

# Three-phase monitoring relay CM-PFS

The CM-PFS is a three-phase monitoring relay that is used to monitor three phase mains for incorrect phase sequence and phase failure. 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 and failure
- Powered by the measuring circuit
- Closed-circuit principle
- 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
- 2 LEDs for the indication of operational states

## Approvals

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

## Marks

- CE CE
- C-Tick

## Order data

### Three-phase monitoring relay

| Type     | Rated control supply voltage = measuring voltage | Connection technology | Order code         |
|----------|--|-----------------------|--------------------|
| CM-PFS.P | 3 x 200-500 V AC                                 | Push-in terminals     | 1SVR 740 824 R9300 |
| CM-PFS.S | 3 x 200-500 V AC                                 | Screw type terminals  | 1SVR 730 824 R9300 |

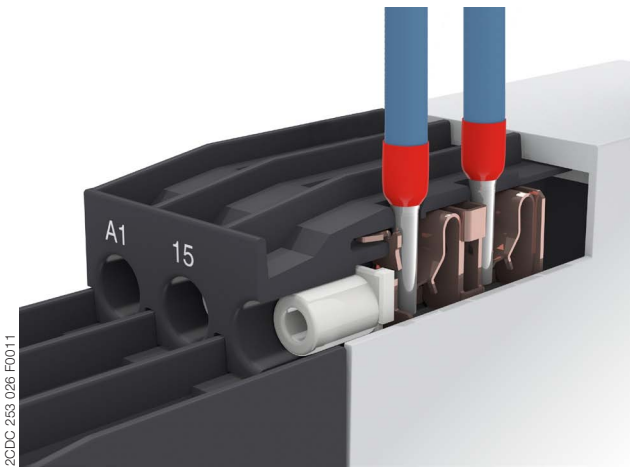
## Accessories

| Type   | Description                | Order code         |
|--------|----------------------------|--------------------|
| ADP.01 | Adapter for screw mounting | 1SVR 430 029 R0100 |
| MAR.01 | Marker label               | 1SVR 366 017 R0100 |
| COV.11 | Sealable transparent cover | 1SVR 730 005 R0100 |

## Connection technology

Maintenance free Easy Connect Technology with push-in terminals

Type designation CM-xxS.yyP

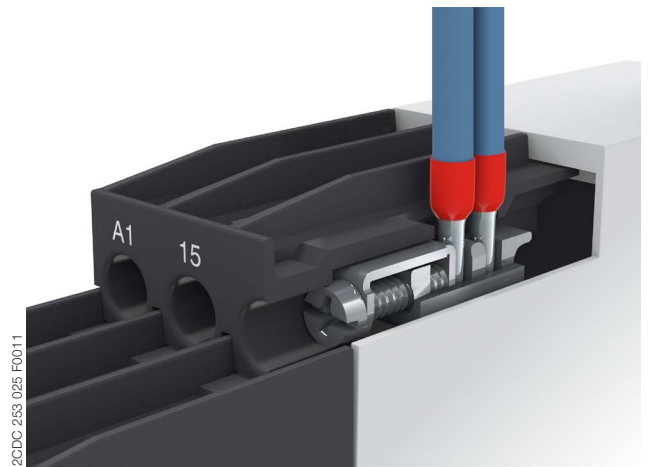


### Push-in terminals

- Tool-free connection of rigid and flexible wires with wire end ferrule according to DIN 46228-1-A, DIN 46228-4-E  
Wire size:  $2 \times 0.5\text{-}1.5 \text{ mm}^2$ , (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  $\varnothing$  4.5 mm (0.177 in))
- Constant spring force on terminal point independent of the applied wire type, wire size or ambient conditions (e. g. vibrations or temperature changes)
- Opening for testing the electrical contacting
- Gas-tight

Approved screw connection technology with double-chamber cage connection terminals

Type designation CM-xxS.yyS



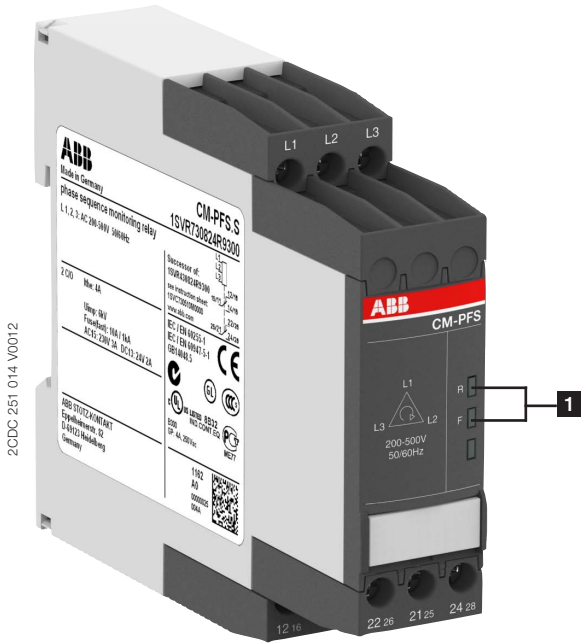
### Double-chamber cage connection terminals

- Terminal spaces for different wire sizes:  
fine-strand with/without wire end ferrule:  
 $1 \times 0.5\text{-}2.5 \text{ mm}^2$  (2 x 20 - 14 AWG),  
 $2 \times 0.5\text{-}1.5 \text{ mm}^2$  (2 x 20 - 16 AWG)  
rigid:  
 $1 \times 0.5\text{-}4 \text{ mm}^2$  (1 x 20 - 12 AWG),  
 $2 \times 0.5\text{-}2.5 \text{ mm}^2$  (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  $\varnothing$  4.5 mm (0.177 in)

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

## Functions

### Operating controls



#### 1 Indication of operational states

R: yellow LED – status indication of the output relays

F: red LED – fault message

### Application

The CM-PFS is used to monitor three-phase mains for incorrect phase sequence and phase failure.

### Operating mode

The three-phase main to be monitored is connected to terminals L1, L2, L3 in accordance to the wiring diagram.

The device operates according to the closed-circuit principle  – incorrect phase sequence or phase failure: relays de-energize.

The signalling of status indication is made by means of the front-face LEDs.

### Function diagram

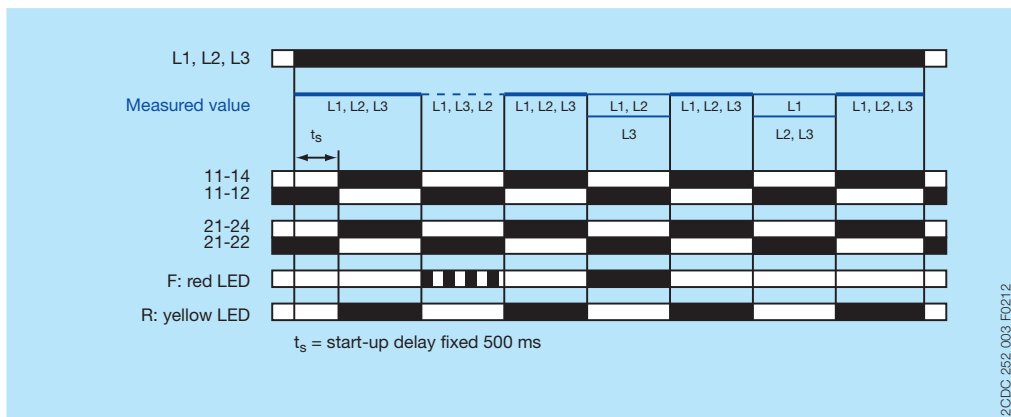
#### Phase sequence and phase failure monitoring

If all phases are present with the correct phase sequence, the output relays energize after the start-up delay  $t_s$  is complete.

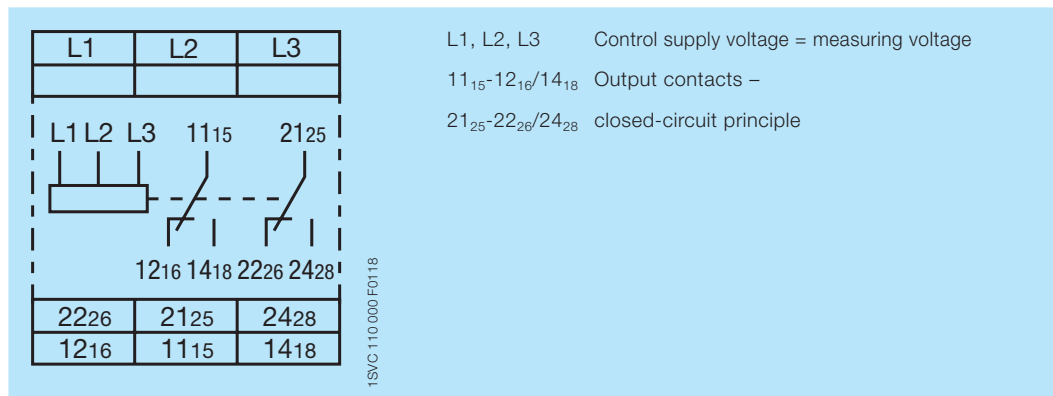
If a phase failure or a phase sequence error occurs, the output relays de-energize instantaneously.

The LED R is on when output relays are 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.



## Electrical connection



Connection diagram

## Technical data

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

### Input circuits

| Supply circuit = measuring circuit                     |          | L1, L2, L3       |
|--|----------|------------------|
| Rated control supply voltage $U_s$ = measuring voltage |          | 3 x 200-500 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                    | 400 V AC | 16 mA / 11 VA    |

| Measuring circuit                         |           | L1, L2, L3                      |
|---|-----------|---------------------------------|
| Monitoring functions                      |           | phase failure<br>phase sequence |
| Measuring range                           |           | 3 x 200-500 V AC                |
| Threshold value for phase failure         | $U_{min}$ | $0.6 \times U_n$                |
| Hysteresis related to the threshold value |           | -                               |
| Rated frequency of the measuring signal   |           | 50/60 Hz                        |
| Frequency range of the measuring signal   |           | 45-65 Hz                        |
| Response time                             |           | 500 ms                          |
| Measuring principle                       |           | True RMS                        |

| Timing circuit       |              |
|----------------------|--------------|
| Start-up delay $t_s$ | fixed 500 ms |

### User interface

| Indication of operational states |               |                        |
|----------------------------------|---------------|------------------------|
| Relay status R1, R2              | R: yellow LED | Output relay energized |
| Fault message                    | F: red LED    | Phase failure          |
|                                  |               | Phase sequence error   |

## Output circuits

|  |  |  |
|--|--|--|
| Kind of output   | 11(15)-12(16)/14(18)                         | relay, 1st c/o (SPDT) contact              |
|  | 21(25)-22(26)/24(28)                         | relay, 2nd c/o (SPDT) contact              |
|  |  | 1 x 2 c/o (SPDT) contacts                  |
| Operating principle  |  | closed-circuit principle <sup>1)</sup>     |
| Contact material   |  | AgNi alloy, Cd free                        |
| Rated operational voltage (IEC 60947-1)                          |  | 250 V AC                                   |
| Minimum switching voltage / Minimum switching current            |  | 24 V / 10 mA                               |
| Maximum switching voltage / Maximum switching current            |  | ,Load limit curves' on page 7              |
| Rated operational current I <sub>e</sub><br>(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<br>(UL 508)  | utilization category                         | B 300, pilot duty                          |
|  | (Control Circuit Rating Code)                | 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  | AC12, 230 V, 4 A                             | 0.1 x 10 <sup>6</sup> switching cycles     |
| Maximum fuse rating to achieve<br>short-circuit protection       | n/c contact                                  | 6 A fast-acting                            |
|  | n/o contact                                  | 10 A fast-acting                           |
| Conventional thermal current I <sub>th</sub> acc. IEC/EN 60947-1 |  | 4 A  |

<sup>1)</sup> Closed-circuit principle: output relays de-energize if the measured value exceeds/drops below the threshold.

## 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                          |                      | <b>Screw connection technology</b>                                   |
|                                 |                      | <b>Easy Connect Technology (push-in)</b>                             |
|                                 | net weight           | 0.128 kg (0.282 lb)  |
|                                 | gross weight         | 0.156 kg (0.344 lb)  |
| 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 the control supply voltage is higher than 440 V |
| Degree of protection            | housing / terminal   | IP50 / IP20  |

## Electrical connection

|                   |  | <b>Screw connection technology</b>   | <b>Easy Connect Technology (push-in)</b>       |
|-------------------|--|--|--|
| Wire size         | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm <sup>2</sup><br>(1 x 20-14 AWG)<br>2 x 0.5-1.5 mm <sup>2</sup><br>(2 x 20-16 AWG) | 2 x 0.5-1.5 mm <sup>2</sup><br>(2 x 20-16 AWG) |
|                   | rigid                                  | 1 x 0.5-4 mm <sup>2</sup><br>(1 x 20-12 AWG)<br>2 x 0.5-2.5 mm <sup>2</sup><br>(2 x 20-14 AWG)   | 2 x 0.5-1.5 mm <sup>2</sup><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                   |
|                            | transport         | -40...+85 °C                   |
| Climatic category          | IEC/EN 60721-3-3  | 3K3                            |
| 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                      | IEC/EN 60255-21-2 | Class 2                        |

## Isolation data

|   |                                     |                    |
|---|-------------------------------------|--------------------|
| Rated impulse withstand voltage $U_{imp}$<br>(IEC/EN 60947-1, IEC/EN 60664-1) | supply circuit / output circuit     | 6 kV               |
|   | output circuit 1 / output circuit 2 | 4 kV               |
| Pollution degree (IEC/EN 60664-1)   |                                     | 3                  |
| Overvoltage category (IEC/EN 60664-1)   |                                     | III                |
| Rated insulation voltage $U_i$<br>(IEC/EN 60947-1, IEC/EN 60664-1)            | supply circuit / output circuit     | 600 V              |
|   | output circuit 1 / output circuit 2 | 300 V              |
| Basic insulation for rated control supply voltage<br>(IEC/EN 60664-1)         | supply circuit / output circuit     | 600 V AC           |
| Protective separation<br>(IEC/EN 61140, EN 50178)                             | supply circuit / output circuit     | n/a                |
| Test voltage (routine test)   | supply circuit / output circuit     | 2.5 kV, 50 Hz, 1 s |
|   | output circuit 1 / output circuit 2 | 2.5 kV, 50 Hz, 1 s |

## Standards

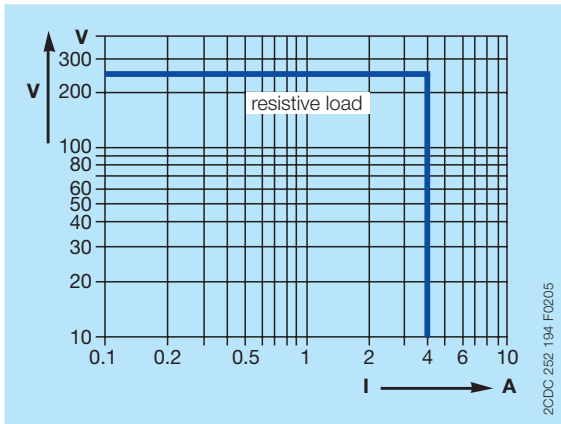
|                       |                        |
|-----------------------|------------------------|
| Product standard      | IEC/EN 60255-1:2010    |
| Other standards       | EN 50178, IEC/EN 60204 |
| Low Voltage Directive | 2006/95/EC             |
| EMC directive         | 2004/108/EC            |
| RoHS Directive        | 2002/95/EC             |

## Electromagnetic compatibility

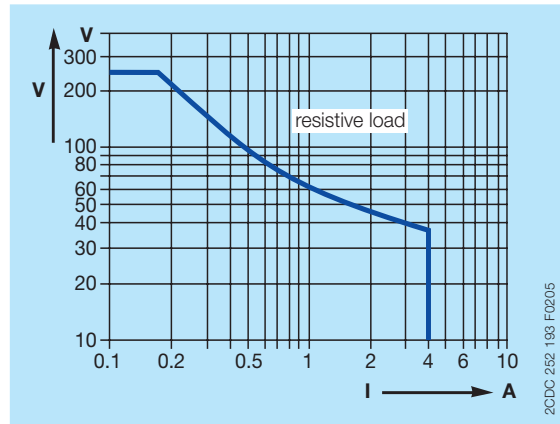
|   |                        |   |
|---|------------------------|---|
| Interference immunity to                                  |                        | IEC/EN 61000-6-1, IEC/EN 61000-6-2                        |
| electrostatic discharge                                   | IEC/EN 61000-4-2       | 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, 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   |
| Interference emission                                     |                        | EN 61000-6-3, 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

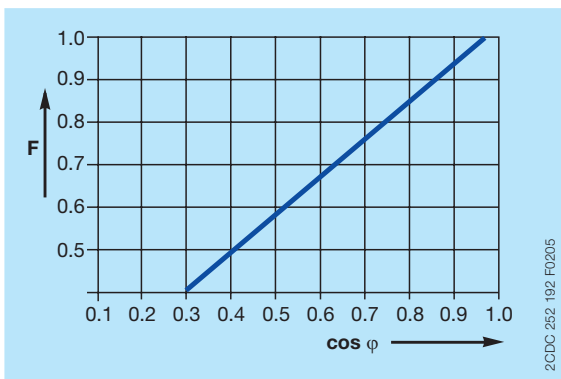
### Load limit curves



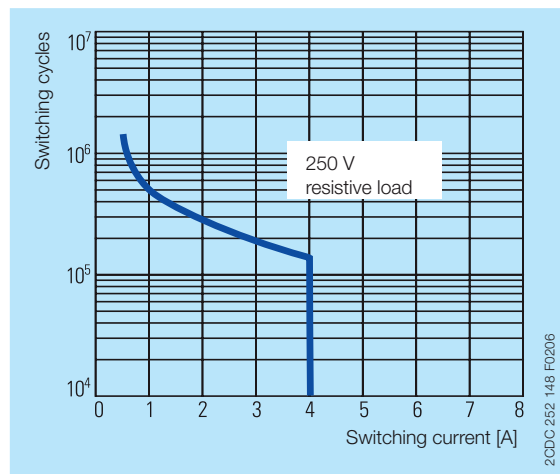
AC load (resistive)



DC load (resistive)



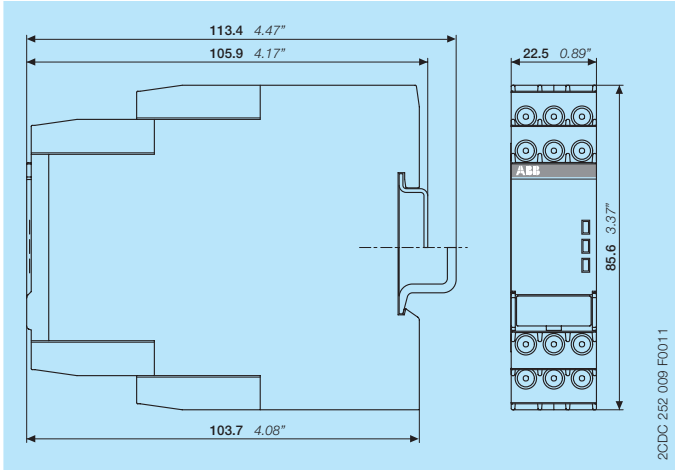
Derating factor F for inductive AC load



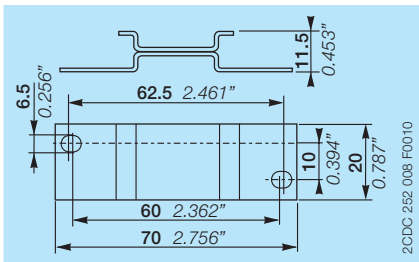
Contact lifetime

## Dimensions

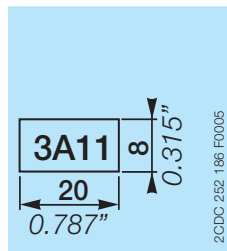
in **mm** and *inches*



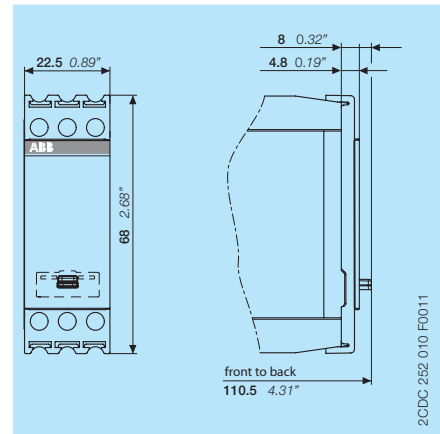
## Accessories



ADP.01 - Adapter for screw mounting



MAR.01 - Marker label



COV.11 - Sealable transparent cover

## Further documentation

| Document title                 | Document type      | Document number    |
|--------------------------------|--------------------|--------------------|
| Electronic Products and Relays | Catalog            | 2CDC 110 004 C02xx |
| CM-PAS, CM-PFS, CM-PSS, CM-PVS | Instruction manual | 1SVC 630 510 M0000 |

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



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