 / IP20                                 |   |   |           |
| <b>Electrical connection</b>                              |  |   |   |   |           |
| Connecting capacity                                       | fine-strand with(out) wire end ferrule                     | <b>Screw connection technology</b>          |   | <b>Easy Connect Technology (Push-in)</b>    |           |
|   |  | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG) | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |           |
| Stripping length  | rigid  | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)   | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG) |   |           |
|   |  | 2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG) | 8 mm (0.32 in)                              |   |           |
| Tightening torque   | 0.6-0.8 Nm (7.08 lb.in)                                    |   |   | -   |           |
| <b>Environmental data</b>                                 |  |   |   |   |           |
| Ambient temperature ranges                                | operation / storage  | -25...+60 °C / -40...+85 °C                 |   |   |           |
| Damp heat, cyclic (IEC/EN 60068-2-30)                     | 6 x 24 h cycle, 55 °C, 95 % RH                             |   |   |   |           |
| Climatic class  | 3K3  |   |   |   |           |
| Vibration, sinusoidal                                     | class 2  |   |   |   |           |
| Shock   | class 2  |   |   |   |           |
| <b>Isolation data</b>                                     |  |   |   |   |           |
| Rated insulation voltage U <sub>i</sub>                   | input circuit / output circuit                             | 600 V                                       |   | 1000 V                                      |           |
|   | output circuit 1 / output circuit 2                        | 300 V                                       |   |   |           |
| Rated impulse withstand voltage U <sub>imp</sub>          | input circuit / output circuit                             | 6 kV; 1.2/50 μs                             |   | 8 kV; 1.2/50 μs                             |           |
|   | output circuit 1 / output circuit 2                        | 4 kV; 1.2/50 μs                             |   |   |           |
| Basic insulation  | input circuit / output circuit                             | 600 V                                       |   | 1000 V                                      |           |
| Protective separation (IEC/EN 61140, EN 50178)            | input circuit / output circuit                             | -   |   |   |           |
| Pollution degree  | 3  |   |   |   |           |
| Overvoltage category                                      | III  |   |   |   |           |
| <b>Standards / Directives</b>                             |  |   |   |   |           |
| Standards   | IEC/EN 60255-27, IEC/EN 60947-5-1 EN 50178                 |   |   |   |           |
| Low Voltage Directive                                     | 2014/35/EU   |   |   |   |           |
| EMC directive   | 2014/30/EU   |   |   |   |           |
| RoHS directive  | 2011/65/EU   |   |   |   |           |
| <b>Electromagnetic compatibility</b>                      |  |   |   |   |           |
| Interference immunity to                                  | IEC/EN 61000-6-2   |   |   |   |           |
| 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)                            |   |   |           |
| electrical fast transient / burst                         | IEC/EN 61000-4-4   | level 3 (2 kV / 2 kHz)                      |   |   |           |
| surge   | IEC/EN 61000-4-5   | level 4 (2 kV L-N)                          | level 4 (2 kV L-L)                          |   |           |
| conducted disturbances, induced by radio-frequency fields | IEC/EN 61000-4-6   | level 3 (10 V)                              |   |   |           |
| harmonics and interharmonics                              | IEC/EN 61000-4-13  | class 3                                     |   |   |           |
| Interference emission                                     | IEC/EN 61000-6-3   |   |   |   |           |
| high-frequency radiated                                   | IEC/CISPR 22, EN 55022                                     | class B                                     |   |   |           |
| high-frequency conducted                                  | IEC/CISPR 22, EN 55022                                     | class B                                     |   |   |           |

Grid feeding monitoring relays -  
Voltage and frequency monitoring functions  
Product group picture

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# Grid feeding monitoring relays - Voltage and frequency monitoring functions Table of contents

## Grid feeding monitoring relays - Voltage and frequency monitoring functions

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# Grid feeding monitoring relays - Voltage and frequency monitoring functions Benefits and advantages, operating controls

## Description

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The grid feeding monitoring relays CM-UFD.M\* are designed to monitor the voltage and the frequency of the public low voltage or medium voltage grid. Whenever the measured values are not within the range of the adjusted threshold values, the CM-UFD.M\* causes tripping of the section switch (consisting of 1 or 2 switching devices according to the applicable standard). This tripping disconnects the power generation such as photovoltaic systems, wind turbines, block-type thermal power stations from the grid.

Optionally, devices with Modbus RTU enable control commands to the grid feeding monitoring relay and provide status information as well as actual process values.

### Characteristics of all CM-UFD.M\* devices

- Monitoring of voltage and frequency in single- and three-phase mains (2-wire, 3-wire or 4-wire AC systems)
- CM-UFD.M\*M with Modbus RTU
- Multiline, backlit LCD display
- True RMS measuring principle
- Over- and undervoltage, 10 minutes average value as well as over- and underfrequency monitoring
- Two-level threshold settings for over-/undervoltage and frequency
- ROCOF (rate of change of frequency) monitoring configurable
- Interrupted neutral detection
- All threshold values and tripping delays adjustable
- Error memory for up to 99 entries (incl. cause of error, measured value, relative timestamp)
- Password setting protection
- 3 control inputs, e.g. for feedback signal, remote trip
- 3 c/o (SPDT) contacts
- LEDs for the indication of operational states

### Further characteristics CM-UFD.M22 / CM-UFD.M22M

- Third party certificate confirming accordance with CEI 0-21
- Autotest function
- Pre-setting according to CEI 0-21

### Further characteristics CM-UFD.M31 / CM-UFD.M31M

- Vector shift detection configurable
- Test function
- Third party certificate confirming accordance with VDE-AR-N 4105 and BDEW
- Pre-settings according to VDE-AR-N 4105 and BDEW

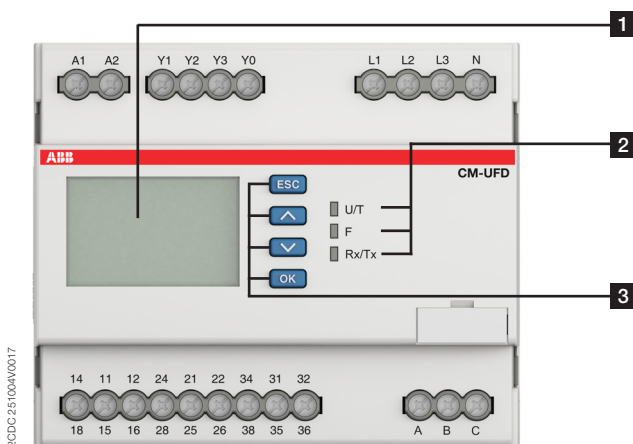
### Further characteristics CM-UFD.M33 / CM-UFD.M33M

- Vector shift detection configurable
- Test function
- Factory certificate confirming accordance with Engineering Recommendations G59/3 and G83/2
- Pre-settings according to G59/3 LV + G83/2 HV
- UL 508, CAN/CSA C22.2 No.14

### Further characteristics CM-UFD.M34 / CM-UFD.M34M

- Vector shift detection configurable
- Autotest function
- Third party certificate confirming accordance with the DRRG standard of DEWA
- Pre-settings according to the DRRG standard of DEWA

### Example: CM-UFD.M22M



#### 1 Display

R1 R2 R3 - relay status; in this case R3 is de-energized  
 FB - status feedback loop Y0-Y1; in this case FB is closed  
 EXT - status input external signal; in this case input is closed  
 REM - status remote trip input; in this case input is closed

#### 2 Indication of operational states

U/T: green LED - supply voltage applied / flashing = timing active  
 F: red LED - failure  
 Rx/Tx: yellow LED - frame reception and transmission

#### 3 Keypad

ESC: escape / return to previous menu  
 ^: up / value increase  
 v: down / value decrease  
 OK: enter / confirm selection

# Grid feeding monitoring relays - Voltage and frequency monitoring functions Selection table - Ordering details



CM-UFD.M\*

2CDC 251 003 S0017

| Type        | Order number    |
|-------------|-----------------|
| CM-UFD.M22  | 1SVR560730R3400 |
| CM-UFD.M22M | 1SVR560731R3700 |
| CM-UFD.M31  | 1SVR560730R3401 |
| CM-UFD.M31M | 1SVR560731R3701 |
| CM-UFD.M33  | 1SVR560730R3402 |
| CM-UFD.M33M | 1SVR560731R3702 |
| CM-UFD.M34  | 1SVR560730R3403 |
| CM-UFD.M34M | 1SVR560731R3703 |

| Rated control supply voltage $U_s$  |   |
|-------------------------------------|---|
| 24-240 V AC/DC                      | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Standard                            |   |
| CEI 0-21                            | ■ ■   |
| VDE AR-N 4105, BDEW                 | ■ ■   |
| G59/3; G83/2                        | ■ ■   |
| DRRG standard of DEWA               | ■ ■ ■ ■                                       |
| Modbus RTU                          |   |
|                                     | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Suitable for monitoring             |   |
| Single-phase mains                  | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Three-phase mains                   | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Monitoring function                 |   |
| Over-/undervoltage                  | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Over-/underfrequency                | ■ ■ ■ ■ ■ ■ ■ ■                               |
| ROCOF (rate of change of frequency) | ■ ■ ■ ■ ■ ■ ■ ■                               |
| 10 minutes average value            | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Vector shift                        | ■ ■ ■ ■ ■ ■ ■ ■                               |
| Thresholds                          |   |
|                                     | adj   adj   adj   adj   adj   adj   adj   adj |

## Ordering details

| Description               | Type        | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|---------------------------|-------------|-----------------|---------------|-----------------------------|
| see above selection table | CM-UFD.M22  | 1SVR560730R3400 |               | 0.304<br>(0.670)            |
|                           | CM-UFD.M22M | 1SVR560731R3700 |               | 0.312<br>(0.688)            |
|                           | CM-UFD.M31  | 1SVR560730R3401 |               | 0.304<br>(0.670)            |
|                           | CM-UFD.M31M | 1SVR560731R3701 |               | 0.312<br>(0.688)            |
|                           | CM-UFD.M33  | 1SVR560730R3402 |               | 0.304<br>(0.670)            |
|                           | CM-UFD.M33M | 1SVR560731R3702 |               | 0.312<br>(0.688)            |
|                           | CM-UFD.M34  | 1SVR560730R3403 |               | 0.304<br>(0.670)            |
|                           | CM-UFD.M34M | 1SVR560731R3703 |               | 0.312<br>(0.688)            |



Further documentation grid feeding monitoring relays on [www.abb.com](http://www.abb.com)

# Insulation monitoring relays for unearthed supply systems

## Product group picture

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# Insulation monitoring relays for unearthed supply systems

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### Insulation monitoring relays for unearthed supply systems

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# Insulation monitoring relays for unearthed supply systems

## Benefits and advantages, Applications

### Overview

The CM-IWx product family offers a convincing solution for monitoring ungrounded AC, AC/DC and DC networks according to EN/IEC 61557-8. An IT network is supplied either by an isolated transformer or a voltage source such as a battery or generator. In these systems no active conductor is directly connected to earth potential.

The high reliability of an IT system is guaranteed thanks to continuous insulation monitoring. The insulation monitoring device recognizes insulation faults (at least one conductor has a galvanic connection to earth potential) as they develop and immediately reports if the insulation resistance has fallen below a given threshold. Therefore, maintenance activities can be scheduled and executed while the plant keeps running.

### Benefits:

- Increase plant availability and avoid costly unplanned stops of a plant / machine by quickly detecting first faults
- Prevents fires due to detection of a creeping deterioration of the insulation resistance
- The adjustment of the setting values is simple and user friendly done with rotary switches on the front of the device
- Device status is displayed with LEDs that are easy to read and understand

### Application

CM-IWS.x and CM-IWN.x series provide excellent insulation monitoring for general purpose supply networks such as

- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Battery networks
- Hybrid and battery-powered vehicles
- Railway applications
- Many more

CM-IWM.x can be additionally used in special applications such as

- Industrial networks with frequency inverters or direct current drives
- Photovoltaic systems with high system leakage capacitance
- Networks with system voltages up to 1500 V DC or 1100 V AC without requiring a coupling unit
- Installation on the AC or DC side of an inverter
- Networks which require measuring circuit deactivation in case two or more unearthed networks are coupled

#### Note:

Only one insulation monitor must be connected and active in a network at the same time.



# Insulation monitoring relays for unearthed supply systems

## Selection table - Insulation monitoring relays

| Type   | Order number | CM-IWS.2S | CM-IWS.2P | CM-IWS.1S | CM-IWS.1P | CM-IVN.1S       | CM-IVN.1P       | CM-IWM.10       | CM-IWM.11       |
|--|--------------|-----------|-----------|-----------|-----------|-----------------|-----------------|-----------------|-----------------|
| <b>Rated control supply voltage <math>U_s</math></b> |              |           |           |           |           |                 |                 |                 |                 |
| 24 - 240 V AC/DC                                     |              | ■         | ■         | ■         | ■         | ■               | ■               |                 |                 |
| 24 V DC  |              |           |           |           |           |                 |                 | ■               | ■               |
| <b>Measuring voltages</b>                            |              |           |           |           |           |                 |                 |                 |                 |
| 250 V AC (L-PE)                                      |              |           | ■         | ■         |           |                 |                 |                 |                 |
| 400 V AC (L-PE)                                      |              | ■         | ■         |           |           | ■               | ■               |                 |                 |
| 690 V AC (L-PE)                                      |              |           |           |           |           | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>2)</sup> |                 |
| 1000 V AC (L-PE)                                     |              |           |           |           |           |                 |                 |                 | ■ <sup>3)</sup> |
| 300 V DC (L-PE)                                      |              |           | ■         | ■         |           |                 |                 |                 |                 |
| 600 V DC (L-PE)                                      |              |           |           |           |           | ■               | ■               |                 |                 |
| 690 V DC (L-PE)                                      |              |           |           |           |           |                 |                 | ■ <sup>2)</sup> |                 |
| 1000 V DC (L-PE)                                     |              |           |           |           |           | ■ <sup>1)</sup> | ■ <sup>1)</sup> |                 | ■ <sup>3)</sup> |
| <b>Measuring range</b>                               |              |           |           |           |           |                 |                 |                 |                 |
| 1 - 100 k $\Omega$                                   |              | ■         | ■         | ■         | ■         | ■               | ■               |                 |                 |
| 2 - 200 k $\Omega$                                   |              |           |           |           |           | ■               | ■               |                 |                 |
| 1 - 250 k $\Omega$                                   |              |           |           |           |           |                 |                 | ■               | ■               |
| <b>System leakage capacitance, max.</b>              |              |           |           |           |           |                 |                 |                 |                 |
| 10 $\mu$ F   |              | ■         | ■         | ■         | ■         |                 |                 |                 |                 |
| 20 $\mu$ F   |              |           |           |           |           | ■               | ■               |                 |                 |
| 1000 $\mu$ F   |              |           |           |           |           |                 |                 | ■               |                 |
| 3000 $\mu$ F   |              |           |           |           |           |                 |                 |                 | ■               |
| <b>Output</b>  |              |           |           |           |           |                 |                 |                 |                 |
| 1 c/o  |              | ■         | ■         | ■         | ■         |                 |                 |                 |                 |
| 1 x 2 c/o or 2 x 1 c/o                               |              |           |           |           |           | ■               | ■               |                 |                 |
| 2 c/o  |              |           |           |           |           |                 |                 | ■               | ■               |
| <b>Operating principle</b>                           |              |           |           |           |           |                 |                 |                 |                 |
| Open-circuit principle                               |              | ■         | ■         | ■         | ■         |                 |                 | ■               | ■               |
| Open- or closed-circuit principle adjustable         |              |           |           |           |           | ■               | ■               |                 |                 |
| <b>Test</b>  |              |           |           |           |           |                 |                 |                 |                 |
| Front-face button or control input                   |              | ■         | ■         | ■         | ■         | ■               | ■               | ■               | ■               |
| <b>Reset and further functions</b>                   |              |           |           |           |           |                 |                 |                 |                 |
| Front-face button or control input                   |              | ■         | ■         | ■         | ■         | ■               | ■               | ■               | ■               |
| Fault storage / latching configurable                |              | ■         | ■         | ■         | ■         | ■               | ■               |                 |                 |
| Non volatile storage configurable                    |              | ■         | ■         | ■         | ■         | ■               | ■               |                 |                 |
| Interrupted wire detection                           |              |           |           |           |           | ■               | ■               | ■               | ■               |
| Threshold values configurable                        |              | 1         | 1         | 1         | 1         | 2               | 2               | 2               | 2               |
| Control input (measuring input deactivation)         |              |           |           |           |           |                 |                 |                 | ■               |
| <b>Connection type</b>                               |              |           |           |           |           |                 |                 |                 |                 |
| Push-in terminals                                    |              |           | ■         |           | ■         |                 | ■               |                 |                 |
| Double-chamber cage connection terminals             |              | ■         |           | ■         |           | ■               |                 |                 |                 |
| Screw terminals                                      |              |           |           |           |           |                 |                 | ■               | ■               |

1) With coupling unit CM-IVN screw version CM-IVN.S: 1SVR750669R9400  
 push-in version CM-IVN.P: 1SVR760669R9400  
 2) Allowed voltage range of the supervised network: 0-760 V AC / 0-1000 V DC  
 3) Allowed voltage range of the supervised network: 0-1100 V AC / 0-1500 V DC

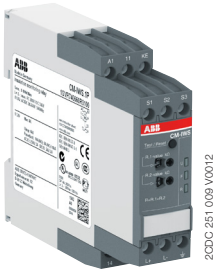


Further documentation insulation monitoring relays on [www.abb.com](http://www.abb.com)

# Insulation monitoring relays for unearthed supply systems

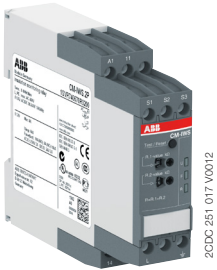
## Ordering details

2



CM-IWS.1

2CDC 251 009 V0012



CM-IWS.2

2CDC 251 011 V0012



CM-IWN.1

2CDC 251 020 V0012



CM-IWM.x

2CDC 112 xxx V0016



CM-IVN

2CDC 252 027 V0012

### Description

The CM-IWx 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 IT DC systems. The devices are able to monitor control circuits (single-phase) and main circuits (3-phase).

### Ordering details

| Rated control supply 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         | Weight (1 pc) |
|------------------------------|--|----------------------------------|---|-----------------|-----------------|---------------|---------------|
|                              |  |                                  |   |                 |                 | 1 pc          | kg (lb)       |
| 24-240 V AC/DC               | 0-250 V AC / 0-300 V DC  | 10 $\mu$ F                       | 1-100 k $\Omega$  | CM-IWS.1S       | 1SVR730660R0100 |               | 0.148 (0.326) |
|                              |  |                                  |   | CM-IWS.1P       | 1SVR740660R0100 |               | 0.137 (0.302) |
|                              | CM-IWS.2S  |                                  |   | 1SVR730670R0200 |                 | 0.141 (0.311) |               |
|                              | CM-IWS.2P  |                                  |   | 1SVR740670R0200 |                 | 0.130 (0.287) |               |
|                              | 0-400 V AC   |                                  |   | CM-IWN.1S       | 1SVR750660R0200 |               | 0.241 (0.531) |
|                              |  |                                  |   | CM-IWN.1P       | 1SVR760660R0200 |               | 0.217 (0.478) |
|                              | 0-400 V AC / 0-600 V DC  | 20 $\mu$ F                       | 1-100 k $\Omega$ / 2-200 k $\Omega$                                   |                 |                 |               |               |

### Description

The CM-IWM.x provides best and up to date insulation monitoring of modern IT supply systems in an optimum and state of the art way according to IEC 61558-8 including annex C.

The device can be used in the most flexible way for AC, DC and AC/DC systems even with a large leakage capacity to earth (PE) and under adverse conditions.

### Ordering details

| Rated control supply 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 | Weight (1 pc) |
|------------------------------|--|----------------------------------|---|-----------|-----------------|-------|---------------|
|                              |  |                                  |   |           |                 | 1 pc  | kg (lb)       |
| 24 V DC                      | 0-690 V AC/DC <sup>1)</sup>                                      | 1000 $\mu$ F                     | 1-250 k $\Omega$ / 20 k $\Omega$ -2 M $\Omega$                        | CM-IWM.10 | 1SVR470670R1000 |       | 0.500 (1.1)   |
|                              | 0-1000 V AC/DC <sup>2)</sup>                                     |                                  |   | CM-IWM.11 | 1SVR470670R1100 |       |               |

1) Allowed voltage range of the supervised network: 0-760 V AC / 0-1000 V DC

2) Allowed voltage range of the supervised network: 0-1100 V AC / 0-1500 V DC

### Ordering details - Coupling unit

| Rated control supply voltage = measuring voltage | Nominal voltage $U_n$ of the distribution system to be monitored | Type     | Order code      | Price | Weight (1 pc) |
|--|--|----------|-----------------|-------|---------------|
|  |  |          |                 | 1 pc  | kg (lb)       |
| Passive device, no control supply voltage needed | 0-690 V AC / 0-1000 V DC   | CM-IVN.S | 1SVR750669R9400 |       | 0.179 (0.395) |
|  |  | CM-IVN.P | 1SVR760669R9400 |       | 0.165 (0.364) |

S: screw connection

P: push-in connection

# Insulation monitoring relays for unearthed supply systems

## Technical data - CM-IWx

Data at  $T_a = 25\text{ °C}$  and rated values, unless otherwise indicated

|   |  | CM-IWS.2                                       | CM-IWS.1  | CM-IWN.1   |
|---|--|--|---|--|
| <b>Input circuit - Supply circuit</b>   |  | <b>A1 - A2</b>                                 |   |  |
| 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<br>30 mA / 0.7 VA                      | 35 mA / 0.9 VA  | 55 mA / 1.3 VA   |
|   |  | 115 V AC<br>12 mA / 1.4 VA                     | 17 mA / 2.0 VA  | 20 mA / 2.3 VA   |
|   |  | 230 V AC<br>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  |   |  |
| Start-up time $t_s$ , fixed   |  | min. 10 s                                      | max. 15 s   | min. 15 s  |
| <b>Input circuit - Measuring circuit</b>  |  | <b>L, <math>\downarrow</math></b>              | <b>L+, L-, <math>\downarrow</math>, KE</b>                          | <b>L+, L-, <math>\downarrow</math>, KE</b>                                       |
| Monitoring function   |  | insulation resistance monitoring of IT systems |   |  |
| 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 /<br>0-300 V DC  | 0-400 V AC /<br>0-600 V DC   |
| Voltage range of the distribution system to be monitored  |  | 0-460 V AC<br>(tolerance +15 %)                | 0-287.5 V AC /<br>0-345 V DC<br>(tolerance +15 %)                   | 0-460 V AC /<br>0-690 V DC<br>(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 $\mu$ F                                     |   | 20 $\mu$ F   |
| Tolerance of the rated frequency $f_N$  |  | 45-65 Hz                                       | 13.5-440 Hz   | 13.5-440 Hz  |
| Extraneous DC voltage $U_{ig}$ (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 $\Omega$                                 |   | -  |
|   | min.-max. R1                                     | -  |   | 1-100 k $\Omega$   |
|   | min.-max. R2                                     | -  |   | 2-200 k $\Omega$ (activated / de-activated by DIP-switch)                        |
| Adjustment resolution   |  | 1 k $\Omega$                                   |   | 1 k $\Omega$   |
|   | R1   | 1 k $\Omega$                                   |   | 2 k $\Omega$   |
|   | R2   | -  |   | $\geq 15\%$ , max. $\pm 1\text{ k}\Omega$ , with CM-IVN $\pm 1.5\text{ k}\Omega$ |
| Tolerance of the adjusted threshold value / Relative percentage uncertainty A at -5...+45 °C, $U_n = 0-115\%$ , $U_s = 85-110\%$ , $f_N, f_s, C_e = 1\mu\text{F}$ | at 1-10 k $\Omega$ $R_F$ (yellow marked scale)   | $\geq 15\%$ , max. $\pm 0.5\text{ k}\Omega$    |   | -  |
|   | at 10-100 k $\Omega$ $R_F$                       | $\pm 6\%$                                      |   | -  |
|   | at 10-15 k $\Omega$ $R_F$                        | -  |   | $\pm 1\text{ k}\Omega$ , with CM-IVN $\pm 1.5\text{ k}\Omega$                    |
|   | at 15-200 k $\Omega$ $R_F$                       | -  |   | $\pm 8\%$  |
| Hysteresis related to the threshold value   |  | 25 %; min. 2 k $\Omega$                        |   |  |
| Internal impedance $Z_i$  | at 50 Hz   | 135 k $\Omega$                                 | 100 k $\Omega$  | 155 k $\Omega$   |
| Internal DC resistance $R_i$  |  | 185 k $\Omega$                                 | 115 k $\Omega$  | 185 k $\Omega$   |
| 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 $t_{an}$  | pure AC system                                   | 0.5 x $R_{an}$ and $C_e = 1\mu\text{F}$        | 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 k $\Omega$ $R_F$                         | 5 $\Omega$ / K                                 |   |  |
|   | at 10-100 k $\Omega$ $R_F$                       | 0.05 % / K                                     |   |  |
|   | at 10-200 k $\Omega$ $R_F$                       | -  |   |  |
|   |  |  |   | 0.05 % / K   |
| Transient overvoltage protection ( $\downarrow$ - terminal)   |  | Z-diode  | avalanche diode   |  |
| <b>Input circuit - Control circuits</b>   |  | <b>S1 - S2 - S3</b>                            |   |  |
| 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                                |   |  |
| Minimum control pulse length  |  | 150 ms   |   |  |
| No-load voltage at the control input  |  | $\leq 24\text{ V} \pm 5\%$                     | $\leq 24\text{ V DC}$   |  |

# Insulation monitoring relays for unearthed supply systems

## Technical data - CM-IWx

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|   | CM-IWS.2   | CM-IWS.1                                | CM-IWN.1   |
|---|--|---|--|
| <b>Indication of operational states</b>                             |  |   |  |
| Control supply voltage  | LED U (green)  |   |  |
| Fault message   | LED F (red)  |   |  |
| Relay status  | LED R (yellow)   |   |  |
| <b>Output circuits</b>  |  |   |  |
| 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 <sup>1)</sup>   |   | open- or closed circuit principle <sup>1)</sup> configurable |
| Contact material  | AgNi alloy, Cd free  |   |  |
| Min. switching voltage / Min. switching current                     | 24 V / 10 mA   |   |  |
| Max. switching voltage / Max. switching current                     | see data sheet   |   |  |
| Rated operational voltage $U_n$ and rated operational current $I_n$ | 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 B 300 pilot duty; general purpose 250 V, 4 A, $\cos \varphi$ 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 <sup>6</sup> switching cycles  |   |  |
| Electrical lifetime (AC-12, 230 V, 4 A)                             | 0.1 x 10 <sup>6</sup> 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  |   |  |
| <b>General data</b>   |  |   |  |
| Duty cycle  | 100 %  |   |  |
| Dimensions  | see 'Dimensional drawings'   |   |  |
| 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 $U_n > 240$ V        | not necessary  |
| Material of housing   | UL 94 V-0  |   |  |
| Degree of protection  | housing / terminal   | IP50 / IP20                             |  |
| <b>Electrical connection</b>  |  |   |  |
|   |  | <b>Screw connection technology</b>      | <b>Easy Connect Technology (Push-in)</b>                     |
| Connecting capacity   | fine-strand with(out) wire end ferrule   | rigid                                   | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)                  |
|   |  |   | 2 x 0.5-2.5 mm <sup>2</sup> (2 x 18-16 AWG)                  |
|   |  |   | 2 x 0.5-1.5 mm <sup>2</sup> (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)            |  |
| <b>Environmental data</b>   |  |   |  |
| Ambient temperature ranges  | operation / storage / transport  | -25...+60 °C/-40...+85 °C/-40...+85 °C  |  |
| 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                            |  |

<sup>1)</sup> Closed-circuit principle: Output relay(s) de-energize(s) if a fault is occurring  
 Open-circuit principle: Output relay(s) energize(s) if a fault is occurring



# Insulation monitoring relays for unearthed supply systems

## Technical data - CM-IWx

|  |                             | CM-IWS.2  | CM-IWS.1            | CM-IWN.1            |
|--|-----------------------------|---|---------------------|---------------------|
| <b>Isolation data</b>  |                             |   |                     |                     |
| Rated impulse withstand voltage $U_{imp}$                    | supply / measuring circuit  | 6 kV  |                     |                     |
|  | supply / output circuit     | 6 kV  |                     |                     |
|  | measuring / output circuit  | 6 kV  |                     |                     |
| Rated insulation voltage $U_i$                               | output 1 / output circuit 2 |   |                     | 4 kV                |
|  | supply / measuring circuit  | 400 V   | 300 V               | 600 V               |
|  | supply / output circuit     | 300 V   |                     |                     |
| Basic insulation   | supply / measuring circuit  | 400 V   | 300 V               | 600 V               |
|  | output 1 / output circuit 2 | -   | -                   | 300 V               |
|  | supply / output circuit     | 400 V AC / 300 V DC   | 250 V AC / 300 V DC | 400 V AC / 600 V DC |
| Protective separation<br>(IEC/EN 61140, EN 50178)            | supply / output circuit     | 250 V AC / 300 V DC   | 250 V AC / 300 V DC | 400 V AC / 600 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   |                     |                     |
| Pollution degree   | supply / output circuit     | 250 V AC / 250 V DC   |                     |                     |
|  | supply / measuring circuit  | 250 V AC / 250 V DC   |                     |                     |
| Overvoltage category   | measuring / output circuit  | 250 V AC / 250 V DC   |                     |                     |
|  |                             | 3   |                     |                     |
| <b>Standards / Directives</b>                                |                             |   |                     |                     |
| 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  |                     |                     |
| <b>Electromagnetic compatibility</b>                         |                             |   |                     |                     |
| Interference immunity to                                     |                             | 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<br>1 kV L-L, 2 kV L-earth |                     |                     |
| conducted disturbances, induced by<br>radio-frequency fields | IEC/EN 61000-4-6            | level 3, 10 V   |                     |                     |
| voltage dips, short interruptions and<br>voltage variations  | IEC/EN 61000-4-11           | class 3   |                     |                     |
| harmonics and interharmonics                                 | IEC/EN 61000-4-13           | class 3   |                     |                     |
| Interference emissions                                       |                             | IEC/EN 61000-6-3  |                     |                     |
| high-frequency radiated                                      | IEC/CISPR 22, EN 55022      | class B   |                     |                     |
| high-frequency conducted                                     | IEC/CISPR 22, EN 55022      | class B   |                     |                     |

# Insulation monitoring relays for unearthed supply systems

## Technical data - CM-IVN

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| Input circuit - Measuring circuit  |   | VL+, VL-, V+   |
|--|---|--|
| Function   | expansion of the nominal voltage range of the insulation monitoring relay CM-IWN to 690 V AC or 1000 V DC, max. length of connection cable 40 cm see CM-IWN |  |
| Measuring principle  | see CM-IWN  |  |
| 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 $C_s$   | 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 $-5...+45\text{ }^\circ\text{C}$ , $U_n = 0-115\%$ , $U_s = 85-110\%$ , $f_N, f_{st}, C_s = 1\text{ }\mu\text{F}$ | at 1-15 k $\Omega$ $R_e$  | $\pm 1.5\text{ k}\Omega$   |
|  | at 15-200 k $\Omega$ $R_e$  | $\pm 8\%$  |
| Internal impedance $Z$   | at 50 Hz  | 195 k $\Omega$   |
| Internal DC resistance $R_i$   |   | 200 k $\Omega$   |
| Measuring voltage $U_m$  |   | 24 V   |
| Tolerance of measuring voltage $U_m$   |   | +10 %  |
| Measuring current $I_m$  |   | 0.15 mA  |
| <b>General data</b>  |   |  |
| MTBF   | on request  |  |
| Duty cycle   | 100 %   |  |
| Dimensions   | see "Dimensional drawings"  |  |
| 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 $U_n > 600\text{ V}$  |
| Degree of protection   | IP50 / IP20   |  |
| <b>Electrical connection</b>   |   |  |
| Connecting capacity  | fine-strand with(out) wire end ferrule  | 2 x 0.75-2.5 mm <sup>2</sup> (2 x 18-14 AWG)   |
|  | rigid   | 2 x 0.5-4 mm <sup>2</sup> (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  | 40 cm   |  |
| <b>Environmental data</b>  |   |  |
| 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  |
| <b>Isolation data</b>  |   |  |
| Rated impulse withstand voltage $U_{imp}$  | input circuit / PE  | 8 kV   |
| Rated insulation voltage $U_i$   | input circuit / PE  | 1000 V   |
| Pollution degree   |   | 3  |
| Overvoltage category   |   | III  |
| <b>Standards / Directives</b>  |   |  |
| 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  |  |
| <b>Electromagnetic compatibility</b>   |   |  |
| Interference immunity to   | 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 surge  | IEC/EN 61000-4-4  | level 3, 2 kV / 5 kHz  |
|  | 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  |  |
| 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 - CM-IWM

| Type   | CM-IWM.10   | CM-IWM.11                                     |
|--|---|---|
| <b>Input circuit</b>   |   |   |
| Rated control supply voltage $U_s$                           | 24 V DC   |   |
| Voltage range  | 20-30 V DC  |   |
| Typical power consumption                                    | max. 5 W  |   |
| <b>Measuring circuit</b>                                     |   |   |
|  | L(+) / L(-) to PE / KE  |   |
| Nominal voltage $U_N$  | 0-690 V AC/DC   | 0-1000 V AC/DC                                |
| Allowed voltage range of the supervised network              | 0-760 V AC / 0-1000 V DC  | 0-1100 V AC / 0-1500 V DC                     |
| Frequency range  | DC or 16-1000 Hz  | DC or 16-1000 Hz                              |
| Max. system leakage capacitance $C_E$                        | 1000 $\mu$ F  | 3000 $\mu$ F                                  |
| Internal resistance (AC/DC)                                  | > 280 k $\Omega$  |   |
| Measuring voltage  | approx. $\pm$ 95 V  |   |
| Max. measured current ( $R_E = 0$ )                          | < 0.35 mA   |   |
| Response values $R_E$<br>each adjustable via rotary switches | pre-warning ("VW")  | warning ("AL")                                |
|  | 20 k $\Omega$   | 1 k $\Omega$                                  |
|  | 30 k $\Omega$   | 3 k $\Omega$                                  |
|  | 50 k $\Omega$   | 10 k $\Omega$                                 |
|  | 70 k $\Omega$   | 20 k $\Omega$                                 |
|  | 100 k $\Omega$  | 30 k $\Omega$                                 |
|  | 150 k $\Omega$  | 50 k $\Omega$                                 |
|  | 250 k $\Omega$  | 70 k $\Omega$                                 |
|  | 500 k $\Omega$  | 100 k $\Omega$                                |
|  | 1000 k $\Omega$   | 150 k $\Omega$                                |
|  | 2000 k $\Omega$   | 250 k $\Omega$                                |
| Response inaccuracy  | IEC/EN 61557-8  | $\pm$ 15 % + 1.5 k $\Omega$                   |
| Response value hysteresis                                    | at range 10 k $\Omega$ ... 700 k $\Omega$<br>out of range:      | approx. 25 %<br>approx. 40 % + 0.5 k $\Omega$ |
| ON delay   | at $C_E = 1 \mu$ F<br>$R_E$ of $\infty$ to 0.5 * response value | < 10 s  |
| <b>Control input</b>   |   |   |
| Current flow   | between T, R and G  | between HM, T, R and G                        |
| No-load voltage to ground                                    | approx. 12 V  |   |
| Permissible wire length                                      | < 50 m  |   |
| Min. activation time   | 0.5 s   |   |
| <b>Output</b>  |   |   |
| Contacts   | 2 x 1 c/o contacts for VW and AL                                |   |
| Thermal current $I_{th}$                                     | 4 A   |   |
| Switching capacity to AC-15                                  | n/o contact   | 3 A / AC 230 V acc. to IEC/EN 60947-5-1       |
|  | n/c contact   | 1 A / AC 230 V acc. to IEC/EN 60947-5-1       |
| Electrical life  | at 8 A, AC 250 V  | 1 x 10 <sup>5</sup> switching cycles          |
| Short circuit strength max. fuse rating                      | 4 A gL acc. to IEC/EN 60947-5-1                                 |   |
| Mechanical life  | 10 x 10 <sup>6</sup> switching cycles                           |   |
| <b>General Data</b>  |   |   |
| Operating mode   | continuous operation  |   |
| Temperature range  | operation   | - 25 ... + 60 °C                              |
|  | storage   | - 40 ... + 70 °C                              |
| Relative air humidity  | 93 % at 40 °C   |   |
| Atmospheric pressure   | 860-1600 mbar (86-106 kPa)                                      |   |
| Altitude   | IEC/EN 60664-1<br>< 4000 m                                      |   |
| Clearance and creepage distances                             | IEC/EN 60664-1  |   |
| Rated impulse voltage / pollution degree                     | IEC/EN 60664-1  |   |
| Measuring circuit  | auxiliary voltage DC and relay contacts VW, AL                  | 8 kV / 2                                      |
| L(+) / L(-) to   | auxiliary voltage DC to relay contacts VW, AL                   | 8 kV / 2                                      |
|  | relay contacts VW to relay contact AL                           | 4 kV / 2                                      |
| Insulation test voltage, routine test                        | AC 5 kV; 1 s<br>AC 2.5 kV; 1 s                                  |   |

# Insulation monitoring relays for unearthed supply systems

## Technical data CM-IWM

2

| Technical data                             |                              |   |
|--|------------------------------|---|
| EMC  |                              |   |
| Electrostatic discharge (ESD)              | IEC/EN 61000-4-2             | 8 kV (air)  |
| HF irradiation                             | IEC/EN 61000-4-3             | 80 MHz-2.7 GHz: 10 V/m  |
| Fast transients                            | IEC/EN 61000-4-4             | 4 kV  |
| Surge voltages                             | IEC/EN 61000-4-5             | between<br>A1 - A2: 1 kV<br>L(+) - L(-): 2 kV<br>A1, A2 - PE: 4 kV<br>L(+), L(-) - PE: 4 kV<br>control line: 0.5 kV<br>control line and earth: 1 kV   |
| HF-wire guided<br>Interference suppression | IEC/EN 61000-4-6<br>EN 55011 | 10 V<br>limit value class A<br>when connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken  |
| Degree of protection                       |                              |   |
| Housing                                    | IEC/EN 60529                 | IP 40   |
| Terminals                                  | IEC/EN 60529                 | IP 20   |
| Housing                                    |                              | thermoplastic with V0 behaviour according to UL subject 94  |
| Vibration resistance                       | IEC/EN 60068-2-6             | 10-55 Hz: 0.35 mm<br>2-13.2 Hz: ± 1 mm<br>13.2-100 Hz: ± 7 g  |
| Shock resistance                           | IEC/EN 60068-2-27            | 10 g / 11 ms, 3 pulses  |
| Climate resistance                         | IEC/EN 60068-1               | 25 / 060 / 04   |
| Terminal designation                       |                              |   |
| Connecting capacity                        |                              | EN 50005<br>1 x 4 mm <sup>2</sup> solid<br>1 x 2.5 mm <sup>2</sup> stranded ferruled (isolated)<br>2 x 1.5 mm <sup>2</sup> stranded ferruled (isolated)<br>DIN 46228-1/-2/-3-4<br>2 x 2.5 mm <sup>2</sup> stranded ferruled (isolated)<br>DIN 46228-1/-2/-3 |
| Stripping length                           |                              | 8 mm  |
| Tightening torque                          |                              | 0.8 Nm  |
| Wire fixing                                |                              | plus-minus terminal screws M3.5 terminal with wire protection   |
| Mounting                                   | IEC/EN 60715                 | DIN rail  |
| Dimensions                                 | width x height x depth       | 90 x 90 x 121 mm  |

# Insulation monitoring relays for unearthed supply systems

## Notes

# Motor control and protection

## Product group picture

2



# Motor control and protection

## Table of contents

### Motor control and protection

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# Motor control and protection

## Benefits and advantages

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UMC100.3 is a flexible, modular and expandable motor management system for constant-speed low-voltage range motors. It's most important tasks include motor protection, prevention of plant standstills and the reduction of down time. This is made possible by early information relating to possible motor problems which avoids unplanned plant standstills. Even if a motor trips, quick diagnosis of the cause of the fault serves to reduce downtime.

UMC100.3 combines in a very compact unit:

### Motor protection

- Overload, underload
- Overvoltage, undervoltage
- Blocked rotor, low / high current
- Phase failure, imbalance, phase sequence
- Earth leakage
- Thermistor protection
- Limitation of starts per time
- One single version with integrated measuring system covers the rated motor current from 0.24 to 63 A

### Motor control

- Integrated and easy to parametrize motor starter functions like direct, reverse, star-delta,...
- Additionally free programmable logic for application specific control functions
- Expansion modules DX111, DX122 for more I/Os
- Expansion modules VI150, VI155 for 3-phase voltage measuring
- Analog and temperature module AI111

### Motor diagnostics

- Quick and comprehensive access to all relevant data via fieldbus and/or operator panel
- Current, thermal load
- Phase voltages
- Power factor
- Energy

### Communication

- Communication-independent basic device
- Freely selectable fieldbus protocol with FieldBusPlug
- Profibus DP
- DeviceNet
- Modbus RTU
- Ethernet Modbus TCP
- EtherNet/IP
- Profinet

### Typical application segments

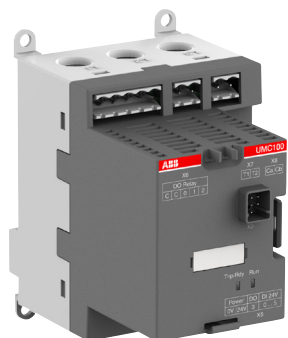
- Oil & gas
- Cement
- Paper
- Mining
- Steel
- Chemical industry

Further information

UMC Catalog            2CDC 190 022 C0206  
UMC Brochure         2CDC 135 011 B0204

# Motor control and protection

## Technical data



### Basic devices UMC100.3

Versions with ATEX approval and conformal coating are available.

#### Main power

|                          |   |
|--------------------------|---|
| Voltage                  | max 1000 V AC   |
| Frequency                | 45...65 Hz  |
| Rated motor current      | 0.24...63 A, without accessories<br>Higher currents with external transformer |
| Tripping classes         | 5E, 10E, 20E, 30E, 40E in accordance with IEC/EN 60947-4-1                    |
| Short-circuit protection | Separate fuse on network side   |

#### Control unit

|                |  |
|----------------|--|
| Supply voltage | 24 V DC, 110-240 V AC/DC                               |
| Inputs         | 6 digital inputs 24 V DC<br>1 PTC input                |
| Outputs        | 3 digital relay outputs<br>1 digital transistor output |

### Expansion modules

The UMC100.3 can be expanded with maximum 4 expansion modules: One digital expansion module DX111 or DX122, one module VI150 or VI155 and 2 analog modules AI111.

Communication takes place via a simple two-wire line. The maximum distance allowed between the UMC100.3 and the expansion module is 3 m.



#### Digital expansion modules DX111 / DX122-FBP.0

expand the UMC100.3 to include additional digital inputs and outputs and an analog output

|                |  |
|----------------|--|
| Supply voltage | 24 V DC  |
| Inputs         | DX111: 8 digital inputs 24 V DC<br>DX122 8 digital inputs 110/230 V AC           |
| Outputs        | 4 digital relay outputs<br>1 analog output, 0/4...20 mA, / 0...10 V configurable |

#### Voltage modules VI150/VI155-FBP.0

Voltage modules for determining phase voltages, power factor ( $\cos \varphi$ ), active power, apparent power, energy, harmonic content (THD)

VI150 for use in grounded networks

VI155 for use in grounded and ungrounded networks



|                     |                        |
|---------------------|------------------------|
| Supply voltage      | 24 V DC                |
| Voltage inputs      | L1, L2, L3             |
| Rated voltage range | 150 ... 690 V AC       |
| Outputs             | 1 digital relay output |

#### Analog module AI111.0

expands the UMC100.3 with analog and temperature inputs

|                |  |
|----------------|--|
| Supply voltage | 24 V DC  |
| Inputs         | 0-10 V, 0/4-20 mA<br>PT100, PT1000, 2- or 3-wire connection<br>KTY83, KTY84, NTC |



# Motor control and protection

## Technical data

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### Ethernet communication interfaces

Mounted in the MCC cable chamber; connection of 1 to 4 motor controllers UMC100.3 via simple cables

|             |                 |
|-------------|-----------------|
| MTQ22-FBP.0 | for Modbus TCP  |
| PNQ22-FBP.0 | for Profinet IO |



### Fieldbus communication interfaces

can be mounted directly on the UMC100.3 or separately in the cable chamber of the MCC. Connection for standard fieldbus cables with 9-pole Sub-D (Profibus DP) or terminal blocks

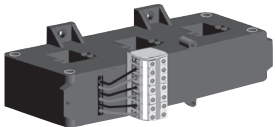
|         |                 |
|---------|-----------------|
| PDP32.0 | for Profibus DP |
| DNP31.0 | for DeviceNet   |
| MRP31.0 | for Modbus RTU  |



### CEM11 Earth leakage sensors

Summation current transformer for connecting to a digital input  
Mounting with bracket on DIN busbar or wall

|               |                 |          |
|---------------|-----------------|----------|
| CEM11-FBP.20  | 80 – 1.700 mA   | 20 mm Ø  |
| CEM11-FBP.35  | 100 – 3.400 mA  | 35 mm Ø  |
| CEM11-FBP.60  | 120 – 6.800 mA  | 60 mm Ø  |
| CEM11-FBP.120 | 300 – 13.600 mA | 120 mm Ø |



### Current transformer CT4L / CT5L

Only required for rated motor currents >63 A  
Linear transformer, 3-phase with terminal block, designed for connecting leads Cu 2.5 mm<sup>2</sup>



### UMC100-PAN control panel

Installation on the device or on the switching cabinet door  
Graphics-enabled and backlit display, 3 LEDs for status indication  
Freely configurable error messages  
USB port for PC connection  
Multilingual: German, English, French, Italian, Polish, Portuguese, Spanish, Russian

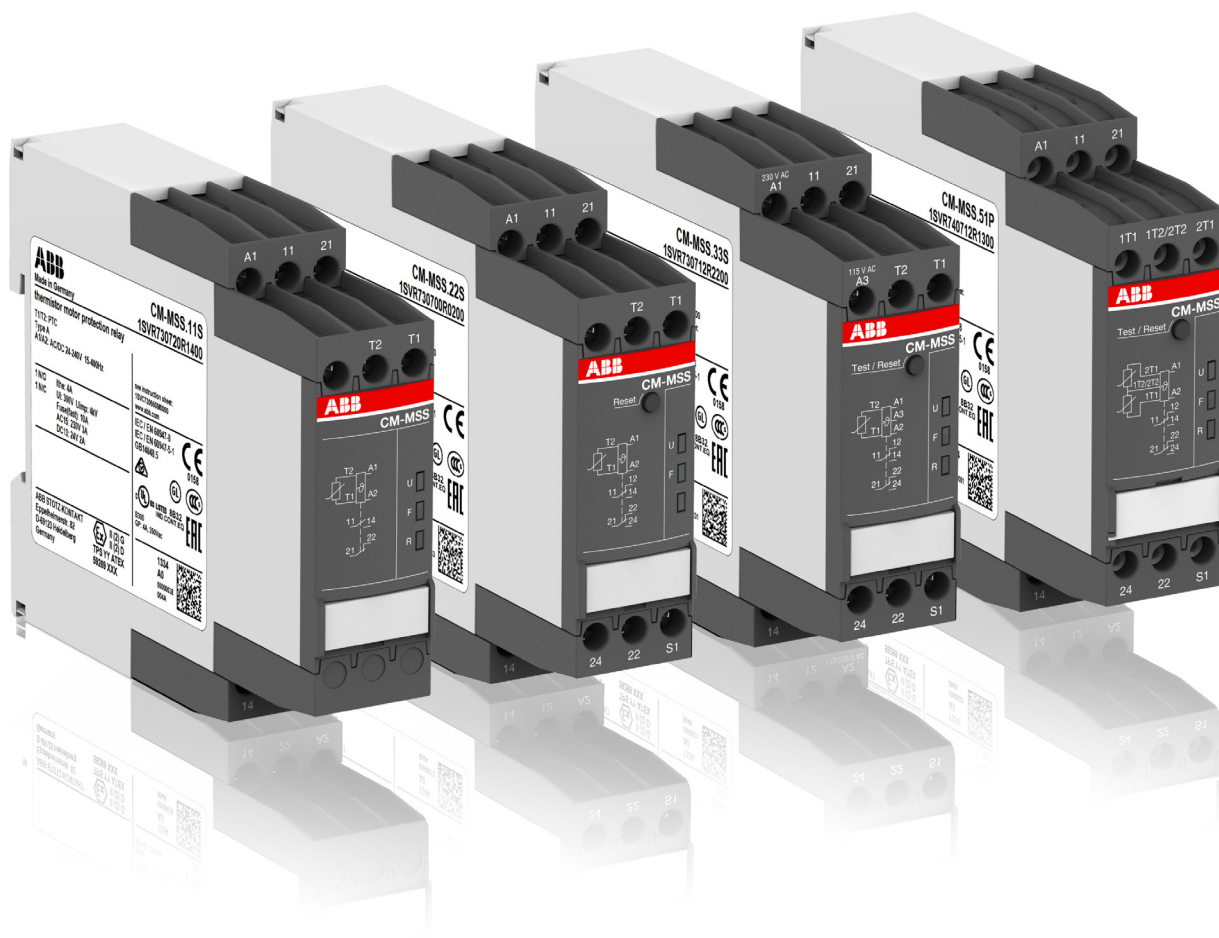
# Motor control and protection

## Notes

# Thermistor motor protection relays

## Product group picture

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# Thermistor motor protection relays

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### Thermistor motor protection relays

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| Ordering details                                     | 2/74 |
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# Thermistor motor protection relays

## Benefits and advantages, Applications

The thermistor motor protection relays of the CM-MSx range protect motors with PTC sensors against high temperature. These sensors are incorporated in the motor windings thus measuring the motor heat directly.

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### Direct temperature measuring

Generally, motor damages caused by overload or overheating situations can be prevented in different ways. Compared to the indirect temperature measuring which monitors the motor current, the temperature inside the motor can be measured by direct temperature measuring.

This enables direct control and evaluation of the following operating conditions like:

- Heavy duty starting
- Increased switching frequency
- Single phase operation
- Phase unbalance
- High ambient temperature
- Insufficient cooling
- Breaking operation

Therefore the consequences from overheating like abrasion as well as electrical failures can be prevented.

The direct measuring principle is carried out by a combination of the thermistor motor protection relay and 3 PTC sensors which are installed directly in the motor by the manufacturer. Those 3 PTC sensors are placed directly at the thermal hotspots, the motor windings.

### Characteristics CM-MSS<sup>1)</sup>

- Different types of contacts available
  - 1 x 2 c/o (SPDT) contacts
  - 2 x 1 c/o (SPDT) contact
  - 1 n/o and 1 n/c contact
- 1 or 2 measuring circuits
- Different types of reset functions
  - Automatic
  - Manual
  - Remote
- Rated control supply voltages
  - 24 V AC/DC
  - 24-240 V AC/DC
  - 110-130 V AC, 220-240 V AC
- Various approvals and marks

### Characteristics CM-MSE

- Auto reset
- Connection of several sensors (max. 6 sensors connected in series)
- Monitoring of bimetals
- 1 n/o contact
- Excellent cost / performance ratio

### Monitoring the motor

The thermistor motor protection relay measures the resistance of the PTC sensors which reflects the internal motor temperature permanently. If the temperature in the motor windings rises excessively and reaches the nominal response temperature (NRT), the thermistor motor protection relay detects this situation and the output relay switches off.

By doing so the motor contactor gets triggered and switches off the motor.

### CM-MSS functionality video



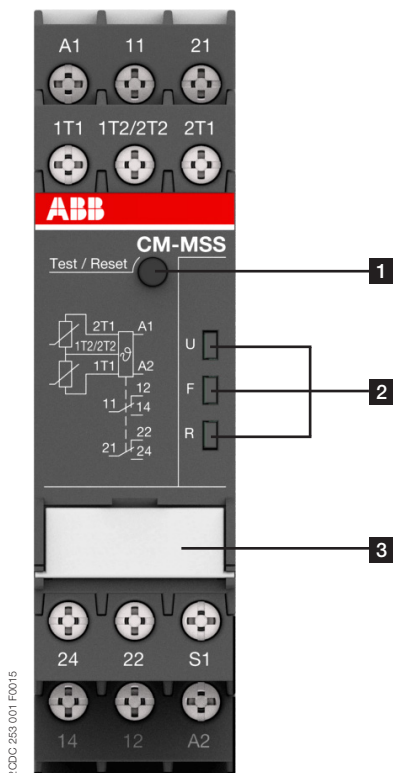
### Features <sup>1)</sup>


- Additional functions:
  - Dynamic interrupted wire detection
  - Short-circuit monitoring of the sensor circuit
  - Non-volatile fault storage
  - Single or sum evaluation
- Easy configuration via DIP switches
- LEDs to distinguish between different failure causes
- Screw connection technology or Easy Connect Technology available
- Test/Reset button available

<sup>1)</sup> Depending on device the characteristics vary, for detailed overview see "Selection table - Thermistor motor protection relays" on page 2/73.























# Thermistor motor protection relays

## Operating controls



- 1 Test / Reset button**  
Reset - only possible if measured value < switch-on resistance
- 2 Indication of operational states with LEDs**  
U: green LED - Status indication of control supply voltage  
 Control supply voltage applied  
 F: red LED - Fault message  
 R: yellow LED - Status indication of the output relay
- 3 Marker label / DIP switches (depending on device)**

### LEDs, status information and fault messages CM-MSS (in order of priority)

| Operational state                                     | U: green LED  | F: red LED  | R: yellow LED   |
|---|---|---|---|
| Absence of control supply voltage                     | OFF   | OFF   | OFF   |
| Internal fault <sup>1)</sup>                          | OFF   |  |  |
| Internal fault <sup>1)</sup>                          |  |  |  |
| Control supply voltage not within the tolerance range |  |  | OFF   |
| Short circuit   |  |  | OFF   |
| Interrupted wire                                      |  |  | OFF   |
| Measuring circuit 2: Overtemperature                  |  |  | OFF   |
| Measuring circuit 1: Overtemperature                  |  |  | OFF   |
| Fault rectified but not confirmed                     |  | -- <sup>2)</sup>  |  |
| Test function   |  | OFF   | OFF   |
| Change of configuration not confirmed                 |  | OFF   |  |
| No fault  |  | OFF   |  |

<sup>1)</sup> Depending on the fault with the highest priority

<sup>2)</sup> Restart the device. If after restart the same fault is indicated, replace the device.

In case of several faults, the fault with the higher priority is shown. The reset can be made after rectification and confirmation of the last fault.

# Thermistor motor protection relays

## Selection table - Thermistor motor protection relays

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| Type  | Order code | 1SVR550805R9300 | 1SVR550800R9300 | 1SVR550801R9300 | 1SVR740720R1400 | 1SVR730720R1400 | 1SVR740700R0100 | 1SVR730700R0100 | 1SVR740700R2100 | 1SVR730700R2100 | 1SVR740722R1400 | 1SVR730722R1400 | 1SVR740700R0200 | 1SVR730700R0200 | 1SVR740700R2200 | 1SVR730700R2200 | 1SVR740712R1400 | 1SVR730712R1400 | 1SVR740712R0200 | 1SVR730712R0200 | 1SVR740712R200  | 1SVR730712R200  | 1SVR740712R2200 | 1SVR730712R2200 | 1SVR740712R1200 | 1SVR730712R1200 | 1SVR740712R1300 | 1SVR730712R1300 |
|---|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Characteristics</b>                            |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| ATEX approval                                     |            |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Number of sensor circuits                         | 1          | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 2               | 2               |
| Single or accumulative evaluation                 |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |
| Number of LEDs                                    |            |                 |                 | 3               | 3               | 2               | 2               | 2               | 2               | 3               | 3               | 2               | 2               | 2               | 2               | 2               | 3               | 3               | 3               | 3               | 3               | 3               | 3               | 3               | 3               | 3               | 3               | 3               |
| <b>Contacts</b>                                   |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 1 c/o (SPDT) contact                              |            |                 |                 |                 |                 | ■               | ■               | ■               | ■               |                 |                 |                 | ■               | ■               | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 2 c/o (SPDT) contacts                             |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               |                 |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| 1 n/o   | ■          | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 1 n/c and 1 n/o                                   |            |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 2 x 1 c/o or 1 x 2 c/o contacts, configurable     |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |
| <b>Reset</b>                                      |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Manual  |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Remote  |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Auto  | ■          | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>1)</sup> | ■ <sup>2)</sup> | ■ <sup>2)</sup> |
| Test button                                       |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |                 |
| <b>Functions</b>                                  |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Short-circuit detection                           |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Short-circuit detection, configurable             |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               |
| Dynamic interrupted wire detection                |            |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               | ■               |
| Non-volatile fault storage                        |            |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Non-volatile fault storage, configurable          |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               |
| <b>Rated control supply voltage U<sub>s</sub></b> |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 24 V AC   | ■          |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 110-130 V AC                                      |            | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 220-240 V AC                                      |            |                 | ■               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| 24-240 V AC/DC                                    |            |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 | ■               | ■               | ■               | ■               |
| 24 V AC/DC  |            |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |                 |                 |
| 110-130 V AC, 220-240 V AC                        |            |                 |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 | ■               | ■               |                 |                 |                 |                 |                 |                 |
| <b>Connection type</b>                            |            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Push-in terminals                                 |            |                 |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |
| Double-chamber cage connection terminals          |            |                 |                 |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               |                 | ■               | ■               |

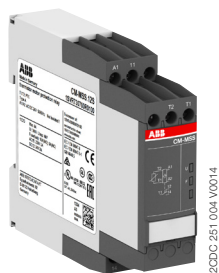
<sup>1)</sup> For automatic reset, connect terminals S1 to T2.

<sup>2)</sup> For automatic reset, connect terminals S1 to 1T2/2T2.



# Thermistor motor protection relays

## Ordering details



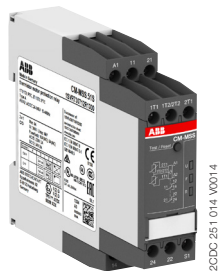
CM-MSS.12S

2CDC 251 004 V0014



CM-MSS.41S

2CDC 251 013 V0014



CM-MSS.51S

2CDC 251 014 V0014

### Description

The thermistor motor protection relay CM-MSS monitors the winding temperature and thus protects the motor from overheating, overload and insufficient cooling in accordance to the product standard IEC/EN 60947-8.

### Ordering details CM-MSx

| Characteristics | Type       | Order code      | Price | Weight        |
|-----------------|------------|-----------------|-------|---------------|
|                 |            |                 | 1 pc  | (1 pc)        |
|                 |            |                 |       | kg (lb)       |
|                 | CM-MSE     | 1SVR550805R9300 |       | 0.11 (0.24)   |
|                 | CM-MSE     | 1SVR550800R9300 |       | 0.11 (0.24)   |
|                 | CM-MSE     | 1SVR550801R9300 |       | 0.11 (0.24)   |
|                 | CM-MSS.11P | 1SVR740720R1400 |       | 0.119 (0.263) |
|                 | CM-MSS.11S | 1SVR730720R1400 |       | 0.127 (0.280) |
|                 | CM-MSS.12P | 1SVR740700R0100 |       | 0.105 (0.231) |
|                 | CM-MSS.12S | 1SVR730700R0100 |       | 0.113 (0.249) |
|                 | CM-MSS.13P | 1SVR740700R2100 |       | 0.147 (0.324) |
|                 | CM-MSS.13S | 1SVR730700R2100 |       | 0.155 (0.342) |
|                 | CM-MSS.21P | 1SVR740722R1400 |       | 0.118 (0.260) |
|                 | CM-MSS.21S | 1SVR730722R1400 |       | 0.126 (0.278) |
|                 | CM-MSS.22P | 1SVR740700R0200 |       | 0.121 (0.267) |
|                 | CM-MSS.22S | 1SVR730700R0200 |       | 0.132 (0.291) |
|                 | CM-MSS.23P | 1SVR740700R2200 |       | 0.163 (0.359) |
|                 | CM-MSS.23S | 1SVR730700R2200 |       | 0.174 (0.384) |
|                 | CM-MSS.31P | 1SVR740712R1400 |       | 0.120 (0.265) |
|                 | CM-MSS.31S | 1SVR730712R1400 |       | 0.128 (0.282) |
|                 | CM-MSS.32P | 1SVR740712R0200 |       | 0.120 (0.265) |
|                 | CM-MSS.32S | 1SVR730712R0200 |       | 0.130 (0.287) |
|                 | CM-MSS.33P | 1SVR740712R2200 |       | 0.162 (0.357) |
|                 | CM-MSS.33S | 1SVR730712R2200 |       | 0.172 (0.379) |
|                 | CM-MSS.41P | 1SVR740712R1200 |       | 0.130 (0.287) |
|                 | CM-MSS.41S | 1SVR730712R1200 |       | 0.141 (0.311) |
|                 | CM-MSS.51P | 1SVR740712R1300 |       | 0.135 (0.298) |
|                 | CM-MSS.51S | 1SVR730712R1300 |       | 0.145 (0.320) |

See "Selection table - Thermistor motor protection relays" on page 2/73.

S: screw connection  
P: push-in connection



Further documentation thermistor motor protection monitoring relays on [www.abb.com](http://www.abb.com)

# Thermistor motor protection relays

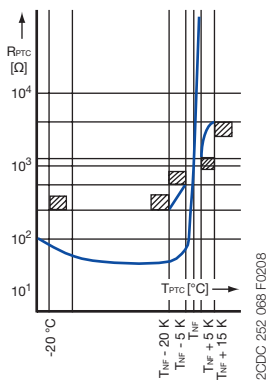
## Ordering details - PTC temperature sensors C011

2



1SWC 110 000 F0531

Temperature sensor characteristics



2CDC 252 068 F0208

### Description

The PTC temperature sensors (temperature-dependent with positive temperature coefficient) are selected by the manufacturer of the motor depending on:

- the motor insulation class according to IEC/EN 60034-11,
- the special characteristics of the motor, such as the conductor cross-section of the windings, the permissible overload factor etc.
- special conditions prescribed by the user, such as the permissible ambient temperature, risks resulting from locked rotor, extent of permitted overload etc.

One temperature sensor must be embedded in each phase winding. For instance, in case of three-phase squirrel cage motors, three sensors are embedded in the stator windings. For pole-changing motors with one winding (Dahlander connection), 3 sensors are also sufficient. Pole-changing motors with two windings, however, require 6 sensors. The sensors are suitable for embedding in motor windings with rated operating voltages of up to 600 V AC. Conductor length: 500 mm per sensor. A 14 V varistor can be connected in parallel to protect the sensors from overvoltage. Due to their characteristics, the thermistor motor protection relays can also be used with PTC temperature sensors of other manufacturers which comply with DIN 44 081 and DIN 44 082.

If an additional warning is required before the motor is switched off, separate sensors for a correspondingly lower temperature must be embedded in the winding. They have to be connected to a second control unit.

### Ordering details CM-MSS accessories

| Rated response temperature $T_{NF}$  | Color coding | Type       | Order code      | Price<br>1 pc | Weight<br>(1 pc)<br>kg (lb) |
|--|--------------|------------|-----------------|---------------|-----------------------------|
| <b>Temperature sensor C011, standard version acc. to DIN 44081</b><br>1 set = 3 pieces |              |            |                 |               |                             |
| 70 °C  | white-brown  | C011-70    | GHC0110003R0001 |               | 0.02 (0.044)                |
| 80 °C  | white-white  | C011-80    | GHC0110003R0002 |               | 0.02 (0.044)                |
| 90 °C  | green-green  | C011-90    | GHC0110003R0003 |               | 0.02 (0.044)                |
| 100 °C   | red-red      | C011-100   | GHC0110003R0004 |               | 0.02 (0.044)                |
| 110 °C   | brown-brown  | C011-110   | GHC0110003R0005 |               | 0.02 (0.044)                |
| 120 °C   | gray-gray    | C011-120   | GHC0110003R0006 |               | 0.02 (0.044)                |
| 130 °C   | blue-blue    | C011-130   | GHC0110003R0007 |               | 0.02 (0.044)                |
| 140 °C   | white-blue   | C011-140   | GHC0110003R0011 |               | 0.02 (0.044)                |
| 150 °C   | black-black  | C011-150   | GHC0110003R0008 |               | 0.02 (0.044)                |
| 160 °C   | blue-red     | C011-160   | GHC0110003R0009 |               | 0.02 (0.044)                |
| 170 °C   | white-green  | C011-170   | GHC0110003R0010 |               | 0.02 (0.044)                |
| <b>Triple temperature sensor C011-3</b>  |              |            |                 |               |                             |
| 150 °C   | black-black  | C011-3-150 | GHC0110033R0008 |               | 0.05 (0.11)                 |

### Technical data

| Characteristic data  | Sensor type C011          |
|--|---------------------------|
| Cold-state resistance  | 50 -100 $\Omega$ at 25 °C |
| Warm-state resistance $\pm 5$ up to 6 K of rated response temperature $T_{NF}$ | 10 000 $\Omega$           |
| Thermal time constant, sensor open <sup>1)</sup>                               | < 5 s                     |
| Permitted ambient temperature  | +180 °C                   |

| Rated response temperature $\pm$ tolerance<br>$T_{NF} \pm \Delta T_{NF}$ | PTC resistance R from -20 °C to $T_{NF} - 20$ K | PTC resistance R <sup>2)</sup> at PTC temperatures of: |   |  |                    |
|--|---|--|---|--|--------------------|
|  |   | $T_{NF} - \Delta T_{NF}$<br>(UPTC $\leq 2.5$ V)        | $T_{NF} + \Delta T_{NF}$<br>(UPTC $\leq 2.5$ V) | $T_{NF} + 15$ K<br>(UPTC $\leq 7.5$ V) |                    |
| 70 $\pm 5$ °C  | $\leq 100 \Omega$                               | $\leq 570 \Omega$                                      | $\geq 570 \Omega$                               | -                                      |                    |
| 80 $\pm 5$ °C  |   |  |   |  |                    |
| 90 $\pm 5$ °C  |   |  |   |  |                    |
| 100 $\pm 5$ °C   |   |  |   |  |                    |
| 110 $\pm 5$ °C   |   |  |   |  |                    |
| 120 $\pm 5$ °C   |   |  |   |  |                    |
| 130 $\pm 5$ °C   |   |  | $\leq 550 \Omega$                               | $\geq 1330 \Omega$                     | $\geq 4000 \Omega$ |
| 140 $\pm 5$ °C   |   |  |   |  |                    |
| 150 $\pm 5$ °C   |   |  |   |  |                    |
| 160 $\pm 5$ °C   |   |  |   |  |                    |
| 170 $\pm 7$ °C   |   | $\leq 570 \Omega$                                      | $\geq 570 \Omega$                               | -                                      |                    |

<sup>1)</sup> Not embedded in windings.

<sup>2)</sup> For triple temperature sensor take values x 3.

# Thermistor motor protection relays

## Technical data - CM-MSS

### Technical data

Data at  $T_a = 25\text{ °C}$  and rated values, unless otherwise indicated

| Supply circuit - Input circuit                                      |  | CM-MSS.x1   | CM-MSS.x2  | CM-MSS.x3    |
|---|--|---|------------|--------------|
| Rated control supply voltage $U_s$                                  | A1-A2  | 24-240 V AC/DC  | 24 V AC/DC | 220-240 V AC |
|   | A2-A3  | -   | -          | 110-130 V AC |
| Rated control supply voltage $U_s$ tolerance                        |  | -15...+10 %   |            |              |
| Rated frequency   |  | 15-400 Hz   | 50-60 Hz   |              |
| Electrical insulation between supply circuit and measuring circuit  |  | yes   | no         | yes          |
| Power failure buffering time  |  | 20 ms   |            |              |
| <b>Supply circuit - Measuring circuit / Sensor circuit</b>          |  |   |            |              |
| Number of circuits  |  | 1 (CM-MSS.51: 2)  |            |              |
| Sensor type   |  | PTC type A (DIN/EN 44081, DIN/EN 44082)                                   |            |              |
| Max. total resistance of sensors connected in series, cold state    |  | < 750 $\Omega$  |            |              |
| Overtemperature monitoring  | switch-off resistance (relay de-energizes)         | 2.83 k $\Omega$ $\pm$ 1% (CM-MSS.12 /13 /22 /23: 2.7 k $\Omega$ $\pm$ 5%) |            |              |
|   | switch-on resistance (relay energizes)             | 1.1 k $\Omega$ $\pm$ 1% (CM-MSS.12 /13 /22 /23: 1.2 k $\Omega$ $\pm$ 5%)  |            |              |
| Maximum voltage in sensor circuit                                   | 1.33 k $\Omega$                                    | 2.5 V   |            |              |
|   | 4 k $\Omega$                                       | 3.7 V   |            |              |
|   | $\infty$ k $\Omega$                                | 5.5 V   |            |              |
| Maximum current in sensor circuit                                   |  | 3.7 mA  |            |              |
| Maximum sensor cable length   |  | 2 x 100 m at 0.75 mm <sup>2</sup> , 2 x 400 m at 2.5 mm <sup>2</sup>      |            |              |
| Accuracy within the rated control supply voltage tolerance          |  | 0.50 % (CM-MSS.12 /13 /22 /23: 5 %)                                       |            |              |
| Accuracy within the temperature range                               |  | 0.01 %/K (CM-MSS.12 /13 /22 /23: 0.5 %/K)                                 |            |              |
| Repeat accuracy (constant parameters)                               |  | on request  |            |              |
| Reaction time of the safety function                                |  | < 100 ms  |            |              |
| Hardware fault tolerance (HFT)                                      |  | 0   |            |              |
| <b>Control circuit</b>  |  |   |            |              |
| Control function  |  | see "Selection table - Thermistor motor protection relays" on page 2/73   |            |              |
| Maximum no-load voltage   |  | 5.5 V   |            |              |
| Max. current  |  | 0.6 mA (CM-MSS.12 /13 /22 /23: 1.2 mA)                                    |            |              |
| Maximum cable length  |  | 2 x 100 m at 0.75 mm <sup>2</sup> , 2 x 400 m at 2.5 mm <sup>2</sup>      |            |              |
| <b>Indication of operational states</b>                             |  |   |            |              |
| Control supply voltage  | U  | LED green   |            |              |
| Relay status  | R  | LED yellow  |            |              |
| Fault message   | F  | LED red   |            |              |
| <b>Output circuit</b>   |  |   |            |              |
| Kind of output  |  | see "Selection table - Thermistor motor protection relays" on page 2/73   |            |              |
| Operating principle   |  | closed-circuit principle  |            |              |
| Contact material  |  | AgNi alloy, Cd free   |            |              |
| Minimum switching voltage / Minimum switching current               |  | 24 V / 10 mA  |            |              |
| Maximum switching voltage / Maximum switching current               |  | see data sheet  |            |              |
| Rated operational voltage $U_o$ and rated operational current $I_o$ | 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   |            |              |
|   | maximum rated operational voltage                  | 300 V AC  |            |              |
|   | maximum continuous thermal current at B 300        | 5 A   |            |              |
|   | maximum making/breaking apparent power at B 300    | 3600/360 VA   |            |              |
|   | general purpose rating                             | 250 V AC - 4 A  |            |              |
| Mechanical lifetime   |  | 30 x 10 <sup>6</sup> switching cycles                                     |            |              |
| Electrical lifetime   | at AC-12, 230 V AC, 4 A                            | 0.1 x 10 <sup>6</sup> switching cycles                                    |            |              |
| Maximum fuse rating to achieve short-circuit protection             | n/c contact  | 10 A fast-acting (CM-MSS.12, CM-MSS.13, CM-MSS.51: 6 A)                   |            |              |
|   | n/o contact  | 10 A fast-acting  |            |              |

# Thermistor motor protection relays

## Technical data - CM-MSS

2

| General data                                     |   |  |   |
|--|---|--|---|
| MTBF   |   | on request   |   |
| Duty cycle                                       |   | 100 %  |   |
| Dimensions                                       |   | see 'Dimensional drawings'   |   |
| Mounting   |   | DIN rail (IEC/EN 60715), snap-on mounting without any tool   |   |
| Mounting position                                |   | any  |   |
| Minimum distance to other units                  | vertical / horizontal                             | 10 mm (0.39 in) if switching current > 2 A   |   |
| Material of housing                              |   | UL 94 V-0  |   |
| Degree of protection                             | housing   | IP50   |   |
|  | terminals   | IP20   |   |
| Electrical connection                            |   | Screw connection technology  | Easy Connect Technology (push-in)           |
| Connection capacity                              | fine-strand with(out) wire end ferrule            | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)<br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)           | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |
|  | rigid   | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)             | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 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)   |   |
| Damp heat, cyclic (IEC/EN 60068-2-30)            |   | 6 x 24 h cycle, 55 °C, 95 % RH   |   |
| Climatic class (IEC/EN 60721-3-3)                |   | 3K5 (no condensation, no ice formation)  |   |
| Vibration, sinusoidal                            |   | 5-13.2 Hz: ±1 mm; 13.2-100 Hz: 0.7 g   |   |
| Shock  |   | 10 g / 11 ms   |   |
| Isolation data                                   |   |  |   |
| Rated insulation voltage U <sub>i</sub>          | supply circuit / measuring circuit <sup>1)</sup>  | 300 V AC (CM-MSS.x2: n/a)  |   |
|  | supply circuit / output circuits                  | 300 V AC   |   |
|  | measuring circuit <sup>1)</sup> / output circuits | 300 V AC   |   |
|  | output circuit 1 / output circuit 2               | 300 V AC   |   |
| Rated impulse withstand voltage U <sub>imp</sub> | supply circuit / measuring circuit <sup>1)</sup>  | 4 kV (CM-MSS.x2: n/a)  |   |
|  | supply circuit / output circuits                  | 4 kV   |   |
|  | measuring circuit <sup>1)</sup> / output circuits | 4 kV   |   |
|  | output circuit 1 / output circuit 2               | 4 kV   |   |
| Basic insulation                                 | supply circuit / measuring circuit <sup>1)</sup>  | 600 V AC (CM-MSS.x2: n/a)  |   |
|  | supply circuit / output circuits                  | 600 V AC   |   |
|  | measuring circuit <sup>1)</sup> / output circuits | 600 V AC   |   |
|  | output circuit 1 / output circuit 2               | 300 V AC   |   |
| Protective separation (IEC/EN 61140, EN 50178)   | supply circuit / measuring circuit <sup>1)</sup>  | yes, up to 300 V   |   |
|  | supply circuit / output circuits                  | yes (CM-MSS.x2: n/a)   |   |
|  | measuring circuit <sup>1)</sup> / output circuits | yes  |   |
|  | output circuit 1 / output circuit 2               | no   |   |
| Pollution degree                                 |   | 3  |   |
| Overvoltage category                             |   | III  |   |
| Standards / Directives                           |   |  |   |
| Standards  |   | IEC/EN 60947-5-1, IEC/EN 60947-8   |   |
| Low Voltage Directive                            |   | 2014/35/EU   |   |
| EMC directive                                    |   | 2014/30/EU   |   |
| ATEX directive                                   |   | 2014/34/EC (only ATEX variants, "Selection table - Thermistor motor protection relays" on page 2/73) |   |
| RoHS directive                                   |   | 2011/65/EU   |   |

<sup>1)</sup> Potential of measuring circuit = Potential of control circuit

# Thermistor motor protection relays

## Technical data - CM-MSS

### Electromagnetic compatibility

|  |                        |   |
|--|------------------------|---|
| Interference immunity to   |                        | IEC/EN 61000-6-2, IEC/EN 60947-8  |
| electrostatic discharge  | IEC/EN 61000-4-2       | level 3, 6 kV contact discharge, 8 kV air discharge   |
| 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-N                        |
| conducted disturbances, induced by radio-frequency fields  | IEC/EN 61000-4-6       | level 3, 0.15-80 MHz, 10 V, 80 % AM (1kHz)  |
| voltage dips, short interruptions and voltage variations   | IEC/EN 61000-4-11      | class 3   |
| harmonics and interharmonics   | IEC/EN 61000-4-13      | class 3   |
| Additional interference immunity according to product standard IEC/EN 60255-1 (reference on IEC/EN 60255-26) |                        |   |
| radiated, radio-frequency, electromagnetic field   | IEC/EN 61000-4-3       | 10 V/m (80 MHz - 3 GHz)   |
| conducted disturbances, induced by radio-frequency fields  | IEC/EN 61000-4-6       | 10 V at stated frequencies  |
| damped oscillatory waves   | IEC/EN 61000-4-18      | signal lines, symmetric coupling: 1 kV peak voltage<br>power supply, asymmetric coupling: 2.5 kV peak voltage |
| Interference emissions   |                        | IEC/EN 61000-6-3  |
| high-frequency radiated  | IEC/CISPR 22, EN 55022 | class B   |
| high-frequency conducted   | IEC/CISPR 22, EN 55022 | class B   |
| high-frequency radiated  | Germanischer Lloyd     | increased requirements in the emergency call frequency band   |

# Thermistor motor protection relays

## Technical data - CM-MSE

### Technical data

Data at  $T_a = 25\text{ °C}$  and rated values, unless otherwise indicated

| Supply circuit - Input circuit                                      |  | CM-MSE  |
|---|--|---|
| Rated control supply voltage $U_s$ power consumption                | 1SVR550805R9300                                    | 24 V AC approx. 1.5 A   |
|   | 1SVR550800R9300                                    | 110-130 V AC approx. 1.5 A  |
|   | 1SVR550801R9300                                    | 220-240 V AC approx. 1.5 A  |
| Rated control supply voltage $U_s$ tolerance                        |  | -15...+10 %   |
| Rated frequency   |  | 50-60 Hz  |
| Measuring circuit   |  |   |
| Monitoring function   | T1-T2  | temperature monitoring by means of PTC sensors  |
| Number of sensor circuits   |  | 1   |
| Sensor circuit  |  |   |
| Sensor type   |  | PTC type A (DIN/EN 44081, DIN/EN 44082)   |
| Max. total resistance of sensors connected in series, cold state    |  | $\leq 1.0\text{ k}\Omega$   |
| Overtemperature monitoring  | switch-off resistance (relay de-energizes)         | 2.0-3.0 $\text{k}\Omega$  |
|   | switch-on resistance (relay energizes)             | 1.2-1.65 $\text{k}\Omega$   |
| Maximum voltage in sensor circuit                                   | 4 $\text{k}\Omega$                                 | 5 V   |
|   | $\infty\text{ k}\Omega$                            | 15 V  |
| Maximum current in sensor circuit                                   |  | 2 mA  |
| Maximum sensor cable length   |  | 2 x 100 m at 0.75 mm <sup>2</sup> , 2 x 400 m at 2.5 mm <sup>2</sup>  |
| Reaction time   |  | <100 ms   |
| Output circuit  |  |   |
| Kind of output  | 13-14  | 1 n/o contact   |
| Operational principle   |  | closed-circuit principle (output relay de-energizes if the measured value exceeds/drops below the adjusted threshold) |
| Maximum switching voltage   |  | 250 V   |
| Rated operational voltage $U_e$ and 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   |
|   | maximum rated operational voltage                  | 300 V AC  |
|   | maximum continuous thermal current at B 300        | 5 A   |
|   | maximum making/breaking apparent power at B 300    | 3600/360 VA   |
|   | general purpose rating                             | 250 V AC - 4 A  |
| Mechanical lifetime   |  | 30 x 10 <sup>6</sup> switching cycles   |
| Electrical lifetime   | at AC-12, 230 V AC, 4 A                            | 0.1 x 10 <sup>6</sup> switching cycles  |
| Maximum fuse rating to achieve short-circuit protection             | n/c contact  | 10 A fast-acting  |
|   | n/o contact  | 10 A fast-acting  |
| General data  |  |   |
| Dimensions  |  | see 'Dimensional drawings'  |
| Duty cycle  |  | 100 %   |
| Mounting  |  | DIN rail (IEC/EN 60715)   |
| Mounting position   |  | any   |
| Degree of protection  | housing / terminals                                | IP50 / IP20   |
| Electrical connection   |  |   |
| Connecting capacity   | fine strand with wire end ferrule                  | 2 x 1.5 mm <sup>2</sup> (2 x 16 AWG)  |
|   | fine strand without wire end ferrule               | 2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG)  |
|   | rigid  | 2 x 1-1.5 mm <sup>2</sup> (2 x 18-16 AWG)   |
| Stripping length  |  | 2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG)  |
| Tightening torque   |  | 0.6-0.8 Nm (5.31-7.08 lb.in)  |
| Environmental data  |  |   |
| Ambient temperature ranges  | operation  | -20...+60 °C  |
|   | storage  | -40...+85 °C  |
| Damp heat   | IEC/EN 60068-2-30                                  | 40 °C, 93 % RH, 4 days  |
| Vibration withstand   | IEC/EN 60068-2-6                                   | 10-57 Hz: 0.075 mm; 57-150 Hz: 1 g  |

# Thermistor motor protection relays

## Technical data - CM-MSE

### Isolation data

|  |                                    |                    |
|--|------------------------------------|--------------------|
| Rated insulation voltage U <sub>i</sub>          | supply, measuring / output circuit | 250 V              |
| Rated impulse withstand voltage U <sub>imp</sub> | between all isolated circuits      | 4 kV / 1.2 - 50 μs |
| Pollution degree                                 |                                    | 3                  |
| Overvoltage category                             |                                    | III                |

### Standards / Directives

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

### Electromagnetic compatibility

|   |                                  |  |
|---|----------------------------------|--|
| Interference immunity to                                  | IEC/EN 61000-6-2, IEC/EN 60947-8 |  |
| electrostatic discharge                                   | IEC/EN 61000-4-2                 | level 3, 6 kV contact discharge, 8 kV air discharge                                    |
| 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-N |
| conducted disturbances, induced by radio-frequency fields | IEC/EN 61000-4-6                 | level 3, 0.15-80 MHz, 10 V, 80 % AM (1kHz)   |
| Interference emission                                     | IEC/EN 61000-6-3                 |  |
| high-frequency radiated                                   | IEC/CISPR 22, EN 55022           | class B  |
| high-frequency conducted                                  | IEC/CISPR 22, EN 55022           | class B  |

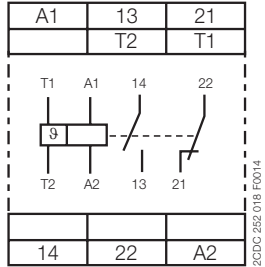


# Thermistor motor protection relays

## Connection diagrams

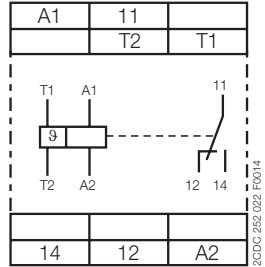
2

**CM-MSS.11, CM-MSS.21**



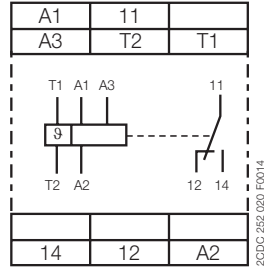
A1 – A2 Control supply voltage  
 13 – 14 n/o contact  
 21 – 22 n/c contact  
 T1 – T2 Measuring circuit

**CM-MSS.12**



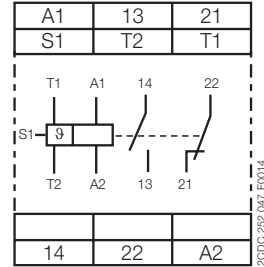
A1 – A2 Control supply voltage  
 11 – 12/14 c/o contact  
 T1 – T2 Measuring circuit

**CM-MSS.13**



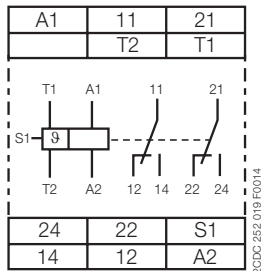
A1 – A2 Control supply voltage  
 220-240 V AC  
 A2 – A3 Control supply voltage  
 110-130 V AC  
 11 – 12/14 c/o contact  
 T1 – T2 Measuring circuit

**CM-MSS.31**



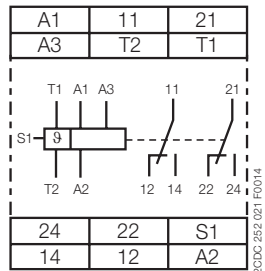
A1 – A2 Control supply voltage  
 13 – 14 n/o contact  
 21 – 22 n/c contact  
 S1 – T2 Automatic reset  
 (jumpered)  
 T1 – T2 Measuring circuit

**CM-MSS.22, CM-MSS.32, CM-MSS.41**



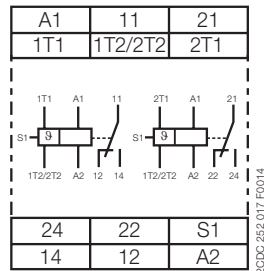
A1 – A2 Control supply  
 voltage 24 V AC/DC  
 11 – 12/14 1st c/o (SPDT)  
 contact  
 21 – 22/24 2nd c/o (SPDT)  
 contact  
 S1 – T2 Automatic reset  
 (jumpered)  
 T1 – T2 Measuring circuit

**CM-MSS.23, CM-MSS.33**



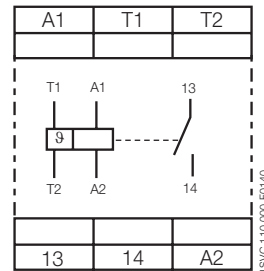
A1 – A2 Control  
 supply voltage  
 220-240 V AC  
 A2 – A3 Control supply  
 voltage 110-130  
 V AC  
 11 – 12/14 1st c/o (SPDT)  
 contact  
 21 – 22/24 2nd c/o (SPDT)  
 contact  
 S1 – T2 Automatic reset  
 (jumpered)  
 T1 – T2 Measuring  
 circuit

**CM-MSS.51**



A1 – A2 Control  
 supply voltage  
 220-240 V AC  
 11 – 12/14 1st c/o (SPDT)  
 contact  
 21 – 22/24 2nd c/o (SPDT)  
 contact  
 S1 – 1T2/2T2 Automatic reset  
 (jumpered)  
 1T1 – 1T2/2T2 Measuring circuit 1  
 2T1 – 1T2/2T2 Measuring circuit 2

**CM-MSE**

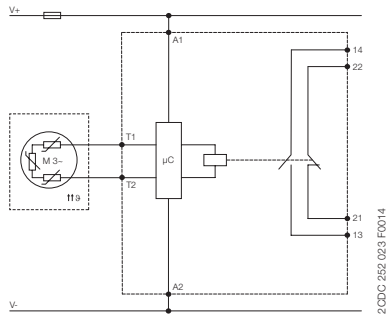


A1 – A2 Control supply voltage  
 24 V AC  
 T1-T2 Sensor circuit  
 13-14 Output contact -  
 Closed circuit principle

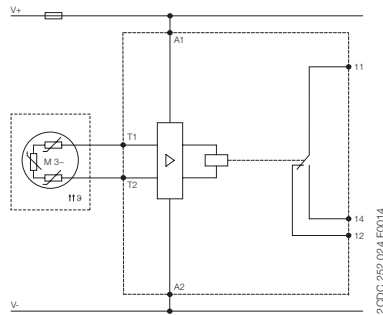
# Thermistor motor protection relays

## Circuit diagrams

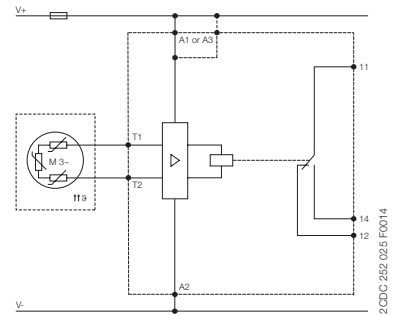
CM-MSS.11, CM-MSS.21



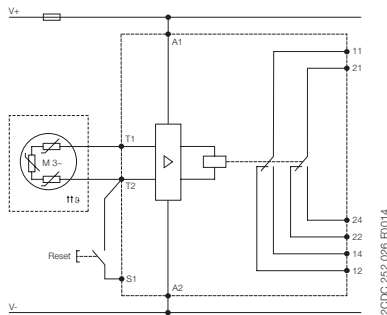
CM-MSS.12



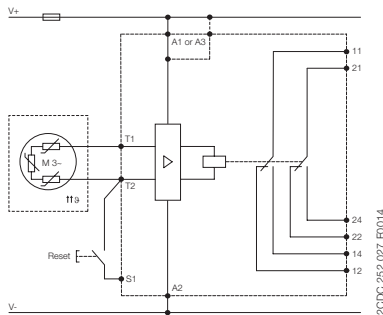
CM-MSS.13



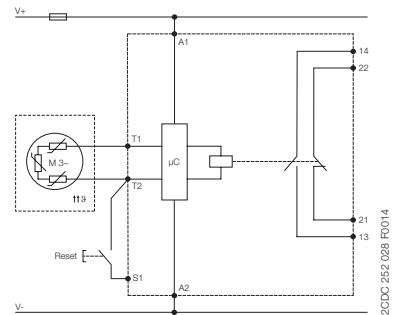
CM-MSS.22



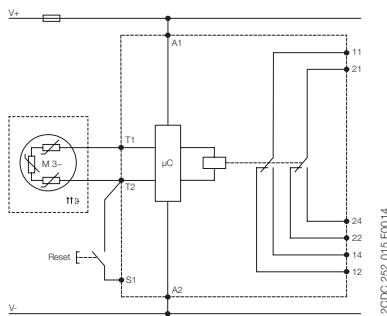
CM-MSS.23



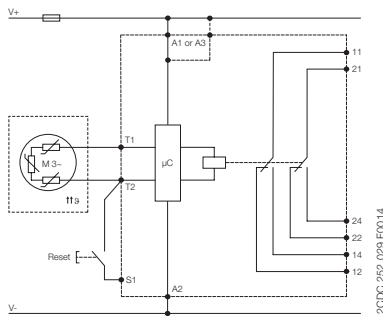
CM-MSS.31



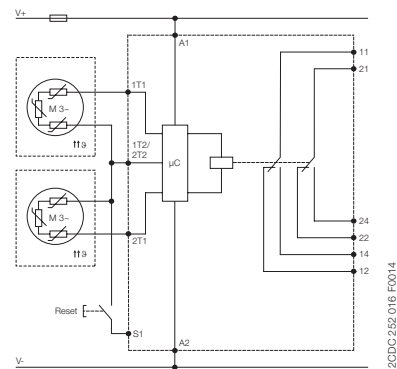
CM-MSS.32, CM-MSS.41



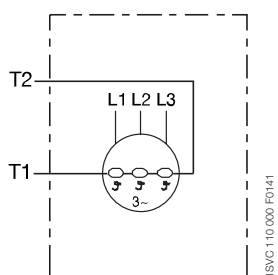
CM-MSS.33



CM-MSS.51



CM-MSE



# Temperature monitoring relays

## Product group picture

2



# Temperature monitoring relays

## Table of contents

### Temperature monitoring relays

|  |      |
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| Benefits and advantages, Operating controls        | 2/85 |
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| Function diagrams and DIP switches                 | 2/89 |
| Connection diagram, Resistance thermometer sensors | 2/90 |
| Technical data - CM-TCS                            | 2/91 |

# Temperature monitoring relays

## Benefits and advantages, Operating controls

2

### Overview

The temperature monitoring relays can be used for temperature measurement in solid, liquid and gaseous media. The temperature is acquired by the sensor in the medium, evaluated by the device and monitored to determine whether it is within an operating range (range monitoring function) or has exceeded or fallen below a threshold.

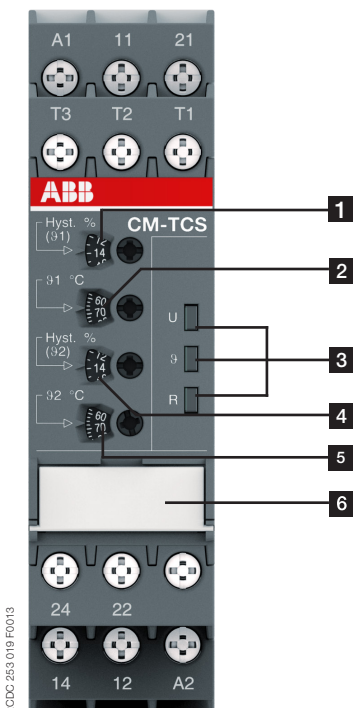
### Functional description

The temperature monitoring relays CM-TCS monitor overtemperature, undertemperature, or temperatures between two threshold values (window monitoring) with PT100 sensor. As soon as the temperature falls below or exceeds the threshold value the output relays change their positions according to the configured functionality and the front-face LEDs display the current status. Regardless of the selected configuration, the device is monitoring its measuring circuit for interrupted wires or short-circuits.

### Characteristics

- Adjustable sensor type PT100
- Functionality like overtemperature monitoring, undertemperature monitoring, temperature window monitoring configurable
- All configurations and adjustments by front-face operating elements
- Precise adjustment with direct reading scales
- One or two threshold values
- Hysteresis 2...20 % adjustable
- Operating temperature range -40...+60 °C
- 1 x 2 c/o or 2 x 1 c/o configurable
- Open- or closed-circuit principle configurable
- Short-circuit monitoring and interrupted wire detection
- 22.5 mm (0.89 in) width
- LEDs for status indication
- Various approvals and marks

### Operating controls



**1** Adjustment of the hysteresis for threshold value θ1

**2** Adjustment of the threshold value θ1

**3** Indication of operational states

U: green LED – status indication of control supply voltage

θ: red LED – fault message, state of measuring input

R: yellow LED – status indication of the output relays

**4** Adjustment of the hysteresis for threshold value θ2

**5** Adjustment of the threshold value θ2

**6** DIP switch functions / marker label (on page 2/104)

Overtemperature monitoring

Undertemperature monitoring

Temperature window monitoring activated

Temperature window monitoring de-activated

Closed-circuit principle

Open-circuit principle

2 x 1 c/o (SPDT) contact

1 x 2 c/o (SPDT) contacts

2CDC 253 019 F0013

# Temperature monitoring relays

## Selection table - Temperatur monitoring relays

|   | Type                     | Order number             |
|---|--------------------------|--------------------------|
|   | CM-TCS.21S               | 1SVR 730 740 R9100       |
|   | CM-TCS.21P               | 1SVR 740 740 R9100       |
|   | CM-TCS.11S               | 1SVR 730 740 R0100       |
|   | CM-TCS.11P               | 1SVR 740 740 R0100       |
|   | CM-TCS.22S               | 1SVR 730 740 R9200       |
|   | CM-TCS.22P               | 1SVR 740 740 R9200       |
|   | CM-TCS.12S               | 1SVR 730 740 R0200       |
|   | CM-TCS.12P               | 1SVR 740 740 R0200       |
|   | CM-TCS.23S               | 1SVR 730 740 R9300       |
|   | CM-TCS.23P               | 1SVR 740 740 R9300       |
|   | CM-TCS.13S               | 1SVR 730 740 R0300       |
|   | CM-TCS.13P               | 1SVR 740 740 R0300       |
| <b>Rated control supply voltage U<sub>g</sub></b> |                          |                          |
| 24 V AC/DC  | <input type="checkbox"/> | <input type="checkbox"/> |
| 24-240 V AC/DC                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>Sensor circuits (2 or 3 wire)</b>              |                          |                          |
| Number of temperature sensors                     | 1                        | 1                        |
| Number of thresholds                              | 2                        | 2                        |
| <b>Measuring temperature range</b>                |                          |                          |
| -50...+50 °C                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| 0...+100 °C                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 0...+200 °C                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>Monitoring function</b>                        |                          |                          |
| Overtemperature                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| Undertemperature                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| Window temperature                                | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>Operating principle</b>                        |                          |                          |
| Open- or closed-circuit principle                 | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>Output contacts</b>                            |                          |                          |
| c/o   | 2                        | 2                        |

# Temperature monitoring relays

## Ordering details

2



CM-TCS

### Description

The temperature monitoring relays CM-TCS are able to measure temperatures of solids, liquids and gaseous media using different types of sensors. Overtemperature and undertemperature monitoring as well as open- or closed-circuit principle is configurable for all devices. As soon as the temperature falls below or exceeds the set threshold value the output relays change their positions according to the configured functionality and the front-face LEDs display the current status.

### Ordering details - Temperature monitoring relays CM-TCS

| Rated control supply voltage | Measuring range | Temperature sensors | Type       | Order code      | Price | Weight            |
|------------------------------|-----------------|---------------------|------------|-----------------|-------|-------------------|
|                              |                 |                     |            |                 | 1 pc  | (1 pc)<br>kg (lb) |
| 24-240 V AC/DC               | -50...+50 °C    | PT100               | CM-TCS.11S | 1SVR730740R0100 |       | 0.151 (0.333)     |
|                              |                 |                     | CM-TCS.11P | 1SVR740740R0100 |       | 0.140 (0.309)     |
|                              | 0...+100 °C     |                     | CM-TCS.12S | 1SVR730740R0200 |       | 0.151 (0.333)     |
|                              |                 |                     | CM-TCS.12P | 1SVR740740R0200 |       | 0.140 (0.309)     |
|                              | 0...+200 °C     |                     | CM-TCS.13S | 1SVR730740R0300 |       | 0.151 (0.333)     |
|                              |                 |                     | CM-TCS.13P | 1SVR740740R0300 |       | 0.140 (0.309)     |
| 24 V AC/DC                   | -50...+50 °C    |                     | CM-TCS.21S | 1SVR730740R9100 |       | 0.138 (0.304)     |
|                              |                 |                     | CM-TCS.21P | 1SVR740740R9100 |       | 0.127 (0.280)     |
|                              | 0...+100 °C     |                     | CM-TCS.22S | 1SVR730740R9200 |       | 0.138 (0.304)     |
|                              |                 |                     | CM-TCS.22P | 1SVR740740R9200 |       | 0.127 (0.280)     |
|                              | 0...+200 °C     |                     | CM-TCS.23S | 1SVR730740R9300 |       | 0.138 (0.304)     |
|                              |                 |                     | CM-TCS.23P | 1SVR740740R9300 |       | 0.127 (0.280)     |

S: screw connection  
P: push-in connection



Further documentation temperature monitoring relays on [www.abb.com](http://www.abb.com)



# Temperature monitoring relays

## Function diagrams

### Overtemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

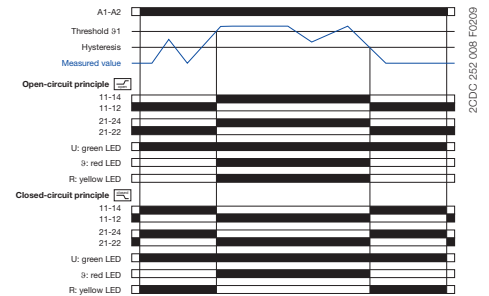
With this configuration, settings via  $\vartheta 2$  have no influence on the operating function ( $\vartheta 2$  disabled).

Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value  $\vartheta 1$ , the output relays energize. If the measured value drops again below the adjusted threshold value  $\vartheta 1$  minus the adjusted hysteresis, the output relays de-energize.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



### Overtemperature monitoring, 2 x 1 c/o contact 2x1 c/o

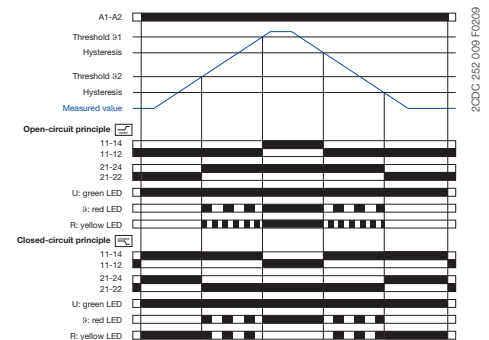
Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value  $\vartheta 2$ , output relay R2 (prewarning) energizes. If the measured value exceeds the adjusted threshold value  $\vartheta 1$ , output relay R1 (final switch-off) energizes.

If the measured value drops again below the adjusted threshold value  $\vartheta 1$  minus the adjusted hysteresis, output relay R1 (final switch-off) de-energizes. If the measured value drops below the adjusted threshold value  $\vartheta 2$  minus the adjusted hysteresis, output relay R2 (prewarning) de-energizes.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



### Undertemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

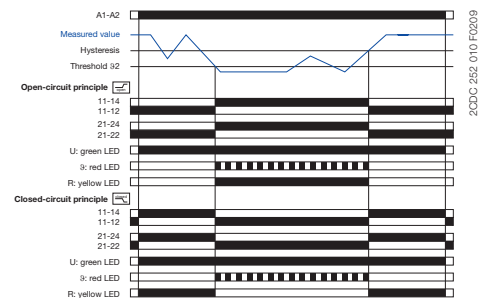
With this configuration, settings via  $\vartheta 1$  have no influence on the operating function ( $\vartheta 1$  disabled).

Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value drops below the adjusted threshold value  $\vartheta 2$ , the output relays energize. If the measured value exceeds again the adjusted threshold value  $\vartheta 2$  plus the adjusted hysteresis, the output relays de-energize.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



### Undertemperature monitoring, 2 x 1 c/o contact 2x1 c/o

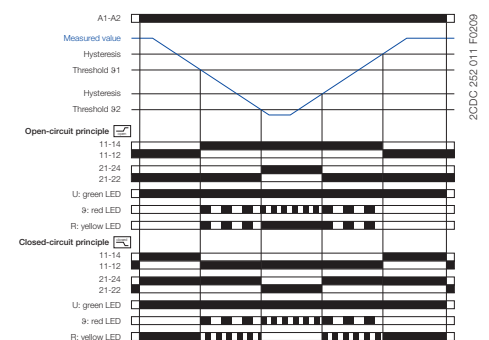
Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value drops below the adjusted threshold value  $\vartheta 1$ , output relay R1 (prewarning) energizes. If the measured value drops below the adjusted threshold value  $\vartheta 2$ , output relay R2 (final switch-off) energizes.

If the measured value exceeds again the adjusted threshold value  $\vartheta 2$  plus the adjusted hysteresis, output relay R2 (final switch-off) de-energizes. If the measured value exceeds the adjusted threshold value  $\vartheta 1$  plus the adjusted hysteresis, output relay R1 (prewarning) de-energizes.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



# Temperature monitoring relays

## Function diagrams and DIP switches

2

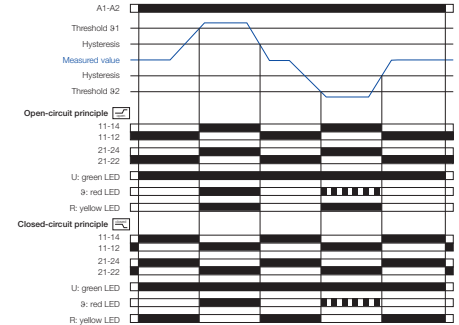
### Temperature window monitoring, 1 x 2 c/o contacts

Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value  $\vartheta_1$  or drops below the adjusted threshold value  $\vartheta_2$ , the output relays energize. If the measured value drops again below the adjusted threshold value  $\vartheta_1$  minus the adjusted hysteresis or exceeds again the adjusted threshold value  $\vartheta_2$  plus the adjusted hysteresis, the output relays de-energize.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 012 F0209

### Temperature window monitoring, 2 x 1 c/o contact

Open-circuit principle:

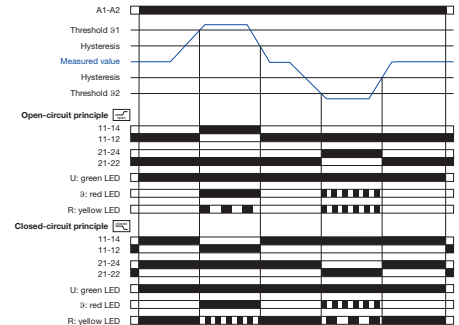
If the measured value is correct, the output relays remain de-energized when control supply voltage is applied.

If the measured value exceeds the adjusted threshold value  $\vartheta_1$  or drops below the adjusted threshold value  $\vartheta_2$ , output relay R1 ( $> \vartheta_1$ ) or R2 ( $< \vartheta_2$ ) respectively energizes.

If the measured value drops again below the adjusted threshold value  $\vartheta_1$  minus the adjusted hysteresis or exceeds again the adjusted threshold value  $\vartheta_2$  plus the adjusted hysteresis, output relay R1 ( $> \vartheta_1$ ) or R2 ( $< \vartheta_2$ ) respectively de-energizes.









Closed-circuit principle:









The behavior is inverse to the one with open-circuit principle.



2CDC 252 013 F0209

### DIP switches CM-TCS

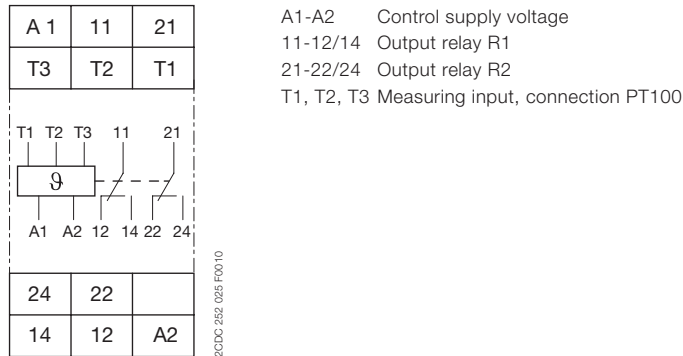
| Position | 4   | 3   | 2   | 1   |
|----------|---|---|---|---|
| ON ↑     |  |  |  |  |
| OFF      |  |  |  |  |

|  | ON  | OFF (default)  |
|--|---|--|
| DIP switch 1<br>Monitoring principle                     | Overtemperature monitoring <br>If overtemperature monitoring is selected, the CM-TCS recognizes temperatures above the selected threshold and trips the output relay according to the selected operating principle.                    | Undertemperature monitoring <br>If undertemperature monitoring is selected, the CM-TCS recognizes temperatures below the selected threshold and trips the output relay according to the selected operating principle.   |
| DIP switch 2<br>Temperature window monitoring            | Temperature window monitoring activated <br>If temperature window monitoring is selected, the CM-TCS monitors over- and undertemperature. If temperature window monitoring is activated, DIP switch 1 is disabled.                     | Temperature window monitoring de-activated <br>Temperature window monitoring is de-selected.  |
| DIP switch 3<br>Operating principle of the output relays | Closed-circuit principle <br>If closed-circuit principle is selected, the output relays are energized. They de-energize if a fault is occurring.   | Open-circuit principle <br>If open-circuit principle is selected, the output relays are deenergized. They energize if a fault is occurring.   |
| DIP switch 4<br>2 x 1 c/o contact, 1 x 2 c/o contacts    | 2 x 1 c/o (SPDT) contact <br>If operating principle 2 x 1 c/o contact is selected, the output relay R1 (11-12/14) reacts to threshold value $\vartheta_1$ and the output relay R2 (21-22/24) reacts to threshold value $\vartheta_2$ . | 1 x 2 c/o (SPDT) contacts <br>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 one threshold value.<br>Overtemperature monitoring: Settings of the threshold value $\vartheta_2$ have no effect on the operation.<br>Undertemperature monitoring: Settings of the threshold values $\vartheta_2$ have no effect on the operation. |

# Temperature monitoring relays

## Connection diagram, Resistance thermometer sensors

### Connection diagram

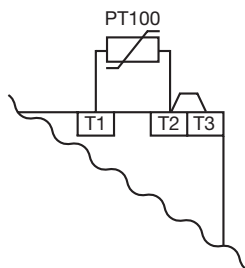


### Connection of resistance thermometer sensors

#### 2-wire measurement

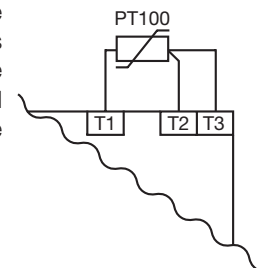
When using 2-wire temperature sensors the sensor resistance and the wire resistance are added together. The resulting systematic errors must be taken into account when adjusting the tripping device. A jumper must be connected between the terminals T2 and T3. The following table can be used for PT100 sensors to determine the temperature errors caused by the line length.

When using resistance sensors with two-wire connection a bridge must be inserted between terminals T2 and T3.



#### 3-wire measurement

To minimize the influence of the wire resistance, a three-wire connection is usually used. By means of the additional wire two measuring circuits are created. One of these two circuits is used for reference. This way, the tripping device can calculate and take into account the wire resistance automatically.



#### Error caused by the line

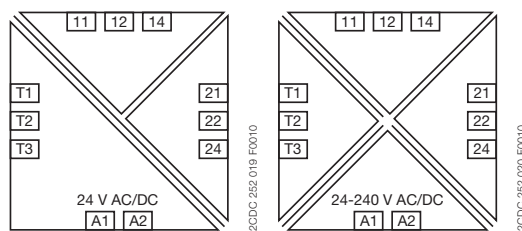
The error resulting from the line resistance amounts to approx. 2.5 Kelvin/Ohm. If the resistance of the line is not known and it is not possible to measure it, the error caused by the line can be estimated using the following table.

#### Temperature error

(depending on the line length and conductor cross section for PT100 sensors at an ambient temperature of 20 °C, in K)

| Line length in m | Wire size mm <sup>2</sup> |      |      |      |
|------------------|---------------------------|------|------|------|
|                  | 0.50                      | 0.75 | 1    | 1.5  |
| 0                | 0.0                       | 0.0  | 0.0  | 0.0  |
| 10               | 1.8                       | 1.2  | 0.9  | 0.6  |
| 25               | 4.5                       | 3.0  | 2.3  | 1.5  |
| 50               | 9.0                       | 6.0  | 4.5  | 3.0  |
| 75               | 13.6                      | 9.0  | 6.8  | 4.5  |
| 100              | 18.1                      | 12.1 | 9.0  | 6.0  |
| 200              | 36.3                      | 24.2 | 18.1 | 12.1 |
| 500              | 91.6                      | 60.8 | 45.5 | 30.2 |

#### Electrical isolation



- Electrical isolation
- Protective separation acc. to IEC/EN 61140, EN 50178

# Temperature monitoring relays

## Technical data - CM-TCS

2

| Type  |   | CM-TCS.11/12/13   | CM-TCS.21/22/23 |
|---|---|---|-----------------|
| <b>Input circuit</b>  |   |   |                 |
| Rated control supply voltage $U_c$                                  | A1-A2   | 24-240 V AC/DC  | 24 V AC/DC      |
| Rated control supply voltage $U_c$ tolerance                        |   | -15...+10 %   |                 |
| Typical current / power / consumption                               | 24 V DC   | 33 mA / 0.8 VA  | 18 mA / 0.45 VA |
|   | 115 V AC  | 12.5 mA / 1.5 VA  | n/a             |
|   | 230 V AC  | 13 mA / 2.9 VA  | n/a             |
| Rated frequency   | AC  | 15-400 Hz   | 50/60 Hz        |
| Frequency range   | AC  | 13.5-440 Hz   | 45-65 Hz        |
| Power failure buffering time  | min.  | 20 ms   |                 |
| <b>Measuring circuit</b>  |   | <b>T1, T2, T3</b>   |                 |
| Sensor type   |   | PT100   |                 |
| Connection of the sensor  | 2-wire  | yes, jumper between T2-T3   |                 |
|   | 3-wire  | yes, use terminal T1, T2, T3                                      |                 |
| Monitoring function   |   | overtemperature, undertemperature or window monitoring            |                 |
| Threshold values adjustable within the measuring range              | CM-TCS.x1                                       | -50...+50 °C  |                 |
|   | CM-TCS.x2                                       | 0...+100 °C   |                 |
|   | CM-TCS.x3                                       | 0...+200 °C   |                 |
| Number of possible thresholds                                       |   | 2   |                 |
| Tolerance of the adjusted threshold value                           |   | typ. $\pm 5$ % of the range end value                             |                 |
| Hysteresis related to the threshold value                           |   | 2-20 % of threshold value, min. 1 °C                              |                 |
| Measuring principle   |   | continuous current  |                 |
| Typical current in the sensor circuit                               |   | 0.8 mA  |                 |
| Maximum current in sensor circuit                                   |   | 0.9 mA  |                 |
| Interrupted wire detection  |   | yes, indicated via LED status                                     |                 |
| Short-circuit detection   |   | yes, indicated via LED status                                     |                 |
| Accuracy within the rated control supply voltage tolerance          |   | < 0.2 °C / or < 0.01 %/K  |                 |
| Accuracy within the temperature range                               |   | < 0.2 °C / or < 0.01 %/K  |                 |
| Repeat accuracy (constant parameters)                               |   | < 0.2 % of full scale   |                 |
| Maximum measuring cycle   |   | 320 ms  |                 |
| <b>Output circuit</b>   |   |   |                 |
| Kind of output  |   | 2 x 1 or 1 x 2 c/o (SPDT) contacts configurable                   |                 |
| Operating principle   |   | open- or closed-circuit principle configurable <sup>1)</sup>      |                 |
| Contact material  |   | AgNi alloy, Cd free   |                 |
| Minimum switching voltage / Minimum switching current               |   | 24 V / 10 mA  |                 |
| Maximum switching voltage / Maximum switching current               |   | see 'Load limit curves'   |                 |
| Rated operational voltage $U_o$ and rated operational current $I_o$ | AC-12 (resistive) 230 V                         | 4 A   |                 |
|   | AC-15 (inductive 230 V                          | 3 A   |                 |
|   | DC-12 (resistive) 24 V                          | 4 A   |                 |
|   | DC-13 (inductive) 24 V                          | 2 A   |                 |
| AC Rating (UL508)   | utilization category                            | B 300 pilot duty; general purpose 250 V, 4 A, $\cos \varphi$ 0.75 |                 |
|   | maximum rated operational voltage               | 250 V AC  |                 |
|   | maximum continuous thermal current at B 300     | 4 A   |                 |
|   | maximum making/breaking apparent power at B.300 | 3600/360 VA   |                 |
| Mechanical lifetime   |   | 30 x 10 <sup>6</sup> switching cycles                             |                 |
| Electrical lifetime (AC-12, 230 V, 4 A)                             |   | 0.1 x 10 <sup>6</sup> switching cycles                            |                 |
| Maximum 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   |                 |
| <b>General data</b>   |   |   |                 |
| Dimensions  |   | see 'Dimensional drawings'  |                 |
| Mounting  |   | DIN rail (IEC/EN 60715), snap-on mounting without any tool        |                 |
| Mounting position   |   | any   |                 |
| Ambient temperature range   | operation                                       | -40...+60 °C  |                 |
|   | storage/transport                               | -40...+85 °C  |                 |
| Degree of protection  | enclosure / terminals                           | IP50 / IP20   |                 |

<sup>1)</sup> Closed-circuit principle: Output relay(s) de-energize(s) if measured value exceeds or falls below the adjusted threshold value

# Temperature monitoring relays

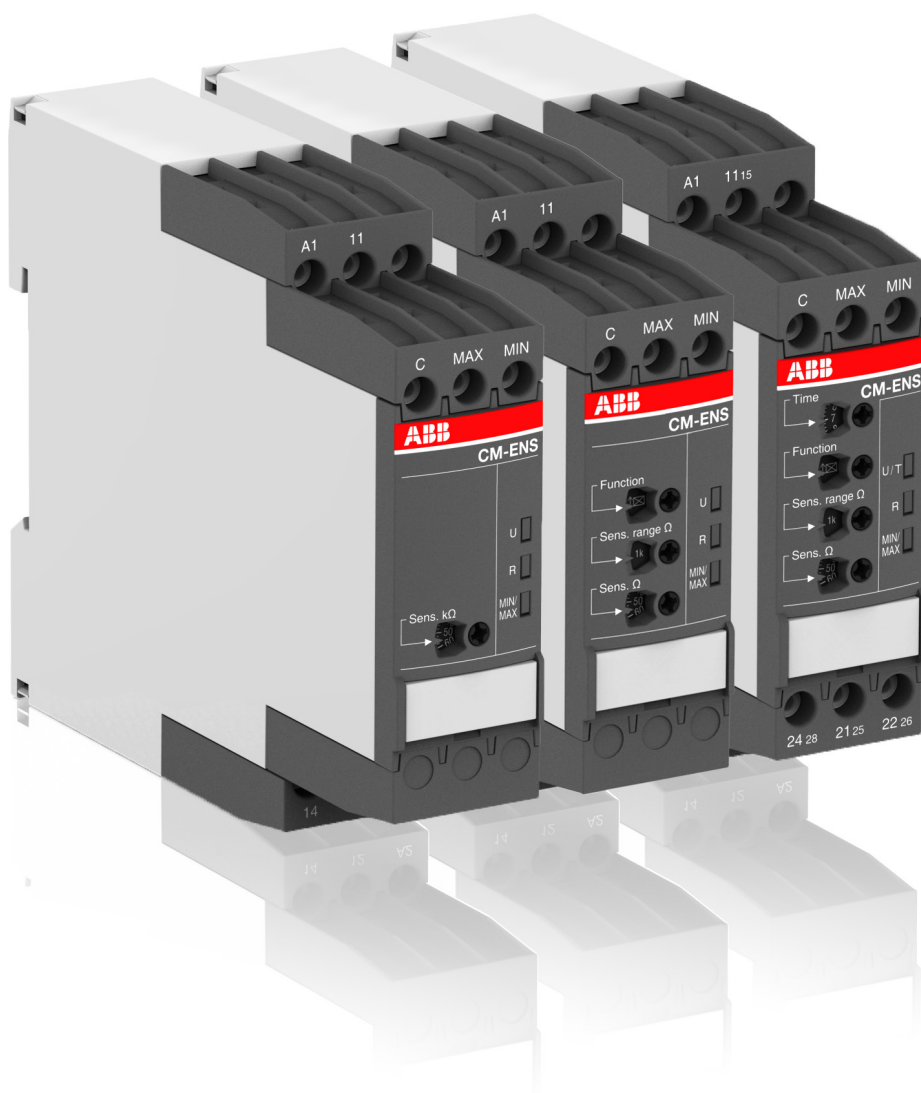
## Technical data - CM-TCS

| Type  |  | CM-TCS.11/12/13                | CM-TCS.21/22/23  |  |   |
|---|--|--------------------------------|--|--|---|
| <b>Electrical connection</b>                              |  |                                |  |  |   |
| Connecting capacity                                       | fine-strand without wire end ferrule                     | A1, A2, 11, 12, 14, 21, 22, 24 | Screw connection technology<br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)                 | Easy Connect Technology (Push-in)<br>connection with lever                                   |   |
|   |  | T1, T2, T3                     |  |  | 2 x 0.2-1.5 mm <sup>2</sup> (2 x 24-16 AWG)   |
|   | fine-strand with wire end ferrule                        | A1, A2, 11, 12, 14, 21, 22, 24 | 1 x 0.5-2.5 mm <sup>2</sup> (1 x 20-14 AWG)  | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)  | connection: push-in   |
|   |  | T1, T2, T3                     | 1 x 0.2-2.5 mm <sup>2</sup> (1 x 24-14 AWG)  | 2 x 0.2-1.5 mm <sup>2</sup> (2 x 24-16 AWG)  | insulated ferrule (DIN 46228-4-E):<br>connection: push-in<br>ferrule (DIN 46228-1-A):<br>< 0.5 mm <sup>2</sup> , connection with lever<br>≥ 0.5 mm <sup>2</sup> , connection: push-in |
|   | rigid  | A1, A2, 11, 12, 14, 21, 22, 24 | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)   | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)<br>connection: push-in                           |   |
|   |  | T1, T2, T3                     | 1 x 0.2-4 mm <sup>2</sup> (1 x 24-12 AWG)<br>2 x 0.2-2.5 mm <sup>2</sup> (2 x 24-14 AWG)   | < 0.5 mm <sup>2</sup> , connection with lever<br>≥ 0.5 mm <sup>2</sup> , connection: push-in |   |
| Stripping length  |  |                                | 8 mm (0.32 in)   |  |   |
| Tightening torque   |  | < 0.5 mm <sup>2</sup>          | 0.5 Nm (4.43 lb.in)  | -  |   |
|   |  | ≥ 0.5 mm <sup>2</sup>          | 0.6-0.8 Nm (7.08 lb.in)  | -  |   |
| <b>Environmental data</b>                                 |  |                                |  |  |   |
| Ambient temperature ranges                                | operation/storage/ transport                             |                                | -40...+60°C/-40...+85°C/-40...+85°C  |  |   |
| Climatic class  |  | IEC/EN 60721-3-3               | 3K5 (no condensation, no ice formation)  |  |   |
| Damp heat, cyclic   |  | IEC/EN 600068-2-30             | 6 x 24 h cycle, 55 °C, 95 % RH   |  |   |
| Vibration, sinusoidal                                     |  |                                | class 2  |  |   |
| Shock   |  |                                | class 2  |  |   |
| <b>Isolation data</b>                                     |  |                                |  |  |   |
| Rated impulse withstand voltage U <sub>imp</sub>          | supply circuit / measuring circuit                       |                                | 4 kV   | -  |   |
|   | supply circuit / output circuits                         |                                | 4 kV   |  |   |
|   | measuring circuit / output circuits                      |                                | 4 kV   |  |   |
|   | output circuit 1 / output circuit 2                      |                                | 4 kV   |  |   |
| Rated insulation voltage U <sub>i</sub>                   | supply circuit / measuring circuit                       |                                | 300 V  | -  |   |
|   | supply circuit / output circuits                         |                                | 300 V  |  |   |
|   | measuring circuit / output circuits                      |                                | 300 V  |  |   |
|   | output circuit 1 / output circuit 2                      |                                | 300 V  |  |   |
| Basic insulation  | supply circuit / measuring circuit                       |                                | 250 V AC / 300 V DC  | -  |   |
|   | supply circuit / output circuits                         |                                | 250 V AC / 300 V DC  |  |   |
|   | measuring circuit / output circuits                      |                                | 250 V AC / 300 V DC  |  |   |
|   | output circuit 1 / output circuit 2                      |                                | 250 V AC / 300 V DC  |  |   |
| Protective separation (IEC/EN 61140, EN 50178)            | supply circuit / measuring circuit                       |                                | 250 V AC / 250 V DC  | -  |   |
|   | supply circuit / output circuits                         |                                | 250 V AC / 300 V DC  | 250 V AC / 250 V DC  |   |
|   | measuring circuit / output circuits                      |                                | 250 V AC / 300 V DC  | 250 V AC / 250 V DC  |   |
| Pollution degree  |  |                                | 3  |  |   |
| Overvoltage category                                      |  |                                | III  |  |   |
| <b>Standards / Directives</b>                             |  |                                |  |  |   |
| Standards   |  |                                | IEC/EN 60255-27, IEC/EN 60947-5-1  |  |   |
| Low Voltage Directive                                     |  |                                | 2014/35/EU   |  |   |
| EMC Directive   |  |                                | 2014/30/EU   |  |   |
| RoHS Directive  |  |                                | 2011/65/EU   |  |   |
| <b>Electromagnetic compatibility</b>                      |  |                                |  |  |   |
| Interference immunity to electrostatic discharge          |  | IEC/EN 61000-4-2               | IEC/EN 61000-6-2<br>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 surge                     |  | IEC/EN 61000-4-4               | level 3, 2 kV / 5 kHz  |  |   |
|   |  | 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   |  |   |
| high-frequency radiated                                   |  | IEC/CISPR 22, EN 55022         | class B  |  |   |
| high-frequency conducted                                  |  | IEC/CISPR 22, EN 55022         | class B  |  |   |

# Liquid level monitors and controls

## Product group picture

2



# Liquid level monitors and controls

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### Liquid level monitors and controls

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# Liquid level monitors and controls

## Benefits and advantages

2

### CM-ENS.1x

- Control of one or two liquid levels (min/max)
- Fill or drain function
- Adjustable response sensitivity 5-100 k $\Omega$

### CM-ENS.2x

- Control of one or two liquid levels (min/max)
- Fill (UP) or Drain (DOWN), adjustable via front-face potentiometer
- Adjustable response sensitivity 0.1-1000 k $\Omega$

### CM-ENS.31

- Control of one or two liquid levels (min/max)
- Fill (UP) or Drain (DOWN), adjustable via front-face potentiometer
- Adjustable response sensitivity 0.1-1000 k $\Omega$
- Selectable ON- or OFF-delay
- 2 c/o (SPDT) contacts

### All CM-ENS devices

- Devices with wide rated control supply voltage 24-240 V AC/DC
- Cascadable
- High EMC immunity
- 3 LEDs for the indication of operational states
- Screw connection technology or Easy Connect Technology
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting and demounting on DIN rail
- 22.5 mm (0.89 in) width

ABB's liquid level monitoring relays are the ideal solution to regulate and control liquid levels and ratios of mixtures of conductive fluids. The assortment includes single- or multifunctional devices which can be used for overflow protection, dry-running protection of pumps, filling and draining applications as well as max. and min. level alarming.



### Global availability

You will find ABB control products in any application and corner of the world. They are in skyscrapers or windfarms, in offshore platforms or industrial areas which power the world. Approved by local and international standards. We believe in the strength of our brand and products - which is supported by our global service network to ensure your peace of mind.

- Latest approvals supports your installation complies to your local standards
- The product can be used in all installations in the world
- Giving you the confidence of world-wide sourcing - no matter where you build, install or operate your equipment



### Reliable in harsh conditions

Our engineers thrive on the challenge to develop products that need to operate in the most difficult electrical, mechanical and environmental conditions. Our solutions protect your application from overloads, network irregularities, mechanical wear, and environmental stresses ensuring your peace of mind. When you buy an ABB product, you buy extensive environmental testing guarantee.

- High immunity against electromagnetic disturbances due to advanced measuring technology
- Operation in environment with high vibrations



### Improve installation efficiency

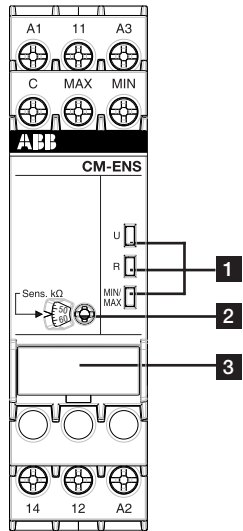
In everything we do, we think of the customer and the application first. Our engineers constantly look for ways to simplify the installation process by developing innovative product designs which facilitate the product assembly and avoid mounting errors. ABB product can improve our customers' productivity and machinery quality.

- Simplified wiring even in case of different cable diameters
- Easy to adjust via front-face potentiometer
- Tool-free mounting and demounting
- Tool free installation due to push-in technology

# Liquid level monitors and controls

## Operating controls

### CM-ENS.1x

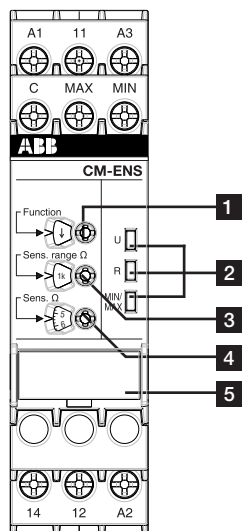


- 1 Indication of operational states with LEDs**
  - U: green LED - Status indication of control supply voltage  
 control supply voltage applied
  - R: yellow LED - Status indication of the output relays  
 energized
  - MIN/MAX: yellow LED - Status indication of the electrodes  
 MIN and MAX wet  
 MIN wet

- 2 Adjustment of the response sensitivity**
  - R: yellow LED - relay status
  - U: green LED - control supply voltage

- 3 Marker label**

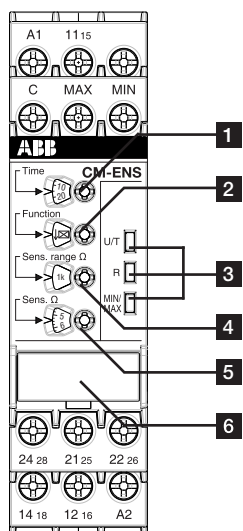
### CM-ENS.2x



- 1 Adjustment of the function**
  - ↑ Fill
  - ↓ Drain
- 2 Indication of operational states**
  - U: green LED - Status indication of control supply voltage  
 control supply voltage applied
  - R: yellow LED - Status indication of the output relays  
 energized
  - MIN/MAX: yellow LED - Status indication of the electrodes  
 MIN and MAX wet  
 MIN wet

- 3 Adjustment of the response sensitivity range**
- 4 Adjustment of the response sensitivity**
- 5 Marker label**

### CM-ENS.31



- 1 Adjustment of the time delay**
- 2 Adjustment of the function**
  - ↑ ON-delayed Fill
  - ↑ ON-delayed Drain
  - ↓ OFF-delayed Fill
  - ↓ OFF-delayed Drain
- 3 Indication of operational states**
  - U: green LED - Status indication of control supply voltage  
 control supply voltage applied  
 time delay is running
  - R: yellow LED - Status indication of the output relays  
 energized
  - MIN/MAX: yellow LED - Status indication of the electrodes  
 MIN and MAX wet  
 MIN wet

- 4 Adjustment of the response sensitivity range**
- 5 Adjustment of the response sensitivity**
- 6 Marker label**

# Liquid level monitors and controls

## Selection table - Liquid level monitors and controls

2

|   | 1SVR 550 855 R9500 | 1SVR 550 850 R9500 | 1SVR 550 851 R9500 | 1SVR 550 855 R9400 | 1SVR 550 850 R9400 | 1SVR 550 851 R9400 | 1SVR 730 850 R0100 | 1SVR 740 850 R0100 | 1SVR 730 850 R2100 | 1SVR 740 850 R2100 | 1SVR 730 850 R0200 | 1SVR 740 850 R0200 | 1SVR 730 850 R2200 | 1SVR 740 850 R2200 | 1SVR 730 850 R0300 | 1SVR 740 850 R0300 |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|   | CM-ENE MIN         | CM-ENE MIN         | CM-ENE MIN         | CM-ENE MAX         | CM-ENE MAX         | CM-ENE MAX         | CM-ENS.11S         | CM-ENS.11P         | CM-ENS.13S         | CM-ENS.13P         | CM-ENS.21S         | CM-ENS.21P         | CM-ENS.23S         | CM-ENS.23P         | CM-ENS.31S         | CM-ENS.31P         |
| <b>Rated control supply voltage U<sub>s</sub></b> |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| 24-240 V AC/DC                                    |                    |                    |                    |                    |                    |                    | ■                  | ■                  |                    |                    | ■                  | ■                  |                    |                    | ■                  | ■                  |
| 24 V AC   | ■                  |                    |                    | ■                  |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| 110-130 V AC                                      |                    | ■                  |                    |                    | ■                  |                    |                    |                    | ■                  | ■                  |                    |                    | ■                  | ■                  |                    |                    |
| 220-240 V AC                                      |                    |                    | ■                  |                    |                    | ■                  |                    |                    | ■                  | ■                  |                    |                    | ■                  | ■                  |                    |                    |
| <b>Sensor circuit</b>                             |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| Number of electrodes (including ground reference) | 2                  | 2                  | 2                  | 2                  | 2                  | 2                  | 3                  | 3                  | 3                  | 3                  | 3                  | 3                  | 3                  | 3                  | 3                  | 3                  |
| <b>Response sensitivity range</b>                 |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| 0-100 kOhm  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| 5-100 kOhm  |                    |                    |                    |                    |                    |                    | adj                | adj                | adj                | adj                |                    |                    |                    |                    |                    |                    |
| 0.1-1000 kOhm                                     |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    | adj                | adj                | adj                | adj                | adj                | adj                |
| <b>Monitoring function</b>                        |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| Dry running protection                            | ■                  | ■                  | ■                  |                    |                    |                    | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  |
| Overflow protection                               |                    |                    |                    | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  |
| Liquid level control                              |                    |                    |                    | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  |
| <b>Operating principle</b>                        |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| Open-circuit principle                            | ■                  | ■                  | ■                  |                    |                    |                    | ■                  | ■                  | ■                  | ■                  |                    |                    |                    |                    |                    |                    |
| Closed-circuit principle                          |                    |                    |                    | ■                  | ■                  | ■                  |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| Open- or closed-circuit principle                 |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    | sel                | sel                | sel                | sel                | sel                | sel                |
| <b>Adjustable ON-/OFF-delay</b>                   |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| 0.1-10 s  |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    | ■                  | ■                  |
| <b>Output contacts</b>                            |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| n/o   | 1                  | 1                  | 1                  | 1                  | 1                  | 1                  |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| c/o (SPTD)  |                    |                    |                    |                    |                    |                    | 1                  | 1                  | 1                  | 1                  | 1                  | 1                  | 1                  | 1                  | 2                  | 2                  |
| <b>Connection type</b>                            |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| Push-in terminals                                 |                    |                    |                    |                    |                    |                    | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  |
| Double-chamber cage connection terminals          |                    |                    |                    |                    |                    |                    | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  | ■                  |

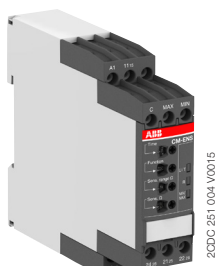
adj: adjustable  
sel: selectable

# Liquid level monitors and controls

## Ordering details



CM-ENE MIN



CM-ENS.3x



Bar electrode



Suspension electrode



Further documentation liquid level monitoring relays on [www.abb.com](http://www.abb.com)

### Description

The liquid level monitoring relay CM-ENS monitors and controls the liquid level and ratios of mixtures of conductive fluids. It is used for filling and draining applications, to protect pumps against dry-running, tanks against overflow and for signalization of the status of the monitored liquid level.

### Liquid level monitoring relays are

| Suitable for   |                          | Not suitable for             |                      |
|----------------|--------------------------|------------------------------|----------------------|
| spring water   | acids, bases             | chemically pure water        | ethylene glycol      |
| drinking water | liquid fertilizers       | fuel                         | concentrated alcohol |
| sea water      | milk, beer, coffee       | oils                         | paraffin             |
| sewage         | non-concentrated alcohol | explosive areas (liquid gas) | lacquers             |

### Ordering details

| Characteristics  | Type       | Order code      | Price | Weight            |
|--|------------|-----------------|-------|-------------------|
|  |            |                 | 1 pc  | (1 pc)<br>kg (lb) |
| See "Selection table - Liquid level monitors and controls" on page 2/97. | CM-ENE MIN | 1SVR550855R9500 |       | 0.15 (0.33)       |
|  |            | 1SVR550850R9500 |       | 0.15 (0.33)       |
|  | CM-ENE MAX | 1SVR550851R9500 |       | 0.15 (0.33)       |
|  |            | 1SVR550855R9400 |       | 0.15 (0.33)       |
|  |            | 1SVR550850R9400 |       | 0.15 (0.33)       |
|  |            | 1SVR550851R9400 |       | 0.15 (0.33)       |

### Ordering details

| Characteristics  | Type       | Order code      | Price | Weight            |
|--|------------|-----------------|-------|-------------------|
|  |            |                 | 1 pc  | (1 pc)<br>kg (lb) |
| See "Selection table - Liquid level monitors and controls" on page 2/97. | CM-ENS.11S | 1SVR730850R0100 |       | 0.124 (0.273)     |
|  | CM-ENS.11P | 1SVR740850R0100 |       | 0.117 (0.258)     |
|  | CM-ENS.13S | 1SVR730850R2100 |       | 0.153 (0.337)     |
|  | CM-ENS.13P | 1SVR740850R2100 |       | 0.145 (0.320)     |
|  | CM-ENS.21S | 1SVR730850R0200 |       | 0.125 (0.276)     |
|  | CM-ENS.21P | 1SVR740850R0200 |       | 0.117 (0.258)     |
|  | CM-ENS.23S | 1SVR730850R2200 |       | 0.154 (0.340)     |
|  | CM-ENS.23P | 1SVR740850R2200 |       | 0.147 (0.324)     |
|  | CM-ENS.31S | 1SVR730850R0300 |       | 0.143 (0.315)     |
|  | CM-ENS.31P | 1SVR740850R0300 |       | 0.134 (0.295)     |

S: screw connection  
P: push-in connection

### Ordering details - Bar electrodes

| Description                          | Material no. | Type       | Order code      | Price | Weight            |
|--------------------------------------|--------------|------------|-----------------|-------|-------------------|
|                                      |              |            |                 | 1 pc  | (1 pc)<br>kg (lb) |
| Compact support for 3 bar electrodes | -            | CM-KH-3    | 1SVR450056R6000 |       | 0.06 (0.132)      |
| Distance plate for 3 bar electrodes  | -            | CM-AH-3    | 1SVR450056R7000 |       | 0.06 (0.132)      |
| Counter nut for 1" thread            | -            | CM-GM-1    | 1SVR450056R8000 |       | 0.06 (0.132)      |
| Length: 300 mm                       | 1.4301       | CM-SE-300  | 1SVR450056R0000 |       | 0.08 (0.176)      |
| Length: 600 mm                       | 1.4301       | CM-SE-600  | 1SVR450056R0100 |       | 0.08 (0.176)      |
| Length: 1000 mm                      | 1.4301       | CM-SE-1000 | 1SVR450056R0200 |       | 0.08 (0.176)      |

### Ordering details - Suspension electrodes

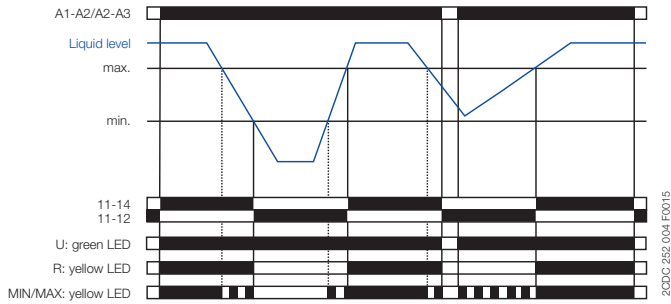
| Description   | Material no. | Type   | Order code      | Price | Weight            |
|---|--------------|--------|-----------------|-------|-------------------|
|   |              |        |                 | 1 pc  | (1 pc)<br>kg (lb) |
| CM-HE suspension electrode                              | 1.4104       | CM-HE  | 1SVR402902R0000 |       | 0.074 (0.163)     |
| CM-HC suspension electrode                              | 1.4104       | CM-HC  | 1SVR402902R1000 |       | 0.09 (0.198)      |
| CM-HCT suspension electrode suitable for drinking water | 1.4301       | CM-HCT | 1SVR402902R2000 |       | 0.09 (0.198)      |

# Liquid level monitors and controls

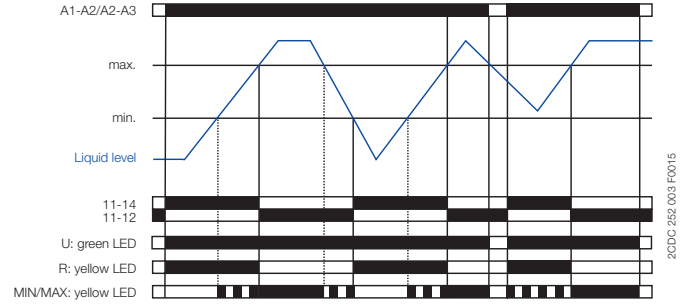
## Function diagrams

### CM-ENS

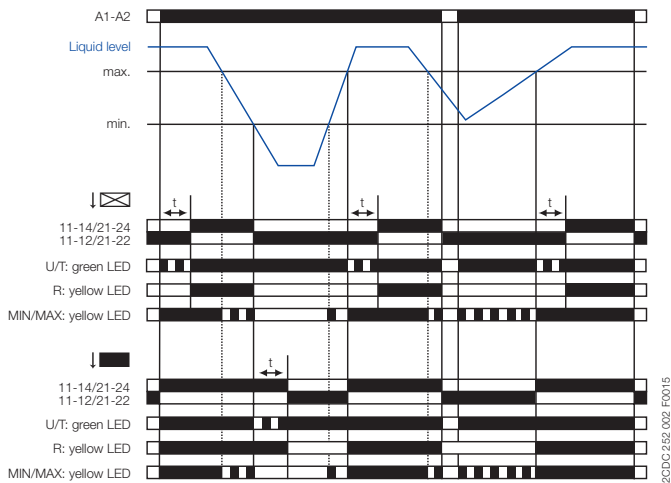
2



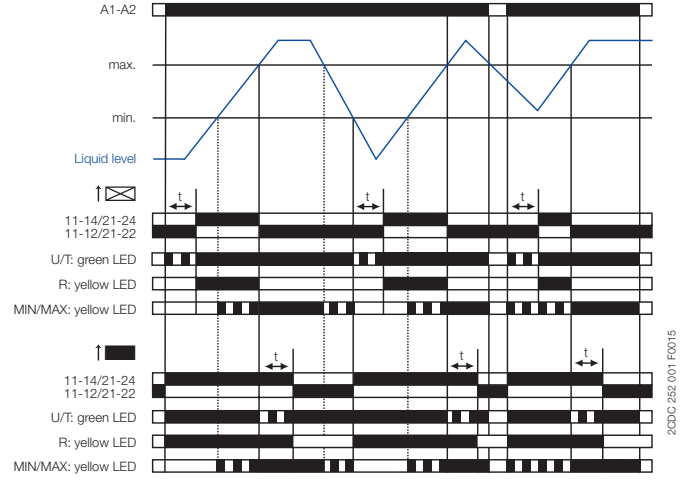
Drain: CM-ENS.1x, CM-ENS.2x



Fill: CM-ENS.2x

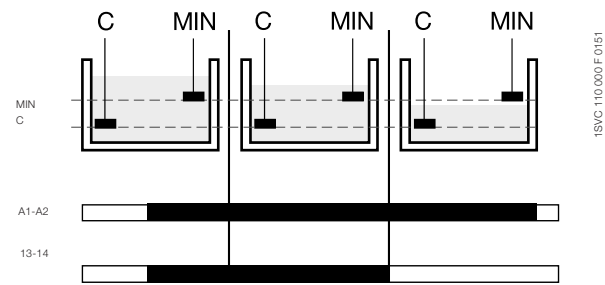


Drain: CM-ENS.31



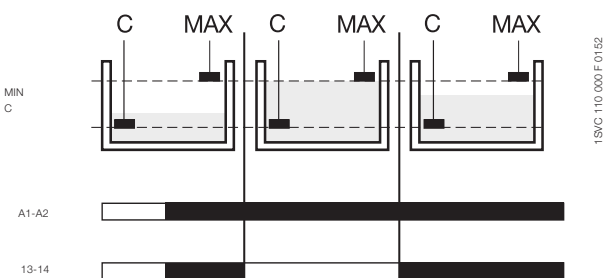
Fill: CM-ENS.31

### CM-ENE MIN



1S/C 110 000 F 0151

### CM-ENE MAX



1S/C 110 000 F 0152

The liquid level relays CM-ENE MIN and CM-ENE MAX are used to monitor levels of conductive liquids, for example in pump control systems for dry-running or overflow monitoring.

The measuring principle is based on the occurring resistance change when moistening single-pole electrodes. The single-pole electrodes (see also section Accessories) are connected to the terminals C and MIN or MAX.

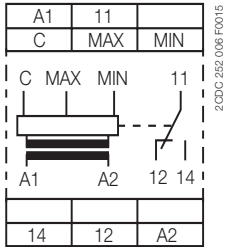
If the supply voltage is applied to A1-A2 and the electrodes are wet, the output relay of the CM-ENE MIN is energized and the output relay of the CM-ENE MAX is de-energized.

The output relay of the CM-ENE MIN de-energizes if the electrodes are no longer wet. The output relay of the CM-ENE MAX energizes if the electrodes are no longer wet.

# Liquid level monitors and controls

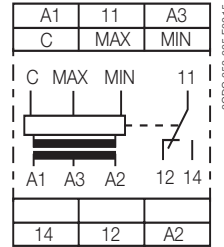
## Connection diagrams

### CM-ENS.11, CM-ENS.21



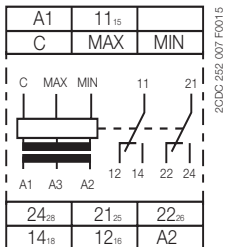
- A1-A2 Control supply voltage  
 11-12/14 1 c/o (SPDT) contact  
 C Reference electrode  
 MAX Maximum level electrode  
 MIN Minimum level electrode

### CM-ENS.13, CM-ENS.23



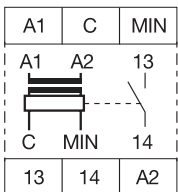
- A1-A2 Control supply voltage  
 220-240 V AC  
 A3-A2 Control supply voltage  
 110-130 V AC  
 11-12/14 1 c/o (SPDT) contact  
 C Reference electrode  
 MAX Maximum level electrode  
 MIN Minimum level electrode

### CM-ENS.31



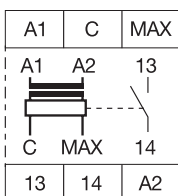
- A1-A2 Control supply voltage  
 11<sub>15</sub>-12<sub>16</sub>/14<sub>18</sub> 1 c/o (SPDT) contact  
 21<sub>25</sub>-22<sub>26</sub>/24<sub>28</sub> 2nd c/o (SPDT) contact  
 C Reference electrode  
 MAX Maximum level electrode  
 MIN Minimum level electrode

### CM-ENE MIN



- A1-A2 Rated control supply voltage  
 C Reference electrode  
 MIN Minimum level  
 13-14 Output contact -open-circuit principle

### CM-ENE MAX



- A1-A2 Rated control supply voltage  
 C Reference electrode  
 MIN Maximum level  
 13-14 Output contact -open-circuit principle

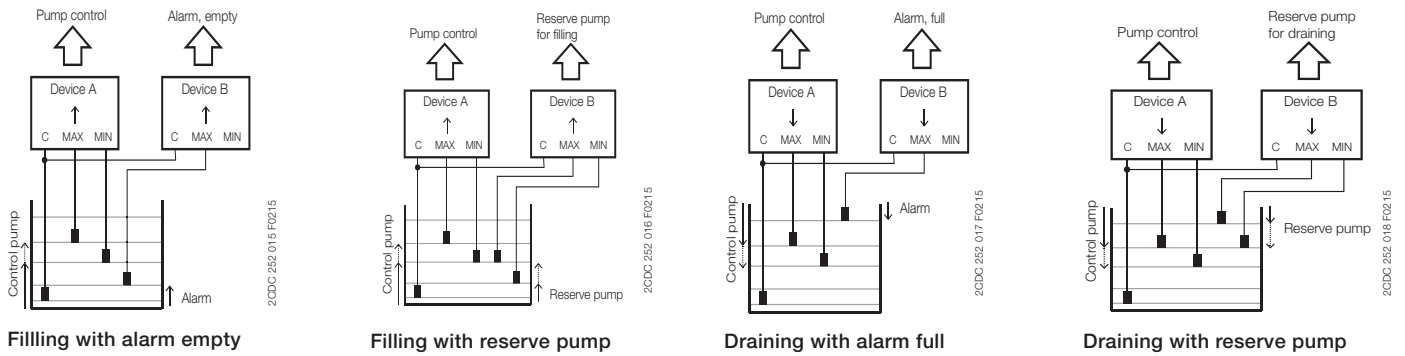
# Liquid level monitors and controls

## Cascading of several devices, application examples

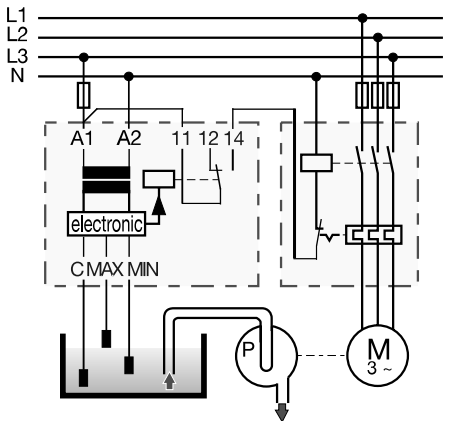
### Two devices in one tank

Several CM-ENS can be used in one tank. This extends the functionality with a pre-warning by two additional electrodes. In this way, two additional alarm outputs for exceeding or dropping below the normal level can be implemented in addition to the filling levels MAX and MIN.

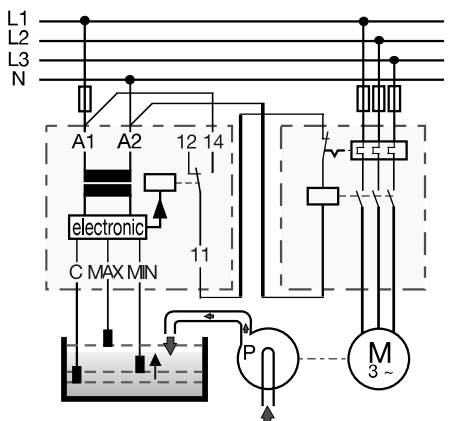
2



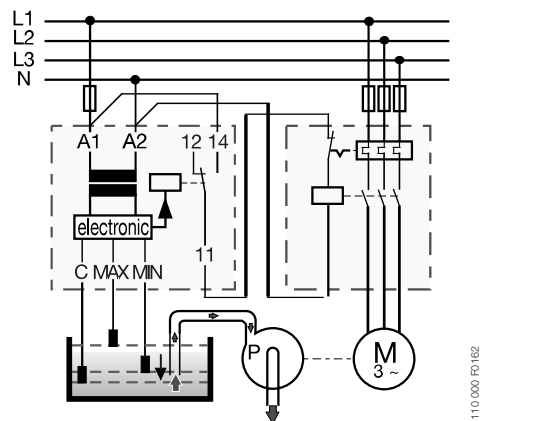
### Application examples



CM-ENS.1x  
Liquid level control - drain



CM-ENS.2x, CM-ENS.31  
Liquid level control - fill - selected function "↑" (UP)



CM-ENS.2x, CM-ENS.31  
Liquid level control - drain - selected function "↓" (Down)



# Liquid level monitors and controls

## Technical data - CM-ENE

| Type  |  | CM-ENE MIN                                   | CM-ENE MAX                             |
|---|--|--|--|
| <b>Supply circuit</b>   |  |  |  |
| Rated control supply voltage $U_s$ - power consumption                  | A1-A2  | 24 V AC approx. 1.5 VA                       |  |
|   | A1-A2  | 110-130 V AC approx. 1.2 VA                  |  |
|   | A1-A2  | 220-240 V AC approx. 1.4 VA                  |  |
| Rated control supply voltage $U_s$ tolerance                            |  | -15...+15 %                                  |  |
| Rated frequency   |  | 50-60 Hz                                     |  |
| <b>Measuring circuit</b>  |  |  |  |
| Monitoring function   |  | dry-running protection                       | overflow protection                    |
| Response sensitivity  |  | 0-100 k $\Omega$ , not adjustable            |  |
| Maximum electrode voltage / current                                     |  | 30 V AC / 1.5 mA                             |  |
| Electrode supply line   | max. cable length / capacity                       | 30 m / 3 nF                                  |  |
| <b>Timing circuit</b>   |  |  |  |
| Tripping delay  |  | fixed approx. 200 ms                         |  |
| <b>Indication of operational states</b>                                 |  |  |  |
| Output relay energized  |  | R: yellow LED                                |  |
| <b>Output circuits</b>  |  |  |  |
| Kind of output  |  | 1 n/o contact                                |  |
| Operational principle   |  | open-circuit principle <sup>1)</sup>         | closed-circuit principle <sup>1)</sup> |
| Minimum switching voltage / minimum switching current                   |  | - / -  |  |
| Maximum switching voltage   |  | 250 V  |  |
| Rated operational voltage $U_o$ and rated operational current $I_o$     | AC-12 (resistive) 230 V                            | 4 A  |  |
|   | AC-15 (inductive) 230 V                            | 3 A  |  |
|   | DC-12 (resistive) 24 V                             | 4 A  |  |
|   | DC-13 (inductive) 24 V                             | 2 A  |  |
| AC rating (UL 508)  | utilization category (Control Circuit Rating Code) | B 300  |  |
|   | max. rated operational voltage                     | 300 V AC                                     |  |
|   | max. continuous thermal current at B 300           | 5 A  |  |
|   | max. making/breaking apparent power at B 300       | 3600/360 VA                                  |  |
| Mechanical lifetime   |  | 30 x 10 <sup>6</sup> switching cycles        |  |
| Electrical lifetime (AC-12, 230 V, 4 A)                                 |  | 0.3 x 10 <sup>6</sup> switching cycles       |  |
| Max. fuse rating to achieve short-circuit protection                    | n/c contact  | -  |  |
|   | n/o contact  | 10 A fast-acting                             |  |
| <b>General data</b>   |  |  |  |
| Duty cycle  |  | 100 %  |  |
| Dimensions  |  | see 'Dimensional drawings'                   |  |
| Mounting  |  | DIN rail (IEC/EN 60715)                      |  |
| Mounting position   |  | any  |  |
| Degree of protection  | housing / terminals                                | IP50 / IP20                                  |  |
| <b>Electrical connection</b>  |  |  |  |
| Connecting capacity   | fine-strand with wire-end ferrule                  | 2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |  |
|   | fine-strand without wire-end ferrule               | 2 x 1-1.5 mm <sup>2</sup> (2 x 18-16 AWG)    |  |
|   | rigid  | 2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG) |  |
| Stripping length  |  | 10 mm (0.39 inch)                            |  |
| Tightening torque   |  | 0.6-0.8 Nm                                   |  |
| <b>Environmental data</b>   |  |  |  |
| Ambient temperature ranges  | operation/storage                                  | -20...+60 °C / -40...+85 °C                  |  |
| Damp heat   | IEC/EN 60068-2-30                                  | 40 °C, 93 % RH, 4 days                       |  |
| Vibration withstand   | IEC/EN 60068-2-6                                   | 10-57 Hz: 0.075 mm; 57-150 Hz: 1 g           |  |
| <b>Isolation data</b>   |  |  |  |
| Rated insulation voltage U between supply, measuring / output circuit   |  | 250 V  |  |
| Rated impulse withstand voltage $U_{imp}$ between all isolated circuits |  | 4 kV / 1.2-50 $\mu$ s                        |  |
| Pollution degree  |  | 3  |  |
| Overvoltage category  |  | III  |  |
| <b>Standards / Directives</b>   |  |  |  |
| Standards   |  | IEC/EN 60947-5-1, EN 50178                   |  |
| Low Voltage Directive   |  | 2014/35/EU                                   |  |
| EMC Directive   |  | 2014/30/EU                                   |  |
| RoHS Directive  |  | 2011/65/EU                                   |  |
| <b>Electromagnetic compatibility</b>                                    |  |  |  |
| Interference immunity to  |  | IEC/EN 61000-6-2                             |  |
| 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)                             |  |
| electrical fast transient / burst                                       | IEC/EN 61000-4-4                                   | level 3 (2 kV / 5 kHz)                       |  |
| surge   | IEC/EN 61000-4-5                                   | level 4 (2 kV L-L)                           |  |
| conducted disturbances, induced by radio-frequency fields               | IEC/EN 61000-4-6                                   | level 3 (10 V)                               |  |
| Interference emission   |  | IEC/EN 61000-6-3                             |  |
| high-frequency radiated   | IEC/CISPR 22, EN 55022                             | class B                                      |  |
| high-frequency conducted  | IEC/CISPR 22, EN 55022                             | class B                                      |  |

<sup>1)</sup> Open-circuit principle: Output relay energizes if the measured value exceeds/drops below the adjusted threshold.

Closed-circuit principle: Output relay de-energizes if the measured value exceeds/drops below the adjusted threshold.

# Liquid level monitors and controls

## Technical data - CM-ENS

2

| Type  |  | CM-ENS.1x   | CM-ENS.2x                                      | CM-ENS.31                     |                         |
|---|--|---|--|-------------------------------|-------------------------|
| <b>Supply circuit</b>   |  |   |  |                               |                         |
| Rated control supply voltage $U_s$                                  | CM-ENS.11, CM-ENS.21, CM-ENS.31: A1-A2               | 24-240 V AC/DC  |  |                               |                         |
|   | CM-ENS.13, CM-ENS.23: A1-A2                          | 220-240 V AC  |  |                               |                         |
|   | CM-ENS.13, CM-ENS.23: A3-A2                          | 110-130 V AC  |  |                               |                         |
| Rated control supply voltage $U_s$ tolerance                        |  | -15...+10 %   |  |                               |                         |
| Rated frequency   |  | 50-60 Hz  |  |                               |                         |
| Frequency range   |  | 47-63 Hz  |  |                               |                         |
| Typical current / power consumption                                 | 24 V AC  | 25 mA / 0.6 W   | 25 mA / 0.6 W                                  | 25 mA / 0.6 W                 |                         |
|   | 110-130 V AC   | 20 mA / 2.6 VA  | 20 mA / 2.6 VA                                 | 8 mA / 1.1 VA                 |                         |
|   | 220-240 V AC   | 8.5 mA / 2.1 VA   | 8.5 mA / 2.1 VA                                | 10 mA / 2.4 VA                |                         |
|   | 24-240 V AC/DC                                       | 11 mA / 2.6 VA  | 11 mA / 2.6 VA                                 | 11 mA / 2.6 VA                |                         |
| Power failure buffering time  | min.   | 20 ms   |  |                               |                         |
| Start-up time $t_s$   | range 5-100 k $\Omega$                               | max. 1.3 s  | -  | -                             |                         |
|   | range 0.1-1 k $\Omega$                               | -   | max. 900 ms                                    | -                             |                         |
|   | range 1-10 k $\Omega$                                | -   | max. 900 ms                                    | -                             |                         |
|   | range 10-100 k $\Omega$                              | -   | max. 1.3 s                                     | -                             |                         |
|   | range 100-1000 k $\Omega$                            | -   | max. 6.3 s                                     | -                             |                         |
| <b>Measuring circuit</b>  |  |   |  |                               |                         |
| Sensor type   |  | electrode   |  |                               |                         |
| Monitoring function   |  | fill or drain   | fill or drain, selectable                      |                               |                         |
| Measuring principle   |  | conductivity measurement  |  |                               |                         |
| Number of electrodes  |  | 3   |  |                               |                         |
| Response sensitivity  |  | adjustable: 5-100 k $\Omega$                                      | adjustable: 0.1-1000 k $\Omega$                |                               |                         |
| Maximum electrode voltage   |  | 6 V AC  |  |                               |                         |
| Maximum electrode current   |  | 1 mA  | 2 mA   |                               |                         |
|   |  | <b>max cable capacity</b>   | <b>max cable length</b>                        | <b>max cable capacity</b>     | <b>max cable length</b> |
| Electrode supply line   | range 5-100 k $\Omega$                               | 10 nF   | 100 m  | -                             | -                       |
|   | range 0.1-1 k $\Omega$                               | -   | -  | 200 nF                        | 1000 m                  |
|   | range 1-10 k $\Omega$                                | -   | -  | 200 nF                        | 1000 m                  |
|   | range 10-100 k $\Omega$                              | -   | -  | 20 nF                         | 100 m                   |
|   | range 100-1000 k $\Omega$                            | -   | -  | 4 nF                          | 20 m                    |
| Max. measuring cycle  | range 5-100 k $\Omega$                               | 1000 ms   | -  | -                             | -                       |
|   | range 0.1-1 k $\Omega$                               | -   | -  | 700 ms                        | -                       |
|   | range 1-10 k $\Omega$                                | -   | -  | 700 ms                        | -                       |
|   | range 10-100 k $\Omega$                              | -   | -  | 1.1 s                         | -                       |
|   | range 100-1000 k $\Omega$                            | -   | -  | 5 s                           | -                       |
| <b>Timing circuit</b>   |  |   |  |                               |                         |
| Time delay  |  | -   | 0.1-30 s, adjustable, ON- or OFF-delay         |                               |                         |
| <b>Indication of operational states</b>                             |  |   |  |                               |                         |
| Control supply voltage  |  | U: green LED  |  |                               |                         |
| Output relay energized  |  | R: Yellow LED   |  |                               |                         |
| Electrode / alarm status  |  | MAX/MIN: Yellow LED   |  |                               |                         |
| <b>Output circuits</b>  |  |   |  |                               |                         |
| Kind of output  | 11 <sub>15</sub> -12 <sub>16</sub> /14 <sub>18</sub> | relay, 1 c/o (SPDT) contact                                       |  | relay, 1st c/o (SPDT) contact |                         |
|   | 21 <sub>15</sub> -22 <sub>16</sub> /24 <sub>18</sub> | -   |  | relay, 2nd c/o (SPDT) contact |                         |
| Operational principle   |  | open-circuit principle  | open- or closed-circuit principle (selectable) |                               |                         |
| Contact material  |  | AgNi alloy, Cd free   |  |                               |                         |
| Minimum switching voltage / minimum switching current               |  | 12 V / 10 mA  |  |                               |                         |
| Maximum switching voltage / Maximum switching current               |  | see data sheets   |  |                               |                         |
| Rated operational voltage $U_o$ and rated operational current $I_o$ | AC-12 (resistive) 230 V                              | 4 A   |  |                               |                         |
|   | AC-15 (inductive) 230 V                              | 3 A   |  |                               |                         |
|   | DC-12 (resistive) 24 V                               | 4 A   |  |                               |                         |
|   | DC-13 (inductive) 24 V                               | 2 A   |  |                               |                         |
| AC rating (UL 508)  | utilization category (Control Circuit Rating Code)   | B 300 pilot duty; general purpose 250 V, 4 A, $\cos \varphi$ 0.75 |  |                               |                         |
|   | max. rated operational voltage                       | 300 V AC  |  |                               |                         |
|   | max. continuous thermal current at B 300             | 5 A   |  |                               |                         |
|   | max. making/breaking apparent power at B 300         | 3600/360 VA   |  |                               |                         |
| Mechanical lifetime   |  | 10 x 10 <sup>6</sup> switching cycles                             |  |                               |                         |
| Electrical lifetime (AC-12, 230 V, 4 A)                             |  | 0.1 x 10 <sup>6</sup> switching cycles                            |  |                               |                         |
| Max. fuse rating to achieve short-circuit protection                | n/c / n/o contact                                    | 6 A / 10 A fast-acting  |  | 10 A / 10 A fast-acting       |                         |
| Conventional thermal current $I_{th}$                               |  | 4 A   |  |                               |                         |

# Liquid level monitors and controls

## Technical data - CM-ENS

| Type  |   | CM-ENS.1x  | CM-ENS.2x  | CM-ENS.31 |
|---|---|--|--|-----------|
| <b>General data</b>                               |   |  |  |           |
| MTBF  |   | on request   |  |           |
| Duty cycle  |   | 100 %  |  |           |
| Dimensions  |   | see 'Dimensional drawings'   |  |           |
| Mounting  |   | DIN rail (IEC/EN 60715), snap-on mounting without any tool   |  |           |
| Mounting position                                 |   | any  |  |           |
| Minimum distance to other units                   |   | CM-ENS.x1: not necessary<br>CM-ENS.x3: 10 mm if contact current > 2 A  |  |           |
| Degree of protection                              | housing / terminals                                       | IP50 / IP20  |  |           |
| Material of housing                               |   | UL 94 V-0  |  |           |
| <b>Electrical connection</b>                      |   |  |  |           |
| Connecting capacity                               | fine-strand with(out) wire end ferrule                    | <b>Screw connection technology</b><br>1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)<br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG) | <b>Easy Connect Technology (push-in)</b><br>2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)    |           |
|   | rigid   | 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)   | 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)  |           |
| Stripping length                                  |   | 8 mm (0.32 in)   |  |           |
| Tightening torque                                 |   | 0.6-0.8 Nm (7.08 lb.in)  |  | -         |
| <b>Environmental data</b>                         |   |  |  |           |
| Ambient temperature ranges                        | operation   | -25...+60 °C   |  |           |
|   | storage   | -40...+85 °C   |  |           |
| Damp heat, cyclic                                 | IEC/EN 60068-2-30   | 6 x 24 h cycle, 55 °C, 95 % RH   |  |           |
| Climatic class                                    | IEC/EN 60721-3-3  | 3K5 (no condensation, no ice formation)  |  |           |
| Vibration, sinusoidal                             |   | class 2  |  |           |
| Shock   |   | class 2  |  |           |
| <b>Isolation data</b>                             |   |  |  |           |
| Rated impulse withstand voltage<br>$U_{imp}$      | supply circuit / measuring circuit                        | 4 kV   |  |           |
|   | supply circuit / output circuits                          | 4 kV   |  |           |
|   | measuring circuit / output circuits                       | 4 kV   |  |           |
|   | output circuit 1 / output circuit 2                       | 4 kV   |  |           |
| Rated insulation voltage $U_i$                    | supply circuit / measuring circuit                        | 300 V  |  |           |
|   | supply circuit / output circuits                          | 300 V  |  |           |
|   | measuring circuit / output circuits                       | 300 V  |  |           |
|   | output circuit 1 / output circuit 2                       | 300 V  |  |           |
| Basic insulation                                  | supply circuit / measuring circuit                        | 250 V AC / 300 V DC  |  |           |
|   | supply circuit / output circuits                          | 250 V AC / 300 V DC  |  |           |
|   | measuring circuit / output circuits                       | 250 V AC / 300 V DC  |  |           |
|   | output circuit 1 / output circuit 2                       | 250 V AC / 300 V DC  |  |           |
| Protective separation<br>(IEC/EN 61140, EN 50178) | supply circuit / measuring circuit                        | 250 V AC / 300 V DC  |  |           |
|   | supply circuit / output circuits                          | 250 V AC / 300 V DC  |  |           |
|   | measuring circuit / output circuits                       | 250 V AC / 300 V DC  |  |           |
| Pollution degree                                  |   | 3  |  |           |
| Overvoltage category                              |   | III  |  |           |
| <b>Standards / Directives</b>                     |   |  |  |           |
| Standards   |   | IEC/EN 60255-27, IEC/EN 60947-5-1  |  |           |
| Low Voltage Directive                             |   | 2014/35/EU   |  |           |
| EMC Directive                                     |   | 2014/30/EU   |  |           |
| RoHS Directive                                    |   | 2011/65/EU   |  |           |
| <b>Electromagnetic compatibility</b>              |   |  |  |           |
| Interference immunity to                          | electrostatic discharge                                   | IEC/EN 61000-4-2   | IEC/EN 61000-6-2, IEC/EN 60255-26<br>level 3 (6 kV / 8 kV)                                 |           |
|   | radiated, radio-frequency, electromagnetic field          | IEC/EN 61000-4-3   | level 3 (10 V/m)   |           |
|   | electrical fast transient / burst surge                   | IEC/EN 61000-4-4   | level 3, 2 kV / 5 kHz  |           |
|   |   | 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  |           |
| Interference emission                             | high-frequency radiated                                   | IEC/CISPR 22, EN 55022   | IEC/EN 61000-6-3<br>class B  |           |
|   | high-frequency conducted                                  | IEC/CISPR 22, EN 55022   | class B  |           |

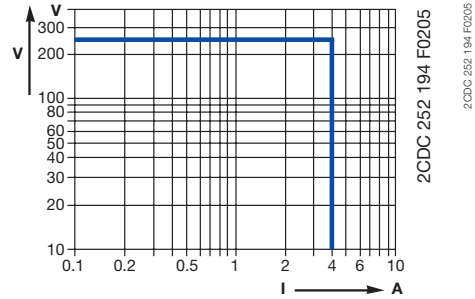
# General technical data

## Technical diagrams - CM-range

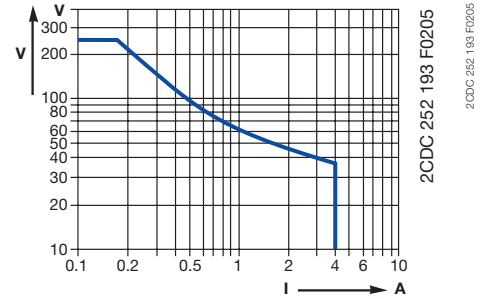
### Load limit curves

CM-E (22.5 mm), CM-N (45 mm), CM-S (22.5 mm), CM-UFD.Mxx

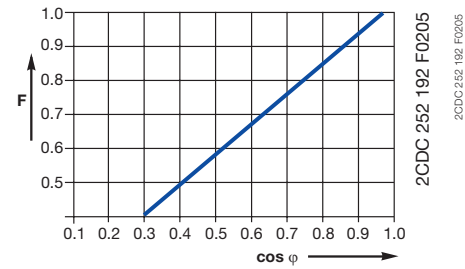
AC load (resistive)



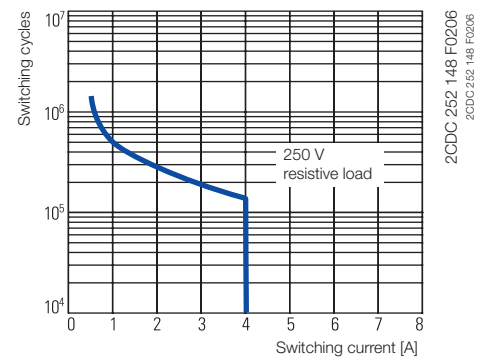
DC load (resistive)



Derating factor F for inductive AC load



Contact lifetime

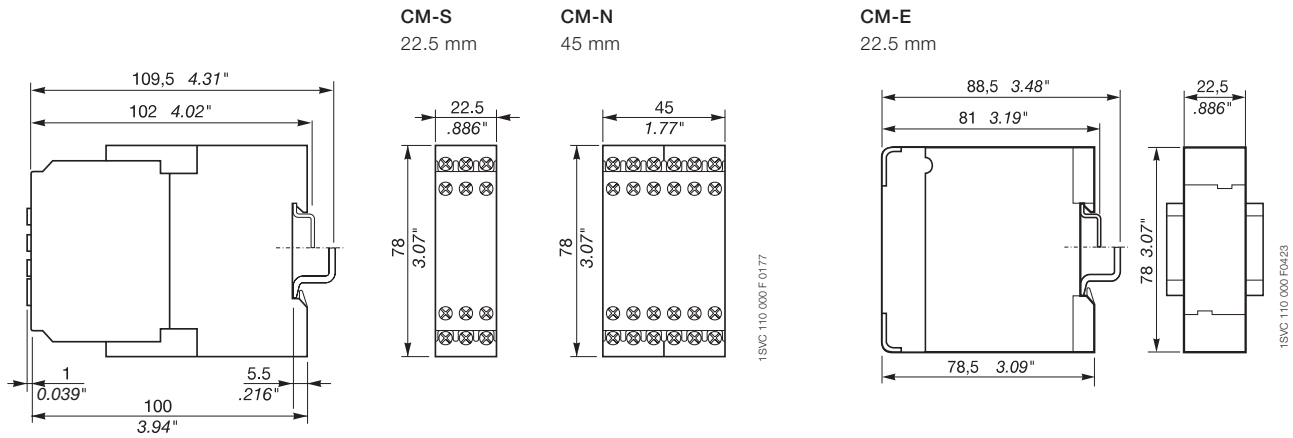


# General technical data

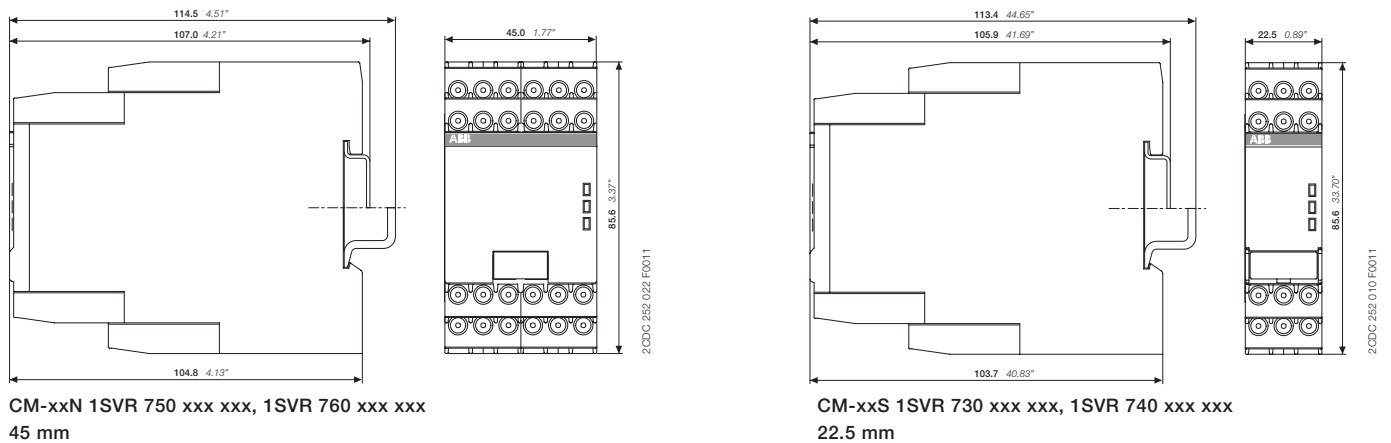
## Dimensional drawings

### Measuring and monitoring relays CM range, old housing

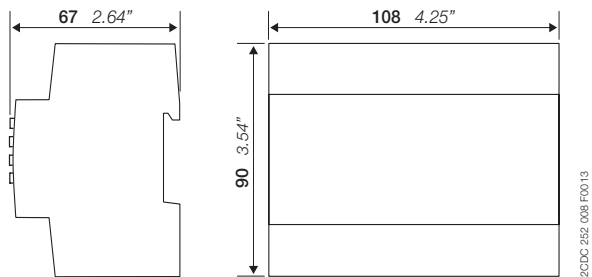
Dimensions in mm



### Measuring and monitoring relays CM range, new housing



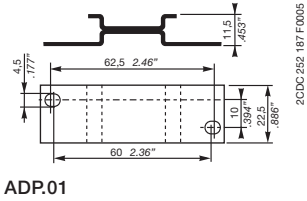
### Grid feeding monitoring relays CM-UFD.M\*



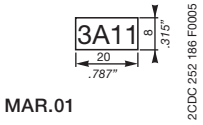
# Accessories, Current transformers

## Ordering details - CM-range accessories

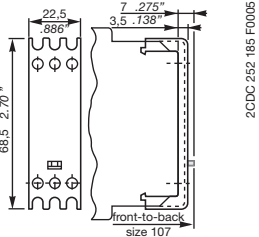
2



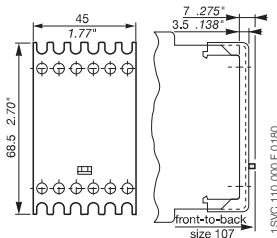
ADP.01



MAR.01



Sealable cover  
COV.01



Sealable cover  
COV.02

### Accessories

#### Ordering details

| Description                | For type                           | Width in mm | for devices          | Type   | Order code      | Price pc | Pkg qty | Weight (1 pc) g (oz) |
|----------------------------|------------------------------------|-------------|----------------------|--------|-----------------|----------|---------|----------------------|
| Adapter for screw mounting | CM-S<br>CM-S.S/P                   | 22.5        |                      | ADP.01 | 1SVR430029R0100 |          | 1       | 18.4 (0.65)          |
|                            | CM-N<br>CM-N.S/P                   | 45          |                      | ADP.02 | 1SVR440029R0100 |          | 1       | 36.7 (1.30)          |
| Marker label               | CM-S, CM-N<br>CM-S.S/P<br>CM-N.S/P |             | without DIP switches | MAR.01 | 1SVR366017R0100 |          | 10      | 0.19 (0.007)         |
|                            | CM-S, CM-N                         |             | with DIP switches    | MAR.02 | 1SVR430043R0000 |          | 10      | 0.13 (0.005)         |
|                            | CM-S.S/P<br>CM-N.S/P               |             | with DIP switches    | MAR.12 | 1SVR730006R0000 |          | 10      | 0.152 (0.335)        |
| Sealable transparent cover | CM-S                               | 22.5        |                      | COV.01 | 1SVR430005R0100 |          | 1       | 5.2 (0.18)           |
|                            | CM-N                               | 45          |                      | COV.02 | 1SVR440005R0100 |          | 1       | 7.7 (0.27)           |
|                            | CM-S.S/P                           | 22.5        |                      | COV.11 | 1SVR730005R0100 |          | 1       | 4.0 (0.129)          |
|                            | CM-N.S/P                           | 45          |                      | COV.12 | 1SVR750005R0100 |          | 1       | 7 (0.247)            |

# Accessories, Current transformers

## Ordering details - CM-CT current transformers

2CDC 251 002 F0005



CM-CT

### Plug-in current transformers CM-CT

- Without primary conductor though with foot angle, insulating protective cap and bar fastening screws
- Primary / rated current from 50 A to 600 A
- Secondary current of 1 A or 5 A
- Class 1

### Ordering details

| Rated primary current | Secondary current | Burden class | Type            | Order code      | Price pc      | Weight (1 pc) g (oz) |
|-----------------------|-------------------|--------------|-----------------|-----------------|---------------|----------------------|
| 50 A                  | 1 A               | 1 VA / 1     | CM-CT 50/1      | 1SVR450116R1000 |               | 0.31 (0.683)         |
| 75 A                  |                   | 1.5 VA / 1   | CM-CT 75/1      | 1SVR450116R1100 |               | 0.31 (0.683)         |
| 100 A                 |                   | 2.5 VA / 1   | CM-CT 100/1     | 1SVR450116R1200 |               | 0.276 (0.608)        |
| 150 A                 |                   | 2.5 VA / 1   | CM-CT 150/1     | 1SVR450116R1300 |               | 0.32 (0.705)         |
| 200 A                 |                   | 2.5 VA / 1   | CM-CT 200/1     | 1SVR450116R1400 |               | 0.222 (0.489)        |
| 300 A                 |                   | 5 VA / 1     | CM-CT 300/1     | 1SVR450117R1100 |               | 0.29 (0.639)         |
| 400 A                 | 5 A               | 5 VA / 1     | CM-CT 400/1     | 1SVR450117R1200 |               | 0.27 (0.595)         |
| 500 A                 |                   | 5 VA / 1     | CM-CT 500/1     | 1SVR450117R1300 |               | 0.29 (0.639)         |
| 600 A                 |                   | 5 VA / 1     | CM-CT 600/1     | 1SVR450117R1400 |               | 0.24 (0.529)         |
| 50 A                  |                   | 1 VA / 1     | CM-CT 50/5      | 1SVR450116R5000 |               | 0.3 (0.661)          |
| 75 A                  |                   | 1.5 VA / 1   | CM-CT 75/5      | 1SVR450116R5100 |               | 0.31 (0.683)         |
| 100 A                 |                   | 2.5 VA / 1   | CM-CT 100/5     | 1SVR450116R5200 |               | 0.31 (0.683)         |
| 150 A                 | 2.5 VA / 1        | CM-CT 150/5  | 1SVR450116R5300 |                 | 0.28 (0.617)  |                      |
| 200 A                 | 5 VA / 1          | CM-CT 200/5  | 1SVR450116R5400 |                 | 0.29 (0.639)  |                      |
| 300 A                 | 5 VA / 1          | CM-CT 300/5  | 1SVR450117R5100 |                 | 0.252 (0.556) |                      |
| 400 A                 | 5 VA / 1          | CM-CT 400/5  | 1SVR450117R5200 |                 | 0.26 (0.573)  |                      |
| 500 A                 | 5 VA / 1          | CM-CT 500/5  | 1SVR450117R5300 |                 | 0.208 (0.459) |                      |
| 600 A                 | 5 VA / 1          | CM-CT 600/5  | 1SVR450117R5400 |                 | 0.21 (0.463)  |                      |

2CDC 251 003 F0005



CM-CT with mounted accessories

### Ordering details - Accessories

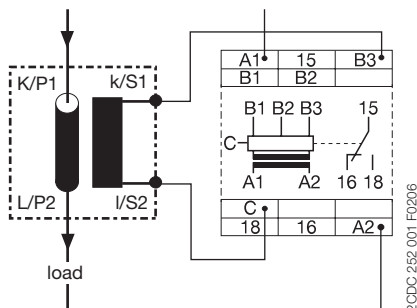
| Description                                     | Type    | Order code      | Price 10 pcs | Weight (1 pc) g (oz) |
|---|---------|-----------------|--------------|----------------------|
| Snap-on fastener for DIN rail mounting of CM-CT | CM-CT A | 1SVR450118R1000 |              | 0.009 (0.02)         |

2CDC 251 159 F0006

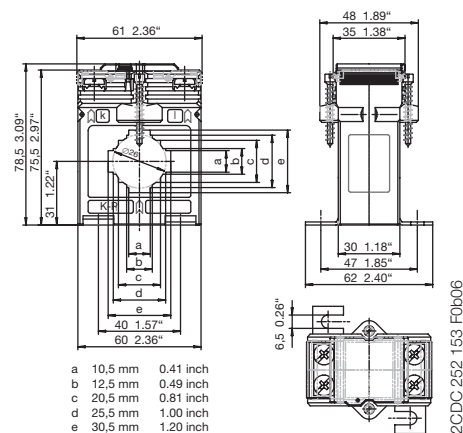


CM-CT-A mounted on DIN rail

### Operating principle / circuit diagram



### Dimensional drawing



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