

# 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 <sup>1)</sup>
- Adjustable ON-delay/OFF-delay time <sup>1)</sup>
- 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 <sup>1)</sup>
- Over- and undervoltage monitoring (fixed or adjustable)<sup>1)</sup>
- Wide-range operating voltage guarantees world-wide operation

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

### Phase unbalance monitoring

If the supply by the three-phase system is unbalanced due to uneven distribution of the load, the motor will convert a part of the energy into reactive power. This energy gets lost unexploited; also the motor is exposed to higher thermal 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 states of the installation are likely to occur. E.g. the startup process of motors is disturbed. All three-phase monitors of the ABB CM range detect a phase loss as soon as the voltage of one phase drops below 60% of its nominal value.

### 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 states of the installation and cause damage or destruction of valuable parts.

### 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  $V_{\text{ref}}/V_{\text{max}}$

**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

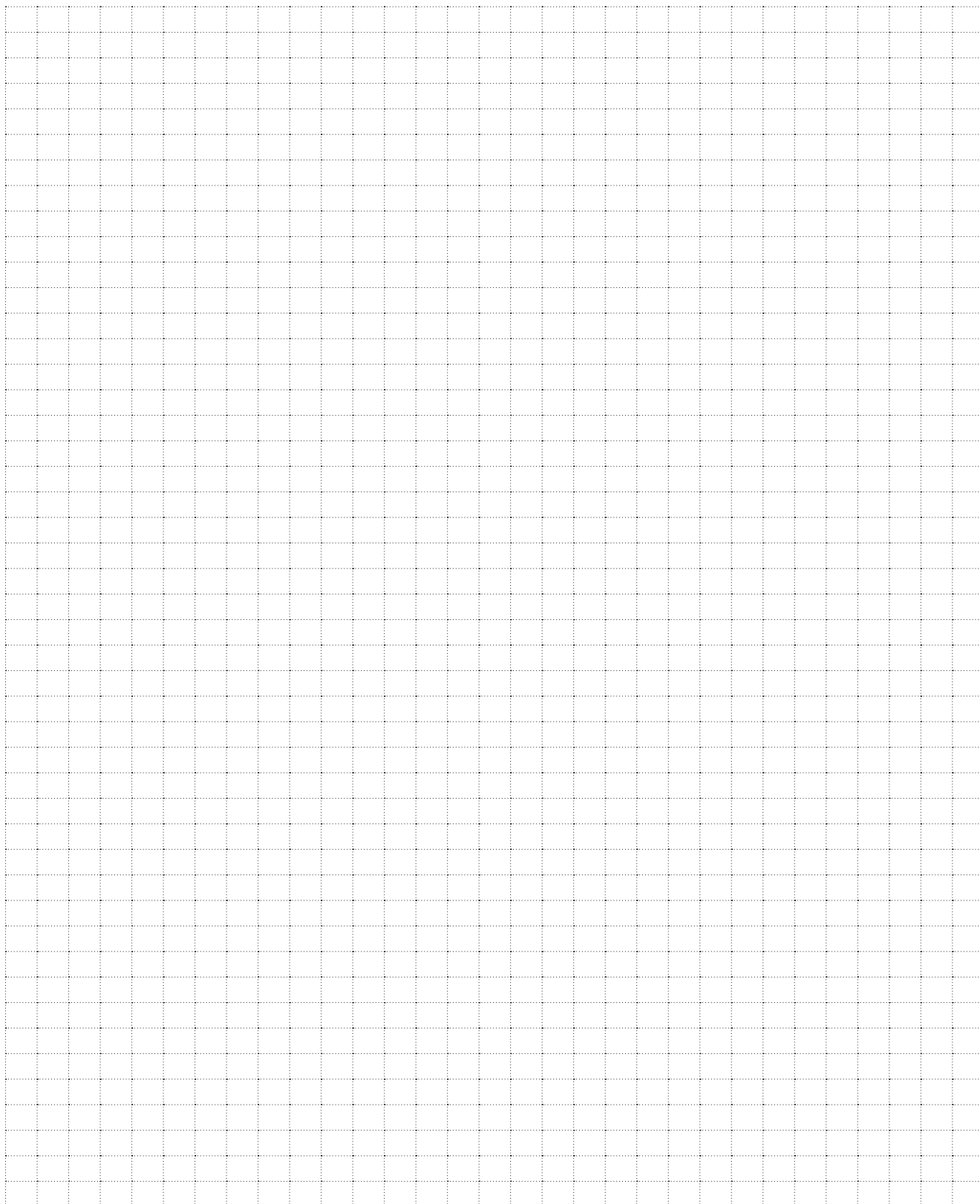
- phase sequence:  
F1 and F2 alternately flashing

**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

## Ordering details



CM-PBE



CM-PSS.41P



CM-PAS.31P

NEW

### Description

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

### 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 <sup>1)</sup>	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 <sup>1)</sup>	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 <sup>2)</sup>	1SVR550824R9100		0.08 (0.17)
3x200-500 V AC			CM-PFS <sup>2)</sup>	1SVR430824R9300		0.15 (0.33)
3x380 V AC	Over- / under-voltage with fixed threshold values $\pm 10\%$		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)

<sup>1)</sup> 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.

<sup>2)</sup> 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

2CDC 251 065 V0011



CM-MPN.52P

2CDC 251 062 V0011

### Ordering details

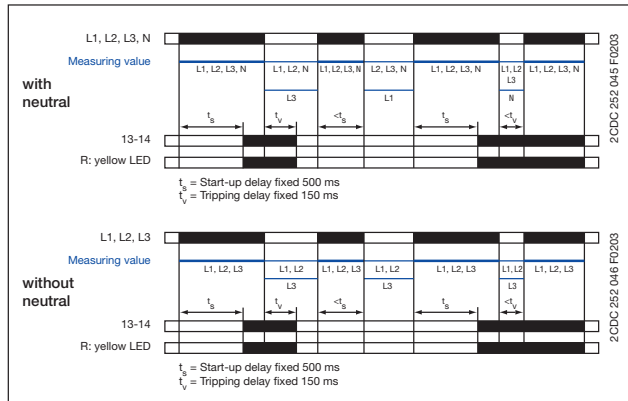
Rated control supply voltage = measuring voltage	Monitoring function	Neutral monitoring	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)	
90-170 V AC	Multifunctional (Three-phase phase failure detection, Phase sequence monitoring, overvoltage, undervoltage, Phase unbalance)	yes	CM-MPS.11S	1SVR730885R1300		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		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

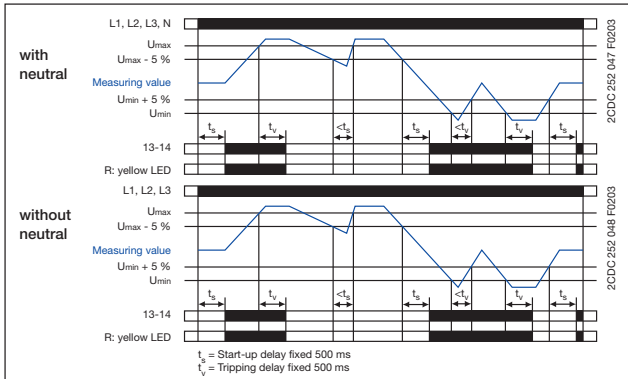
## Function diagrams

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



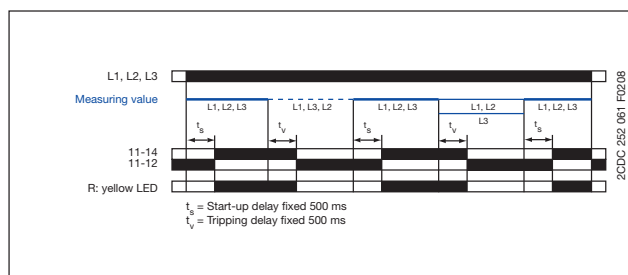
If all phases (and the neutral) are present, the output relay energizes after the start-up delay  $t_s$  is complete. If a phase failure occurs, the tripping delay  $t_v$  starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of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

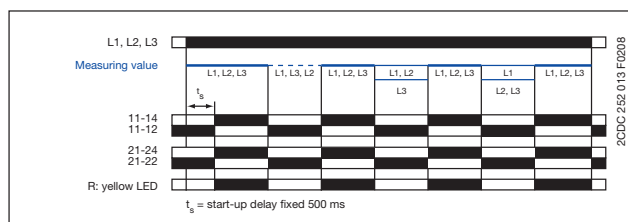
### Function diagram - CM-PFE



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 instantaneously. 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

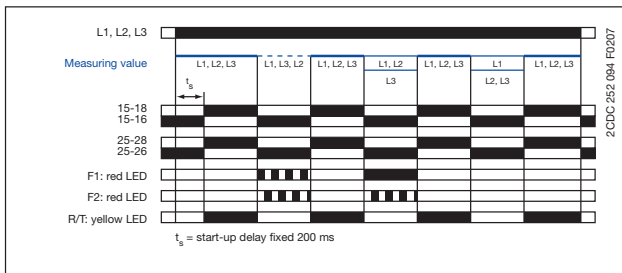
Applying control supply voltage begins the fixed start-up delay  $t_s$ . When  $t_s$  is complete and all phases are present with correct voltage, the output relays energize and the yellow LED R/T glows.

#### 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.



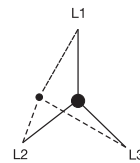
### Interrupted neutral monitoring CM-MPS.11, CM-MPS.21, CM-MPS.23

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



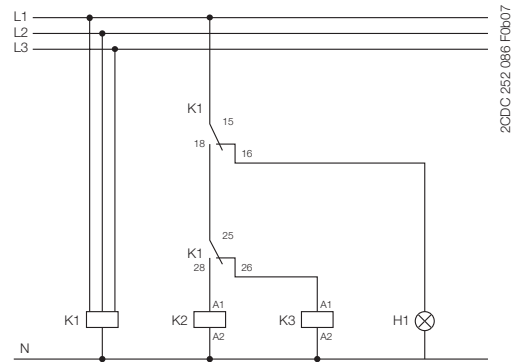
### Automatic phase sequence correction CM-MPS.x3, CM-MPN.x2

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

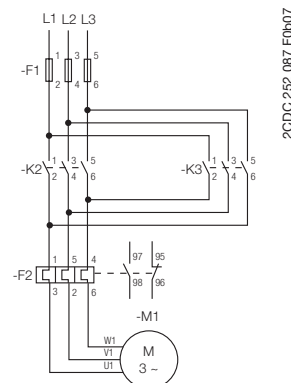
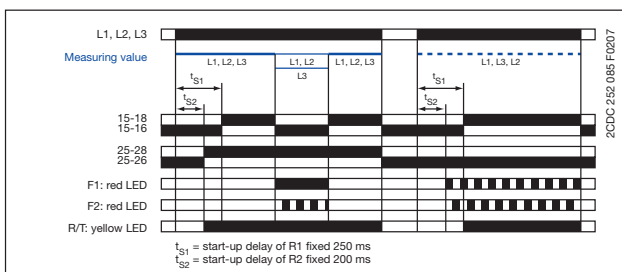
Applying control supply voltage begins the fixed start-up delay  $t_{s1}$ . When  $t_{s1}$  is complete and all phases are present with correct voltage, output relay R1 energizes. Output relay R2 energizes when the fixed start-up delay  $t_{s2}$  is complete and all phases are present with correct phase 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<sup>1)</sup>, CM-PVS.xx<sup>2)</sup>, CM-MPS.xx<sup>2)</sup>, CM-MPN.xx<sup>2)</sup>

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

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

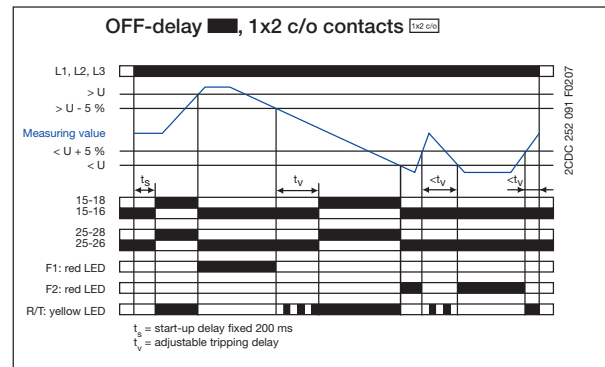
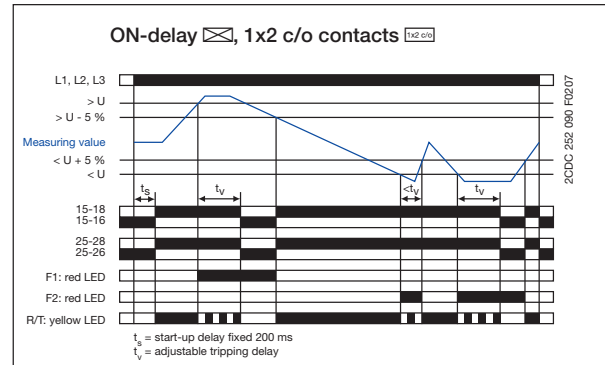
If the voltage to be monitored exceeds or falls below the fixed<sup>1)</sup> or set<sup>2)</sup> threshold value, the output relays de-energize after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize.

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

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

If the voltage to be monitored exceeds or falls below the fixed<sup>1)</sup> or set<sup>2)</sup> threshold value, the output relays de-energize instantaneously and the LED R/T turns off.

As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize automatically after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns steady when timing is complete.



### 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

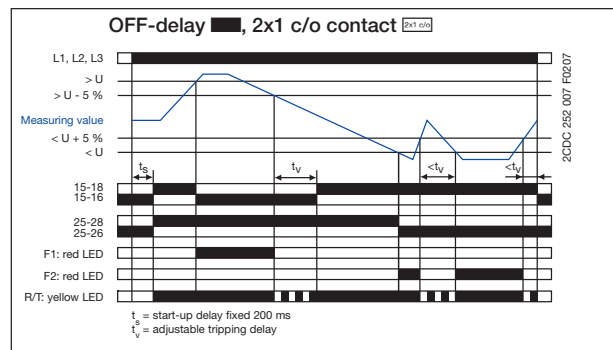
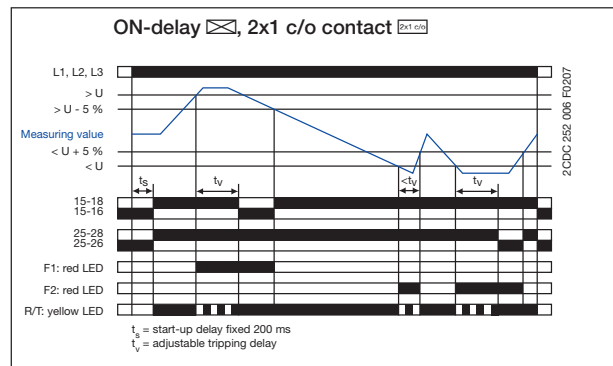
If the voltage to be monitored exceeds or falls below the set threshold value, output relay R1 (overvoltage) or output relay R2 (undervoltage) de-energizes after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing.

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

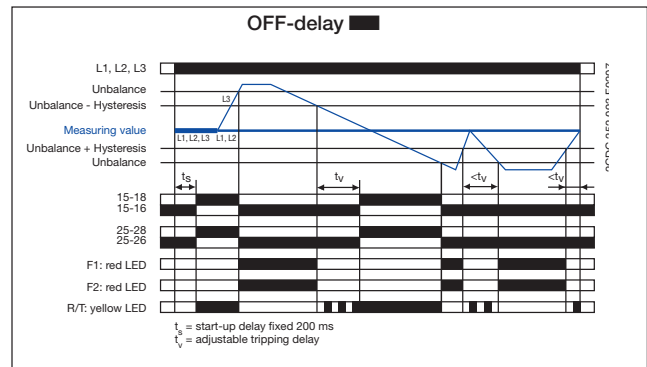
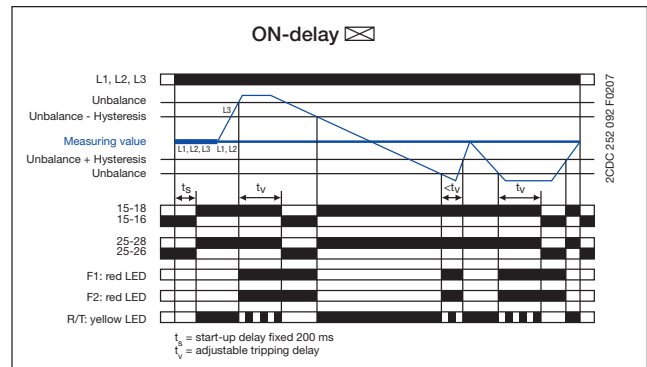
If the voltage to be monitored exceeds or falls below the set phase unbalance threshold value, the output relays de-energize after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize.

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	-		
Overvoltage	-		-
Undervoltage	-	-	
Phase unbalance	-		
Interruption of the neutral	-		
Adjustment error <sup>1)</sup>			

<sup>1)</sup> Possible misadjustments of the front-face operating controls:

Overlapping of the threshold values: An overlapping of the threshold values is given, if the threshold value for overvoltage is set to a smaller value than the threshold value for undervoltage.

DIP switch 3 = OFF and DIP switch 4 = ON: Automatic phase sequence correction is activated and selected operating mode is 1x2 c/o contacts

DIP switch 2 and 4 = ON: Phase sequence detection is deactivated and the automatic phase sequence correction is activated

### Type of tripping delay 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 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

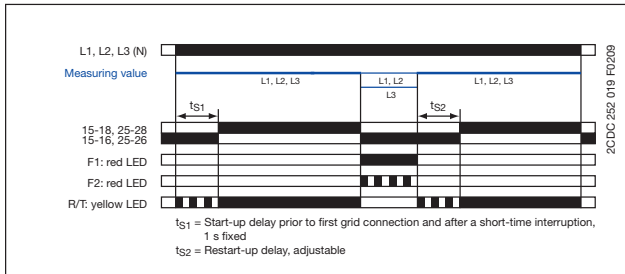
#### Function of the yellow LED

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.

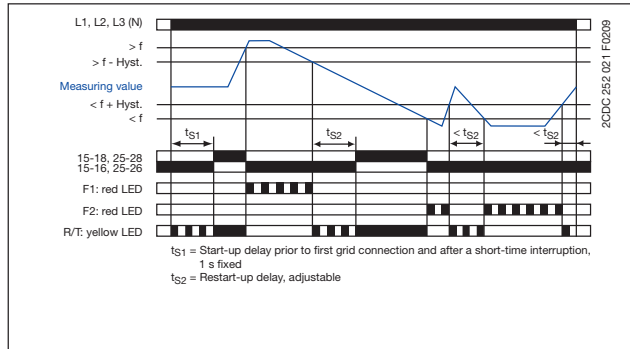
As soon as all 3 phases are present again, the output relays re-energize automatically after the set restart delay  $t_{S2}$  is complete.



### Over- and 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.

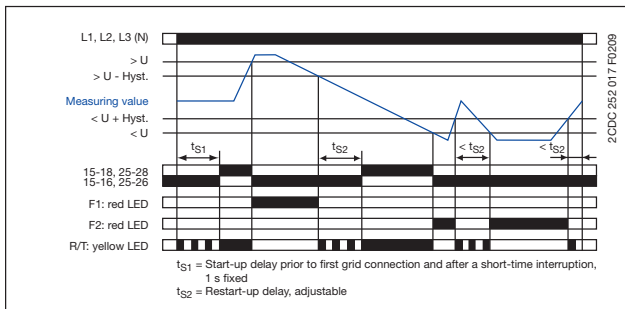
If the frequency to be monitored exceeds or falls below the fixed threshold value, the output relays deenergize instantaneously. The fault type is indicated by LEDs. As soon as the frequency returns to the tolerance range, taking into account a fixed hysteresis, the output relays re-energize after the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



### Over- and undervoltage monitoring

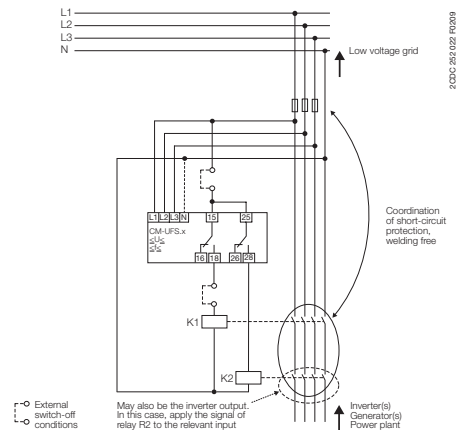
Applying control supply voltage begins the fixed start-up delay  $t_{S1}$ . When  $t_{S1}$  is complete and all phases are present with correct voltage and frequency, the output relays energize.

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.



### Function diagram legend

- Control supply voltage not applied / Output contact open / LED off
- Control supply voltage applied / Output contact closed / LED glowing



### LED Funktionen

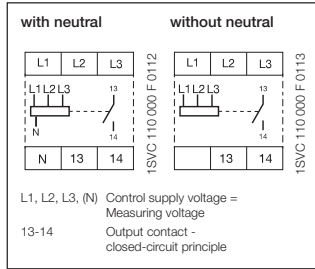
Function	R/T: yellow LED	F1: red LED	F2: red LED
Output relay energized	■	-	-
Delay active	□	-	-
Overvoltage	-	■	-
Undervoltage	-	-	■
Overfrequency	-	■	-
Underfrequency	-	-	■
Phase failure	-	■	■

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

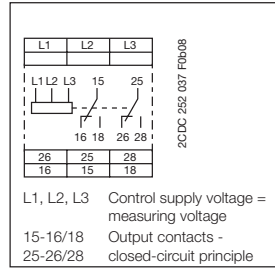
# Three-phase monitoring relays

## Connection diagrams, DIP switches

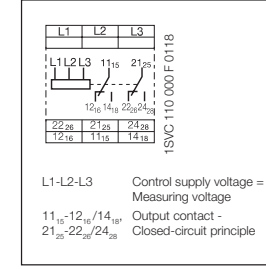
Connection diagrams CM-PBE



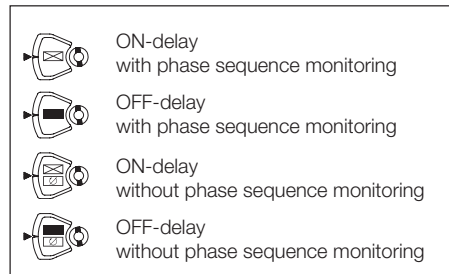
Connection diagram CM-PVS.x1



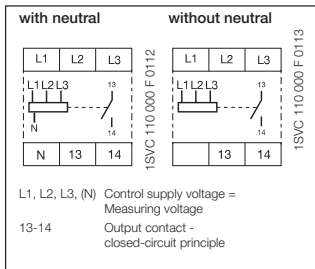
Connection diagram CM-PFS



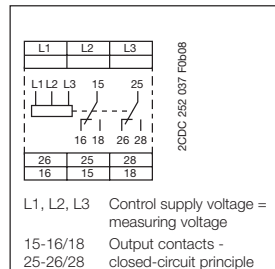
Rotary switch "Function" CM-PVS



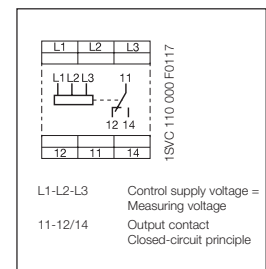
Connection diagrams CM-PVE



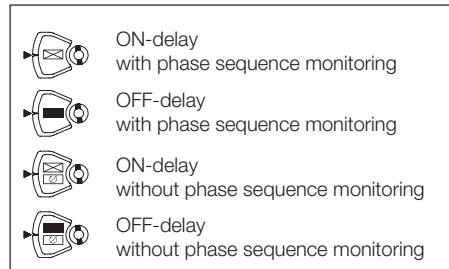
Connection diagram CM-PSS.x1



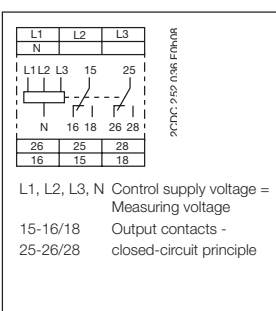
Connection diagram CM-PFE



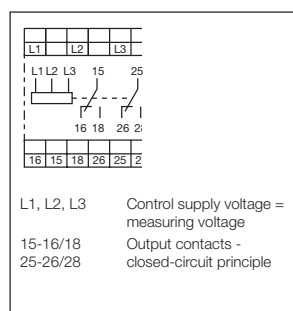
Rotary switch "Function" CM-PSS



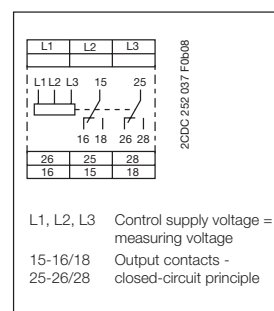
Connection diagram CM-UFS.2



Connection diagram CM-MPN.x2



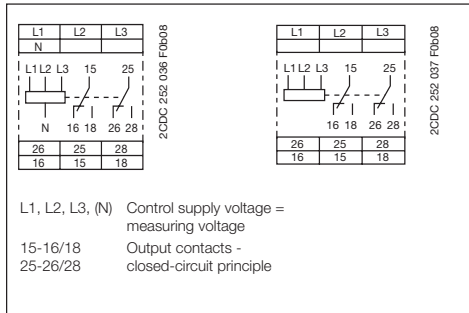
Connection diagram CM-PAS.x1



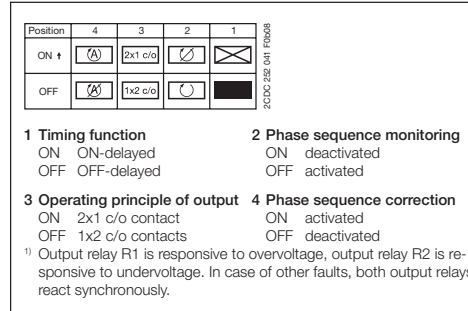
# Three-phase monitoring relays

## Connection diagrams, DIP switches, Rotary switches

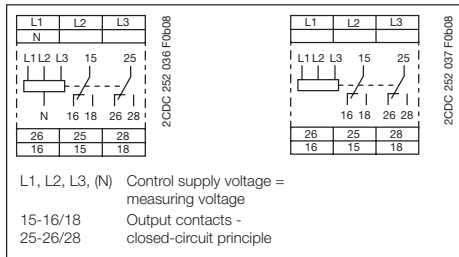
Connection diagram CM-MPS.x3



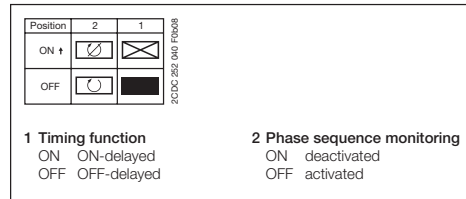
DIP switch functions CM-MPS.x3 and CM-MPN.x2



Connection diagram CM-MPS.x1

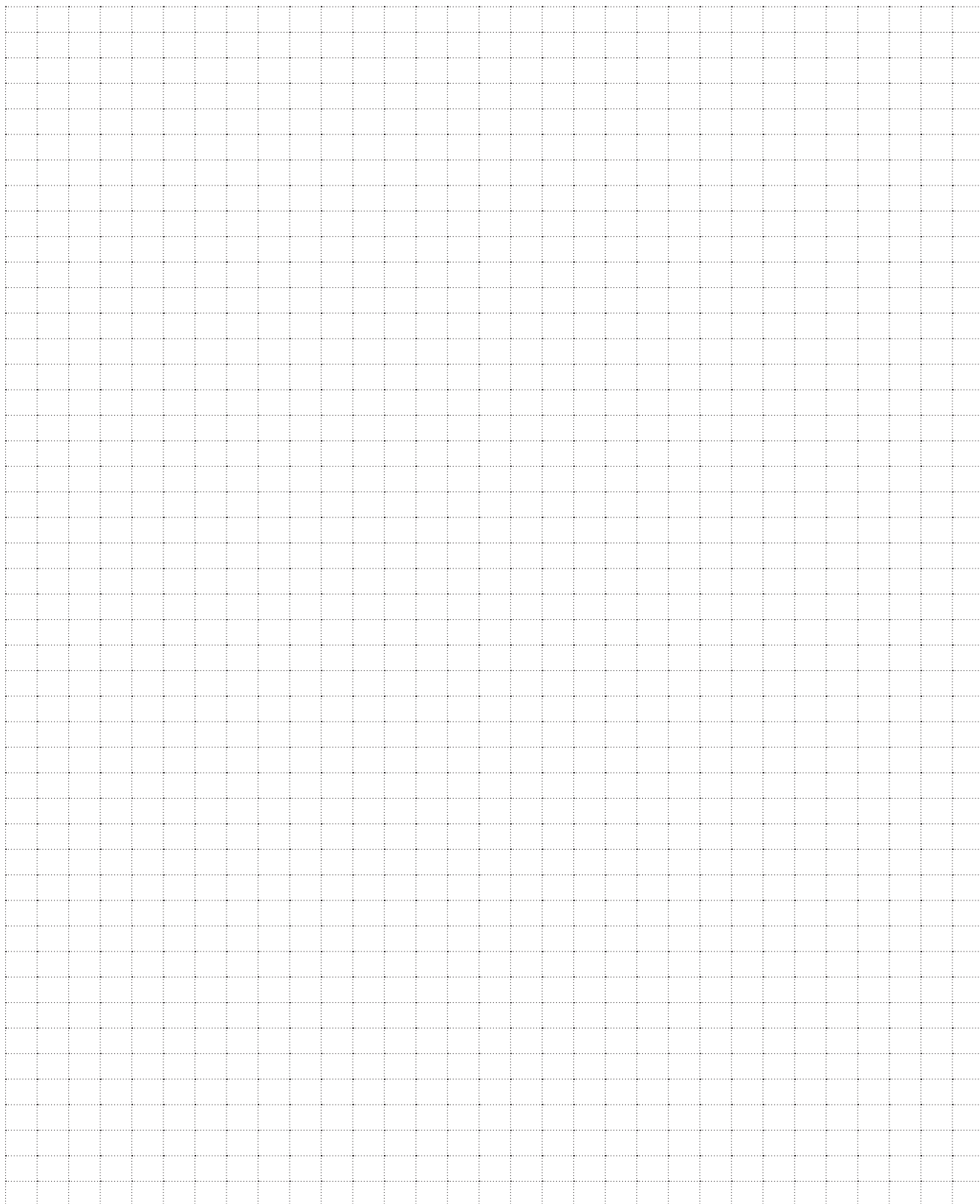


DIP switch functions CM-MPS.x1



# Three-phase monitoring relays

## Notes

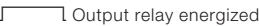




# Three-phase monitoring relays

## Technical data

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

Type	CM-PBE <sup>1)</sup>	CM-PBE	CM-PVE <sup>1)</sup>	CM-PVE	CM-PFE	CM-PFS
<b>Supply circuit = measuring circuit</b>	<b>L1-L2-L3-N</b>	<b>L1-L2-L3</b>	<b>L1-L2-L3-N</b>	<b>L1-L2-L3</b>	<b>L1-L2-L3</b>	
Rated control supply voltage $U_s$ = measuring voltage	3x380-440 V AC, 220-240 V AC	3x380-440 V AC	3x320-460 V AC, 185-265 V AC	3x320-460 V AC	3x208-440 V AC	3x200-500 V AC
Power consumption	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	$\Delta U \leq 0.06\ % / \text{°C}$					
<b>Timing circuit</b>						
Start-up delay $t_s$	fixed 500 ms ( $\pm 20\ %$ )				fixed 500 ms	
Tripping $t_v$	fixed 150 ms ( $\pm 20\ %$ )	at over- / undervoltage fixed 500 ms ( $\pm 20\ %$ )		fixed 500 ms	-	
<b>Indication of operational states</b>						
Relay status	R: yellow LED	 Output relay energized				
<b>Output circuits</b>	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 <sup>2)</sup>	closed-circuit principle					
Contact material	AgCdO				AgNi	
Rated operational voltage U	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 10 <sup>6</sup> switching cycles					
Electrical lifetime (AC12, 230 V, 4 A)	0.1 x 10 <sup>6</sup> switching cycles					
Max. fuse rating to achieve short-circuit protection	n/o 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				

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

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

# Three-phase monitoring relays

## Technical data

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

Type	CM-PBE <sup>1)</sup>	CM-PBE	CM-PVE <sup>1)</sup>	CM-PVE	CM-PFE	CM-PFS
<b>General data</b>						
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				
<b>Electrical connection</b>						
Wire size	fine-strand with wire end ferrule	2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG)				2 x 0.75- 2.5 mm <sup>2</sup> (2 x 8-14 AWG)
	fine-strand without wire end ferrule	2 x 1-1.5 mm <sup>2</sup> (2 x 18-16 AWG)				
	rigid	2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16 AWG)				2 x 0.5- 4 mm <sup>2</sup> (2 x 20-12 AWG)
Stripping length		10 mm (0.39 in)				7 mm (0.28 in)
Tightening torque		0.6-0.8 Nm				
<b>Environmental data</b>						
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
<b>Isolation data</b>						
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				
<b>Standards</b>						
Product standard		IEC 255-6, EN 60255-6				
Low Voltage Directive		2006/95/EC				
EMC Directive		2004/108/EC				
<b>Electromagnetic compatibility</b>						
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 kV-L				
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 - 10 V				
Interference emission		EN 61000-6-4				

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

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

# Three-phase monitoring relays

## Technical data

Data at  $T_a = 25\text{ °C}$  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	
<b>Input circuit = Measuring circuit</b>								
Rated control supply voltage $U_s =$ measuring voltage	3x380 V AC	3x400 V AC	3x160-300 V AC	3x300-500 V AC	3x200-400 V AC	3x160-300 V AC	3x300-500 V AC	
Rated control supply voltage $U_s$ tolerance				-15...+10 %				
Rated frequency				50/60 Hz				
Frequency range				45-65 Hz				
Typical current / power consumption	25 mA / 18 VA (380 V AC)	25 mA / 18 VA (400 V AC)	25 mA / 10 VA (230 V AC)	25 mA / 18 VA (400 V AC)	19 mA / 10 VA (300 V AC)	25 mA / 10 VA (230 V AC)	25 mA / 18 VA (400 V AC)	
<b>Measuring circuit</b>								
<b>L1, L2, L3</b>								
Monitoring functions	Phase failure	■	■	■	■	■	■	
	Phase sequence	can be switched off						
	Automatic phase sequence correction	-	-	-	-	-	-	
	Over- / undervoltage	■	■	■	■	■	-	
	Phase unbalance	-	-	-	-	■	■	
	Neutral	-	-	-	-	-	-	
Measuring range	Overvoltage	3x418 V AC	3x440 V AC	3x220-300 V AC	3x420-500 V AC	3x300-400 V AC	-	
	Undervoltage	3x342 V AC	3x360 V AC	3x160-230 V AC	3x300-380 V AC	3x210-300 V AC	-	
	Phase unbalance	-	-	-	-	-	2-25 % of average of phase voltages	
Thresholds	Overvoltage	fixed	adjustable within measuring range				-	-
	Undervoltage	fixed	adjustable within measuring range				-	-
	Phase unbalance (switch-off value)	-	-	-	-	-	adjust. within meas. range	
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				$\Delta U \leq 0.06\ \% / \text{°C}$				
Measuring method				True RMS				
<b>Timing circuit</b>								
Start-up delay $t_s$	fixed 200 ms							
Tripping delay $t_v$	ON- or OFF-delay 0; 0.1-30 s adjustable					ON- delay 0; 0.1-30 s adjustable		
Repeat accuracy (constant parameters)	-	-	-	-	1 w 0.2 %	-	-	
Accuracy within the rated control supply voltage tolerance				$\Delta t \leq 0.5\ %$				
Accuracy within the temperature range				$\Delta t \leq 0.06\ \% / \text{°C}$				
Indication of operational states	Details see function description / -diagrams		1 yellow LED, 2 red LED's			Details see function description / -diagrams		
<b>Output circuits</b>								
<b>15-16/18, 25-26/28</b>								
Kind of output	2x1 c/o contacts (Relays)							
Operating principle <sup>1)</sup>	closed-circuit principle							
Contact material	AgNi alloy, Cd free							
Rated operational voltage $U_n$	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  $T_a = 25\text{ °C}$  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 $I_n$ (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 <sup>6</sup> switching cycles			
Electrical lifetime (AC12, 230 V, 4 A)					0.1 x 10 <sup>6</sup> switching cycles			
Max. fuse rating to achieve short-circuit protection	n/c contact				6 A fast-acting			
	n/o contact				10 A fast-acting			
<b>General data</b>								
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			
<b>Electrical connection</b>								
Wire size			<b>Screw connection technology</b>		<b>Easy Connect Technology (Push-in)</b>			
	fine-strand with(out) wire end ferrule			1 x 0.5-2.5 mm <sup>2</sup> (1 x 20-14 AWG)	2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)			
				2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)				
	rigid			1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)	2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)			
		2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)						
Stripping length					8 mm (0.32 in)			
Tightening torque					0.6-0.8 Nm (5.31-7.08 lb.in)			
<b>Environmental data</b>								
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			
<b>Isolation data</b>								
Rated insulation voltage U <sub>i</sub>	input circuit / output circuit				600 V			
	output circuit 1 / output circuit 2				300 V			
Rated impulse withstand voltage U <sub>imp</sub> (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			
<b>Standards</b>								
Product standard					IEC/EN 60255-6, EN 50178			
Low Voltage Directive					2006/95/EG			
EMC directive					2004/108/EG			
RoHS directive					2002/95/EG			
<b>Electromagnetic compatibility</b>								
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  $T_a = 25\text{ °C}$  and rated values, unless otherwise indicated

Type	CM-MPS.11	CM-MPS.21	CM-MPS.31	CM-MPS.41
<b>Input circuit = Measuring circuit</b>				
	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)
<b>Measuring circuit</b>				
	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
	Undervoltage	3x90-130 V AC	3x180-220 V AC	3x160-230 V AC
	Phase unbalance	2-25 % of average of phase voltages		
Thresholds	Overvoltage	adjustable within measuring range		
	Undervoltage	adjustable within measuring range		
	Phase unbalance (switch-off value)	adjustable within measuring range		
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	$\Delta U \leq 0.06\% / \text{°C}$			
Measuring method	True RMS			
<b>Timing circuit</b>				
Start-up delay $t_s$	fixed 200 ms			
Tripping delay $t_v$	ON- or OFF-delay 0; 0.1-30 s adjustable			
Accuracy within the rated control supply voltage tolerance	$\Delta t \leq 0.5\%$			
Accuracy within the temperature range	$\Delta t \leq 0.06\% / \text{°C}$			
Indication of operational states	Details see function description / -diagrams			
<b>Output circuits</b>				
Kind of output	15-16/18, 25-26/28			
Operating principle <sup>1)</sup>	1x2 c/o contacts (Relays)			
Contact material	closed-circuit principle			
Rated operational voltage $U_n$ (IEC/EN 60947-1)	AgNi alloy, Cd free			
Minimum switching power	250 V			
Maximum switching voltage	24 V / 10 mA			
Rated operational current $I_B$ (IEC/EN 60947-5-1)	see load limit curve			
	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 <sup>6</sup> switching cycles			
Electrical lifetime (AC12, 230 V, 4 A)	0.1 x 10 <sup>6</sup> switching cycles			
Max. fuse rating to achieve short-circuit protection	n/c contact	6 A fast-acting		
	n/o contact	10 A fast-acting		

# Three-phase monitoring relays

## Technical data

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

Type	CM-MPS.11	CM-MPS.21	CM-MPS.31	CM-MPS.41	
<b>General data</b>					
MTBF	on request				
Duty time	100%				
Dimensions	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)			
(W x H x D)					
Weight	<b>Screw connection technology</b>		<b>Easy Connect Technology (Push-in)</b>		
	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			
<b>Electrical connection</b>					
Wire size	<b>Screw connection technology</b>		<b>Easy Connect Technology (Push-in)</b>		
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm <sup>2</sup> (1 x 20-14 AWG)		2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)	
		2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)			
rigid	1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)		2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)		
Stripping length	8 mm (0.32 in)				
Tightening torque	0.6-0.8 Nm (5.31-7.08 lb.in)			-	
<b>Environmental data</b>					
Ambient temperature ranges	operation / storage	-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				
<b>Isolation data</b>					
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 $\mu$ s			
	output circuit	4 kV; 1.2/50 $\mu$ s			
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				
Overtoltage category (VDE 0110, IEC 60664)	III				
<b>Standards</b>					
Product standard	IEC/EN 60255-6, EN 50178				
Low Voltage Directive	2006/95/EG				
EMC directive	2004/108/EG				
RoHS directive	2002/95/EG				
<b>Electromagnetic compatibility</b>					
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			

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

# Three-phase monitoring relays

## Technical data

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

Type	CM-MPS.23	CM-MPS.43	CM-MPN.52	CM-MPN.62	CM-MPN.72
<b>Input circuit = Measuring circuit</b>	<b>L1, L2, L3, N</b>		<b>L1, L2, L3</b>		
Rated control supply voltage $U_s =$ measuring voltage	3x180-280 V AC	3x300-500 V AC	3x350-580 V AC	3x450-720 V AC	3x530-820 V AC
Rated control supply voltage $U_s$ tolerance			-15...+10 %		
Rated frequency	50/60/400 Hz		50/60 Hz		
Frequency range	45-440 Hz		45-65 Hz		
Typical current / power consumption	5 mA / 4 VA (230 V AC)	5 mA / 4 VA (400 V AC)	29 mA / 41 VA (480 V AC)	29 mA / 52 VA (600 V AC)	29 mA / 59 VA (690 V AC)
<b>Measuring circuit</b>	<b>L1, L2, L3, N</b>		<b>L1, L2, L3</b>		
Monitoring functions	Phase failure		■		
	Phase sequence		■		
	Automatic phase sequence correction		can be switched off		
	Over- / undervoltage		■		
	Phase unbalance		■		
	Interrupted neutral		■		
Measuring range	Overvoltage		3x240-280 V AC		
	Undervoltage		3x180-220 V AC		
Thresholds	Phase unbalance		2-25 % of average of phase voltages		
	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			$\Delta U \leq 0.06\% / \text{°C}$		
Measuring method			True RMS		
<b>Timing circuit</b>					
Start-up delay $t_s$ and $t_{sd}$	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	$\Delta t \leq 0.06\% / \text{°C}$				
Indication of operational states	Details see function description / -diagrams				
<b>Output circuits</b>	<b>15-16/18, 25-26/28</b>				
Kind of output	2x1 or 1x2 c/o contacts configurable (Relays)				
Operating principle <sup>1)</sup>	closed-circuit principle				
Contact material	AgNi alloy, Cd free				
Rated operational voltage $U_o$	IEC/EN 60947-1 250 V				
Minimum switching power	24 V / 10 mA				
Maximum switching voltage	see load limit curve				
Rated operational current $I_o$	4 A				
(IEC/EN 60947-5-1)	AC12 (resistive) 230 V				
	AC15 (inductive) 230 V				
	DC12 (resistive) 24 V				
	DC13 (inductive) 24 V				
AC rating	Utilization category (Control Circuit Rating Code)				
(UL 508)	max. rated operational voltage				
	max. continuous thermal current at B 300				
	max. making/breaking apparent power at B 300				
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				
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  $T_a = 25\text{ °C}$  and rated values, unless otherwise indicated

Type	CM-MPS.23	CM-MPS.43	CM-MPN.52	CM-MPN.62	CM-MPN.72
<b>General data</b>					
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			
<b>Electrical connection</b>					
Wire size		<b>Screw connection technology</b>		<b>Easy Connect Technology</b>	
				<b>(Push-in)</b>	
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm <sup>2</sup> (1 x 20-14 AWG) 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)		2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)	
	rigid	1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG) 2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)		2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)	
Stripping length		8 mm (0.32 in)			
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)			
<b>Environmental data</b>					
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			
<b>Isolation data</b>					
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 $\mu$ s		8 kV; 1.2/50 $\mu$ s	
	output circuit			4 kV; 1.2/50 $\mu$ s	
Test voltage (type test) between	isolated output circuits	2.5 kV, 50 Hz, 1 s		2.5 kV, 50 Hz, 1 s	
	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	
Overtoltage category (VDE 0110, IEC 60664)				III	
<b>Standards</b>					
Product standard		IEC/EN 60255-6, EN 50178			
Low Voltage Directive		2006/95/EG			
EMC directive		2004/108/EG			
RoHS directive		2002/95/EG			
<b>Electromagnetic compatibility</b>					
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			

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



# Three-phase monitoring relays

## Technical data

Data at  $T_a = 25\text{ °C}$  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	3 x 320-480 V AC	3 x 184-276 V AC
Thresholds		Frequency range 45-55 Hz
		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
Accuracy within the rated control supply voltage tolerance		10 minutes average value $\Delta U \leq 0,5\%$
Accuracy within the temperature range		$\Delta U \leq 0,06\% / \text{°C}$
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		$\Delta t \leq 0,06\% / \text{°C}$
Indication of operational states	1 yellow LED, 2 red LEDs 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 <sup>1)</sup>	closed-circuit principle	
Contact material	AgNi alloy, Cd free	
Rated operational voltage $U_o$ (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 $I_o$ (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 10 <sup>6</sup> switching cycles	
Electrical lifetime (AC12, 230 V, 4 A)	0,1 x 10 <sup>6</sup> switching cycles	
Max. fuse rating to achieve short-circuit protection	n/c contact	6 A fast-acting
	n/o contact	10 A fast-acting

# Three-phase monitoring relays

## Technical data

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

Type		CM-UFS.2
<b>General data</b>		
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
<b>Electrical connection</b>		
Wire size	fine-strand with(out) wire end ferrule	<b>Screw connection technology</b>
		<b>Easy Connect Technology (Push-in)</b>
		1 x 0.5-2.5 mm <sup>2</sup> (1 x 20-14 AWG) 2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)
	rigid	1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG) 2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)
Stripping length		8 mm (0.32 in)
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)
<b>Environmental data</b>		
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
<b>Isolation data</b>		
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 $\mu$ s
	output circuit	4 kV; 1,2/50 $\mu$ s
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
<b>Standards</b>		
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	
<b>Electromagnetic compatibility</b>		
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

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