Three-phase monitoring relays
Product group picture

2

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

Characteristics of the CM range three-phase monitors

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

[1)] depending on device type
[2)] Applicable in rail application following the latest standards for rail applications: NF F 16-101/102 (I2/F2 classified), EN 45545 (Hazard Level 3), DIN 5510, EN 50155, IEC 60571. Further information is available in our rail segment brochure 2CD-C110084B0201.

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 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. Especially for moveable equipment, such as construction machinery, phase sequence detection prior to the startup process is highly reasonable.

Phase loss

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

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 installtion and cause damage or destruction of valuable parts.

Extended 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.

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.

Structure of the type designation

CM-_ _ x.yz

x: width of enclosure

y: Control supply voltage / measuring range

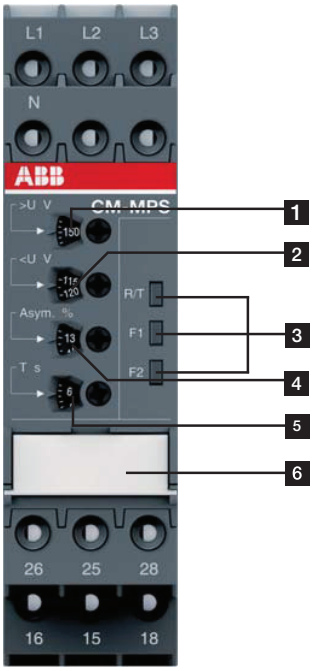
1	110, 115, 120, 127 V supply systems (phase-neutral)
2	220, 230, 240 V supply systems (phase-neutral)
3	200, 208, 220, 230, 240, 257, 260 V supply systems (phase-phase)
4	440, 460 V supply systems (phase-phase)
5	480, 500 V supply systems (phase-phase)
6	575, 600 V supply systems (phase-phase)
7	660, 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

Three-phase monitoring relays
Operating controls

S-Range Housing



1 Adjustment of the hysteresis >U for overvoltage

2 Adjustment of the threshold value <U for undervoltage

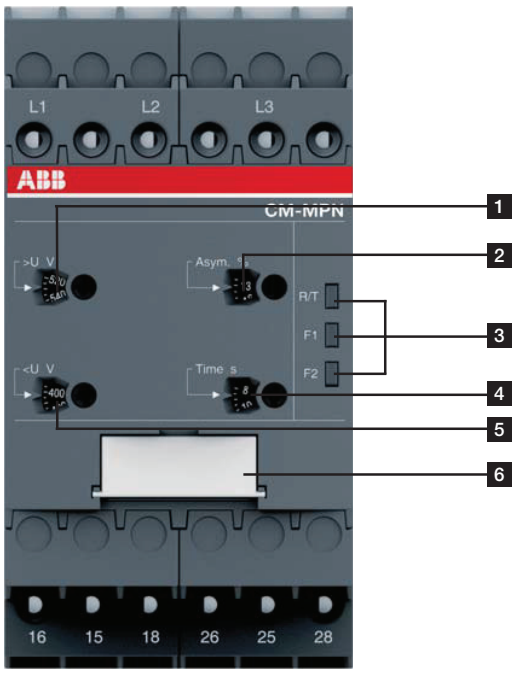
3 Indication of operational states
- R/T: red LED – Relay status / timing
- F1: yellow LED – Fault message
- F2: yellow LED – Fault message

4 Adjustment of the threshold value Asym. for phase unbalance

5 Adjustment of the tripping delay T_v

6 DIP switches (see DIP switch functions on page 2/40)
- 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

N-Range Housing



1 Adjustment of the hysteresis >U for overvoltage

2 Adjustment of the threshold value Asym. for phase unbalance

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

4 Adjustment of the tripping delay T_v

5 Adjustment of the hysteresis <U for undervoltage

6 DIP switches (see DIP switch functions on page 2/40)
- 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

Rated control supply voltage U_s	Order number	1SVR 550 881 R9400	1SVR 550 882 R9500	1SVR 550 870 R9400	1SVR 550 871 R9500	1SVR 550 824 R9100	1SVR 730 824 R9300	1SVR 740 824 R9300	1SVR 730 784 R2300	1SVR 740 784 R2300	1SVR 730 784 R3300	1SVR 740 784 R3300	1SVR 730 794 R1300	1SVR 730 794 R3300	1SVR 740 794 R3300	1SVR 730 794 R2300	1SVR 740 794 R2300	1SVR 730 774 R1300	1SVR 740 774 R1300	1SVR 730 774 R3300	1SVR 740 774 R3300
	Type	CM-PBE	CM-PBE	CM-PVE	CM-PVE	CM-PFE	CM-PFS.S	CM-PFS.P	CM-PSS.31S	CM-PSS.31P	CM-PSS.41S	CM-PSS.41P	CM-PVS.31S	CM-PVS.41S	CM-PVS.41P	CM-PVS.81S	CM-PVS.81P	CM-PAS.31S	CM-PAS.31P	CM-PAS.41S	CM-PAS.41P
Phase to Phase																					
160-300 V AC													■					■	■		
200-400 V AC																■	■				
200-500 V AC							■	■													
208-440 V AC						■															
300-500 V AC														■	■					■	■
320-460 V AC				■	■																
350-580 V AC																					
380 V AC									■	■											
380-440 V AC		■	■																		
400 V AC											■	■									
Phase to Neutral																					
185-265 V AC				■																	
220-240 V AC		■																			
Rated frequency																					
50/60 Hz		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Suitable for monitoring																					
Single-phase mains		■		■																	
Three-phase mains		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Monitoring function																					
Phase failure		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase sequence						■	■	■	sel	sel	sel	sel	sel	sel	sel	sel	sel	■	■	■	■
Automatic phase sequence correction																					
Overvoltage				■	■				■	■	■	■	■	■	■	■	■				
Undervoltage				■	■				■	■	■	■	■	■	■	■	■				
Unbalance																		■	■	■	■
Neutral [1]		■		■																	
Thresholds		fix	fix	fix	fix	fix	fix	fix	fix	fix	fix	fix	fix	adj	adj	adj	adj	adj	adj	adj	adj
Timing functions for tripping delay																					
ON delay							fix	fix										sel	sel	sel	sel
On and OFF delay		fix	fix	fix	fix	fix			adj	adj	adj	adj	adj	adj	adj	adj	adj				
Connection type																					
Push-in terminals										■		■			■		■		■		■
Double-chamber cage connection terminals									■		■		■	■		■		■		■	

[1] The external conductor voltage towards the neutral conductor is measured.

adj: adjustable
sel: selectable

Three-phase monitoring relays
Selection table multifunctional

Rated control supply voltage U_s	Order number	1SVR 730 885 R1300	1SVR 740 885 R1300	1SVR 730 885 R3300	1SVR 740 885 R3300	1SVR 730 884 R1300	1SVR 740 884 R1300	1SVR 730 884 R3300	1SVR 740 884 R3300	1SVR 730 885 R4300	1SVR 740 885 R4300	1SVR 730 884 R4300	1SVR 740 884 R4300	1SVR 750 487 R8300	1SVR 760 487 R8300	1SVR 750 488 R8300	1SVR 760 488 R8300	1SVR 750 489 R8300	1SVR 760 489 R8300
	Type	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
Phase to Phase																			
160-300 V AC						■	■												
300-500 V AC								■	■			■	■						
350-580 V AC														■	■				
450-720 V AC																■	■		
530-820 V AC																		■	■
Phase to Neutral																			
90-170 V AC		■	■																
180-280 V AC				■	■					■	■								
Rated frequency																			
50/60 Hz		■	■	■	■	■	■	■	■					■	■	■	■	■	■
50/60/400 Hz										■	■	■	■						
Suitable for monitoring																			
Single-phase mains		■	■	■	■					■	■								
Three-phase mains		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Monitoring function																			
Phase failure		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase sequence		sel	sel	sel	sel	sel	sel	sel	sel	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
Automatic phase sequence correction										adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
Overvoltage		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Undervoltage		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Unbalance		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Neutral [1]		■ [2]	■ [2]	■ [2]	■ [2]					■ [2]	■ [2]								
Thresholds		adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
Timing functions for tripping delay																			
On and OFF delay		adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
Connection type																			
Push-in terminals			■		■		■		■		■		■		■		■		■
Double-chamber cage connection terminals		■		■		■		■		■		■		■		■		■	

[1] The external conductor voltage towards the neutral conductor is measured.
[2] Interrupted neutral monitoring

adj: adjustable
sel: selectable

Three-phase monitoring relays
Ordering details - Singlefunctional

2

Description

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

CM-PBE

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)	■	CM-PBE [1]	1SVR550881R9400		0.08 (0.17)
3x380-440 V AC			CM-PBE	1SVR550882R9500		0.08 (0.17)
3x320-460 V AC, 185-265 V AC	Over- / undervoltage and phase failure detection (Single- and three-phase)	■	CM-PVE [1]	1SVR550870R9400		0.08 (0.17)
3x320-460 V AC			CM-PVE	1SVR550871R9500		0.08 (0.17)
3x208-440 V AC	Phase sequence monitoring and phase failure detection (Three-phase)		CM-PFE [2]	1SVR550824R9100		0.08 (0.17)

CM-PSS.41P

Ordering details

Rated control supply voltage = measuring voltage	Monitoring function	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
3x200-500 V AC	Phase sequence monitoring and phase failure detection (Three-phase)	CM-PFS.S	1SVR730824R9300		0.127 (0.280)
		CM-PFS.P	1SVR740824R9300		0.119 (0.262)
3x380 V AC	Over- / undervoltage with fixed threshold values ± 10 %	CM-PSS.31S	1SVR730784R2300		0.132 (0.291)
		CM-PSS.31P	1SVR740784R2300		0.123 (0.271)
3x400 V AC		CM-PSS.41S	1SVR740784R3300		0.132 (0.291)
		CM-PSS.41P	1SVR730784R3300		0.123 (0.271)
3x160-300 V AC	Over- and undervoltage 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)

CM-PAS.31P

[1] The version with neutral monitoring is also suitable for monitoring single-phase mains. For this, all three external conductors (L1,L2,L3) have to be jumpered and connected as one single conductor.
[2] For applications where a reverse fed voltage >60% is expected, we recommend to use our three-phase monitoring relays for unbalance CM-PAS.xx

S: screw connection
P: push-in / easy connect

Three-phase monitoring relays
Ordering details - Multifunctional

CM-MPS.23P

CM-MPN.52P

Ordering details

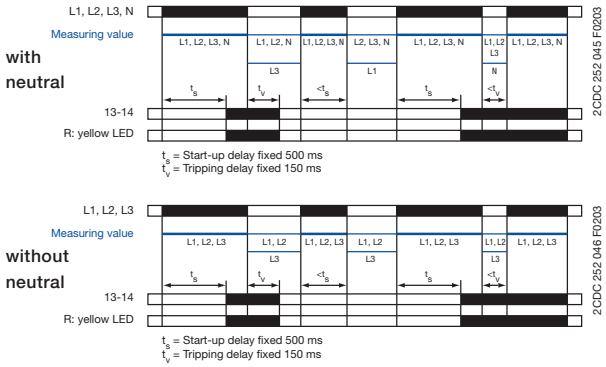
Rated control supply voltage = measuring voltage	DIP switch	Monitoring function	Neutral monitoring	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
90-170 V AC	⊠ ■ ○ ⊘	Multifunctional (Three-phase phase failure detection, Phase sequence monitoring, overvoltage, undervoltage, Phase unbalance)	■	CM-MPS.11S	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)
3x160-300 V AC				CM-MPS.31S	1SVR730884R1300		0.142 (0.313)
				CM-MPS.31P	1SVR740884R1300		0.133 (0.293)
3x300-500 V AC				CM-MPS.41S	1SVR730884R3300		0.140 (0.309)
				CM-MPS.41P	1SVR740884R3300		0.132 (0.291)
180-280 V AC	⊠ ■ ○ ⊘ Ⓐ Ⓐ 2x1 c/o 1x2 c/o	Multifunctional (Three-phase phase failure detection, Phase sequence monitoring, overvoltage, undervoltage, Phase unbalance)	■	CM-MPS.23S	1SVR730885R4300		0.149 (0.328)
				CM-MPS.23P	1SVR740885R4300		0.138 (0.304)
3x300-500 V AC				CM-MPS.43S	1SVR730884R4300		0.148 (0.327)
				CM-MPS.43P	1SVR740884R4300		0.137 (0.302)
3x350-580 V AC	⊠ ■ ○ ⊘ Ⓐ Ⓐ 2x1 c/o 1x2 c/o			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)

S: screw connection
P: push-in / easy connect

⊠ ON-delayed
■ OFF-delayed
○ Phase sequence monitoring activated
⊘ Phase sequence monitoring deactivated
Ⓐ Phase sequence correction activated
Ⓐ Phase sequence correction deactivated
2x1 c/o 2x1 c/o (SPDT) contacts
1x2 c/o 1x2 c/o (SPDT) contacts

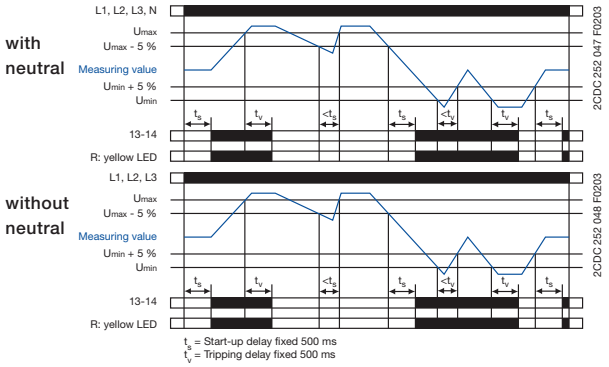
Three-phase monitoring relays
Function diagrams

Function diagrams - Phase failure detection CM-PBE



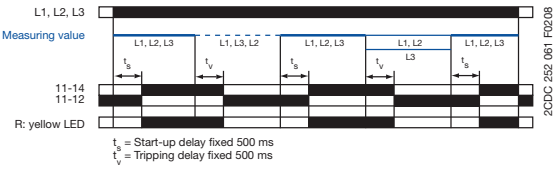
If all phases (and the neutral) are present, the output relay energizes after the start-up delay t_s is complete. If a phase failure occurs, the tripping delay t_v starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of t_s starts.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

Function diagrams - Phase failure under- / overvoltage detection 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.

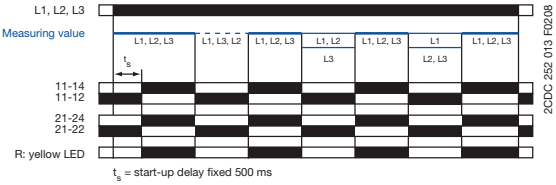
Function diagram - Phase failure detection, phase sequence monitoring CM-PFE



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 - Phase failure detection, phase sequence monitoring CM-PFS



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

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

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

Three-phase monitoring relays
Function diagrams

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

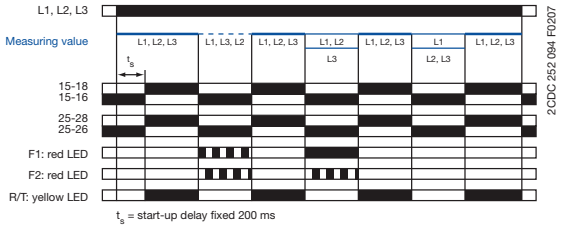
Applying control supply voltage begins the fixed start-up delay t_S. When t_S is complete and all phases are present with correct voltage, the output relays energize and the yellow LED R/T glows.

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 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.



t_s = start-up delay fixed 200 ms

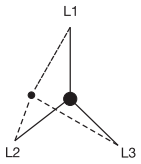
CM-MPS.11, CM-MPS.21, CM-MPS.23
Interrupted neutral monitoring

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 by asymmetrical load in the three-phase main, an interrupted neutral will be detected.

Displacement of the star point



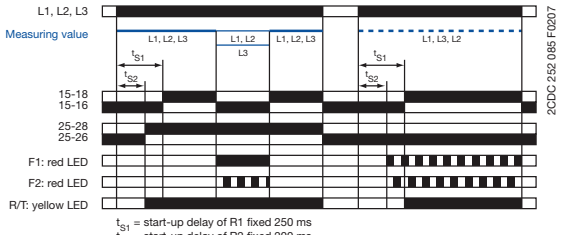
CM-MPS.x3, CM-MPN.x2
Automatic phase sequence correction

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

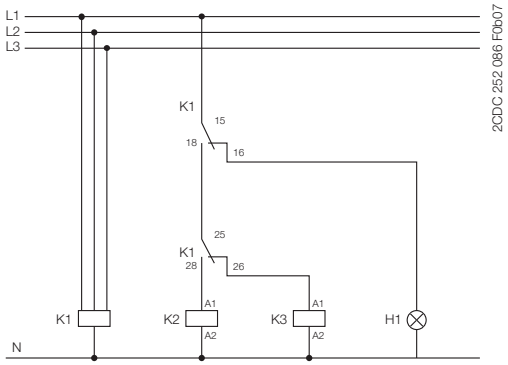
Applying control supply voltage begins the fixed start-up delay t_{S1}. When t_{S1} is complete and all phases are present with correct voltage, output relay R1 energizes. Output relay R2 energizes when the fixed start-up delay t_{S2} is complete and all phases are present with correct phase sequence. Output relay R2 remains de-energized if the phase sequence is incorrect.

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

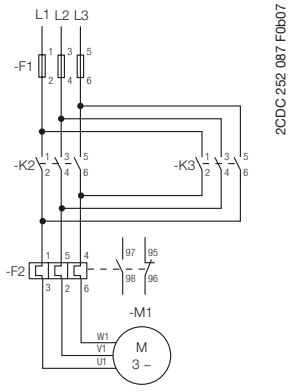
Output relay R2 is responsive only to a false phase sequence. In conjunction with a reversing contactor combination, this enables an automatic correction of the rotation direction. See circuit diagrams on the right.



t_{S1} = start-up delay of R1 fixed 250 ms
t_{S2} = start-up delay of R2 fixed 200 ms



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



Power circuit diagram

Three-phase monitoring relays
Function diagrams

2

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

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 correct phase sequence, the output relays energize and the yellow LED R/T glows.

Type of tripping delay = ON-delay

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

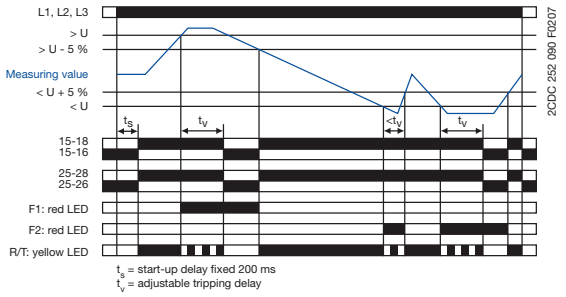
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 % and the LED R/T glows.

Type of tripping delay = OFF-delay

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

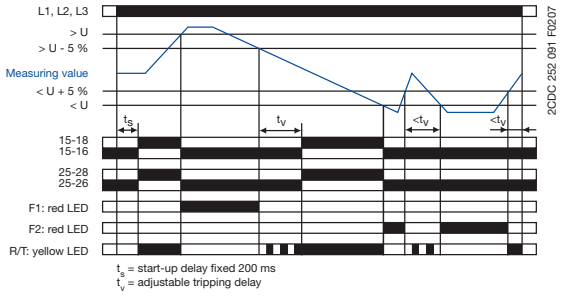
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize automatically after the set tripping delay t_v is complete. The LED R/T flashes during timing and turns steady when timing is complete.

ON-delay ⊠, 1x2 c/o contacts 1x2 c/o



t_s = start-up delay fixed 200 ms
t_v = adjustable tripping delay

OFF-delay ■, 1x2 c/o contacts 1x2 c/o



t_s = start-up delay fixed 200 ms
t_v = adjustable tripping delay

CM-MPS.x3, CM-MPN.x2

Over- and undervoltage monitoring 2x1 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 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.

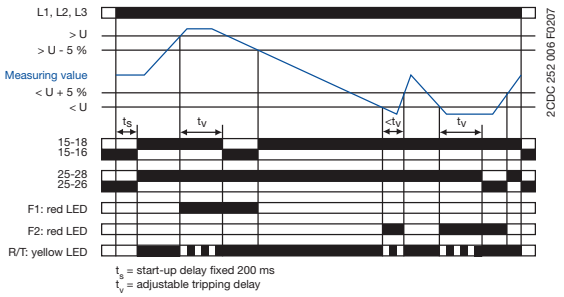
The corresponding output relay re-energizes automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %.

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.

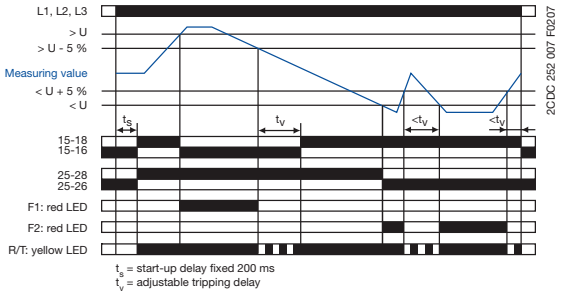
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the corresponding output relay re-energizes automatically after the set tripping delay t_v is complete. The LED R/T flashes during timing.

ON-delay ⊠, 2x1 c/o contact 2x1 c/o



t_s = start-up delay fixed 200 ms
t_v = adjustable tripping delay

OFF-delay ■, 2x1 c/o contact 2x1 c/o



t_s = start-up delay fixed 200 ms
t_v = adjustable tripping delay

Three-phase monitoring relays
Function diagrams

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

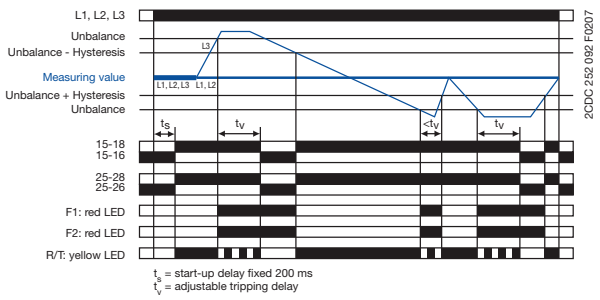
Applying control supply voltage begins the fixed start-up delay t_S. When t_S is complete and all phases are present with correct voltage and with correct phase sequence, the output relays energize and the yellow LED R/T glows.

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 tV 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.

ON-delay ⊠

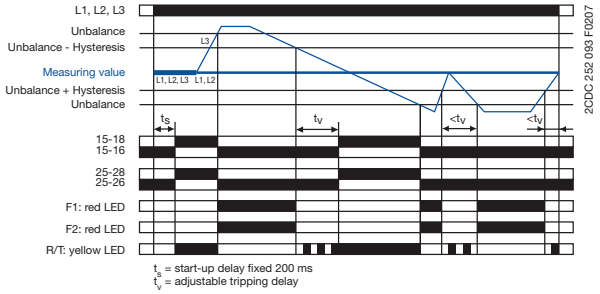


Type of tripping delay = OFF-delay

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.

OFF-delay ■



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_V active	⎍⎍	-	-
Phase failure	-	⎍	⎍⎍
Phase sequence	-	⎍⎍ alternating	
Overvoltage	-	⎍	-
Undervoltage	-	-	⎍
Phase unbalance	-	⎍	⎍
Interruption of the neutral	-	⎍	⎍⎍
Adjustment error [1]	⎍⎍	⎍⎍	⎍⎍

[1] Possible misadjustments of the front-face operating controls:

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

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

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

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

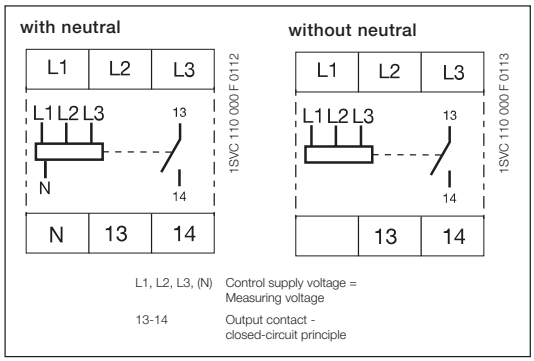
Switch position ON-delay ⊠:
In case of a fault, the de-energizing of the output relays and the respective fault message are suppressed for the adjusted tripping delay t_V.

Switch position OFF-delay ■:
In case of a fault, the output relays de-energize instantaneously and a fault message is displayed and stored for the length of the adjusted tripping delay t_V. Thereby, also momentary undervoltage conditions are recognized.

Three-phase monitoring relays
Connection diagrams

2

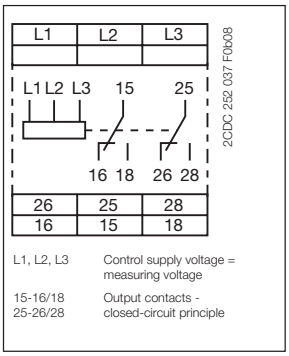
Connection diagrams CM-PBE, CM-PVE



L1, L2, L3, (N) Control supply voltage = Measuring voltage

13-14 Output contact - closed-circuit principle

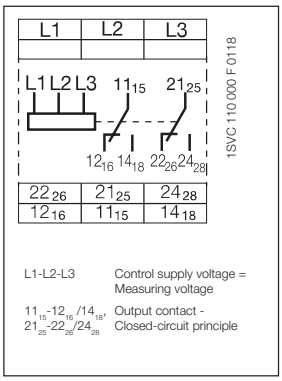
Connection diagram CM-PVS.x1, CM-PSS.x1, CM-PAS.x1



L1, L2, L3 Control supply voltage = measuring voltage

15-16/18 Output contacts - 25-26/28 closed-circuit principle

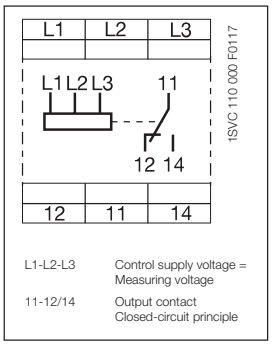
Connection diagram CM-PFS



L1-L2-L3 Control supply voltage = Measuring voltage

11_{15}-12_{16}/14_{18}, 21_{25}-22_{26}/24_{28} Output contact - Closed-circuit principle

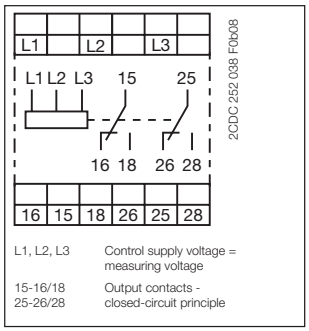
Connection diagram CM-PFE



L1-L2-L3 Control supply voltage = Measuring voltage

11-12/14 Output contact Closed-circuit principle

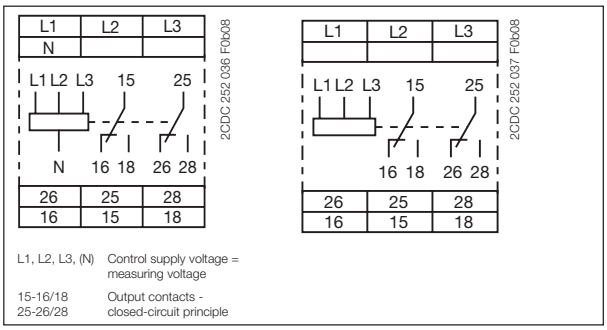
Connection diagram CM-MPN.x2



L1, L2, L3 Control supply voltage = measuring voltage

15-16/18 Output contacts - 25-26/28 closed-circuit principle

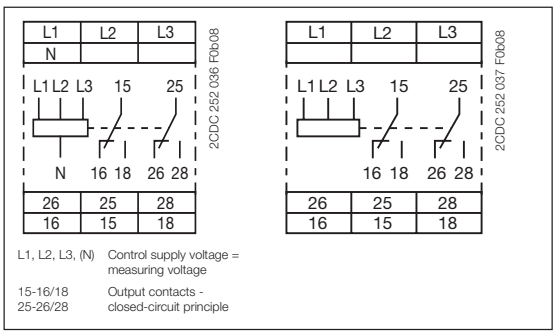
Connection diagram CM-MPS.x1



L1, L2, L3, (N) Control supply voltage = measuring voltage

15-16/18 Output contacts - 25-26/28 closed-circuit principle

Connection diagram CM-MPS.x3



L1, L2, L3, (N) Control supply voltage = measuring voltage

15-16/18 Output contacts - 25-26/28 closed-circuit principle

Three-phase monitoring relays
DIP switches, Rotary switches

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

Rotary switch "Function" CM-PSS

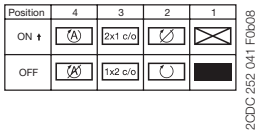
ON-delay
with phase sequence monitoring

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



1 Timing function
ON ON-delayed
OFF OFF-delayed

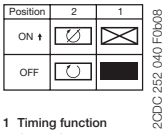
2 Phase sequence monitoring
ON deactivated
OFF activated

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

4 Phase sequence correction
ON activated
OFF deactivated

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

DIP switch functions
CM-MPS.x1



1 Timing function
ON ON-delayed
OFF OFF-delayed

2 Phase sequence monitoring
ON deactivated
OFF activated

Three-phase monitoring relays
Technical data

2

Type			CM-PBE [1]	CM-PBE	CM-PVE [1]	CM-PVE	CM-PFE	CM-PFS
Supply circuit = measuring circuit			L1-L2-L3-N	L1-L2-L3	L1-L2-L3-N	L1-L2-L3	L1-L2-L3	
Rated control supply voltage U_S = measuring voltage			3x380-440 V AC, 220-240 V C	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 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 rated control supply voltage tolerance			-				ΔU ≤ 0.5 %	
Accuracy within the temperature range			-		ΔU ≤ 0.06 % / °C			
Timing circuit								
Start-up delay t_S			fixed 500 ms (±20 %)				fixed 500 ms	
Tripping t_V			fixed 150 ms (±20 %)		at over-/ undervoltage fixed 500 ms (±20 %)		fixed 500 ms	-
Indication of operational states								
Relay status		R: yellow LED	⌐¬ Output relay energized					
Fault message		F: red LED	Only CM-PFS: ⌐¬ Phase failure / ⌐¬ Phase sequence error					
Output circuits			13-14				11-12/14	11(15)-12(16) / 14(18), 21(25)-22(26) / 24(28)
Kind of output			1 n/o contact				1 c/o contact	2 c/o contacts
Operating principle			closed-circuit principle [2]					
Contact material			AgCdO					AgNi allow, Cd free
Rated operational voltage U_e		IEC/EN 60947-1	250 V					250 V AC
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 10^6 switching cycles					
Electrical lifetime (AC12, 230 V, 4 A)			0.1 x 10^6 switching cycles					
Max. fuse rating to achieve short-circuit protection		n/c contact	10 A fast-acting					6 A fast-acting
		n/o contact	10 A fast-acting					
AC rating (UL 508)		Utilization category (Control Circuit Rating Code)	B 300, CM-PFS: B300, 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					

[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 [1]	CM-PBE	CM-PVE [1]	CM-PVE	CM-PFE	CM-PFS
General data								
Dimensions (W x H x D)			22.5 x 78 x 78.5 mm (0.89 x 3.07 x 3.09 in) CM-PFS: 22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in)					
Weight			see data sheet					
Mounting			DIN rail (IEC/EN 60715)					
Mounting position			any					
Degree of protection		housing / terminals	IP50 / IP20					
Electrical connection								
Wire size		fine-strand with wire end ferrule	2 x 0.75-1.5 mm² (2 x 18-16 AWG)					2 x 0.75-2.5 mm² (2 x 8-14 AWG)
		fine-strand without wire end ferrule	2 x 1-1.5 mm² (2 x 18-16 AWG)					
		rigid	2 x 0.75-1.5 mm² (2 x 18-16 AWG)					2 x 0.5-4 mm² (2 x 20-12 AWG)
Stripping length			10 mm (0.39 in)					7 mm (0.28 in)
Tightening torque			0.6-0.8 Nm					
Environmental data								
Ambient temperature range		operation / storage	-20..+60 °C / -40...+85 °C					
Environmental testing (IEC 68-2-30)			24 h cycle time, 55 °C, 93 % rel., 96 h					-
Operational reliability (IEC 68-2-6)			6 g					-
Mechanical resistance (IEC 68-2-6)			10 g					-
Climatic category		IEC/EN 60721-3-3	-					3K3
Damp heat, cyclic		IEC/EN 60068-2-30	CM-PFS: 6 x 24 h cycle, 55 °C, 95 % RH					
Vibration, sinusoidal		IEC/EN 60255-21-1	-					Class 2
Shock		IEC/EN 60255-21-2	-					Class 2
Isolation data								
Rated insulation voltage U_i (IEC/EN 60947-1, IEC/EN 60664-1)		between supply, measuring and output circuits	400 V				-	
		supply circuit / output circuit	-				600 V	
		output circuit 1 / output circuit 2	-				300 V	
Rated impulse withstand voltage U_{imp} between all isolated circuits (VDE 0110, IEC 664)			4 kV / 1.2 - 50 µs					-
		supply circuit / output circuit	-					6 kV
		output circuit 1 / output circuit 2	-					4 kV
Basic insulation for rated control supply voltage (IEC/EN 60664-1)		supply circuit / output circuit	-					600 V AC
Protective seperation (IEC/EN 61140, EN 50178)		supply circuit / output circuit	-					n/a
Test voltage (routine test)			2.5 kV, 50 Hz, 1 min.					-
		supply circuit / output circuit	-					2.5 kV, 50 Hz, 1 min.
		output circuit 1 / output circuit 2	-					2.5 kV, 50 Hz, 1 min.
Pollution degree (IEC/EN 60664-1)			3					
Overvoltage category (IEC/EN 60664-1)			III					
Standards								
Product standard			IEC 255-6, EN 60255-6, CM-PFS: IEC/60255-1:2010					
Other standards			CM-PFS: EN 50178, IEC/EN 60204					
Low Voltage Directive			2006/95/EC					
EMC Directive			2004/108/EC					
RoHS Directive			CM-PFS: 2002/95/EC					
Electromagnetic compatibility								
Interference immunity to			EN 61000-6-2, CM-PFS: 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 (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 kVL-L					
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 3 - 10 V					
voltage dips, short interruptions and voltage variations		IEC/EN 61000-4-11	-					Class 3
harmonics and interharmonics		IEC/EN 61000-4-13	-					Class 3
Interference emission			EN 61000-6-4, CM-PFS:					
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

2

Type		CM-PSS.31	CM-PSS.41	CM-PVS.31	CM-PVS.41	CM-PVS.81	CM-PAS.31	CM-PAS.41
Input circuit = Measuring circuit					L1, L2, L3			
Rated control supply voltage U_S = measuring voltage		3x380 V AC	3x400 V AC	3x160-300 V AC	3x300-500 V AC	3x200-400 V AC	3x160-300 V AC	3x300-500 V AC
Rated control supply voltage U_S tolerance		-15...+10 %						
Rated frequency		50/60 Hz						
Frequency range		45-65 Hz						
Typical current / power consumption		25 mA / 18 VA (380 V AC)	25 mA / 18 VA (400 V AC)	25 mA / 10 VA (230 V AC)	25 mA / 18 VA (400 V AC)	19 mA / 10 VA (300 V AC)	25 mA / 10 VA (230 V AC)	25 mA / 18 VA (400 V AC)
Measuring circuit					L1, L2, L3			
Monitoring functions	Phase failure	■	■	■	■	■	■	■
	Phase sequence	can be switched off					■	■
	Automatic phase sequence correction	-	-	-	-	-	-	-
	Over- / undervoltage	■	■	■	■	■	-	-
	Phase unbalance	-	-	-	-	-	■	■
	Neutral	-	-	-	-	-	-	-
Measuring range	Overvoltage	3x418 V AC	3x440 V AC	3x220-300 V AC	3x420-500 V AC	3x300-400 V AC	-	-
	Undervoltage	3x342 V AC	3x360 V AC	3x160-230 V AC	3x300-380 V AC	3x210-300 V AC	-	-
	Phase unbalance	-	-	-	-	-	2-25 % of average of phase voltages	
Thresholds	Overvoltage	fixed		adjustable within measuring range			-	-
	Undervoltage	fixed		adjustable within measuring range			-	-
	Phase unbalance (switch-off value)	-	-	-	-	-	adjust. within meas. range	
Hysteresis related to the threshold value	Over- / undervoltage	fixed 5 %					-	
	Phase unbalance	-	-	-	-	-	fixed 20 %	
Rated frequency of the measuring signal		50/60 Hz						
Frequency range of the measuring signal		45-65 Hz						
Maximum measuring cycle time		100 ms						
Accuracy within the rated control supply voltage tolerance		$\Delta U \leq 0.5$ %						
Accuracy within the temperature range		$\Delta U \leq 0.06$ % / °C						
Measuring method		True RMS						
Timing circuit								
Start-up delay t_s		fixed 200 ms						
Tripping delay t_v		ON- or OFF-delay 0; 0.1-30 s adjustable					ON- delay 0; 0.1-30 s adjustable	
Repeat accuracy (constant parameters)		-	-	-	-	l w 0.2 %	-	-
Accuracy within the rated control supply voltage tolerance		$\Delta t \leq 0.5$ %						
Accuracy within the temperature range		$\Delta t \leq 0.06$ % / °C						
Indication of operational states				1 yellow LED, 2 red LED's				
		Details see function description / -diagrams		Details see operating mode and function description / -diagrams			Details see function description / -diagrams	
Output circuits					15-16/18, 25-26/28			
Kind of output		relay, 2 x 1 c/o contact						
Operating principle		closed-circuit principle [1]						
Contact material		AgNi alloy, Cd free						
Rated operational voltage U_e	IEC/EN 60947-1	250 V						
Minimum switching power		24 V / 10 mA						
Maximum switching voltage		see load limit curve						

[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 current I_e (IEC/EN 60947-5-1)	AC12 (resistive) 230 V	4 A						
	AC15 (inductive) 230 V	3 A						
	DC12 (resistive) 24 V	4 A						
	DC13 (inductive) 24 V	2 A						
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300						
	max. rated operational voltage	300 V AC						
	max. continuous thermal current at B 300	5 A						
	max. making/breaking apparent power at B 300	3600/360 VA						
Mechanical lifetime		30 x 10^6 switching cycles						
Electrical lifetime (AC12, 230 V, 4 A)		0.1 x 10^6 switching cycles						
Max. fuse rating to achieve short-circuit protection	n/c contact	6 A fast-acting						
	n/o contact	10 A fast-acting						
General data								
MTBF		on request						
Duty time		100%						
Dimensions (W x H x D)	product dimensions	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)						
	packaging dimensions	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)						
Weight		depending on device, see ordering details						
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool						
Mounting position		any						
Minimum distance to other units	vertical / horizontal	not necessary / not necessary						
Material of housing		UL 94 V-0						
Degree of protection	housing / terminals	IP50 / IP20						
Electrical connection								
Wire size		Screw connection technology					Easy Connect Technology (Push-in)	
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm^2 (1 x 20-14 AWG) 2 x 0.5-1.5 mm^2 (2 x 20-16 AWG)					2 x 0.5-1.5 mm^2 (2 x 20-16 AWG)	
	rigid	1 x 0.5-4 mm^2 (1 x 20-12 AWG) 2 x 0.5-2.5 mm^2 (2 x 20-14 AWG)					2 x 0.5-1.5 mm^2 (2 x 20-16 AWG)	
Stripping length		8 mm (0.32 in)						
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)					-	
Environmental data								
Ambient temperature ranges	operation / storage	-25...+60 °C / -40...+85 °C						
Damp heat (IEC 60068-2-30)		55 °C, 6 cycles						
Climatic category		3K3						
Vibration (sinusoidal) (IEC/EN 60255-21-1)		Class 2						
Shock (IEC/EN 60255-21-2)		Class 2						
Isolation data								
Rated insulation voltage U_i	input circuit / output circuit	600 V						
	output circuit 1 / output circuit 2	300 V						
Rated impulse withstand voltage U_{imp} (VDE 0110, IEC/EN 60664)	input circuit	6 kV; 1.2/50 µs						
	output circuit	4 kV; 1.2/50 µs						
Test voltage between all isolated circuits (routine test)		2.5 kV, 50 Hz, 1 s						
Basic insulation	input circuit / output circuit	600 V						
Protective separation (VDE 0106 part 101 and 101/A, IEC/EN 1140)	input circuit / output circuit	-						
Pollution degree (VDE 0110, IEC/EN 60664)		3						
Overvoltage category (VDE 0110, IEC 60664)		III						
Standards								
Product standard		IEC/EN 60255-6, EN 50178						
Low Voltage Directive		2006/95/EC						
EMC directive		2004/108/EC						
RoHS directive		2002/95/EC						
Electromagnetic compatibility								
Interference immunity to		EN 61000-6-1, EN 61000-6-2						
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)						
radiated, radio-frequency, elec-tromagnetic 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 55022	EN 61000-6-3, EN 61000-6-4						
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B						

Three-phase monitoring relays
Technical data

2

Type			CM-MPS.11	CM-MPS.21	CM-MPS.31	CM-MPS.41
Input circuit = Measuring circuit			L1, L2, L3, N		L1, L2, L3	
Rated control supply voltage U_S = measuring voltage			3x90-170 V AC	3x180-280 V AC	3x160-300 V AC	3x300-500 V AC
Rated control supply voltage U_S tolerance			-15...+10 %			
Rated frequency			50/60 Hz			
Frequency range			45-65 Hz			
Typical current / power consumption			25 mA / 10 VA (115 V AC)	25 mA / 18 VA (230 V AC)	25 mA / 10 VA (230 V AC)	25 mA / 18 VA (400 V AC)
Measuring circuit			L1, L2, L3, N		L1, L2, L3	
Monitoring functions		Phase failure	■	■	■	■
		Phase sequence	can be switched off			
		Automatic phase sequence correction	-	-	-	-
		Over- / undervoltage	■	■	■	■
		Phase unbalance	■	■	■	■
		Interrupted neutral	■	■	-	-
Measuring range		Overvoltage	3x120-170 V AC	3x240-280 V AC	3x220-300 V AC	3x420-500 V AC
		Undervoltage	3x90-130 V AC	3x180-220 V AC	3x160-230 V AC	3x300-380 V AC
		Phase unbalance	2-25 % of average of phase voltages			
Thresholds		Overvoltage	adjustable within measuring range			
		Undervoltage	adjustable within measuring range			
		Phase unbalance (switch-off value)	adjustable within measuring range			
Hysteresis related to the threshold value		Over- / undervoltage	fixed 5 %			
		Phase unbalance	fixed 20 %			
Rated frequency of the measuring signal			50/60 Hz			
Frequency range of the measuring signal			45-65 Hz			
Maximum measuring cycle time			100 ms			
Accuracy within the rated control supply voltage tolerance			$\Delta U \leq 0.5$ %			
Accuracy within the temperature range			$\Delta U \leq 0.06$ % / °C			
Measuring method			True RMS			
Timing circuit						
Start-up delay t_S			fixed 200 ms			
Tripping delay t_V			ON- or OFF-delay 0; 0.1-30 s adjustable			
Accuracy within the rated control supply voltage tolerance			$\Delta t \leq 0.5$ %			
Accuracy within the temperature range			$\Delta t \leq 0.06$ % / °C			
Indication of operational states			Details see function description / -diagrams			
Output circuits			15-16/18, 25-26/28			
Kind of output			relay, 1 x 2 c/o contacts			
Operating principle			closed-circuit principle [1]			
Contact material			AgNi alloy, Cd free			
Rated operational voltage U_e (IEC/EN 60947-1)			250 V			
Minimum switching power			24 V / 10 mA			
Maximum switching voltage			see load limit curve			
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) 230 V	4 A			
		AC15 (inductive) 230 V	3 A			
		DC12 (resistive) 24 V	4 A			
		DC13 (inductive) 24 V	2 A			
AC rating (UL 508)		Utilization category (Control Circuit Rating Code)	B 300			
		max. rated operational voltage	300 V AC			
		max. continuous thermal current at B 300	5 A			
		max. making/breaking apparent power at B 300	3600/360 VA			
Mechanical lifetime			30 x 10^6 switching cycles			
Electrical lifetime (AC12, 230 V, 4 A)			0,1 x 10^6 switching cycles			
Max. fuse rating to achieve short-circuit protection		n/c contact	6 A fast-acting			
		n/o contact	10 A fast-acting			

[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
General data						
MTBF			on request			
Duty time			100%			
Dimensions (W x H x D)		product dimensions	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)			
		packaging dimensions	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)			
Weight			**Screw connection technology**		**Easy Connect Technology (Push-in)**	
		net weight	depending on device, see ordering details			
		gross weight	depending on device, see ordering details			
Mounting			DIN rail (IEC/EN 60715), snap-on mounting without any tool			
Mounting position			any			
Minimum distance to other units		vertical / horizontal	not necessary / not necessary			
Material of housing			UL 94 V-0			
Degree of protection		housing / terminals	IP50 / IP20			
Electrical connection						
Wire size			**Screw connection technology**		**Easy Connect Technology (Push-in)**	
		fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm² (1 x 20-14 AWG) 2 x 0.5-1.5 mm² (2 x 20-16 AWG)		2 x 0.5-1.5 mm² (2 x 20-16 AWG)	
		rigid	1 x 0.5-4 mm² (1 x 20-12 AWG) 2 x 0.5-2.5 mm² (2 x 20-14 AWG)		2 x 0.5-1.5 mm² (2 x 20-16 AWG)	
Stripping length			8 mm (0.32 in)			
Tightening torque			0.6-0.8 Nm (5.31-7.08 lb.in)		-	
Environmental data						
Ambient temperature ranges		operation / storage	-25...+60 °C / -40...+85 °C			
Damp heat (IEC 60068-2-30)			55 °C, 6 cycles			
Climatic category			3K3			
Vibration (sinusoidal) (IEC/EN 60255-21-1)			Class 2			
Shock (IEC/EN 60255-21-2)			Class 2			
Isolation data						
Rated insulation voltage U_i		input circuit / output circuit	600 V			
		output circuit 1 / output circuit 2	300 V			
Rated impulse withstand voltage U_{imp} (VDE 0110, IEC/EN 60664)		input circuit	6 kV; 1.2/50 µs			
		output circuit	4 kV; 1.2/50 µs			
Test voltage between all isolated circuits (routine test)			2.5 kV, 50 Hz, 1 s			
Basic insulation		input circuit / output circuit	600 V			
Protective separation (VDE 0106 part 101 and 101/A, IEC/EN 61140)		input circuit / output circuit	yes		-	
Pollution degree (VDE 0110, IEC/EN 60664)			3			
Overvoltage category (VDE 0110, IEC 60664)			III			
Standards						
Product standard			IEC/EN 60255-6, EN 50178			
Low Voltage Directive			2006/95/EC			
EMC directive			2004/108/EC			
RoHS directive			2002/95/EC			
Electromagnetic compatibility						
Interference immunity to			EN 61000-6-1, EN 61000-6-2			
electrostatic discharge		IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)			
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	Level 3 (10 V/m)			
electrical fast transient / burst		IEC/EN 61000-4-4	Level 3 (2 kV / 2 kHz)			
surge		IEC/EN 61000-4-5	Level 4 (2 kV L-L)			
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 3 (10 V)			
harmonics and interharmonics		IEC/EN 61000-4-13	Class 3			
Interference emission			EN 61000-6-3, EN 61000-6-4			
high-frequency radiated		IEC/CISPR 22, EN 55022	Class B			
high-frequency conducted		IEC/CISPR 22, EN 55022	Class B			

Three-phase monitoring relays
Technical data

2

Type			CM-MPS.23	CM-MPS.43	CM-MPN.52	CM-MPN.62	CM-MPN.72
Input circuit = Measuring circuit			L1, L2, L3, N	L1, L2, L3			
Rated control supply voltage U_S = measuring voltage			3x180-280 V AC	3x300-500 V AC	3x350-580 V AC	3x450-720 V AC	3x530-820 V AC
Rated control supply voltage U_S tolerance			-15...+10 %				
Rated frequency			50/60/400 Hz		50/60 Hz		
Frequency range			45-440 Hz		45-65 Hz		
Typical current / power consumption			5 mA / 4 VA (230 V AC)	5 mA / 4 VA (400 V AC)	29 mA / 41 VA (480 V AC)	29 mA / 52 VA (600 V AC)	29 mA / 59 VA (690 V AC)
Measuring circuit			L1, L2, L3, N	L1, L2, L3			
Monitoring functions		Phase failure	■	■	■	■	■
		Phase sequence	can be switched off				
		Automatic phase sequence correction	configurable				
		Over- / undervoltage	■	■	■	■	■
		Phase unbalance	■	■	■	■	■
		Interrupted neutral	■	-	-	-	-
Measuring range		Overvoltage	3x240-280 V AC	3x420-500 V AC	3x480-580 V AC	3x600-720 V AC	3x690-820 V AC
		Undervoltage	3x180-220 V AC	3x300-380 V AC	3x350-460 V AC	3x450-570 V AC	3x530-660 V AC
		Phase unbalance	2-25 % of average of phase voltages				
Thresholds		Overvoltage	adjustable within measuring range				
		Undervoltage	adjustable within measuring range				
		Phase unbalance (switch-off value)	adjustable within measuring range				
Hysteresis related to the threshold value		Over- / undervoltage	fixed 5 %				
		Phase unbalance	fixed 20 %				
Rated frequency of the measuring signal			50/60/400 Hz		50/60 Hz		
Frequency range of the measuring signal			45-440 Hz		45-65 Hz		
Maximum measuring cycle time			100 ms				
Accuracy within the rated control supply voltage tolerance			$\Delta U \leq 0.5$ %				
Accuracy within the temperature range			$\Delta U \leq 0.06$ % / °C				
Measuring method			True RMS				
Timing circuit							
Start-up delay t_s and t_{s2}			fixed 200 ms				
Start-up delay t_{s1}			fixed 250 ms				
Tripping delay t_v			ON- or OFF-delay 0; 0.1-30 s adjustable				
Accuracy within the rated control supply voltage tolerance			$\Delta t \leq 0.5$ %				
Accuracy within the temperature range			$\Delta t \leq 0.06$ % / °C				
Indication of operational states			Details see function description / -diagrams				
Output circuits			15-16/18, 25-26/28				
Kind of output			relay, 2 x 1 or 1 x 2 c/o contacts configurable				
Operating principle			closed-circuit principle [1]				
Contact material			AgNi alloy, Cd free				
Rated operational voltage U_e		IEC/EN 60947-1	250 V				
Minimum switching power			24 V / 10 mA				
Maximum switching voltage			see load limit curve				
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) 230 V	4 A				
		AC15 (inductive) 230 V	3 A				
		DC12 (resistive) 24 V	4 A				
		DC13 (inductive) 24 V	2 A				
AC rating (UL 508)		Utilization category (Control Circuit Rating Code)	B 300				
		max. rated operational voltage	300 V AC				
		max. continuous thermal current at B 300	5 A				
		max. making/breaking apparent power at B 300	3600/360 VA				
Mechanical lifetime			30 x 10^6 switching cycles				
Electrical lifetime (AC12, 230 V, 4 A)			0,1 x 10^6 switching cycles				
Max. fuse rating to achieve short-circuit protection		n/c contact	6 A fast-acting		10 A fast-acting		
		n/o contact	10 A fast-acting				

[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
General data						
MTBF		on request				
Duty time		100%				
Dimensions (W x H x D)	product dimensions	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)				
	packaging dimensions	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)				
Weight		depending on device, see ordering details				
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool				
Mounting position		any				
Minimum distance to other units	vertical / horizontal	not necessary / not necessary				
Material of housing		UL 94 V-0				
Degree of protection	housing / terminals	IP50 / IP20				
Electrical connection						
Wire size		Screw connection technology			Easy Connect Technology (Push-in)	
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm² (1 x 20-14 AWG) 2 x 0.5-1.5 mm² (2 x 20-16 AWG)			2 x 0.5-1.5 mm² (2 x 20-16 AWG)	
	rigid	1 x 0.5-4 mm² (1 x 20-12 AWG) 2 x 0.5-2.5 mm² (2 x 20-14 AWG)			2 x 0.5-1.5 mm² (2 x 20-16 AWG)	
Stripping length		8 mm (0.32 in)				
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)			-	
Environmental data						
Ambient temperature ranges	operation / storage	-25...+60 °C / -40...+85 °C				
Damp heat (IEC 60068-2-30)		55 °C, 6 cycles				
Climatic category		3K3				
Vibration (sinusoidal) (IEC/EN 60255-21-1)		Class 2				
Shock (IEC/EN 60255-21-2)		Class 2				
Isolation data						
Rated insulation voltage U_i	input circuit / output circuit	600 V		1000 V		
	output circuit 1 / 2	300 V				
Rated impulse withstand voltage U_{imp} (VDE 0110, IEC/EN 60664)	input circuit	6 kV; 1.2/50 µs		8 kV; 1.2/50 µs		
	output circuit	4 kV; 1.2/50 µs				
Test voltage (routine test) between	isolated output circuits	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		
Basic insulation	input circuit / output circuit	600 V		1000 V		
Protective separation (VDE 0106 part 101 and 101/A, IEC/EN 61140)	input circuit / output circuit	-				
Pollution degree (VDE 0110, IEC/EN 60664)		3				
Overvoltage category (VDE 0110, IEC 60664)		III				
Standards						
Product standard		IEC/EN 60255-6, EN 50178				
Low Voltage Directive		2006/95/EC				
EMC directive		2004/108/EC				
RoHS directive		2002/95/EC				
Electromagnetic compatibility						
Interference immunity to		EN 61000-6-1, EN 61000-6-2				
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)				
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)				
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3 (2 kV / 2 kHz)				
surge	IEC/EN 61000-4-5	Level 4 (2 kV L-N)	Level 4 (2 kV L-L)			
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 (10 V)				
harmonics and interharmonics	IEC/EN 61000-4-13	Class 3				
Interference emission		EN 61000-6-3, EN 61000-6-4				
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B				
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B				