Data sheet

# Multifunctional three-phase monitoring relays CM-MPS
# CM-MPS.11, CM-MPS.21, CM-MPS.31 and CM-MPS.41

The three-phase monitoring relays CM-MPS.x1 monitor the phase parameters phase sequence, phase failure, over- and undervoltage as well as phase unbalance.
All devices are available with two different terminal versions. You can choose between the proven screw connection technology (double-chamber cage connection terminals) and the completely tool-free Easy Connect Technology (push-in terminals).




## Characteristics

- Monitoring of three-phase mains for phase sequence (can be switched off), phase failure, over- and undervoltage as well as phase unbalance
- TRMS measuring principle
- Interrupted neutral monitoring (CM-MPS.11 and CM-MPS.21)
- CM-MPS.11 and CM-MPS.21 can also be used to monitor single-phase mains
- Threshold values for over- and undervoltage as well as phase unbalance are adjustable as absolute values
- Tripping delay $T_v$ can be adjusted or switched off by means of a logarithmic scale (0 s; 0.1-30 s)
- ON-delayed or OFF-delayed tripping delay selectable
- Powered by the measuring circuit
- Precise adjustment by front-face operating controls
- Screw connection technology or Easy Connect Technology available
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting on DIN rail as well as demounting
- 2 c/o (SPDT) contacts
- 22.5 mm (0.89 in) width
- 3 LEDs for the indication of operational states

## Approvals

UL 508, CAN/CSA C22.2 No.14
GL
GOST
CB scheme
CCC
RMRS

## Marks

CE
C-Tick

Power and productivity for a better world™

## Order data

### Three-phase monitoring relays

| Type | Rated control supply voltage = measuring voltage | Interrupted neutral monitoring | Connection technology | Order code |
|---|---|---|---|---|
| CM-MPS.11P | 3 x 90-170 V AC | yes | Push-in terminals | 1SVR 740 885 R1300 |
| CM-MPS.11S | | yes | Screw terminals | 1SVR 730 885 R1300 |
| CM-MPS.21P | 3 x 180-280 V AC | yes | Push-in terminals | 1SVR 740 885 R3300 |
| CM-MPS.21S | | yes | Screw terminals | 1SVR 730 885 R3300 |
| CM-MPS.31P | 3 x 160-300 V AC | no | Push-in terminals | 1SVR 740 884 R1300 |
| CM-MPS.31S | | no | Screw terminals | 1SVR 730 884 R1300 |
| CM-MPS.41P | 3 x 300-500 V AC | no | Push-in terminals | 1SVR 740 884 R3300 |
| CM-MPS.41S | | no | Screw terminals | 1SVR 730 884 R3300 |

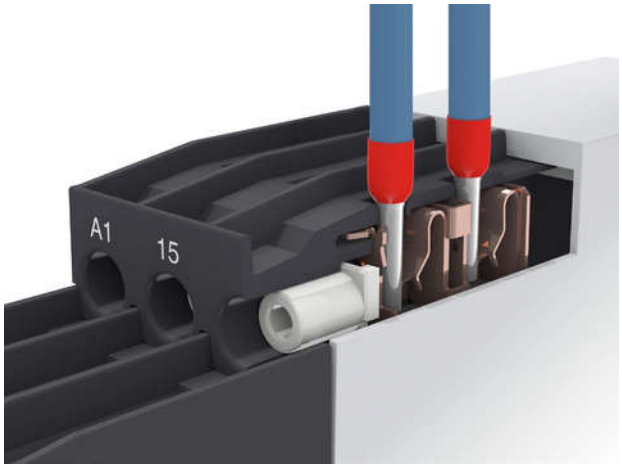
### Accessories

| Type | Description | Order code |
|---|---|---|
| ADP.01 | Adapter for screw mounting | 1SVR 430 029 R0100 |
| MAR.12 | Marker label for devices with DIP switches | 1SVR 730 006 R0000 |
| COV.11 | Sealable transparent cover | 1SVR 730 005 R0100 |

## Connection technology

### Maintenance free Easy Connect Technology with push-in terminals

Type designation CM-xxS.yyP



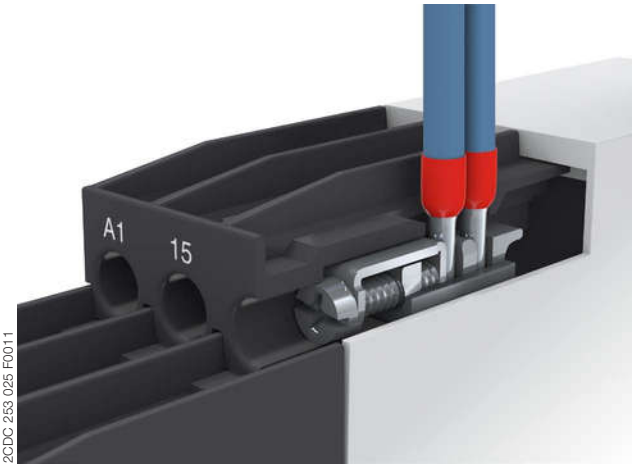

2CDC 253 026 F0011

### Push-in terminals

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

### Approved screw connection technology with double-chamber cage connection terminals

Type designation CM-xxS.yyS




2CDC 253 025 F0011

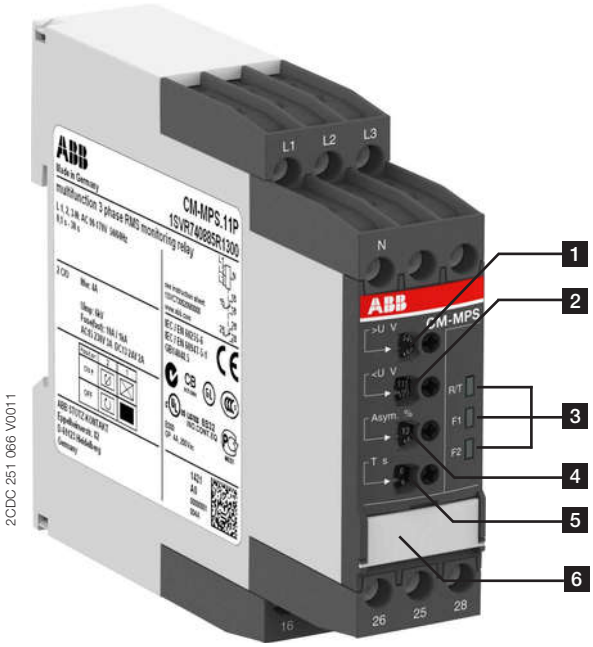
### Double-chamber cage connection terminals

- Terminal spaces for different wire sizes:
  fine-strand with/without wire end ferrule:
  1 x 0.5-2.5 mm² (2 x 20 - 14 AWG),
  2 x 0.5-1.5 mm² (2 x 20 - 16 AWG)
  rigid:
  1 x 0.5-4 mm² (1 x 20 - 12 AWG),
  2 x 0.5-2.5 mm² (2 x 20 - 14 AWG)
- One screw for opening and closing of both cages
- Pozidrive screws for pan- or crosshead screwdrivers according to DIN ISO 2380-1 Form A 0.8 x 4 mm (0.0315 x 0.157 in), DIN ISO 8764-1 PZ1 ø 4.5 mm (0.177 in)

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

## Functions

### Operating controls




2CDC 251 066 V0011

**1** **Adjustment of the hysteresis >U for overvoltage**

**2** **Adjustment of the threshold value <U for undervoltage**

**3** **Indication of operational states**

R/T: red LED – Relay status / timing

F1: yellow LED – Fault message

F2: yellow 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)**

### Application

The three-phase monitoring relays CM-MPS.x1 are designed for use in three-phase mains for monitoring the phase parameters phase sequence, phase failure, over- and undervoltage as well as phase unbalance. The CM-MPS.11 and CM-MPS.21 also monitor the neutral for interruption and are suitable for monitoring single-phase mains.

The CM-MPS.x1 provide an adjustable tripping delay and work and according to the closed-circuit principle.

### Operating mode

The CM-MPS.x1 have 2 c/o (SPDT) contacts and are available for 3-wire AC systems (CM-MPS.31, CM-MPS.41) and 4-wire AC systems (CM-MPS.11, CM-MPS.21).

The units are adjusted with front-face operating controls. The selection of ON- ⊠ or OFF- ■ delay and phase sequence monitoring activated ⟲ or phase sequence monitoring deactivated ∅ is made with DIP switches. Potentiometers, with direct reading scale, allow the adjustment of the threshold values for overvoltage (>U), undervoltage (<U), phase unbalance (Asym %) and the tripping delay $T_v$. The tripping delay $T_v$ is adjustable over a range of instantaneous to a 30 s delay. Timing is displayed by a flashing yellow LED labelled R/T.

For monitoring single-phase mains, all three external conductors (L1, L2, L3) have to be jumpered and connected as one single conductor. Phase sequence monitoring has to be deactivated and the threshold value for phase unbalance has to be set to the maximum (25 %).

## Adjustment potentiometer

### Threshold values

By means of three separate potentiometers with direct reading scales, the threshold values for over- and undervoltage as well as for phase unbalance can be adjusted within the measuring range.

| | Measuring range for overvoltage | Measuring range for undervoltage | Measuring range for phase unbalance |
|---|---|---|---|
| **CM-MPS.11** | 3 x 120-170 V AC | 3 x 90-130 V AC | 2-25 % of average of phase voltages |
| **CM-MPS.21** | 3 x 240-280 V AC | 3 x 180-220 V AC | |
| **CM-MPS.31** | 3 x 220-300 V AC | 3 x 160-230 V AC | |
| **CM-MPS.41** | 3 x 420-500 V AC | 3 x 300-380 V AC | |

### Tripping delay $T_v$

The tripping delay $T_v$ can be adjusted within a range of 0.1 to 30 s by means of a potentiometer with logarithmic scale. By turning to the left stop, the tripping delay can be switched off.

## Indication of operational states

### LEDs, status information and fault messages

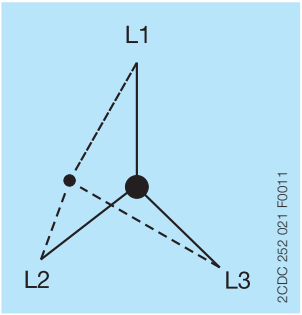
| Operational state | R/T: LED yellow | F1: LED red | F2: LED red |
|---|---|---|---|
| Control supply voltage applied, output relay energized | ⎍ | - | - |
| Tripping delay $T_v$ active | ⎍⎍ | - | - |
| Phase failure | - | ⎍ | ⎍⎍ |
| Phase sequence | - | ⎍⎍ alternating | |
| Overvoltage | - | ⎍ | - |
| Undervoltage | - | - | ⎍ |
| Phase unbalance | - | ⎍ | ⎍ |
| Interruption of the neutral | - | ⎍ | ⎍⎍ |
| Adjustment error [1] | ⎍⎍ | ⎍⎍ | ⎍⎍ |

[1] Overlapping of the threshold values: The threshold value for overvoltage is set to a smaller value than the threshold value for undervoltage.

## Function descriptions / diagrams

### Interrupted neutral monitoring

The interruption of the neutral in the main to be monitored is detected by means of phase unbalance evaluation. If the star point is displaced by asymmetrical load in the three-phase main, an interrupted neutral will be detected. 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.



## Phase sequence and phase failure 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, the output relays energize and the yellow LED R/T is on.

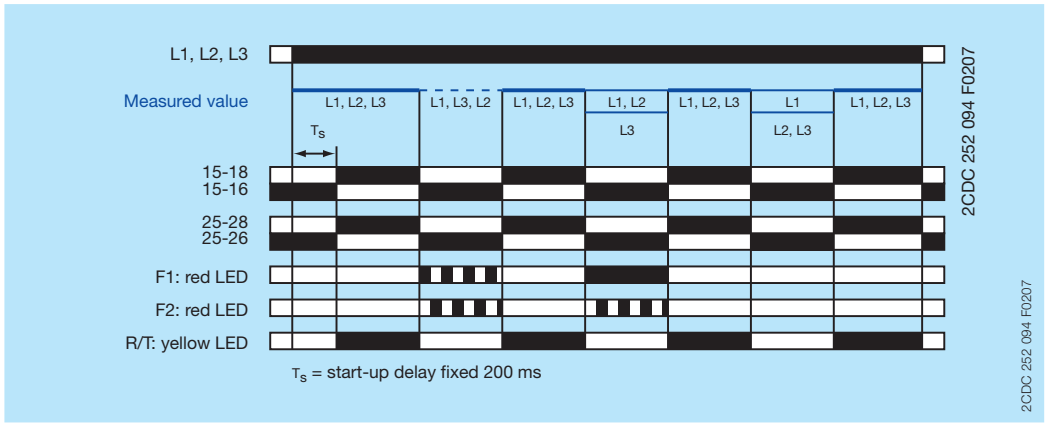
*Phase sequence monitoring:*

If phase sequence monitoring is activated (DIP switch 2 = OFF), 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.

If phase sequence monitoring is deactivated (DIP switch 2 = ON), a phase sequence error will not cause tripping of the relays. The output relays do not change state and the LEDs F1 and F2 don‘t flash.

*Phase failure monitoring:*

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



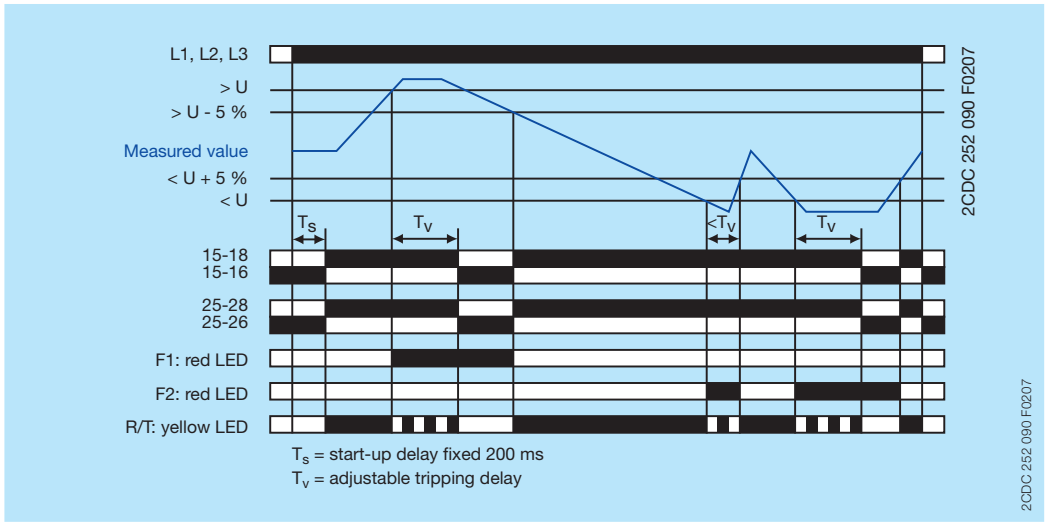
## Over- and undervoltage monitoring

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 is on.

*Type of tripping delay = ON-delay* ⊠

If the voltage to be monitored exceeds or falls below the set 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.

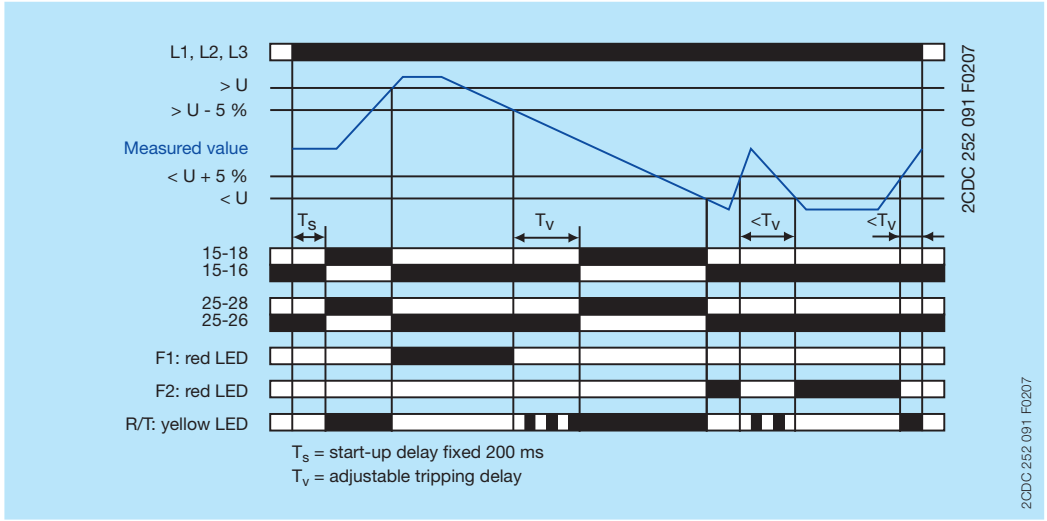
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %. The LED R/T is on.




*Type of tripping delay = OFF-delay* ■

If the voltage to be monitored exceeds or falls below the set 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.



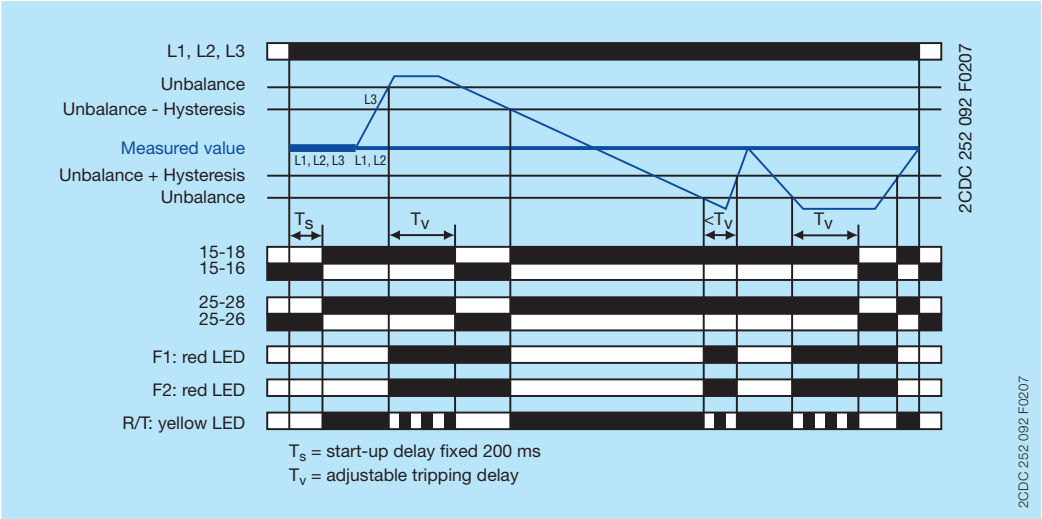
## Phase unbalance monitoring

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 is on.

*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.

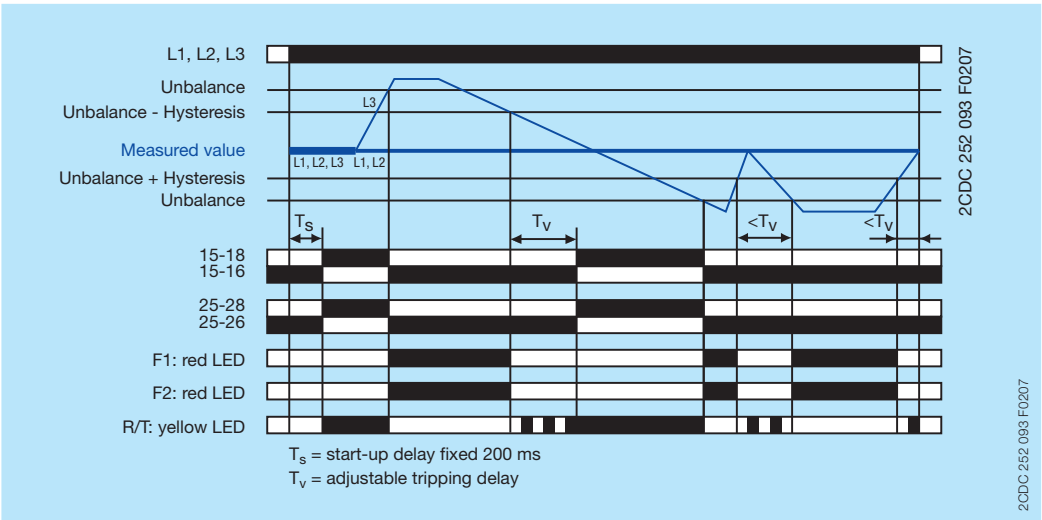
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 20 %. The LED R/T is on.



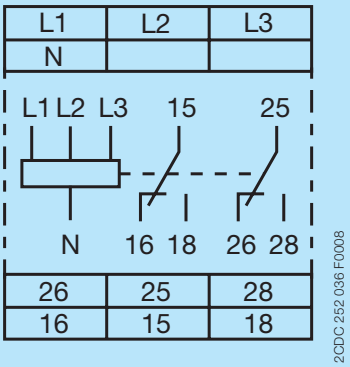

*Type of tripping delay = OFF-delay* ■

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.



## Electrical connection

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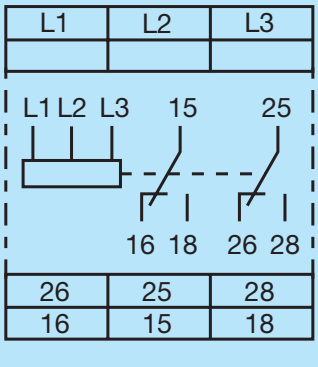
Connection diagram
CM-MPS.11 and CM-MPS.21

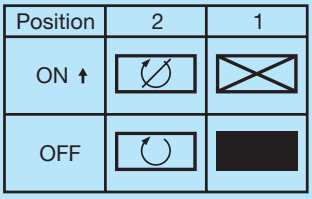



2CDC 252 037 F0008

Connection diagram
CM-MPS.31 and CM-MPS.41

| | |
|---|---|
| L1, L2, L3, (N) | Control supply voltage = measuring voltage |
| 15-16/18 | Output contacts - closed-circuit principle |
| 25-26/28 | |

## DIP switches




2CDC 252 040 F0008

| | | | |
|---|---|---|---|
| **1 Timing function** | ON | ON-delayed | In case of a fault, the de-energizing of the output relays and the respective fault message are suppressed for the adjusted tripping delay $T_v$. |
| | OFF | OFF-delayed | In case of a fault, the output relays de-energize instantaneously and a fault message is displayed and stored for the duration of the adjusted tripping delay $T_v$. Thereby, also momentary undervoltage conditions are recognized. |
| **2 Phase sequence monitoring** | ON | deactivated | Phase sequence errors will not cause tripping of the relays. |
| | OFF | activated | The output relays de-energize as soon as a phase sequence error occurs. The output relays re-energize automatically as soon as the phase sequence is correct again. |

## Technical data

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

### Input circuit

| Type | | CM-MPS.11 | CM-MPS.21 | CM-MPS.31 | CM-MPS.41 |
|---|---|---|---|---|---|
| **Supply circuit = measuring circuit** | | **L1, L2, L3, N** | | **L1, L2, L3** | |
| Rated control supply voltage $U_s$ = measuring voltage | | 3 x 90-170 V AC | 3 x 180-280 V AC | 3 x 160-300 V AC | 3 x 300-500 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 (115 V AC) | 25 mA / 18 VA (230 V AC) | 25 mA / 10 VA (230 V AC) | 25 mA / 18 VA (400 V AC) |

| Measuring circuit | | L1, L2, L3, N | | L1, L2, L3 | |
|---|---|---|---|---|---|
| Monitoring functions | Phase failure | ■ | ■ | ■ | ■ |
| | Phase sequence | can be switched off | can be switched off | can be switched off | can be switched off |
| | Automatic phase sequence correction | - | - | - | - |
| | Over-/undervoltage | ■ | ■ | ■ | ■ |
| | Phase unbalance | ■ | ■ | ■ | ■ |
| | Interrupted neutral | ■ | ■ | - | - |
| Measuring range | Overvoltage | 3 x 120-170 V AC | 3 x 240-280 V AC | 3 x 220-300 V AC | 3 x 420-500 V AC |
| | Undervoltage | 3 x 90-130 V AC | 3 x 180-220 V AC | 3 x 160-230 V AC | 3 x 300-380 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 | | | |
| Hysteresis related to the threshold value | Over-/undervoltage | fixed 5 % | | | |
| | Phase unbalance | fixed 20 % | | | |
| Rated frequency of the measuring signal | | 50/60 Hz | | | |
| Frequency range of the measuring signal | | 45-65 Hz | | | |
| Maximum measuring cycle time | | 100 ms | | | |
| Accuracy within the rated control supply voltage tolerance | | $\Delta U \leq 0.5$ % | | | |
| Accuracy within the temperature range | | $\Delta U \leq 0.06$ % / °C | | | |
| Measuring method | | True RMS | | | |

| Timing circuit | | |
|---|---|---|
| Start-up delay $T_s$ | | fixed 200 ms |
| Tripping delay $T_v$ | | ON- or OFF-delay<br>0 s; 0.1-30 s adjustable |
| Repeat accuracy (constant parameters) | | < ±0.2 % |
| Accuracy within the rated control supply voltage tolerance | | $\Delta t \leq 0.5$ % |
| Accuracy within the temperature range | | $\Delta t \leq 0.06$ % / °C |

### User interface

| Indication of operational states | | |
|---|---|---|
| Relay status / timing | R/T | yellow LED |
| Fault message | F1 | red LED |
| Fault message | F2 | red LED |

Details see table ‚LEDs, status information and fault messages' on page 5 and ‚Function descriptions / diagrams' on page 5.

## Output circuits

| | | |
|---|---|---|
| Kind of output | 15-16/18 | relay, 1st c/o (SPDT) contact |
| | 25-26/28 | relay, 2nd c/o (SPDT) contact |
| | | 1 x 2 (SPDT) contacts |
| Operating principle | | closed-circuit principle [1] |
| Contact material | | AgNi alloy, Cd free |
| Rated operational voltage $U_e$ (IEC/EN 60947-1) | | 250 V |
| Minimum switching voltage / Minimum switching current | | 24 V / 10 mA |
| Maximum switching voltage / Maximum switching current | | see load limit curves |
| Rated operational current $I_e$ (IEC/EN 60947-5-1) | AC12 (resistive) at 230 V | 4 A |
| | AC15 (inductive) at 230 V | 3 A |
| | DC12 (resistive) at 24 V | 4 A |
| | DC13 (inductive) at 24 V | 2 A |
| AC rating (UL 508) | Utilization category (Control Circuit Rating Code) | B 300 |
| | 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 $10^6$ switching cycles |
| Electrical lifetime | AC12, 230 V, 4 A | 0.1 x $10^6$ switching cycles |
| Maximum fuse rating to achieve short-circuit protection | n/c contact | 6 A fast-acting |
| | n/o contact | 10 A fast-acting |

## General data

| | | | | | | |
|---|---|---|---|---|---|---|
| MTBF | | | on request | | | |
| Duty time | | | 100 % | | | |
| Dimensions (W x H x D) | product dimensions | | 22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in) | | | |
| | packaging dimensions | | 97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in) | | | |
| Weight | | | **Screw connection technology** | | **Easy Connect Technology (push-in)** | |
| | net weight | CM-MPS.11 | 0.148 kg (0.326 lb) | | 0.137 kg (0.302 lb) | |
| | | CM-MPS.21 | 0.146 kg (0.322 lb) | | 0.135 kg (0.298 lb) | |
| | | CM-MPS.31 | 0.142 kg (0.313 lb) | | 0.133 kg (0.293 lb) | |
| | | CM-MPS.41 | 0.140 kg (0.309 lb) | | 0.132 kg 0.291 lb) | |
| | gross weight | CM-MPS.11 | 0.173 kg (0.381 lb) | | 0.162 kg (0.357 lb) | |
| | | CM-MPS.21 | 0.171 kg (0.377 lb) | | 0.160 kg (0.353 lb) | |
| | | CM-MPS.31 | 0.167 kg (0.368 lb) | | 0.158 kg (0.348 lb) | |
| | | CM-MPS.41 | 0.165 kg (0.364 lb) | | 0.157 kg (0.346 lb) | |
| Mounting | | | DIN rail (IEC/EN 60715), snap-on mounting without any tool | | | |
| Mounting position | | | any | | | |
| Minimum distance to other units | | | **CM-MPS.11** | **CM-MPS.21** | **CM-MPS.31** | **CM-MPS.41** |
| | | horizontal | 10 mm (0.39 in) in case of continuous voltage of … | | | |
| | | | > 120 V | > 240 V | > 220 V | > 400 V |
| Material of housing | | | UL 94 V-0 | | | |
| Degree of protection | | housing | IP50 | | | |
| | | terminals | IP20 | | | |

[1] Closed-circuit principle: Output relay(s) de-energize(s) if measured value exceeds or falls below the adjusted threshold value.

## Electrical connection

| | | Screw connection technology | Easy Connect Technology (push-in) |
|---|---|---|---|
| Wire size | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm²<br>(1 x 20-14 AWG)<br>2 x 0.5-1.5 mm²<br>(2 x 20-16 AWG) | 2 x 0.5-1.5 mm²<br>(2 x 20-16 AWG) |
| | rigid | 1 x 0.5-4 mm²<br>(1 x 20-12 AWG)<br>2 x 0.5-2.5 mm²<br>(2 x 20-14 AWG) | 2 x 0.5-1.5 mm²<br>(2 x 20-16 AWG) |
| Stripping length | | 8 mm (0.32 in) | |
| Tightening torque | | 0.6 - 0.8 Nm<br>(5.31 - 7.08 lb.in) | - |

## Environmental data

| | | |
|---|---|---|
| Ambient temperature ranges | operation | -25...+60 °C |
| | storage | -40...+85 °C |
| Damp heat, cyclic (IEC/EN 60068-2-30) | | 55 °C, 6 cycles |
| Climatic category | | 3K3 |
| Vibration, sinusoidal (IEC/EN 60255-21-1) | | Class 2 |
| Shock (IEC/EN 60255-21-2) | | Class 2 |

## Isolation data

| Type | | CM-MPS.11 | CM-MPS.21 | CM-MPS.31 | CM-MPS.41 |
|---|---|---|---|---|---|
| Rated insulation voltage $U_i$ | input circuit / output circuit | 600 V | | | |
| | output circuit 1 / output circuit 2 | 300 V | | | |
| Rated impulse withstand voltage $U_{imp}$ (IEC/EN 60664) | input circuit | 6 kV, 1.2/50 µs | | | |
| | output circuit | 4 kV, 1.2/50 µs | | | |
| Test voltage between all isolated circuits (routine test) | | 2.5 kV, 50 Hz, 1 s | | | |
| Basic insulation | input circuit / output circuit | 600 V | | | |
| Protective separation (IEC/EN 61140, EN 50178) | input circuit / output circuit | yes | | - | |
| Pollution degree (IEC/EN 60664, IEC/EN 60255-5) | | 3 | | | |
| Overvoltage category (IEC/EN 60664, IEC/EN 60255-5) | | III | | | |

## Standards

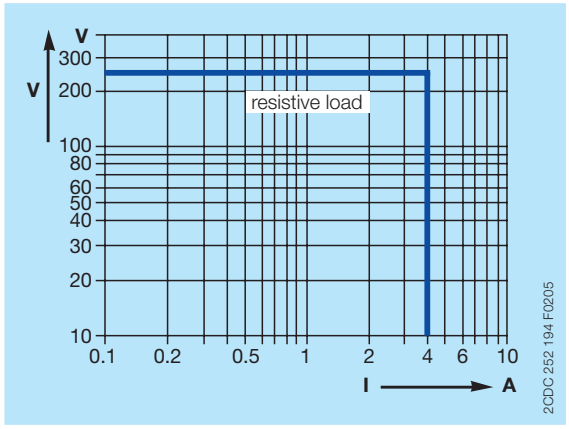
| | |
|---|---|
| Product standard | IEC/EN 60255-6, EN 50178 |
| Low Voltage Directive | 2006/95/EC |
| EMC directive | 2004/108/EC |
| RoHS directive | 2002/95/EC |

## Electromagnetic compatibility

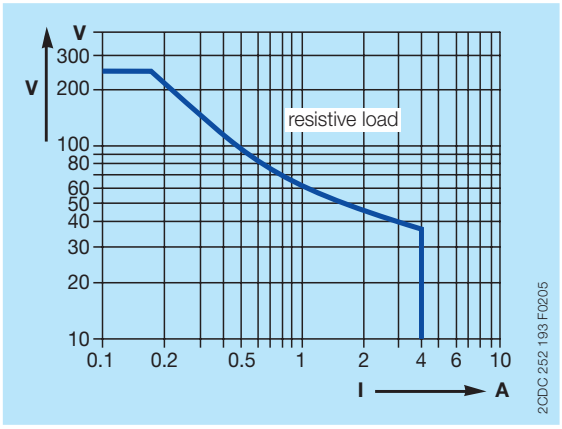
| Type | | CM-MPS.11 | CM-MPS.21 | CM-MPS.31 | CM-MPS.41 |
|---|---|---|---|---|---|
| Interference immunity to | | IEC/EN 61000-6-1, IEC/EN 61000-6-2 | | | |
| electrostatic discharge | IEC/EN 61000-4-2 | Level 3 (6 kV / 8 kV) | | | |
| radiated, radio-frequency, electromagnetic field | IEC/EN 61000-4-3 | 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, IEC/EN 61000-6-4 | | | |
| high-frequency radiated | IEC/CISPR 22, EN 55022 | Class B | | | |
| high-frequency conducted | IEC/CISPR 22, EN 55022 | Class B | | | |

## Technical diagrams

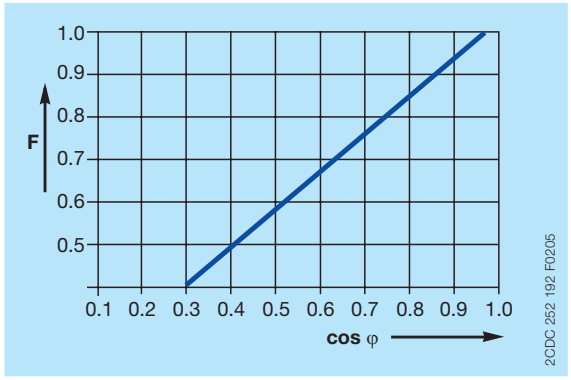
### Load limit curves



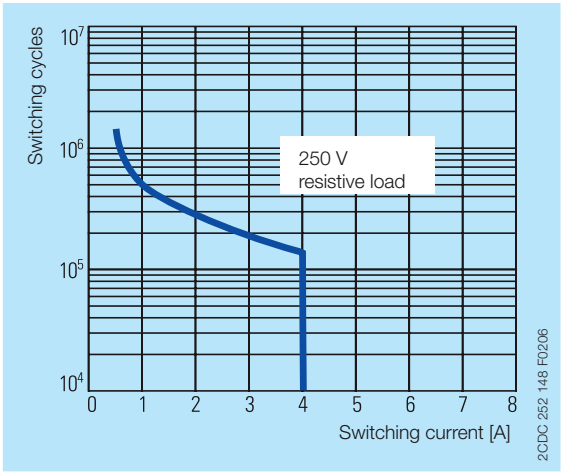

**AC load (resistive)**




**DC load (resistive)**



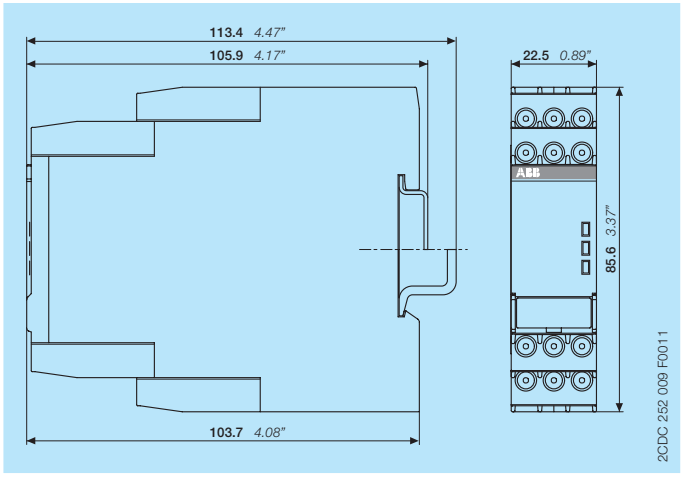

**Derating factor F for inductive AC load**




**Contact lifetime**

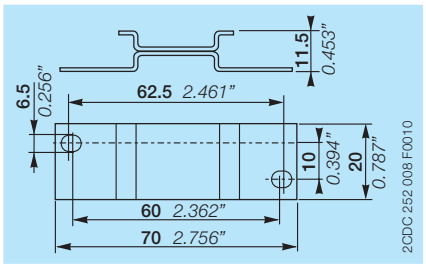
## Dimensions

in **mm** and *inches*

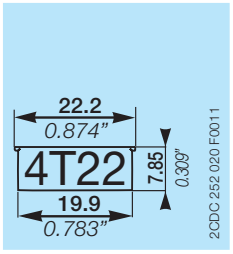



## Accessories

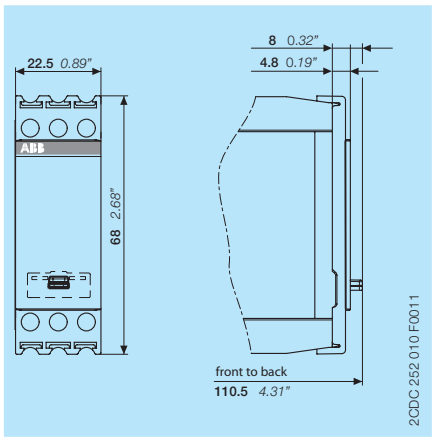
in **mm** and *inches*




**ADP.01 - Adapter for screw mounting**




**MAR.12 - Marker label for devices with DIP switches**




**COV.11 - Sealable transparent cover**

## Further documentation

| Document title | Document type | Document number |
|---|---|---|
| Electronic products and relays | Technical catalogue | 2CDC 110 004 C02xx |
| CM-MPS.11, CM-MPS.21, CM-MPS.31, CM-MPS.41 | Instruction manual | 1SVC 730 520 M0000 |

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

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