# Three-phase monitoring relays
## Product group picture

# Three-phase monitoring relays
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# Three-phase monitoring relays
## Benefits and advantages, Applications

### Characteristics of the CM range three-phase monitors

- Adjustable phase unbalance threshold value [1)]
- Adjustable ON-delay/OFF-delay time [1)]
- Dual frequency measuring 50/60 Hz
- Powered by the measuring circuit
- 1 n/o contact, 1 or 2 contacts
- LED status indication
- Approvals:
- Marks:
- Multifunctional and single-functional devices
- Phase loss monitoring
- Phase sequence monitoring [1)]
- Over- and undervoltage monitoring (fixed or adjustable)[1)]
- Wide-range operating voltage guarantees world-wide operation

[1)] depending on device type

### Expanded 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.

### 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 stats of the installtion and cause damage or destruction of valuable parts.

### 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 strain. 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 stats 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.

### Structure of the type designation

**CM-_ _ x.yz**

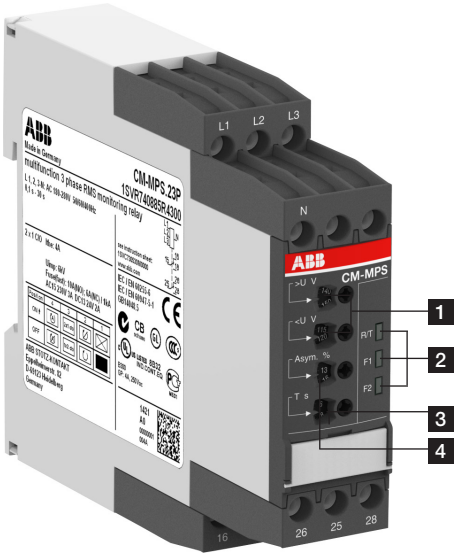
x: width of enclosure

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 oder 2x1 c/o |




1 Threshold value $V_{min}/V_{max}$

2 R/T: yellow LED
Relay status, timing

F1: red LED
fault message

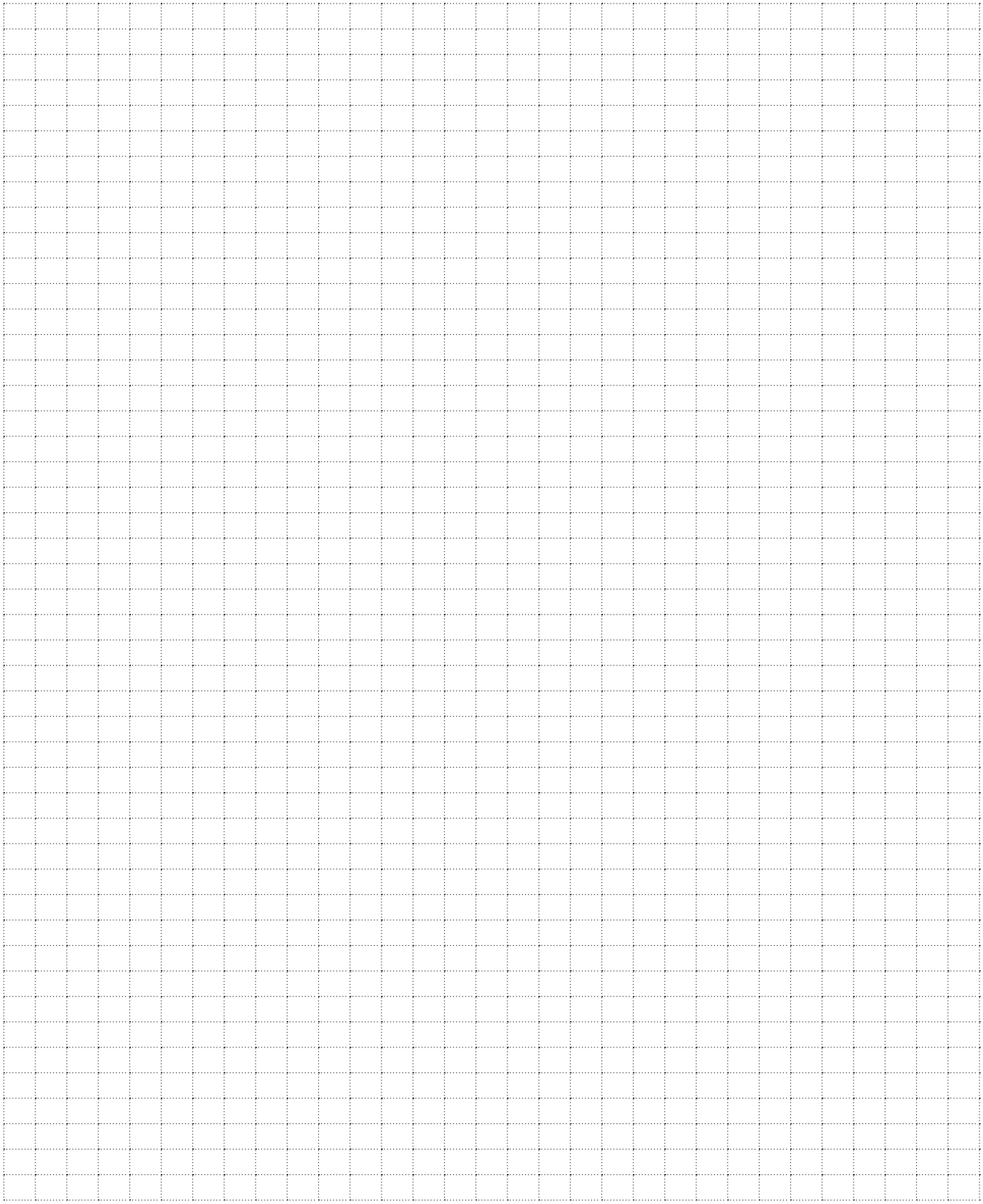
F2: red LED failure:

- overvoltage: F1
- undervoltage: F2
- phase unbalance: F1 and F2 constant
- phase loss: F1 on F2 flashing
- phase sequence: F1 and F2 alternately flashing

3 Adjustment of the tripping delay

4 Time setting 0.1-10 s
Phase sequence and phase loss are indicated without any time delay

# Three-phase monitoring relays
## Notes



# Three-phase monitoring relays
## Selection and conversion

| Three-phase monitoring relays | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | order number | 1SVR 550 881 R9400 | 1SVR 550 882 R9500 | 1SVR 550 870 R9400 | 1SVR 550 871 R9500 | 1SVR 550 824 R9100 | 1SVR 430 824 R9300 | 1SVR 730 784 R2300 | 1SVR 740 784 R2300 | 1SVR 730 784 R3300 | 1SVR 740 784 R3300 | 1SVR 730 794 R1300 | 1SVR 740 794 R1300 | 1SVR 730 794 R3300 | 1SVR 740 794 R3300 | 1SVR 730 794 R2300 | 1SVR 740 794 R2300 | 1SVR 730 774 R1300 | 1SVR 740 774 R1300 | 1SVR 730 774 R3300 | 1SVR 740 774 R3300 | 1SVR 730 885 R1300 | 1SVR 740 885 R1300 | 1SVR 730 885 R3300 | 1SVR 740 885 R3300 |
| **Rated control supply voltage $U_s$** | Type | **CM-PBE** | **CM-PBE** | **CM-PVE** | **CM-PVE** | **CM-PFE** | **CM-PFS** | **CM-PSS.31S** | **CM-PSS.31P** | **CM-PSS.41S** | **CM-PSS.41P** | **CM-PVS.31S** | **CM-PVS.31P** | **CM-PVS.41S** | **CM-PVS.41P** | **CM-PVS.81S** | **CM-PVS.81P** | **CM-PAS.31S** | **CM-PAS.31P** | **CM-PAS.41S** | **CM-PAS.41P** | **CM-MPS.11S** | **CM-MPS.11P** | **CM-MPS.21S** | **CM-MPS.21P** |
| **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 | | | | ■ | ■ | | | | | | | | | | | | | | | | | | | | | |
| 350-580 V AC | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 380 V AC | | | | | | | | ■ | ■ | | | | | | | | | | | | | | | | | |
| 380-440 V AC | | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 400 V AC | | | | | | | | | | ■ | ■ | | | | | | | | | | | | | | | |
| 450-720 V AC | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 530-820 V AC | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Phase to Neutral** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90-170 V AC | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | | | |
| 180-280 V AC | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | |
| 185-265 V AC | | | | ■ | | | | | | | | | | | | | | | | | | | | | | |
| 220-240 V AC | | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| 230 V AC | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Rated frequency** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50/60 Hz | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 50/60/400 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Suitable for monitoring** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Single-phase mains | | ■ | | ■ | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | |
| Three-phase mains | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| **Monitoring function** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Phase failure | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| Phase sequence | | | | | | ■ | ■ | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ■ | ■ | ■ | ■ | ad | ad | ad | ad | |
| Automatic phase sequence correction | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Overvoltage | | | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | ■ | ■ | ■ | ■ | |
| Undervoltage | | | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | ■ | ■ | ■ | ■ | |
| Unbalance | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| Neutral | | ■ | | ■ | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | |
| Overfrequency | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Underfrequency | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Thresholds** | | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | fix | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | |
| **Timing functions for tripping delay** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ON delay | | | | | | | fix | | | | | | | | | | | ad | ad | ad | ad | | | | | |
| On and OFF delay | | fix | fix | fix | fix | fix | | | | | | | | | | | | | | | | | | | | |
| ON or OFF delay | | | | | | | | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | | | | | ad | ad | ad | ad | |
| | Conversion | | | | | | | 1SVR 630 784 R2300 | | 1SVR 630 784 R3300 | | 1SVR 630 794 R1300 | | 1SVR 630 794 R3300 | | 1SVR630794R2300 | | 1SVR 630 774 R1300 | | 1SVR 630 774 R3300 | | 1SVR 630 885 R1300 | | 1SVR 630 885 R3300 | | |
| | | | | | | | | **CM-PSS.31** | | **CM-PSS.41** | | **CM-PVS.31** | | **CM-PVS.41** | | **CM-PVS.81** | | **CM-PAS.31** | | **CM-PAS.41** | | **CM-MPS.11** | | **CM-MPS.21** | | |

# Three-phase monitoring relays
## Selection and conversion

| | CM-MPS.31S | CM-MPS.31P | CM-MPS.41S | CM-MPS.41P | CM-MPS.23S | CM-MPS.23P | CM-MPS.43S | CM-MPS.43P | CM-MPN.52S | CM-MPN.52P | CM-MPN.62S | CM-MPN.62P | CM-MPN.72S | CM-MPN.72P | CM-UFS.2S | CM-UFS.2P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1SVR 730 884 R1300 | 1SVR 740 884 R1300 | 1SVR 730 884 R4300 | 1SVR 740 884 R4300 | 1SVR 730 885 R4300 | 1SVR 740 885 R4300 | 1SVR 730 884 R4300 | 1SVR 740 884 R4300 | 1SVR 750 487 R8300 | 1SVR 760 487 R8300 | 1SVR 750 488 R8300 | 1SVR 760 488 R8300 | 1SVR 750 489 R8300 | 1SVR 760 489 R8300 | 1SVR 730 736 R1300 | 1SVR 740 736 R1300 |
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| | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | fix | fix |
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| | | | | | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | | |
| | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | fix | fix |
| | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | fix | fix |
| | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| | | | | | ■ | ■ | | | | | | | | | | |
| | | | | | | | | | | | | | | | fix | fix |
| | | | | | | | | | | | | | | | fix | fix |
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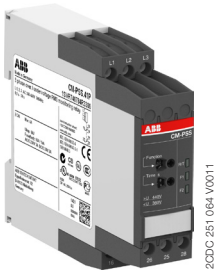
| | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | ad | | |
| | 1SVR 630 884 R1300 | | 1SVR 630 884 R4300 | | 1SVR 630 885 R4300 | | 1SVR 630 884 R4300 | | 1SVR 650 487 R8300 | | 1SVR 650 488 R8300 | | 1SVR 650 489 R8300 | | 1SVR 630 736 R1300 | |
| | CM-MPS.31 | | CM-MPS.41 | | CM-MPS.23 | | CM-MPS.43 | | CM-MPN.52 | | CM-MPN.62 | | CM-MPN.72 | | CM-UFS.2 | |

# Three-phase monitoring relays
## Ordering details

CM-PBE




CM-PSS.41P

CM-PAS.31P

### Description

Only reliable and continuous monitoring of a three-phase network guarantees the trouble-free and economic operation of machines and installations.t

### Ordering details

| Rated control supply voltage = measuring voltage | Monitoring function | Neutral monitoring | Type | Order code | Price 1 pce | Weight (1 pce) kg (lb) |
|---|---|---|---|---|---|---|
| 3x380-440 V AC, 220-240 V AC | Phase failure detection (Single- and three-phase) | yes | CM-PBE [1] | 1SVR550881R9400 | | 0.08 (0.17) |
| 3x380-440 V AC | | no | CM-PBE | 1SVR550882R9500 | | 0.08 (0.17) |
| 3x320-460 V AC, 185-265 V AC | Over- / under-voltage and phase failure detection (Single- and three-phase) | yes | CM-PVE [1] | 1SVR550870R9400 | | 0.08 (0.17) |
| 3x320-460 V AC | | no | CM-PVE | 1SVR550871R9500 | | 0.08 (0.17) |
| 3x208-440 V AC | Phase sequence monitoring and phase failure detection (Three-phase) | | CM-PFE [2] | 1SVR550824R9100 | | 0.08 (0.17) |
| 3x200-500 V AC | | | CM-PFS [2] | 1SVR430824R9300 | | 0.15 (0.33) |
| 3x380 V AC | Over- / under-voltage with fixed threshold values ± 10 % | | CM-PSS.31S | 1SVR730784R2300 | | 0.132 (0.291) |
| | | | CM-PSS.31P | 1SVR740784R2300 | | 0.123 (0.271) |
| 3x400 V AC | | | CM-PSS.41S | 1SVR740784R3300 | | 0.132 (0.291) |
| | | | CM-PSS.41P | 1SVR730784R3300 | | 0.123 (0.271) |
| 3x160-300 V AC | Over- and under-voltage with adjustable threshold values (Three-phase) | | CM-PVS.31S | 1SVR730794R1300 | | 0.141 (0.311) |
| | | | CM-PVS.31P | 1SVR740794R1300 | | 0.132 (0.291) |
| 3x300-500 V AC | | | CM-PVS.41S | 1SVR730794R3300 | | 0.139 (0.306) |
| | | | CM-PVS.41P | 1SVR740794R3300 | | 0.131 (0.289) |
| 3x200-400 V AC | | | CM-PVS.81S | 1SVR730794R2300 | | 0.136 (0.300) |
| | | | CM-PVS.81P | 1SVR740794R2300 | | 0.128 (0.282) |
| 3x160-300 V AC | Phase unbalance (Three-phase) | | CM-PAS.31S | 1SVR730774R1300 | | 0.133 (0.293) |
| | | | CM-PAS.31P | 1SVR740774R1300 | | 0.124 (0.273) |
| 3x300-500 V AC | | | CM-PAS.41S | 1SVR730774R3300 | | 0.132 (0.291) |
| | | | CM-PAS.41P | 1SVR740774R3300 | | 0.123 (0.271) |

NEW

[1] The version with neutral monitoring is also suitable for monitoring single-phase mains. For this, all three external conductors (L1,L2,L3) have to be jumpered and connected as one single conductor.

[2] For applications where a reverse fed voltage >60% is expected, we recommend to use our three-phase monitoring relays for unbalance CM-PAS.xx

# Three-phase monitoring relays
## Ordering details

CM-MPS.23P

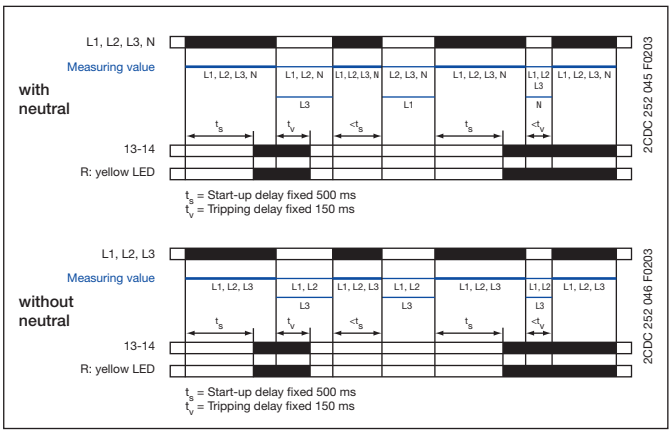
CM-MPN.52P

### Ordering details

| Rated control supply voltage = measuring voltage | Monitoring function | Neutral monitoring | Type | Order code | Price 1 pce | Weight (1 pce) kg (lb) |
|---|---|---|---|---|---|---|
| 90-170 V AC | Multifunctional (Three-phase phase failure detection, Phase sequence monitoring, overvoltage, undervoltage, Phase unbalance) | yes | CM-MPS.11S | 1SVR730885R1300 | | 0.148 (0.326) |
| | | | CM-MPS.11P | 1SVR740885R1300 | | 0.137 (0.302) |
| 180-280 V AC | | | CM-MPS.21S | 1SVR730885R3300 | | 0.146 (0.322) |
| | | | CM-MPS.21P | 1SVR740885R3300 | | 0.135 (0.298) |
| 3x300-500 V AC | | no | 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) |
| 180-280 V AC | Multifunctional (Three-phase phase failure detection, Phase sequence monitoring, overvoltage, undervoltage, Phase unbalance) | yes | CM-MPS.23S | 1SVR730885R4300 | | 0.149 (0.328) |
| | | | CM-MPS.23P | 1SVR740885R4300 | | 0.138 (0.304) |
| 3x300-500 V AC | | no | CM-MPS.43S | 1SVR730884R4300 | | 0.148 (0.327) |
| | | | CM-MPS.43P | 1SVR740884R4300 | | 0.137 (0.302) |
| 3x350-580 V AC | | no | CM-MPN.52S | 1SVR750487R8300 | | 0.230 (0.507) |
| | | | CM-MPN.52P | 1SVR760487R8300 | | 0.226 (0.498) |
| 3x450-720 V AC | | | CM-MPN.62S | 1SVR750488R8300 | | 0.229 (0.505) |
| | | | CM-MPN.62P | 1SVR760488R8300 | | 0.225 (0.496) |
| 3x530-820 V AC | | | CM-MPN.72S | 1SVR750489R8300 | | 0.224 (0.494) |
| | | | CM-MPN.72P | 1SVR760489R8300 | | 0.220 (0.485) |
| 3 x 400 V AC (L-L) / 230 V AC (L-N) | see Three-Phase overview page | yes | CM-UFS.2S | 1SVR730736R1300 | | 0.146 (0.322) |
| | | | CM-UFS.2P | 1SVR740736R1300 | | 0.134 (0.295) |

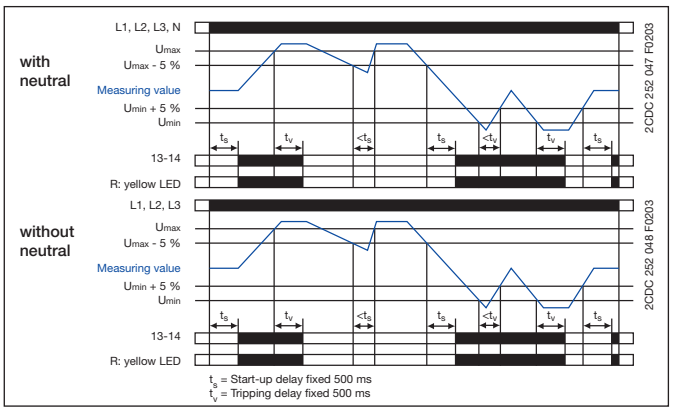
# Three-phase monitoring relays
# Function diagrams

## Function diagrams - Three-phase monitoring CM-PBE



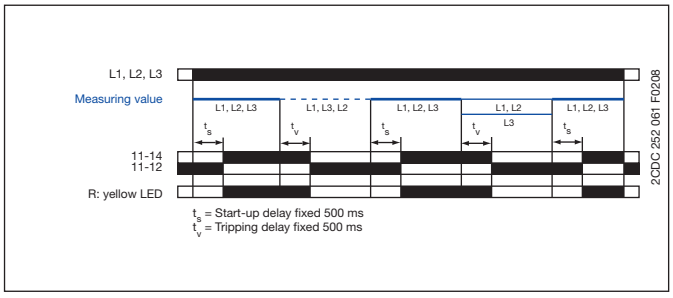

If all phases (and the neutral) are present, the output relay energizes after the start-up delay $t_s$ is complete. If a phase failure occurs, the tripping delay $t_v$ starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of $t_s$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

## Function diagrams - Three-phase monitoring 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.

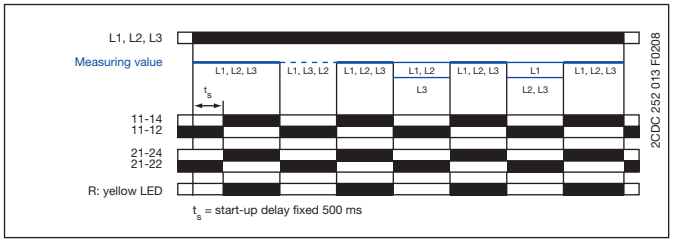
## Function diagram - CM-PFE




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 - 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

### Phase sequence and phase failure monitoring
### CM-PSS.xx, CM-PVS.xx, CM.PAS.xx, CM-MPS.xx, CM-MPN.xx

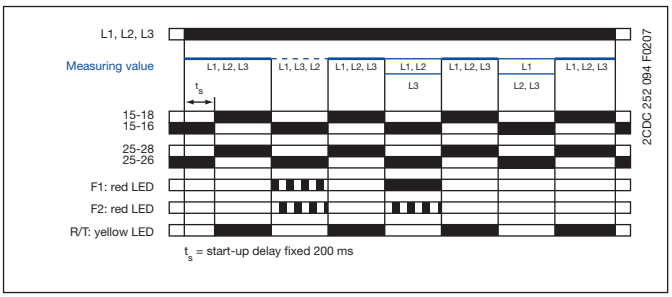
Applying control supply voltage begins the fixed start-up delay $t_S$. When $t_S$ is complete and all phases are present with correct voltage, the output relays energize and the yellow LED R/T glows.

#### 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 monitoring

The output relays de-energize instantaneous 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.



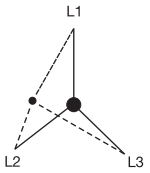

### Interrupted neutral monitoring
### CM-MPS.11, CM-MPS.21, CM-MPS.23

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**



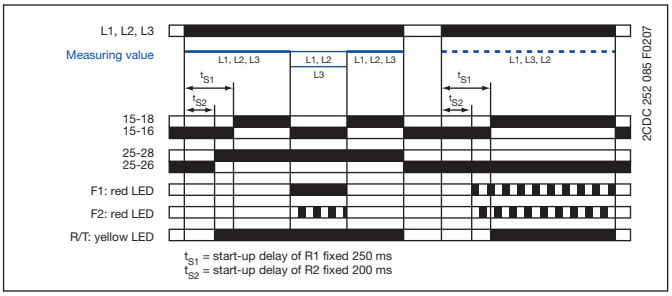

### Automatic phase sequence correction
### CM-MPS.x3, CM-MPN.x2

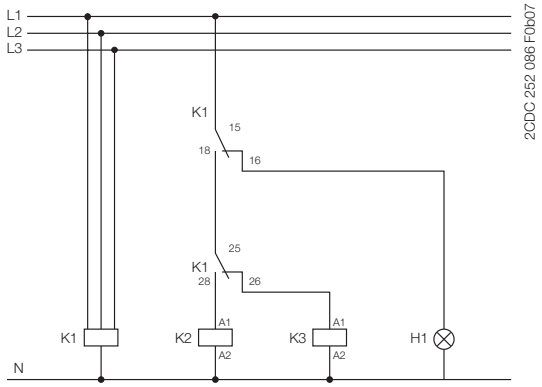
This function can be selected only if phase sequence monitoring is activated ⟲ and operating mode 2x1 c/o (SPDT) contact 1x2 c/o is selected.

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.

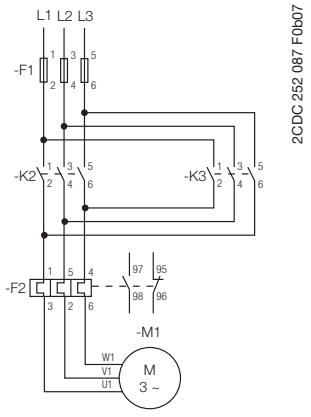
If the voltage to be monitored exceeds or falls below the set threshold values for phase unbalance, over- or undervoltage or if a phase failure occurs, output relay R1 de-energizes and the LEDs F1 and F2 indicate the fault.

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.xx or CM-MPN.xx)




**Power circuit diagram**

# Three-phase monitoring relays
## Function diagrams

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

**CM-PSS.xx[1], CM-PVS.xx[2], CM-MPS.xx[2], CM-MPN.xx[2]**

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

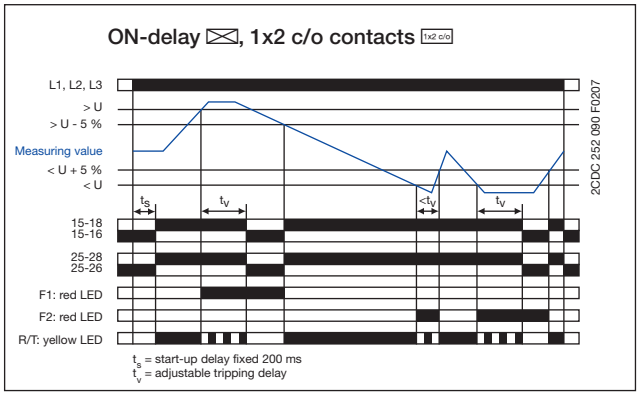
If the voltage to be monitored exceeds or falls below the fixed[1] or set[2] threshold value, the output relays de-energize after the set tripping delay $t_V$ is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize.

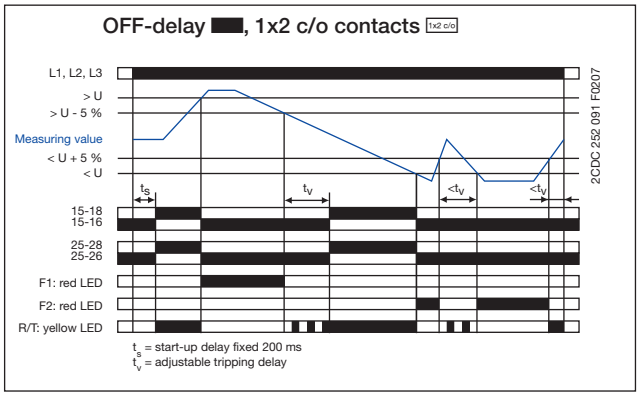
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 % and the LED R/T glows.

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

If the voltage to be monitored exceeds or falls below the fixed[1] or set[2] 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.




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

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

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

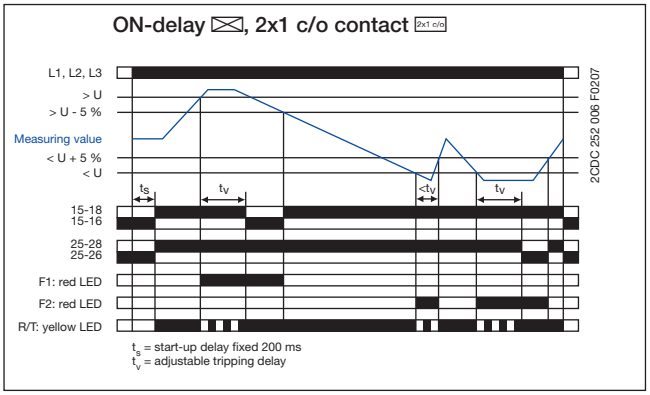
If the voltage to be monitored exceeds or falls below the set threshold value, output relay R1 (overvoltage) or output relay R2 (undervoltage) de-energizes after the set tripping delay $t_V$ is complete. The LED R/T flashes during timing.

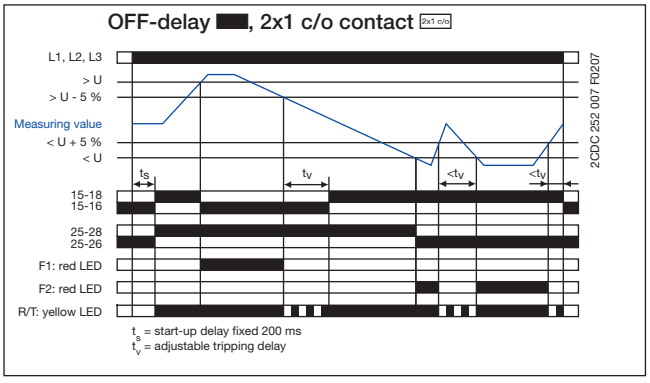
The corresponding output relay re-energizes automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %.

#### 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.



# Three-phase monitoring relays
# Function diagrams

### Phase unbalance monitoring
### CM-PAS.xx, CM-MPS.xx, CM-MPN.xx

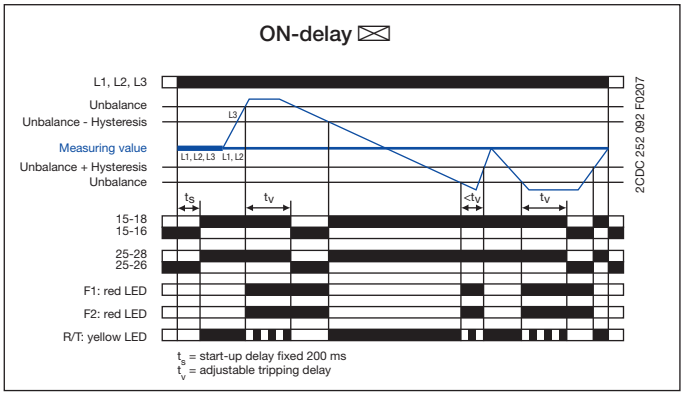
Applying control supply voltage begins the fixed start-up delay $t_S$. When $t_S$ is complete and all phases are present with correct voltage and with correct phase sequence, the output relays energize and the yellow LED R/T glows.

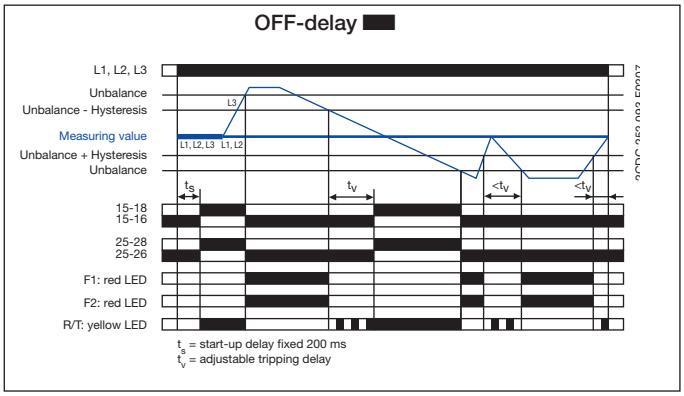
**Type of tripping delay = ON-delay**
If the voltage to be monitored exceeds or falls below the set phase unbalance threshold value, the output relays de-energize after the set tripping delay $t_V$ is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize.

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.




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

| Function | R/T: yellow LED | F1: red LED | F2: red LED |
|---|---|---|---|
| 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] 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 actived

### Type of tripping delay
### CM-PSS.xx, CM-PSV.xx, CM-PAS.xx, CM-MPS.xx, CM-MPN.xx

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
# Function diagrams

## Grid feeding monitoring CM-UFS.2

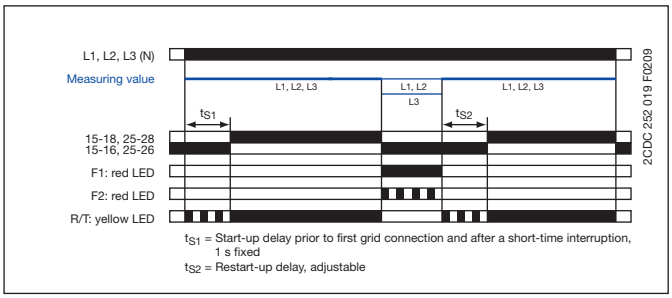
### Function of the yellow LED

The yellow LED is flashing during timing and turns steady as soon as the output relays are energized.

### Phase failure monitoring

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 and frequency, the output relays energize. They de-energize instantaneously if a phase failure occurs. The fault is indicated by LEDs.

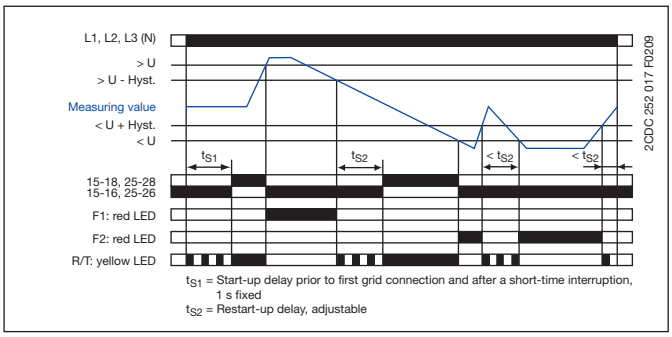
As soon as all 3 phases are present again, the output relays re-energize automatically after the set restart delay $t_{S2}$ is complete.




### Over- and undervoltage monitoring

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 and frequency, the output relays energize.

If the voltage to be monitored exceeds or falls below the fixed threshold value, the output relays de-energize instantaneously. The fault type is indicated by LEDs. As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize after the set restart delay $t_{S2}$ is complete.



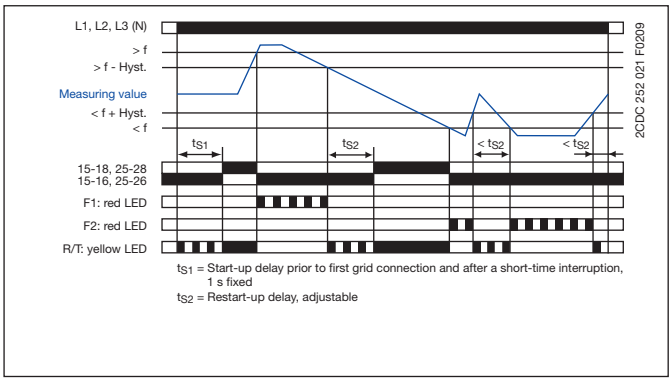

### LED Funktionen

| Function | R/T: yellow LED | F1: red LED | F2: red LED |
|---|---|---|---|
| Output relay energized | ⎍ | - | - |
| Delay active | ⎍⎍ | - | - |
| Overvoltage | - | ⎍ | - |
| Undervoltage | - | - | ⎍ |
| Overfrequency | - | ⎍⎍ | - |
| Underfrequency | - | - | ⎍⎍ |
| Phase failure | - | ⎍ | ⎍⎍ |

### Over- and underfrequency monitoring

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 and frequency, the output relays energize.

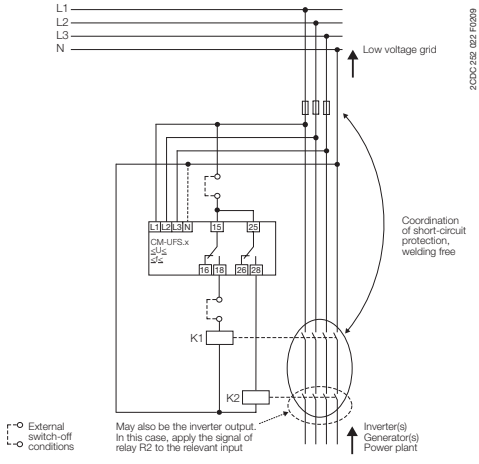
If the frequency to be monitored exceeds or falls below the fixed threshold value, the output relays deenergize instantaneously. The fault type is indicated by LEDs. As soon as the frequency returns to the tolerance range, taking into account a fixed hysteresis, the output relays re-energize after the set restart delay $t_{S2}$ is complete.




### Function diagram legend

Control supply voltage not applied / Output contact open / LED off

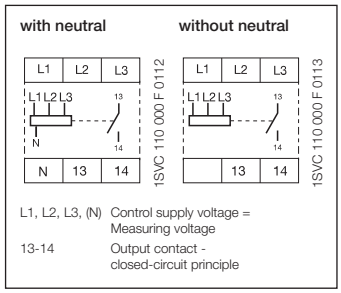
Control supply voltage applied / Output contact closed / LED glowing




**Automatized grid connection instead of a permanently accessible switching point with a disconnection function**

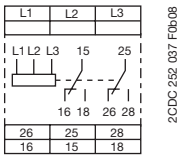
# Three-phase monitoring relays
## Connection diagrams, DIP switches

### Connection diagrams CM-PBE



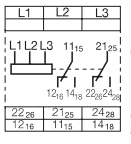

| | |
|---|---|
| L1, L2, L3, (N) | Control supply voltage = Measuring voltage |
| 13-14 | Output contact - closed-circuit principle |

### Connection diagram CM-PVS.x1



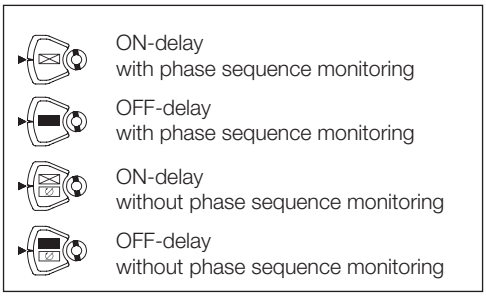

| | |
|---|---|
| L1, L2, L3 | Control supply voltage = measuring voltage |
| 15-16/18 | Output contacts - |
| 25-26/28 | closed-circuit principle |

### Connection diagram CM-PFS

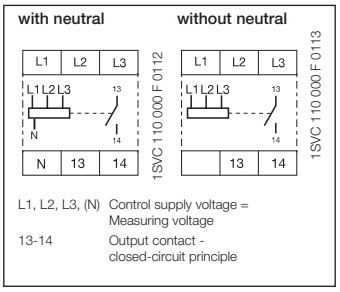



| | |
|---|---|
| L1-L2-L3 | Control supply voltage = Measuring voltage |
| $11_{15}$-$12_{16}$/$14_{18}$, $21_{25}$-$22_{26}$/$24_{28}$ | Output contact - Closed-circuit principle |

### Rotary switch "Function"CM-PVS

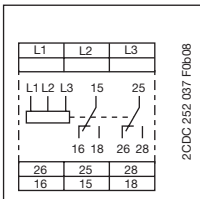



### Connection diagrams CM-PVE



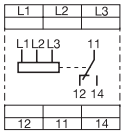

| | |
|---|---|
| L1, L2, L3, (N) | Control supply voltage = Measuring voltage |
| 13-14 | Output contact - closed-circuit principle |

### Connection diagram CM-PSS.x1



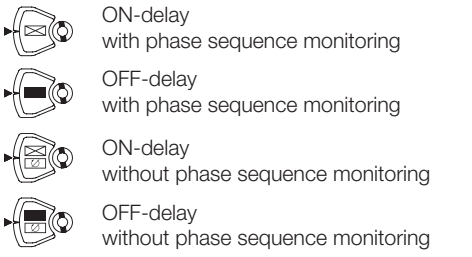

| | |
|---|---|
| L1, L2, L3 | Control supply voltage = measuring voltage |
| 15-16/18 | Output contacts - |
| 25-26/28 | closed-circuit principle |

### Connection diagram CM-PFE

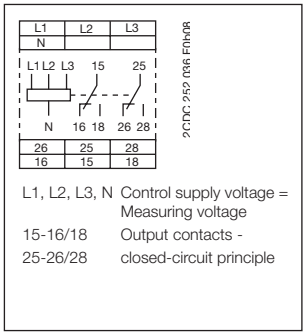



| | |
|---|---|
| L1-L2-L3 | Control supply voltage = Measuring voltage |
| 11-12/14 | Output contact Closed-circuit principle |

### Rotary switch "Function" CM-PSS

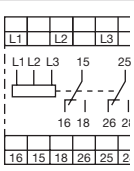



### Connection diagram CM-UFS.2



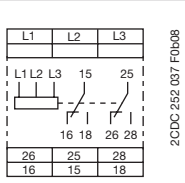

| | |
|---|---|
| L1, L2, L3, N | Control supply voltage = Measuring voltage |
| 15-16/18 | Output contacts - |
| 25-26/28 | closed-circuit principle |

### Connection diagram CM-MPN.x2




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

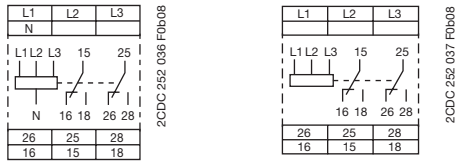
### Connection diagram CM-PAS.x1




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

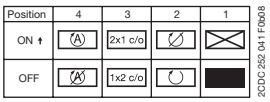
# Three-phase monitoring relays
## Connection diagrams, DIP switches, Rotary switches

### Connection diagram CM-MPS.x3




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

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




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

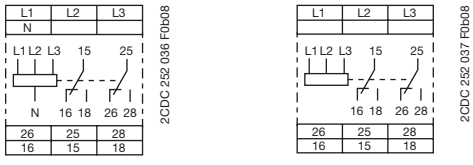
**2 Phase sequence monitoring**
ON deactivated
OFF activated

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

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

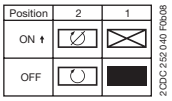
[1] Output relay R1 is responsive to overvoltage, output relay R2 is responsive to undervoltage. In case of other faults, both output relays react synchronously.

### Connection diagram CM-MPS.x1




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

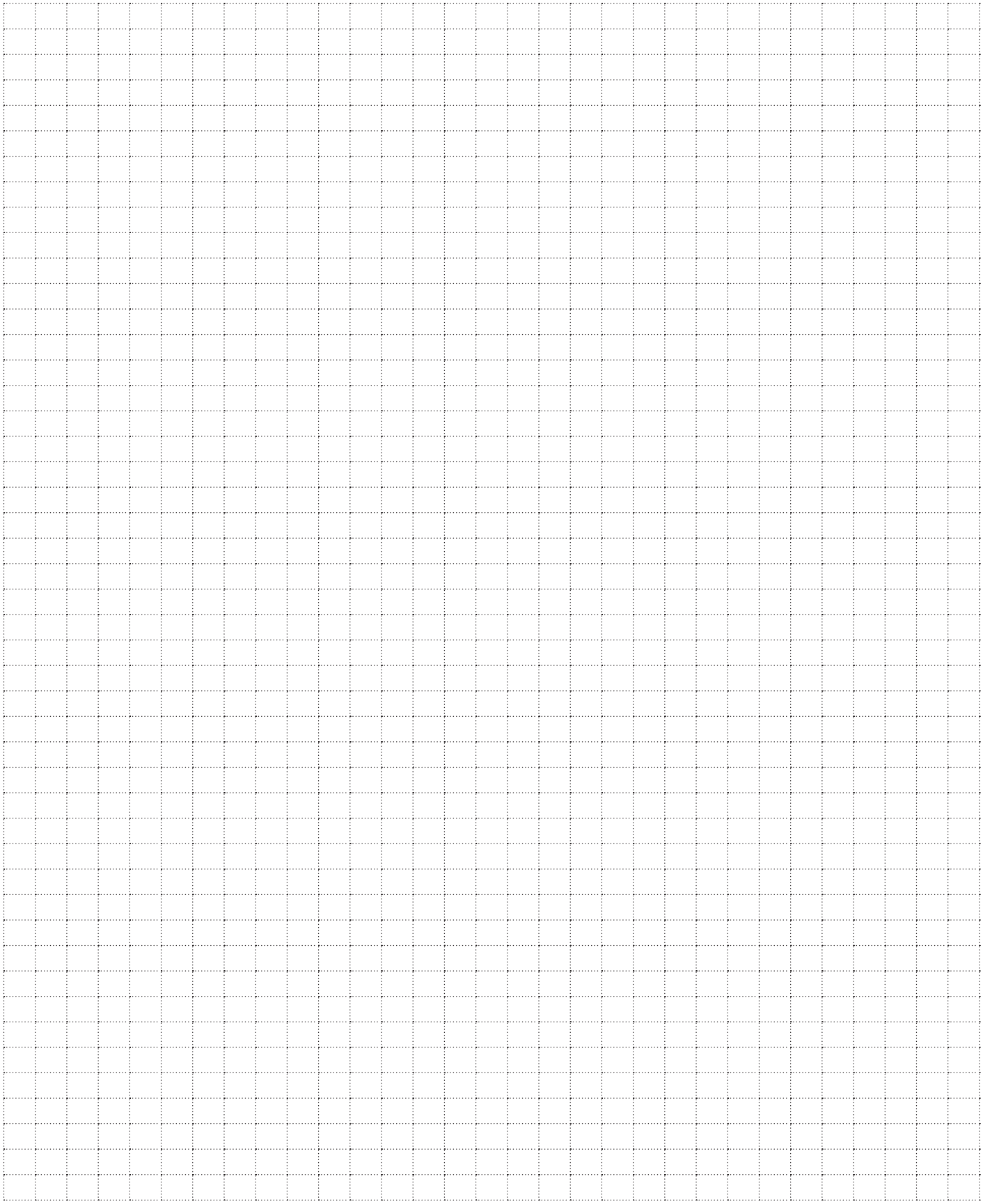
### DIP switch functions CM-MPS.x1




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

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

# Three-phase monitoring relays
## Notes



# Three-phase monitoring relays
## Technical data

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

| Type | | | CM-PBE [1] | CM-PBE | CM-PVE [1] | CM-PVE | CM-PFE | CM-PFS |
|---|---|---|---|---|---|---|---|---|
| **Supply circuit = measuring circuit** | | | **L1-L2-L3-N** | **L1-L2-L3** | **L1-L2-L3-N** | **L1-L2-L3** | **L1-L2-L3** | |
| 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 | | | | | | | approx. 15 VA | |
| Rated control supply voltage $U_S$ tolerance | | | -15...+15 % | | -15...+10 % | | -10...+10 % | -15...+10 % |
| Rated frequency | | | 50/60 Hz | | 50/60 Hz (-10...+10 %) | | | 50/60 Hz |
| Duty time | | | 100 % | | | | | |
| Measuring circuit | | | L1-L2-L3-N | L1-L2-L3 | L1-L2-L3-N | L1-L2-L3 | L1-L2-L3 | |
| Monitoring functions | | phase failure | ■ | ■ | ■ | ■ | ■ | ■ |
| | | phase sequence | - | - | - | - | ■ | ■ |
| | | over- / undervoltage | - | - | ■ | ■ | - | - |
| | | neutral | ■ | - | ■ | - | - | - |
| Measuring ranges | | | 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 |
| Thresholds | | $U_{min}$ | 0.6 x UN | | fixed 185 V / 320 V | fixed 320 V | 0.6 x UN | |
| | | $U_{max}$ | | | fixed 265 V / 460 V | fixed 460 V | | |
| Hysteresis related to the threshold value | | | fixed 5 % (release value = 0.65 x UN) | | fixed 5 % | | | |
| Measuring voltage frequency | | | 50/60 Hz (-10 %...+10 %) | | | | 50/60 Hz | |
| Response time | | | 40 ms | | 80 ms | | 500 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 | | | |
| **Timing circuit** | | | | | | | | |
| Start-up delay $t_S$ | | | fixed 500 ms (±20 %) | | | | fixed 500 ms | |
| Tripping $t_V$ | | | fixed 150 ms (±20 %) | | at over-/ undervoltage fixed 500 ms (±20 %) | | fixed 500 ms | - |
| **Indication of operational states** | | | | | | | | |
| Relay status | | R: yellow LED | ⌜⌝ Output relay energized | | | | | |
| **Output circuits** | | | 13-14 | | | | 11-12/14 | 11(15)-12(16)/14(18), 21(25)-22(26)/24(28) |
| Kind of output | | | 1 n/o contact | | | | 1 c/o contact | 2 c/o contacts |
| Operating principle [2] | | | closed-circuit principle | | | | | |
| Contact material | | | AgCdO | | | | | AgNi |
| Rated operational voltage $U_e$ | | IEC/EN 60947-1 | 250 V | | | | | |
| Minimum switching voltage / Minimum switching current | | | - / - | | | | | |
| Maximum switching voltage | | | 250 V AC, 250 V DC | | | | | |
| Rated operational current $I_e$ (IEC/EN 60947-5-1) | | AC12 (resistive) 230 V | 4 A | | | | | |
| | | AC15 (inductive) 230 V | 3 A | | | | | |
| | | DC12 (resistive) 24 V | 4 A | | | | | |
| | | DC13 (inductive) 24 V | 2 A | | | | | |
| Mechanical lifetime | | | 30 x 106 switching cycles | | | | | |
| Electrical lifetime (AC12, 230 V, 4 A) | | | 0.1 x 106 switching cycles | | | | | |
| Max. fuse rating to achieve short-circuit protection | | n/c contact | 10 A fast-acting | | | | | 4 A fast-acting |
| | | n/o contact | 10 A fast-acting | | | | | 6 A fast-acting |
| 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 | | | | | |

[1] Device with neutral monitoring: The external conductor voltage towards the neutral conductor is measured.

[2] Closed-circuit principle: Output relay is de-energized if the measured value exceeds/drops below the adjusted threshold.

# Three-phase monitoring relays
## Technical data

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

| Type | | CM-PBE [1] | CM-PBE | CM-PVE [1] | CM-PVE | CM-PFE | CM-PFS |
|---|---|---|---|---|---|---|---|
| **General data** | | | | | | | |
| Dimensions (W x H x D) | | 22.5 x 78 x 78.5 mm (0.89 x 3.07 x 3.09 in) | | | | | 22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in) |
| Weight | | see data sheet | | | | | |
| Mounting | | DIN rail (IEC/EN 60715) | | | | | |
| Mounting position | | any | | | | | |
| Degree of protection | housing / terminals | IP50 / IP20 | | | | | |
| **Electrical connection** | | | | | | | |
| Wire size | fine-strand with wire end ferrule | 2 x 0.75-1.5 mm² (2 x 18-16 AWG) | | | | | 2 x 0.75-2.5 mm² (2 x 8-14 AWG) |
| | fine-strand without wire end ferrule | 2 x 1-1.5 mm² (2 x 18-16 AWG) | | | | | |
| | rigid | 2 x 0.75-1.5 mm² (2 x 18-16 AWG) | | | | | 2 x 0.5-4 mm² (2 x 20-12 AWG) |
| Stripping length | | 10 mm (0.39 in) | | | | | 7 mm (0.28 in) |
| Tightening torque | | 0.6-0.8 Nm | | | | | |
| **Environmental data** | | | | | | | |
| Ambient temperature range | operation / storage | -20..+60 °C / -40...+85 °C | | | | | |
| Environmental testing (IEC 68-2-30) | | 24 h cycle time, 55 °C, 93 % rel., 96 h | | | | | |
| Operational reliability (IEC 68-2-6) | | 6 g | | | | | 4 g |
| Mechanical resistance (IEC 68-2-6) | | 10 g | | | | | 6 g |
| **Isolation data** | | | | | | | |
| Rated insulation volt. between supply, measuring and output circuits (VDE 0110, IEC 60947-1) | | 400 V | | | | 500 V | |
| Rated impulse withstand voltage $U_{imp}$ between all isolated circuits (VDE 0110, IEC 664) | | 4 kV / 1.2 - 50 µs | | | | | |
| Test voltage between all isolated circuits | | 2.5 kV, 50 Hz, 1 min. | | | | | |
| Pollution category (VDE 0110, IEC/EN 60664, IEC 255-5) | | 3 | | | | | |
| Overvoltage category (VDE 0110, IEC/EN 60664, IEC 255-5) | | III | | | | | |
| **Standards** | | | | | | | |
| Product standard | | IEC 255-6, EN 60255-6 | | | | | |
| Low Voltage Directive | | 2006/95/EC | | | | | |
| EMC Directive | | 2004/108/EC | | | | | |
| **Electromagnetic compatibility** | | | | | | | |
| Interference immunity to | | 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 kVL-L | | | | | |
| conducted disturbances, induced by radio-frequency fields | IEC/EN 61000-4-6 | Level 3 - 10 V | | | | | |
| Interference emission | | EN 61000-6-4 | | | | | |

[1] Device with neutral monitoring: The external conductor voltage towards the neutral conductor is measured.

[2] Closed-circuit principle: Output relay is de-energized if the measured value exceeds/drops below the adjusted threshold.

# Three-phase monitoring relays
## Technical data

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

| Type | | CM-PSS.31 | CM-PSS.41 | CM-PVS.31 | CM-PVS.41 | CM-PVS.81 | CM-PAS.31 | CM-PAS.41 |
|---|---|---|---|---|---|---|---|---|
| **Input circuit = Measuring circuit** | | | | | L1, L2, L3 | | | |
| 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) |
| **Measuring circuit** | | | | | L1, L2, L3 | | | |
| 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 | |
| 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 0; 0.1-30 s adjustable | | | ON- delay 0; 0.1-30 s adjustable | |
| Repeat accuracy (constant parameters) | | - | - | - | - | l w 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 | | | |
| Indication of operational states | | | | 1 yellow LED, 2 red LED's | | | | |
| | | Details see function description / -diagrams | | Details see operating mode and function description / -diagrams | | | Details see function description / -diagrams | |
| **Output circuits** | | | | | 15-16/18, 25-26/28 | | | |
| Kind of output | | | | | 2x1 c/o contacts (Relays) | | | |
| Operating principle [1] | | | | | closed-circuit principle | | | |
| Contact material | | | | | AgNi alloy, Cd free | | | |
| Rated operational voltage $U_e$ | IEC/EN 60947-1 | | | | 250 V | | | |
| Minimum switching power | | | | | 24 V / 10 mA | | | |
| Maximum switching voltage | | | | | see load limit curve | | | |

# Three-phase monitoring relays
## Technical data

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

| Type | | CM-PSS.31 | CM-PSS.41 | CM-PVS.31 | CM-PVS.41 | CM-PVS.81 | CM-PAS.31 | CM-PAS.41 |
|---|---|---|---|---|---|---|---|---|
| Rated operational current $I_e$ (IEC/EN 60947-5-1) | AC12 (resistive) 230 V | 4 A | | | | | | |
| | AC15 (inductive) 230 V | 3 A | | | | | | |
| | DC12 (resistive) 24 V | 4 A | | | | | | |
| | DC13 (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 $10^6$ switching cycles | | | | | | |
| Electrical lifetime (AC12, 230 V, 4 A) | | 0.1 x $10^6$ switching cycles | | | | | | |
| Max. fuse rating to achieve short-circuit protection | n/c contact | 6 A fast-acting | | | | | | |
| | n/o contact | 10 A fast-acting | | | | | | |
| **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 | | depending on device, see ordering details | | | | | | |
| Mounting | | DIN rail (IEC/EN 60715), snap-on mounting without any tool | | | | | | |
| Mounting position | | any | | | | | | |
| Minimum distance to other units | vertical / horizontal | not necessary / not necessary | | | | | | |
| Material of housing | | UL 94 V-0 | | | | | | |
| Degree of protection | housing / terminals | IP50 / IP20 | | | | | | |
| **Electrical connection** | | | | | | | | |
| Wire size | | **Screw connection technology** | | | | | **Easy Connect Technology (Push-in)** | |
| | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm² (1 x 20-14 AWG)<br>2 x 0.5-1.5 mm² (2 x 20-16 AWG) | | | | | 2 x 0.5-1.5 mm² (2 x 20-16 AWG) | |
| | rigid | 1 x 0.5-4 mm² (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm² (2 x 20-14 AWG) | | | | | 2 x 0.5-1.5 mm² (2 x 20-16 AWG) | |
| Stripping length | | 8 mm (0.32 in) | | | | | | |
| Tightening torque | | 0.6-0.8 Nm (5.31-7.08 lb.in) | | | | | - | |
| | | | | | | | | |
| Environmental data | | | | | | | | |
| Ambient temperature ranges | operation / storage | -25...+60 °C / -40...+85 °C | | | | | | |
| Damp heat (IEC 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** | | | | | | | | |
| Rated insulation voltage $U_i$ | input circuit / output circuit | 600 V | | | | | | |
| | output circuit 1 / output circuit 2 | 300 V | | | | | | |
| Rated impulse withstand voltage $U_{imp}$ (VDE 0110, 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 (type test) | | 2.5 kV, 50 Hz, 1 s | | | | | | |
| Basis isolation | input circuit / output circuit | 600 V | | | | | | |
| Protective separation (VDE 0106 part 101 and 101/A, IEC/EN 1140) | input circuit / output circuit | - | | | | | | |
| Pollution degree (VDE 0110, IEC/EN 60664) | | 3 | | | | | | |
| Overvoltage category (VDE 0110, IEC 60664) | | III | | | | | | |
| **Standards** | | | | | | | | |
| Product standard | | IEC/EN 60255-6, EN 50178 | | | | | | |
| Low Voltage Directive | | 2006/95/EG | | | | | | |
| EMC directive | | 2004/108/EG | | | | | | |
| RoHS directive | | 2002/95/EG | | | | | | |
| **Electromagnetic compatibility** | | | | | | | | |
| Interference immunity to | | EN 61000-6-1, 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 | | Class 3 | | | | | | |
| high-frequency radiated | IEC/CISPR 22, EN 50022 | EN 61000-6-3, EN 61000-6-4 | | | | | | |
| high-frequency conducted | IEC/CISPR 22, EN 50022 | Class B | | | | | | |

# Three-phase monitoring relays
## Technical data

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

| Type | | | CM-MPS.11 | CM-MPS.21 | CM-MPS.31 | CM-MPS.41 |
|---|---|---|---|---|---|---|
| **Input circuit = Measuring circuit** | | | **L1, L2, L3, N** | | **L1, L2, L3** | |
| 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 (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 | | | |
| | | 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 | 3x420-500 V AC |
| | | Undervoltage | 3x90-130 V AC | 3x180-220 V AC | 3x160-230 V AC | 3x300-380 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 0; 0.1-30 s adjustable | | | |
| Accuracy within the rated control supply voltage tolerance | | | $\Delta t \leq 0.5$ % | | | |
| Accuracy within the temperature range | | | $\Delta t \leq 0.06$ % / °C | | | |
| Indication of operational states | | | Details see function description / -diagrams | | | |
| **Output circuits** | | | 15-16/18, 25-26/28 | | | |
| Kind of output | | | 1x2 c/o contacts (Relays) | | | |
| Operating principle [1] | | | closed-circuit principle | | | |
| Contact material | | | AgNi alloy, Cd free | | | |
| Rated operational voltage $U_e$ (IEC/EN 60947-1) | | | 250 V | | | |
| Minimum switching power | | | 24 V / 10 mA | | | |
| Maximum switching voltage | | | see load limit curve | | | |
| Rated operational current $I_e$ (IEC/EN 60947-5-1) | | AC12 (resistive) 230 V | 4 A | | | |
| | | AC15 (inductive) 230 V | 3 A | | | |
| | | DC12 (resistive) 24 V | 4 A | | | |
| | | DC13 (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 $10^6$ switching cycles | | | |
| Electrical lifetime (AC12, 230 V, 4 A) | | | 0,1 x $10^6$ switching cycles | | | |
| Max. fuse rating to achieve short-circuit protection | | n/c contact | 6 A fast-acting | | | |
| | | n/o contact | 10 A fast-acting | | | |

# Three-phase monitoring relays
## Technical data

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

| Type | | | CM-MPS.11 | CM-MPS.21 | CM-MPS.31 | CM-MPS.41 |
|---|---|---|---|---|---|---|
| **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 | depending on device, see ordering details | | | |
| | | gross weight | depending on device, see ordering details | | | |
| Mounting | | | DIN rail (IEC/EN 60715), snap-on mounting without any tool | | | |
| Mounting position | | | any | | | |
| Minimum distance to other units | | vertical / horizontal | not necessary / not necessary | | | |
| Material of housing | | | UL 94 V-0 | | | |
| Degree of protection | | housing / terminals | IP50 / IP20 | | | |
| **Electrical connection** | | | | | | |
| Wire size | | | Screw connection technology | | Easy Connect Technology (Push-in) | |
| | | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm2 (1 x 20-14 AWG)<br>2 x 0.5-1.5 mm2 (2 x 20-16 AWG) | | 2 x 0.5-1.5 mm2 (2 x 20-16 AWG) | |
| | | rigid | 1 x 0.5-4 mm2 (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm2 (2 x 20-14 AWG) | | 2 x 0.5-1.5 mm2 (2 x 20-16 AWG) | |
| Stripping length | | | 8 mm (0.32 in) | | | |
| Tightening torque | | | 0.6-0.8 Nm (5.31-7.08 lb.in) | | - | |
| **Environmental data** | | | | | | |
| Ambient temperature ranges | | operation / storage | -25...+60 °C / -40...+85 °C | | | |
| Damp heat (IEC 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** | | | | | | |
| Rated insulation voltage $U_i$ | | input circuit / output circuit | 600 V | | | |
| | | output circuit 1 / output circuit 2 | 300 V | | | |
| Rated impulse withstand voltage $U_{imp}$ (VDE 0110, 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 (type test) | | | 2.5 kV, 50 Hz, 1 s | | | |
| Basis isolation | | input circuit / output circuit | 600 V | | | |
| Protective separation (VDE 0106 part 101 and 101/A, IEC/EN 61140) | | input circuit / output circuit | yes | | - | |
| Pollution degree (VDE 0110, IEC/EN 60664) | | | 3 | | | |
| Overvoltage category (VDE 0110, IEC 60664) | | | III | | | |
| **Standards** | | | | | | |
| Product standard | | | IEC/EN 60255-6, EN 50178 | | | |
| Low Voltage Directive | | | 2006/95/EG | | | |
| EMC directive | | | 2004/108/EG | | | |
| RoHS directive | | | 2002/95/EG | | | |
| **Electromagnetic compatibility** | | | | | | |
| Interference immunity to | | | EN 61000-6-1, 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) | | | |
| 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 50022 | Class B | | | |
| high-frequency conducted | | IEC/CISPR 22, EN 50022 | Class B | | | |

[1] 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

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

| Type | | | CM-MPS.23 | CM-MPS.43 | CM-MPN.52 | CM-MPN.62 | CM-MPN.72 |
|---|---|---|---|---|---|---|---|
| **Input circuit = Measuring circuit** | | | **L1, L2, L3, N** | **L1, L2, L3** | | | |
| 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) |
| **Measuring circuit** | | | **L1, L2, L3, N** | **L1, L2, L3** | | | |
| 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 | 3x690-820 V AC |
| | | Undervoltage | 3x180-220 V AC | 3x300-380 V AC | 3x350-460 V AC | 3x450-570 V AC | 3x530-660 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 | | | 50/60/400 Hz | | 50/60 Hz | | |
| Frequency range of the measuring signal | | | 45-440 Hz | | 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 $t_S$ 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 | | | ON-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 | | | $\Delta t \leq 0.06$ % / °C | | | | |
| Indication of operational states | | | Details see function description / -diagrams | | | | |
| **Output circuits** | | | **15-16/18, 25-26/28** | | | | |
| Kind of output | | | 2x1 or 1x2 c/o contacts configurable (Relays) | | | | |
| Operating principle [1] | | | closed-circuit principle | | | | |
| Contact material | | | AgNi alloy, Cd free | | | | |
| Rated operational voltage $U_e$ | | IEC/EN 60947-1 | 250 V | | | | |
| Minimum switching power | | | 24 V / 10 mA | | | | |
| Maximum switching voltage | | | see load limit curve | | | | |
| Rated operational current $I_e$ (IEC/EN 60947-5-1) | | AC12 (resistive) 230 V | 4 A | | | | |
| | | AC15 (inductive) 230 V | 3 A | | | | |
| | | DC12 (resistive) 24 V | 4 A | | | | |
| | | DC13 (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 $10^6$ switching cycles | | | | |
| Electrical lifetime (AC12, 230 V, 4 A) | | | 0,1 x $10^6$ switching cycles | | | | |
| Max. fuse rating to achieve short-circuit protection | | n/c contact | 6 A fast-acting | | 10 A fast-acting | | |
| | | n/o contact | 10 A fast-acting | | | | |

# Three-phase monitoring relays
## Technical data

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

| Type | | | CM-MPS.23 | CM-MPS.43 | CM-MPN.52 | CM-MPN.62 | CM-MPN.72 |
|---|---|---|---|---|---|---|---|
| **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 | | | depending on device, see ordering details | | | | |
| Mounting | | | DIN rail (IEC/EN 60715), snap-on mounting without any tool | | | | |
| Mounting position | | | any | | | | |
| Minimum distance to other units | | vertical / horizontal | not necessary / not necessary | | | | |
| Material of housing | | | UL 94 V-0 | | | | |
| Degree of protection | | housing / terminals | IP50 / IP20 | | | | |
| **Electrical connection** | | | | | | | |
| Wire size | | | Screw connection technology | | | Easy Connect Technology (Push-in) | |
| | | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm2 (1 x 20-14 AWG)<br>2 x 0.5-1.5 mm2 (2 x 20-16 AWG) | | | 2 x 0.5-1.5 mm2 (2 x 20-16 AWG) | |
| | | rigid | 1 x 0.5-4 mm2 (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm2 (2 x 20-14 AWG) | | | 2 x 0.5-1.5 mm2 (2 x 20-16 AWG) | |
| Stripping length | | | 8 mm (0.32 in) | | | | |
| Tightening torque | | | 0.6-0.8 Nm (5.31-7.08 lb.in) | | | - | |
| **Environmental data** | | | | | | | |
| Ambient temperature ranges | | operation / storage | -25...+60 °C / -40...+85 °C | | | | |
| Damp heat (IEC 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** | | | | | | | |
| Rated insulation voltage $U_i$ | | input circuit / output circuit | 600 V | | 1000 V | | |
| | | output circuit 1 / 2 | 300 V | | | | |
| Rated impulse withstand voltage $U_{imp}$ (VDE 0110, IEC/EN 60664) | | input circuit | 6 kV; 1.2/50 µs | | 8 kV; 1.2/50 µs | | |
| | | output circuit | 4 kV; 1.2/50 µs | | | | |
| Test voltage (type test) | | isolated output circuits | 2.5 kV, 50 Hz, 1 s | | | | |
| between | | input circuit and isolated output circuits | 2.5 kV, 50 Hz, 1 s | | 4 kV, 50 Hz, 1 s | | |
| Basis isolation | | input circuit / output circuit | 600 V | | 1000 V | | |
| Protective separation (VDE 0106 part 101 and 101/A, IEC/EN 61140) | | input circuit / output circuit | - | | | | |
| Pollution degree (VDE 0110, IEC/EN 60664) | | | 3 | | | | |
| Overvoltage category (VDE 0110, IEC 60664) | | | III | | | | |
| **Standards** | | | | | | | |
| Product standard | | | IEC/EN 60255-6, EN 50178 | | | | |
| Low Voltage Directive | | | 2006/95/EG | | | | |
| EMC directive | | | 2004/108/EG | | | | |
| RoHS directive | | | 2002/95/EG | | | | |
| **Electromagnetic compatibility** | | | | | | | |
| Interference immunity to | | | EN 61000-6-1, 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 | | | EN 61000-6-3, EN 61000-6-4 | | | | |
| high-frequency radiated | IEC/CISPR 22, EN 50022 | | Class B | | | | |
| high-frequency conducted | IEC/CISPR 22, EN 50022 | | Class B | | | | |

[1] 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

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

| Type | | | CM-UFS.2 | |
|---|---|---|---|---|
| **Input circuit - Measuring circuit** | | | **L1, L2, L3** | **L-N** |
| Rated control supply voltage $U_S$ = measuring voltage | | | 3 x 400 V AC | 3 x 230 V AC |
| Rated control supply voltage tolerance $U_S$ | | | -20...+20 % | |
| Control supply voltage range | | | 3 x 300-500 V AC | 3 x 180-280 V AC |
| Rated frequency | | | 50 Hz | |
| Frequency range | | | 45-55 Hz | |
| Typical current / power consumption | | | 23 mA / 16 VA | |
| Power failure buffering time | | | min. 20 ms | |
| **Input circuit - measuring circuit** | | | **L1, L2, L3** | **L-N** |
| Monitoring functions | | Phase failure | ■ | |
| | | Over-/ undervoltage | ■ | |
| | | Over-/ underfrequency | ■ | |
| | | 10 minutes average value | – | |
| Measuring range | | Voltage range | 3 x 320-480 V AC | 3 x 184-276 V AC |
| | | Frequency range | 45-55 Hz | |
| Thresholds | | Overvoltage | fix, 120 % of $U_s$ | |
| | | Undervoltage | fix, 80 % of $U_s$ | |
| | | Overfrequency | 50,3 or 51 Hz, configurable | |
| | | Underfrequency | 49,7 or 49 Hz, configurable | |
| | | 10 minutes average value | – | |
| Hysteresis related to the threshold value | | Over-/ undervoltage | fix 5 % | |
| | | Over-/ underfrequency | fix 20 mHz | |
| Rated frequency of the measuring signal | | | 50 Hz | |
| Frequency range of the measuring signal | | | 45-55 Hz | |
| Maximum measuring cycle time | | | 50 ms | |
| Maximum reaction time (time between fault detection and change of switching status of the relay) | | Over-/ undervoltage | < 120 ms | |
| | | Over-/ underfrequency | < 100 ms | |
| | | 10 minutes average value | – | |
| 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 $t_{S1}$ prior to grid connection after a short interruption | | | fix, 1 s | |
| Restart delay $t_{S2}$ | | | adjustable, 0 s; 0,1 – 30 s | |
| Accuracy within the rated control supply voltage tolerance | | | $\Delta t \leq 0,5$ % | |
| Accuracy within the temperature range | | | $\Delta t \leq 0,06$ % / °C | |
| **Indication of operational states** | | | 1 yellow LED, 2 red LEDs<br>Details see operation mode and function description/diagrams | |
| **Output circuits** | | | 15-16/18, 25-26/28 | |
| Kind of output | | | Relais, 1 x 2 changeover | |
| Operation principle [1] | | | closed-circuit principle | |
| Contact material | | | AgNi alloy, Cd free | |
| Rated operational voltage $U_e$ (IEC/EN 60947-1) | | | 250 V | |
| Minimum switching voltage / switching current | | | 24 V / 10 mA | |
| Maximum switching voltage / switching current | | | see load limit curve | |
| Rated operational current $I_e$ (IEC/EN 60947-5-1) | | AC12 (resistive) 230 V | 4 A | |
| | | AC15 (inductive) 230 V | 3 A | |
| | | DC12 (resistive) 24 V | 4 A | |
| | | DC13 (inductive) 24 V | 2 A | |
| Mechanical lifetime | | | $30 \times 10^6$ switching cycles | |
| Electrical lifetime (AC12, 230 V, 4 A) | | | $0,1 \times 10^6$ switching cycles | |
| Max. fuse rating to achieve short-circuit protection | | n/c contact | 6 A fast-acting | |
| | | n/o contact | 10 A fast-acting | |

# Three-phase monitoring relays
## Technical data

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

| Type | | | CM-UFS.2 | |
|---|---|---|---|---|
| **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 | | gross weight | depending on device, see ordering details | |
| Mounting | | | DIN rail (IEC/EN 60715), snap-on mounting without any tool | |
| Mounting position | | | any | |
| Minimum distance to other units | | vertical / horizontal | not necessary / not necessary | |
| Material of housing | | | UL 94 V-0 | |
| Degree of protection | | housing / terminals | IP50 / IP20 | |
| **Electrical connection** | | | | |
| Wire size | | | **Screw connection technology** | **Easy Connect Technology (Push-in)** |
| | | fine-strand with(out) wire end ferrule | 1 x 0.5-2.5 mm² (1 x 20-14 AWG)<br>2 x 0.5-1.5 mm² (2 x 20-16 AWG) | 2 x 0.5-1.5 mm² (2 x 20-16 AWG) |
| | | rigid | 1 x 0.5-4 mm² (1 x 20-12 AWG)<br>2 x 0.5-2.5 mm² (2 x 20-14 AWG) | 2 x 0.5-1.5 mm² (2 x 20-16 AWG) |
| Stripping length | | | 8 mm (0.32 in) | |
| Tightening torque | | | 0.6-0.8 Nm (5.31-7.08 lb.in) | - |
| **Environmental data** | | | | |
| Ambient temperature range | | operation / storage | -25...+60 °C / -40...+85 °C | |
| Damp heat, cyclic (IEC/EN 60068-2-30) | | | 2 x 12 h cycle, 55 °C, 95 % RH | |
| Climatic category (IEC/EN 60721-3-1) | | | 3K3 | |
| Vibration (sinusoidal) (IEC/EN 60255-21-1) | | | Class 2 | |
| Shock (IEC/EN 60255-21-2) | | | Class 2 | |
| **Isolation data** | | | | |
| Rated impulse withstand voltage $U_i$ | | input circuit / output circuit | 600 V | |
| | | output circuit 1 / 2 | 300 V | |
| Rated impulse withstand voltage $U_{imp}$ (VDE 0110, 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 (type test) | | | 2,5 kV, 50 Hz, 1 s | |
| Basis isolation | | input circuit / output circuit | 600 V | |
| Protective separation (VDE 0160 Part 101 and 101/A, IEC/EN 61140) | | input circuit / output circuit | yes | |
| Pollution degree (VDE 0110, IEC/EN 60664) | | | 3 | |
| Overvoltage category (VDE 0110, IEC 60664) | | | III | |
| **Standards** | | | | |
| Product standard | | | Type-tested in accordance with the "Guideline for Connections to ENEL distribution network" Ed.2.1., January 2011 | |
| Further standards | | | EN 50178, EN 61727 | |
| Low Voltage Directive | | | 2006/95/EG | |
| EMV-Directive | | | 2004/108/EG | |
| RoHS-Directive | | | 2002/95/EG | |
| **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) | |
| 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, L-N) | |
| 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 50022 | | Class B | |
| high-frequency conducted | IEC/CISPR 22, EN 50022 | | Class B | |

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