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# Three-phase monitoring relays

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# Three-phase monitoring relays

## Benefits and advantages



For the monitoring of voltages in a three-phase system or network, ABB's CM range contains a wide selection of powerful and compact devices. This product range includes voltage monitoring relays for phase sequence, phase loss, unbalance and monitoring of over- and under voltage from 160 V to 820 V.



### Continuous operation

Read the status of the relay at a glance: clear visualization of the device status via LEDs. Easy to adjust with rotary wheels and variants with push-in terminals make a quick and easy installation and setting possible.



### Reliable in harsh conditions

All relays work reliably in environments with low temperatures down to  $-25^{\circ}\text{C}$ . Additionally, the housing fulfills the UL 94 V-0 flammability standard requirements. Together with the vibration resistant push-in terminals, the relay is not only reliable no matter the environment temperature but is also durable to shock and vibration. Save time as retightening is no longer needed and enhance the reliability and safety not only for the equipment.



### Easy installation

Like all devices from the measuring and monitoring portfolio, the three-phase monitoring relays are easily configurable via front facing potentiometers. Easy threshold configuration without calculation is accomplished by direct reading scales. For further configuration options, additional settings can be made via dip-switches, offering the flexibility to configure, for example, the working principle of the relays and the output configuration. The device can be set up before installation in the application and easy adjustments during the process are possible.

# Three-phase monitoring relays

## Benefits and advantages



### Characteristics

- True RMS (TRMS) measuring principle
- Device for the use in mains with a frequency of 45-440 Hz and where harmonics are to be expected<sup>(1)</sup>
- Adjustable phase unbalance threshold value
- Adjustable ON-delay/OFF-delay time
- Powered by the measuring circuit
- 1 n/o contact, 1 or 2 c/o contacts
- LEDs for the indication of operational states
- Multifunctional and singlefunctional devices
- Phase failure detection
- Phase sequence monitoring
- Over- and undervoltage monitoring (fixed or adjustable)
- Wide-range operating voltage guarantees world-wide operation
- Various approvals and marks

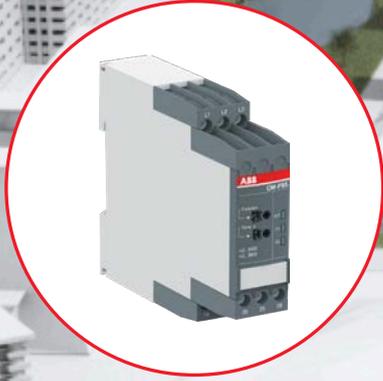
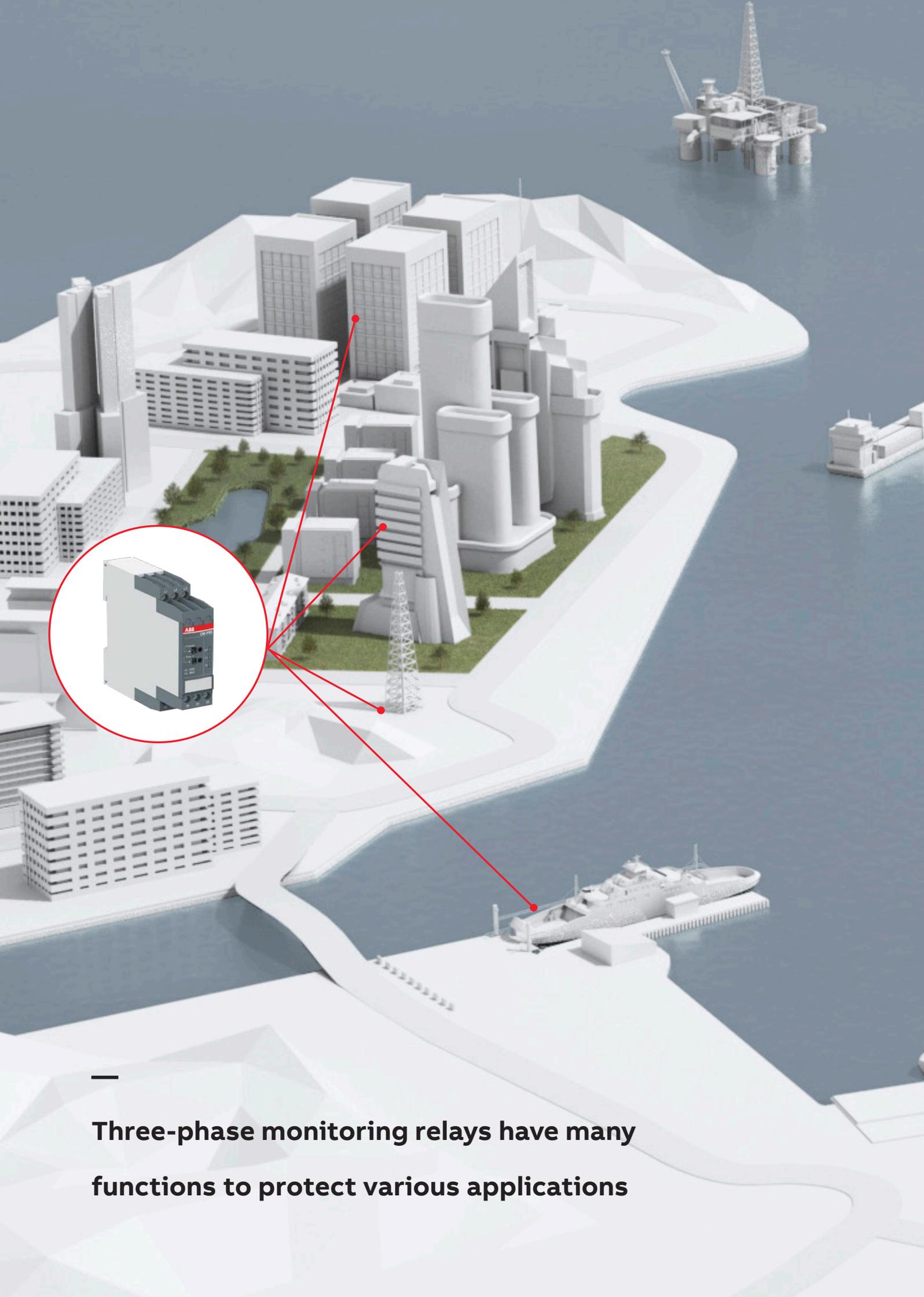
<sup>(1)</sup> devices CM-MPS.23 and CM-MPS.43



### Applications

- Control for connection of moving equipment (e.g. air conditioning compressors, refrigerated trucks and containers, and cranes)
- Control against reverse motor operation (lifting, handling, elevators, escalators, etc.)
- Control of sensitive three-phase supplies
- Overheating of the motor due to asymmetrical voltage
- Protection of a plant against destruction due to overvoltage
- Direction of rotation of the drive





**Three-phase monitoring relays have many functions to protect various applications**

# Three-phase monitoring relays

## Function

### Phase unbalance monitoring

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

### Phase sequence

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

### Phase loss

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

### Voltage monitoring

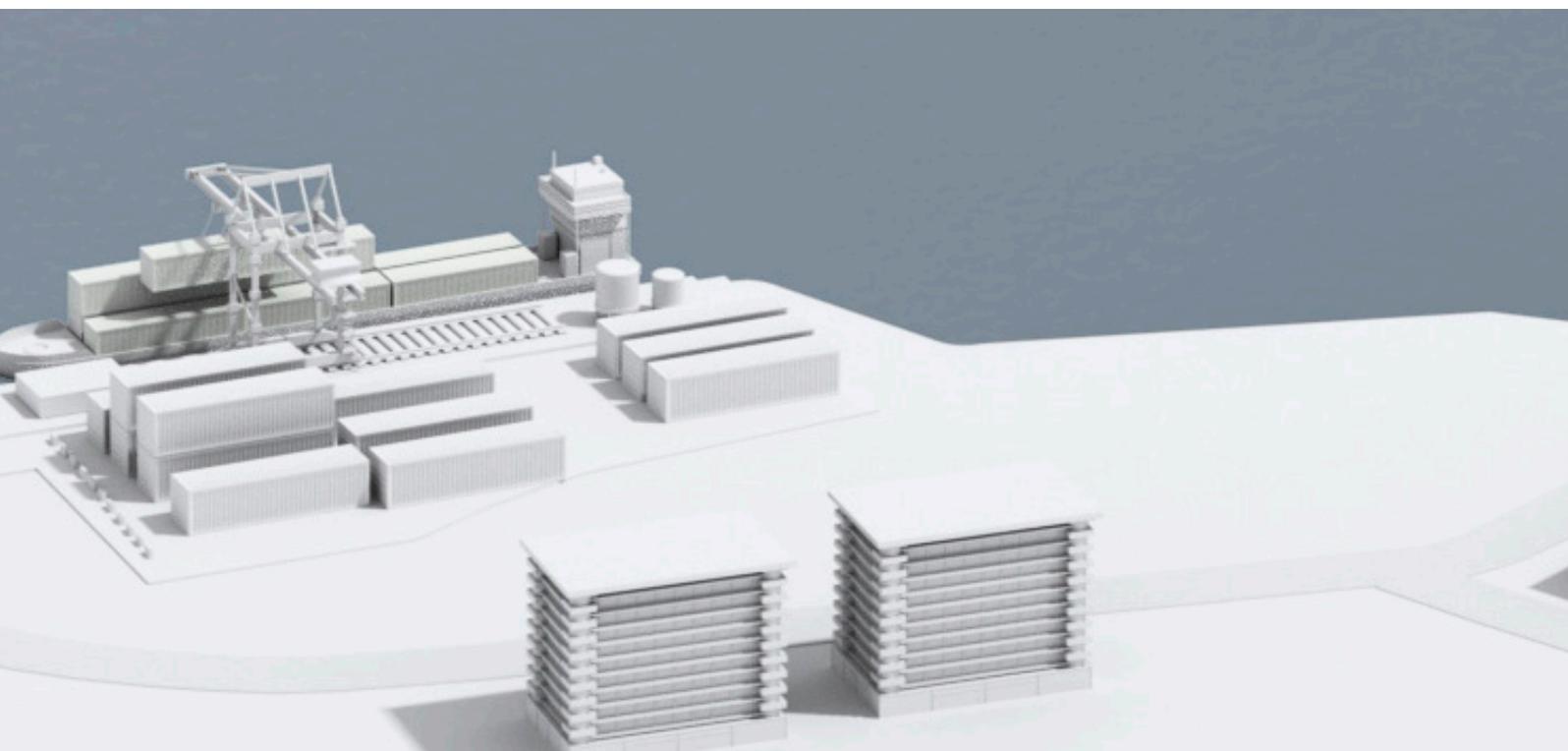
All electric devices can be damaged when operated continuously in a network with out-of-range voltages. For example, safe starting is not ensured in case of undervoltage. Also, the switching state of a contactor is not clearly defined when operated in a "forbidden" voltage range. This can lead to undefined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

### Selectable phase sequence monitoring

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

### Automatic phase sequence correction

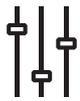
The automatic phase sequence correction is activated by means of a DIP switch. With activated phase sequence correction, it is ensured that for any non-fixed or portable equipment, e.g. construction machinery, the correct phase sequence is always applied to the input terminals of the load. For details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



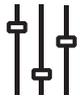
# Three-phase monitoring relays

## Operating controls

### S-range housing



Adjustment of the threshold value  $>U$  for overvoltage

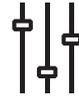
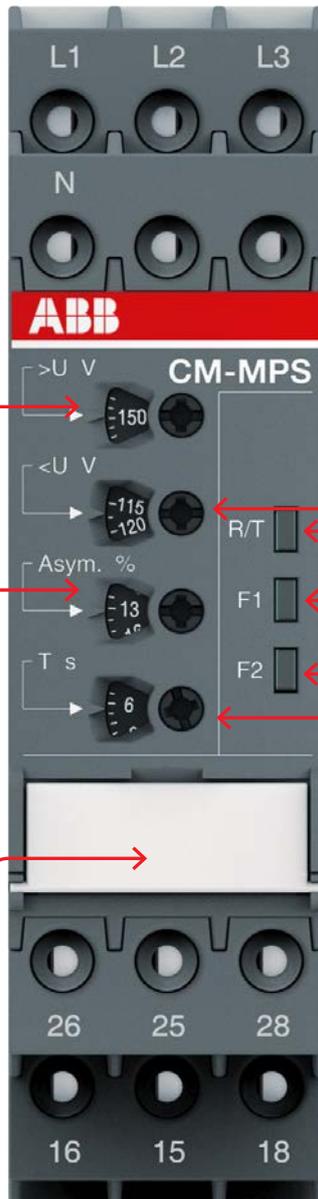


Adjustment of the threshold value Asymmetry for phase unbalance



**DIP switches**

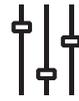
- ON-delay
- OFF-delay
- Phase sequence monitoring deactivated
- Phase sequence monitoring activated
- Phase sequence correction activated
- Phase sequence correction deactivated
- 2x1 c/o (SPDT) contact
- 1x2 c/o (SPDT) contacts



Adjustment of the threshold value  $<U$  for undervoltage



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



Adjustment of the tripping delay T

# Three-phase monitoring relays

## Operating controls

### N-range housing

The image shows the front panel of an ABB CM-MPN three-phase monitoring relay. It features three phase terminals (L1, L2, L3) at the top and three contact terminals (16, 15, 18, 26, 25, 28) at the bottom. The central panel contains four rotary potentiometers for adjusting thresholds: >U V (set to 520), <U V (set to 400), Asym. % (set to 13), and Time s (set to 8). To the right of these potentiometers are three LED indicators labeled R/T, F1, and F2. The relay is marked with the ABB logo and the model name CM-MPN.

**Adjustment of the threshold value >U for overvoltage**

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

**Adjustment of the threshold value Asymmetry for phase unbalance**

**Indication of operational states**  
 R/T: red LED – Relay status / timing  
 F1: yellow LED – Fault message  
 F2: yellow LED – Fault message

**Adjustment of the tripping delay T**

**DIP switches**

- ON-delay
- OFF-delay
- Phase sequence monitoring deactivated
- Phase sequence monitoring activated
- Phase sequence correction activated
- Phase sequence correction deactivated
- 2x1 c/o (SPDT) contact
- 1x2 c/o (SPDT) contacts

# Three-phase monitoring relays

## Selection table - singlefunctional

Type	Order number	CM-PBE	CM-PBE	CM-PVE	CM-PVE	CM-PFE	CM-PFE.2	CM-PFS.S	CM-PFS.P	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	
	1SVR550881R9400																							
	1SVR550882R9500																							
	1SVR550870R9400																							
	1SVR550871R9500																							
	1SVR550824R9100																							
	1SVR550826R9100																							
	1SVR730824R9300																							
	1SVR740824R9300																							
	1SVR730784R2300																							
	1SVR740784R2300																							
	1SVR730784R3300																							
	1SVR740784R3300																							
	1SVR730794R1300																							
	1SVR740794R1300																							
	1SVR730794R3300																							
	1SVR740794R3300																							
	1SVR730794R2300																							
	1SVR740794R2300																							
	1SVR730774R1300																							
	1SVR740774R1300																							
	1SVR730774R3300																							
	1SVR740774R3300																							
<b>Rated control supply voltage <math>U_s</math></b>																								
<b>Phase to phase</b>																								
160-300 V AC																								
200-400 V AC																								
200-500 V AC																								
208-440 V AC																								
300-500 V AC																								
320-460 V AC																								
380 V AC																								
380-440 V AC																								
400 V AC																								
<b>Phase to neutral</b>																								
185-265 V AC																								
220-240 V AC																								
<b>Rated frequency</b>																								
50/60 Hz																								
<b>Suitable for monitoring</b>																								
Single-phase mains																								
Three-phase mains																								
<b>Monitoring function</b>																								
Phase failure																								
Phase sequence																								
Overvoltage																								
Undervoltage																								
Unbalance																								
Neutral <sup>(1)</sup>																								
<b>Thresholds</b>																								
adjustable (adj) or fixed (fix)																								
<b>Timing functions for tripping delay</b>																								
ON delay																								
On and OFF delay																								
<b>Connection type</b>																								
Push-in terminals																								
Double-chamber cage connection terminals																								

(1) The external conductor voltage towards the neutral conductor is measured.

adj: adjustable  
 sel: selectable  
 fix: fixed

## Three-phase monitoring relays

### Ordering details - singlefunctional



CM-PBE



CM-PSS.41P



CM-PAS.31P

#### Description

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

#### Ordering details

Characteristics	Type	Order code	Weight (1 pc) kg (lb)
See selection table	CM-PBE	1SVR550881R9400	0.08 (0.17)
	CM-PBE	1SVR550882R9500	0.08 (0.17)
	CM-PVE	1SVR550870R9400	0.08 (0.17)
	CM-PVE	1SVR550871R9500	0.08 (0.17)
	CM-PFE	1SVR550824R9100	0.08 (0.17)
	CM-PFE.2	1SVR550826R9100	0.067 (0.147)

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

S: screw connection  
P: push-in connection

# Three-phase monitoring relays

## Selection table - multifunctional

Type	Order number	CM-MPS.11S	CM-MPS.11P	CM-MPS.21S	CM-MPS.21P	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	
	1SVR730885R1300																			
	1SVR740885R1300																			
	1SVR730885R3300																			
	1SVR740885R3300																			
	1SVR730884R1300																			
	1SVR740884R1300																			
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	1SVR740885R4300																			
	1SVR730884R4300																			
	1SVR740884R4300																			
	1SVR750487R8300																			
	1SVR760487R8300																			
	1SVR750488R8300																			
	1SVR760488R8300																			
	1SVR750489R8300																			
	1SVR760489R8300																			
<b>Rated control supply voltage U<sub>c</sub></b>																				
<b>Phase to phase</b>																				
160-300 V AC						■	■													
300-500 V AC								■	■				■	■						
350-580 V AC														■	■					
450-720 V AC																■	■			
530-820 V AC																		■	■	
<b>Phase to neutral</b>																				
90-170 V AC	■	■																		
180-280 V AC			■	■						■	■									
<b>Rated frequency</b>																				
50/60 Hz	■	■	■	■	■	■	■	■	■					■	■	■	■	■	■	■
50/60/400 Hz										■	■	■	■							
<b>Suitable for monitoring</b>																				
Mains with harmonic content										■	■	■	■							
Single-phase mains	■	■	■	■						■	■									
Three-phase mains	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<b>Monitoring function</b>																				
Phase failure	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase sequence	sel	sel	sel	sel	sel	sel	sel	sel	sel	adj	adj									
Automatic phase sequence correction										adj	adj									
Overvoltage	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Undervoltage	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Unbalance	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Interrupted neutral monitoring <sup>1)</sup>	■	■	■	■						■	■									
<b>Thresholds</b>																				
Adjustable (adj)	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
<b>Timing functions for tripping delay</b>																				
On- or OFF delay	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
<b>Connection type</b>																				
Push-in terminals		■		■		■		■		■		■		■		■		■		■
Double-chamber cage connection terminals	■		■		■		■		■		■		■		■		■		■	

1) The relay detects by means of a phase unbalance the interruption of the neutral conductor. The external conductor voltage towards the neutral conductor is measured too.

adj: adjustable  
sel: selectable

## Three-phase monitoring relays

### Ordering details - multifunctional



CM-MPS.23P

2CDC251.065.V0011



CM-MPN.52P

2CDC251.062.V0011

#### Description

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

#### Ordering details

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

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

## Three-phase monitoring relays

### Technical data

Type	CM-PBE <sup>1)</sup>	CM-PBE	CM-PVE <sup>1)</sup>	CM-PVE	CM-PFE	CM-PFE.2	CM-PFS
Input circuit - supply circuit	L1-L2-L3-N	L1-L2-L3	L1-L2-L3-N	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						13 mA / 9 VA	approx. 15 VA
Rated control supply voltage $U_s$ tolerance	-15...+15 %		-15...+10 %				
Rated frequency	50/60 Hz		50/60 Hz (-10...+10 %)		50/60 Hz		
Duty time	100 %						
Input circuit - measuring circuit	L1-L2-L3-N	L1-L2-L3	L1-L2-L3-N	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 $U_N$		fixed 185 V / 320 V	fixed 320 V	$0.6 \times U_N$		
	$U_{max}$ -		fixed 265 V / 460 V	fixed 460 V	-		
Hysteresis related to the threshold value	fixed 5 % (release value = 0.65 x $U_N$ )		fixed 5 %		-		
Measuring voltage frequency	50/60 Hz (-10 %...+10 %)				50/60 Hz		
Response time	40 ms		80 ms		500 ms		
Accuracy within the temperature range	-		$\Delta U \leq 0.06 \% / ^\circ C$				
Timing circuit							
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		-
Indication of operational states							
Relay status	R: yellow LED	┌───┐ output relay energized					
Fault message	F: red LED	Only CM-PFS: ┌───┐ phase failure / ┌───┐ phase sequence error					

## Three-phase monitoring relays

### Technical data

Type	CM-PBE <sup>1)</sup>	CM-PBE	CM-PVE <sup>1)</sup>	CM-PVE	CM-PFE	CM-PFE.2	CM-PFS
Output circuits	13-14				11-12/14		11 <sub>15</sub> -12 <sub>16</sub> / 14 <sub>18</sub> , 21 <sub>25</sub> -22 <sub>26</sub> / 24 <sub>28</sub>
Kind of output	1 n/o contact				1 c/o contact		2 c/o contacts
Operating principle	closed-circuit principle <sup>2)</sup>						
Minimum switching voltage / Minimum switching current	24 V / 10 mA						
Maximum switching voltage / maximum switching voltage	see data sheets						
Rated operational voltage U <sub>e</sub> and rated operational current I <sub>e</sub>	AC-12 (resistive) 230 V	4 A					
	AC-15 (inductive) 230 V	3 A					
	DC-12 (resistive) 24 V	4 A					
	DC-13 (inductive) 24 V	2 A					
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300 pilot duty, general purpose 250 V, 4 A, cos phi 0.75					
	max. rated operational voltage	300 V AC					
	max. continuous thermal current at B 300	5 A					
	max. making/breaking apparent power at B 300	3600/360 VA					
Mechanical lifetime	30 x 10 <sup>6</sup> switching cycles						
Electrical lifetime (AC-12, 230 V, 4 A)	0.1 x 10 <sup>6</sup> switching cycles						
Max. fuse rating to achieve short-circuit protection	n/c contact	10 A fast-acting				6 A fast-acting	
	n/o contact	10 A fast-acting					
Conventional thermal current I <sub>th</sub>					4 A		

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

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

## Three-phase monitoring relays

### Technical data

Type	CM-PBE <sup>(1)</sup>	CM-PBE	CM-PVE <sup>(1)</sup>	CM-PVE	CM-PFE	CM-PFE.2	CM-PFS
<b>Electromagnetic compatibility</b>							
Interference immunity to		IEC/EN 61000-6-2					
electrostatic discharge	IEC/EN 61000-4-2	level 3 - 6 kV/ 8 kV					
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	level 3 - 10 V/m					level 3 - 10 V/m (1 GHz) 3 V/m (2 GHz) 1 V/m (2.7 GHz)
electrical fast transient / burst	IEC/EN 61000-4-4	level 3 - 2 kV / 5 kHz					
surge	IEC/EN 61000-4-5	level 4 - 2 kV L-L					
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	level 3 - 10 V					
voltage dips, short interruptions and voltage variations	IEC/EN 61000-4-11	-					class 3
harmonics and interharmonics	IEC/EN 61000-4-13	-					class 3
Interference emission		IEC/EN 61000-6-3					
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B					
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B					

(1) Device with neutral monitoring: The external conductor voltage towards the neutral conductor is measured.

## Three-phase monitoring relays

### Technical data

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

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

Type		CM-PSS.31	CM-PSS.41	CM-PVS.31	CM-PVS.41	CM-PVS.81	CM-PAS.31	CM-PAS.41
Rated operational voltage $U_e$ and rated operational current $I_e$	AC-12 (resistive) 230 V	4 A						
	AC-15 (inductive) 230 V	3 A						
	DC-12 (resistive) 24 V	4 A						
	DC-13 (inductive) 24 V	2 A						
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300						
	max. rated operational voltage	300 V AC						
	max. continuous thermal current at B 300	5 A						
	max. making/breaking apparent power at B 300	3600/360 VA						
Mechanical lifetime		30 x 10 <sup>6</sup> switching cycles						
Electrical lifetime (AC-12, 230 V, 4 A)		0.1 x 10 <sup>6</sup> switching cycles						
Max. fuse rating to achieve short-circuit protection	n/c contact	6 A fast-acting						
	n/o contact	10 A fast-acting						
<b>General data</b>								
MTBF		on request						
Duty cycle		100%						
Dimensions		see dimensional drawings						
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool						
Mounting position		any						
Minimum distance to other units	horizontal	10 mm (0.39 in) in case of continuous measuring voltages						
		> 400 V	> 400 V	> 220 V	> 400 V	-	> 220 V	> 400 V
Material of housing		UL 94 V-0						
Degree of protection	housing / terminals	IP50 / IP20						
<b>Electrical connection</b>								
Wire size		<b>Screw connection technology</b>			<b>Easy Connect Technology (Push-in)</b>			
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG)			2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)			
		2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)						
rigid	1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG)			2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)				
Stripping length		8 mm (0.32 in)						
Tightening torque		0.6-0.8 Nm (7.08 lb.in)			-			
<b>Environmental data</b>								
Ambient temperature ranges	operation / storage	-25...+60 °C / -40...+85 °C						
Damp heat, cyclic (IEC 60068-2-30)		6 x 24 h cycle, 55 °C, 95 % RH						
Climatic class		3K3						
Vibration (sinusoidal)		class 2						
Shock		class 2						
<b>Isolation data</b>								
Rated insulation voltage $U_i$	input circuit / output circuit	600 V						
	output circuit 1 / output circuit 2	300 V						
Rated impulse withstand voltage $U_{imp}$	input circuit	6 kV; 1.2/50 μs						
	output circuit	4 kV; 1.2/50 μs						
Basic insulation	input circuit / output circuit	600 V						
Protective separation	input circuit / output circuit	-						
Pollution degree		3						
Overtoltage category		III						

## Three-phase monitoring relays

### Technical data

Type	CM-PSS.31	CM-PSS.41	CM-PVS.31	CM-PVS.41	CM-PVS.81	CM-PAS.31	CM-PAS.41
<b>Standards / Directives</b>							
Standards	IEC/EN 60255-27, IEC/EN 60947-5-1, EN 50178						
Low Voltage Directive	2014/35/EU						
EMC directive	2014/30/EU						
RoHS directive	2011/65/EU						
<b>Electromagnetic compatibility</b>							
Interference immunity to	EN 61000-6-1						
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)					
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)					
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3 (2 kV / 2 kHz)					
surge	IEC/EN 61000-4-5	Level 4 (2 kV L-L)					
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 (10 V)					
Interference emission	IEC/EN 61000-6-3						
high-frequency radiated	IEC/CISPR 22, EN 55022	class B					
high-frequency conducted	IEC/CISPR 22, EN 55022	class B					

## Three-phase monitoring relays

### Technical data

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

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

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

## Three-phase monitoring relays

### Technical data

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

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

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	see dimensional drawings				
Mounting	DIN rail (IEC/EN 60715), snap-on mounting without any tool				
Mounting position	any				
Minimum distance to other units	horizontal	10 mm (0.39 in)	not necessary		
Material of housing	UL 94 V-0				
Degree of protection	housing / terminals	IP50 / IP20			
<b>Electrical connection</b>					
Wire size			<b>Screw connection technology</b>	<b>Easy Connect Technology (Push-in)</b>	
	fine-strand with(out) wire end ferrule		1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG) 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 18-16 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 (7.08 lb.in)			-	
<b>Environmental data</b>					
Ambient temperature ranges	operation / storage	-25...+60 °C / -40...+85 °C			
Damp heat, cyclic (IEC 60068-2-30)	6 x 24 h cycles, 55 °C, 95 % RH				
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	1000 V		
	output circuit 1 / 2	300 V			
Rated impulse withstand voltage U <sub>imp</sub>	input circuit	6 kV; 1.2/50 μs		8 kV; 1.2/50 μs	
	output circuit	4 kV; 1.2/50 μs			
Basic insulation	input circuit / output circuit	600 V	1000 V		
Protective separation (IEC/EN 61140, EN 50148)	input circuit / output circuit	-			
Pollution degree	3				
Overvoltage category	III				
<b>Standards / Directives</b>					
Standards	IEC/EN 60255-27, IEC/EN 60947-5-1, EN 50178				
Low Voltage Directive	2014/35/EU				
EMC Directive	2014/30/EU				
RoHS Directive	2011/65/EU				
<b>Electromagnetic compatibility</b>					
Interference immunity to		IEC/EN 61000-6-2			
electrostatic discharge	IEC/EN 61000-4-2	level 3 (6 kV / 8 kV)			
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	level 3 (10 V/m)			
electrical fast transient / burst	IEC/EN 61000-4-4	level 3 (2 kV / 2 kHz)			
surge	IEC/EN 61000-4-5	level 4 (2 kV L-N)	Level 4 (2 kV L-L)		
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	level 3 (10 V)			
harmonics and interharmonics	IEC/EN 61000-4-13	class 3			
Interference emission		IEC/EN 61000-6-3			
high-frequency radiated	IEC/CISPR 22, EN 55022	class B			
high-frequency conducted	IEC/CISPR 22, EN 55022	class B			

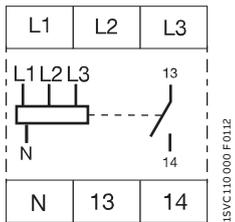
# Three-phase monitoring relays

## Technical diagrams

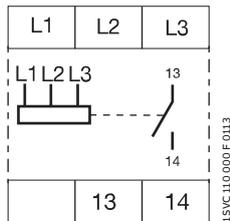
### Connection diagrams

#### CM-PBE, CM-PVE

with neutral

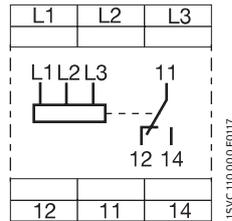


without neutral



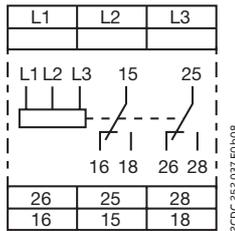
L1, L2, L3, (N) Control supply voltage = Measuring voltage  
13-14 Output contact - closed-circuit principle

#### CM-PFE



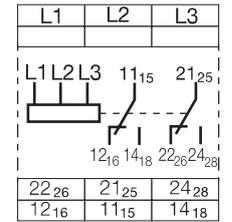
L1, L2, L3 Control supply voltage = Measuring voltage  
11-12/14 Output contact - closed-circuit principle

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



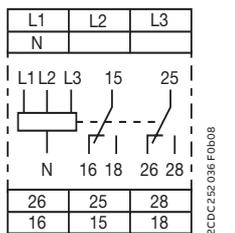
L1, L2, L3 Control supply voltage = Measuring voltage  
15-16/18 Output contact - closed-circuit principle  
25-26/28

#### CM-PFS



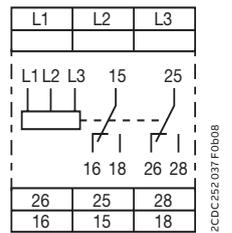
L1, L2, L3 Control supply voltage = Measuring voltage  
11<sub>15</sub>-12<sub>16</sub>/14<sub>18</sub> Output contact - closed-circuit principle  
21<sub>25</sub>-22<sub>26</sub>/24<sub>28</sub>

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



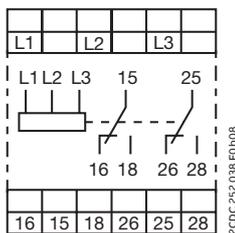
L1, L2, L3, (N) Control supply voltage = Measuring voltage  
15-16/18 Output contact - closed-circuit principle  
25-26/28

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



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

#### CM-MPN.x2



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

## Three-phase monitoring relays

### Technical diagrams

#### Rotary switch "Function"

##### CM-PVS

	ON-delay with phase sequence monitoring
	OFF-delay with phase sequence monitoring
	ON-delay without phase sequence monitoring
	OFF-delay without phase sequence monitoring

##### CM-PSS

	ON-delay with phase sequence monitoring
	OFF-delay with phase sequence monitoring
	ON-delay without phase sequence monitoring
	OFF-delay without phase sequence monitoring

#### DIP switch functions

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

Position	4	3	2	1
ON ↑				
OFF				

2CDC 252 0-40 F00B08

##### 1 Timing function

ON ON-delayed  
OFF OFF-delayed

##### 2 Phase sequence monitoring

ON deactivated  
OFF activated

##### 3 Operating principle of output

ON 2x1 c/o contact  
OFF 1x2 c/o contact

##### 4 Phase sequence correction

ON activated  
OFF deactivated

##### CM-MPS.x1

Position	2	1
ON ↑		
OFF		

2CDC 252 0-40 F00B08

##### 1 Timing function

ON ON-delayed  
OFF OFF-delayed

##### 2 Phase sequence monitoring

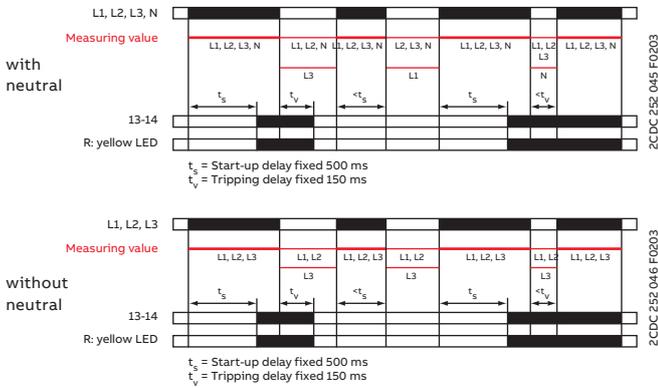
ON deactivated  
OFF activated

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

# Three-phase monitoring relays

## Function diagrams

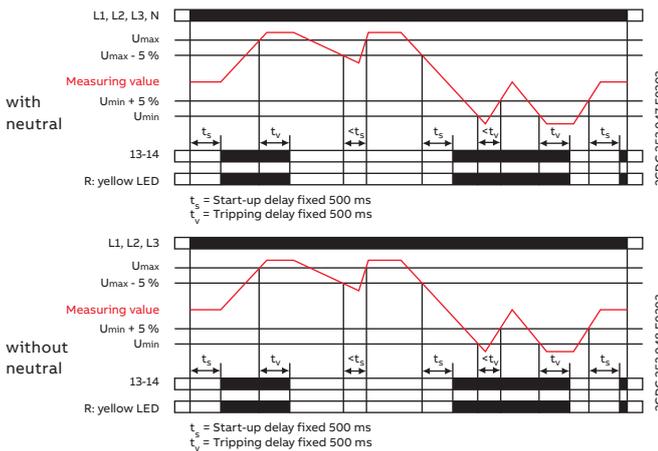
### CM-PBE



#### Phase failure detection

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.

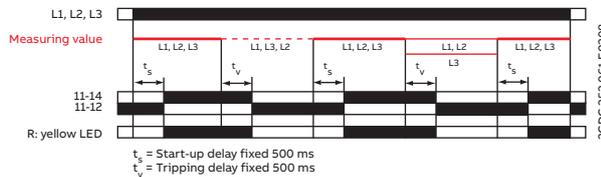
### CM-PVE



#### Phase failure, under- / overvoltage detection

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.

### CM-PFE, CM-PFE.2

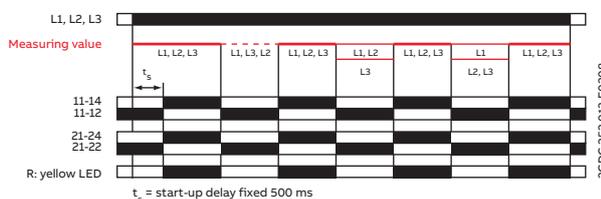


#### Phase failure detection, phase sequence monitoring

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.

### CM-PFS



#### Phase failure detection, phase sequence monitoring

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

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

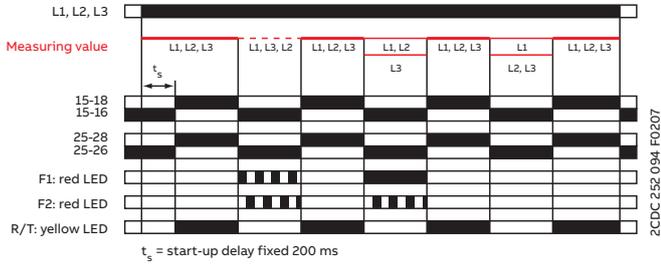
#### ATTENTION

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

# Three-phase monitoring relays

## Function diagrams

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



#### Phase sequence monitoring and phase failure detection

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

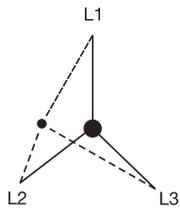
#### Phase sequence monitoring

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 detection

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

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



Displacement of the star point

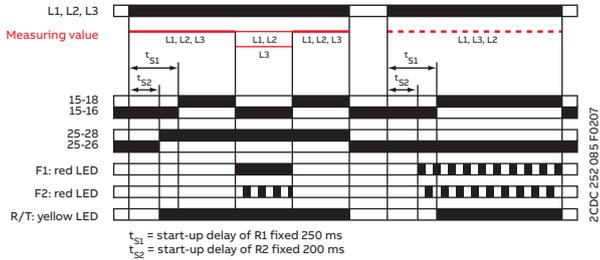
#### Interrupted neutral monitoring

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

# Three-phase monitoring relays

## Function diagrams

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

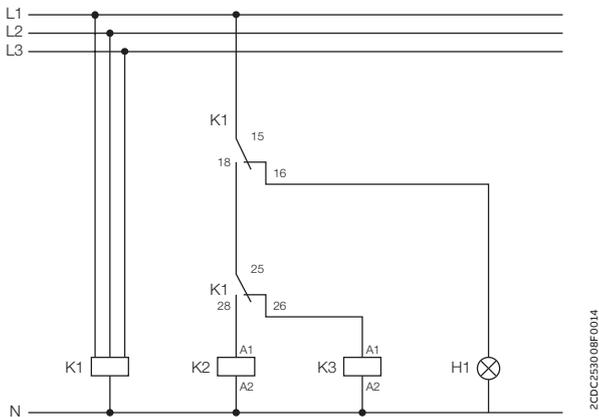


### Automatic phase sequence correction

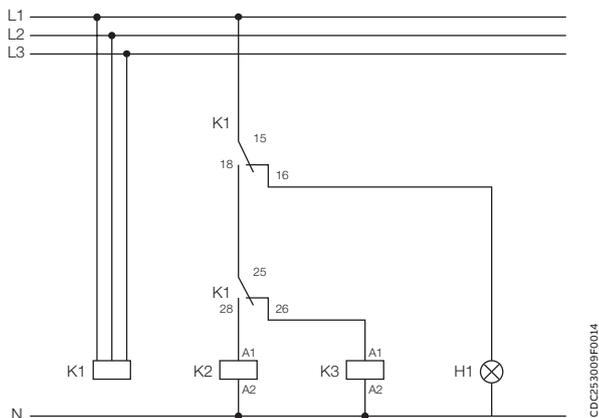
This function can be selected only if phase sequence monitoring is activated  and operating mode 2x1 c/o (SPDT) contact  is selected.

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

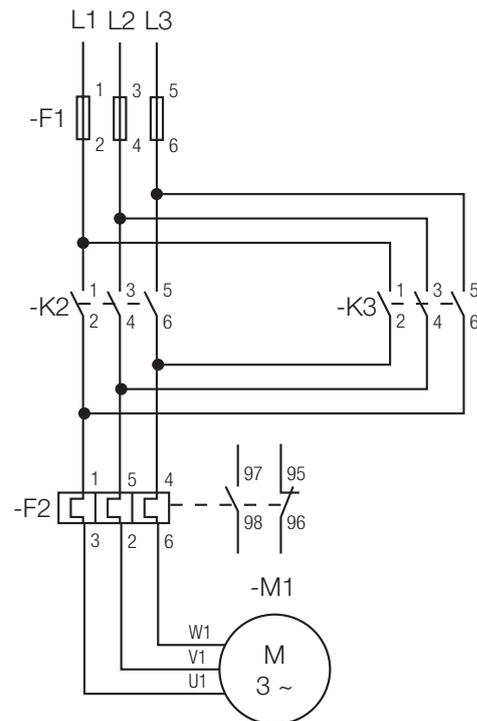
If the voltage to be monitored exceeds or falls below the set threshold values for phase unbalance, over- or undervoltage or if a phase failure occurs, output relay R1 de-energizes and the LEDs F1 and F2 indicate the fault. Output relay R2 is responsive only to a false phase sequence. In conjunction with a reversing contactor combination, this enables an automatic correction of the rotation direction. See circuit diagrams on the right.



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



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



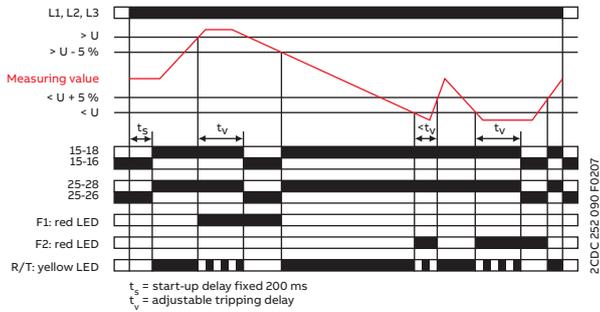
Power circuit diagram

# Three-phase monitoring relays

## Function diagrams

CM-PSS.xx (1), CM-PVS.xx (2), CM-MPS.xx (2), CM-MPN.xx (2)

### ON-delay ☒, 1x2 c/o contacts [1x2 c/o]



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

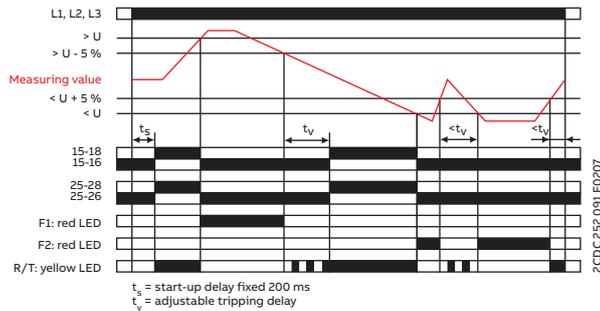
Applying control supply voltage begins the fixed start-up delay  $t_s$ . When  $t_s$  is complete and all phases are present with correct voltage and with the correct phase sequence, the output relays energize and the yellow LED R/T glows.

#### 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.

### OFF-delay ■, 1x2 c/o contacts [1x2 c/o]



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

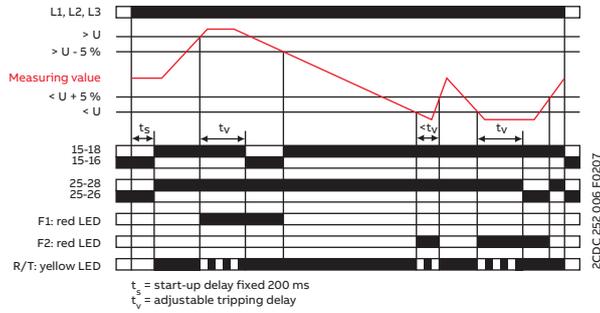
If the voltage to be monitored exceeds or falls below the fixed (1) or set (2) threshold value, the output relays de-energize instantaneously and the LED R/T turns off. As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize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

# Three-phase monitoring relays

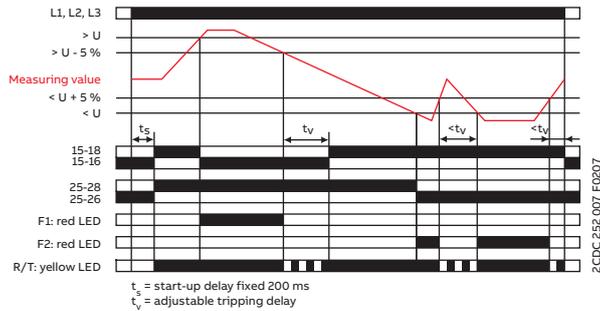
## Function diagrams

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

#### ON-delay ☒, 2x1 c/o contact [2x1 0/0]



#### OFF-delay ■, 2x1 c/o contact [2x1 0/0]



#### Over- and undervoltage monitoring [2x1 0/0]

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 the 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.

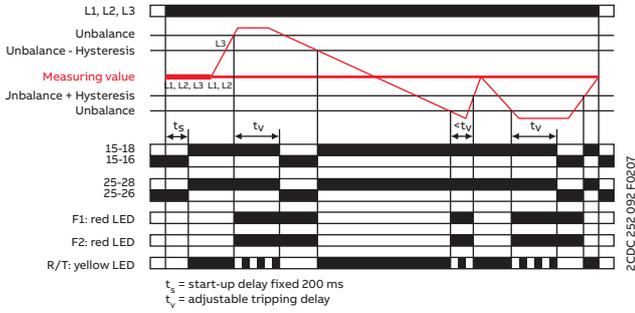
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the corresponding output relay re-energizes automatically after the set tripping delay  $t_v$  is complete. The LED R/T flashes during timing.

# Three-phase monitoring relays

## Function diagrams

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

### ON-delay ☒



### Phase unbalance monitoring

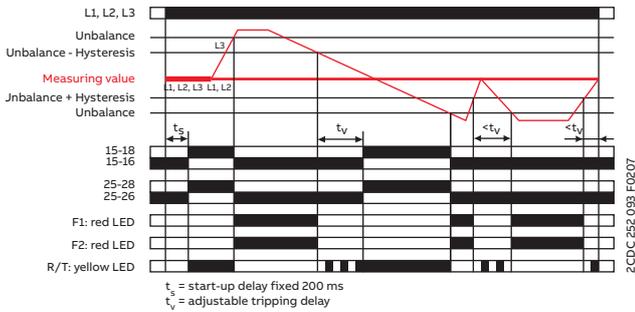
Applying control supply voltage begins the fixed start-up delay  $t_s$ . When  $t_s$  is complete and all phases are present with correct voltage and with the correct phase sequence, the output relays energize and the yellow LED R/T glows.

### 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.

### OFF-delay ■



### 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.

## Three-phase monitoring relays

### Function diagrams

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

#### LED functions

Function	R/T: yellow LED	F1: red LED	F2: red LED
Control supply voltage applied, output relay energized		-	-
Tripping delay t <sub>v</sub> active		-	-
Phase failure	-		
Phase sequence	-	alternating	
Overvoltage	-		-
Undervoltage	-	-	
Phase unbalance	-		
Interruption of the neutral	-		
Adjustment error			

#### Possible wrong adjustments of the front-facing 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
- DIP switch 4 = ON: Automatic phase sequence correction is activated and selected operating mode is 1x2 c/o contacts
- DIP switch 2 and 4 = ON: Phase sequence detection is deactivated and the automatic phase sequence correction is activated

#### Type of tripping delay

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

#### Switch position ON-delay :

In case of a fault, the de-energizing of the output relays and the respective fault message are suppressed for the adjusted tripping delay t<sub>v</sub>.

#### 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<sub>v</sub>. Thereby, also momentary undervoltage conditions are recognized.