Measuring and monitoring relays
Product group picture

2

Measuring and monitoring relays
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Measuring and monitoring relays
Benefits and advantages

CM-N range: Multifunctional

- 45 mm wide housing
- Output contacts: 2 c/o (SPDT) contacts
- Continuous voltage range (24-240 V AC/DC) or single-supply
- Setting and operation via front-face operating controls
- Adjustment of threshold values and switching hysteresis via direct reading scale
- Adjustable time delays
- Integrated and snap-fitted front-face marker label
- Sealable transparent cover (accessory)

CM-S range: Universal and multifunctional

- Only 22.5 mm wide housing
- Output contacts: 1 or 2 c/o (SPDT) contacts
- One supply voltage range or supplied by measuring circuit
- Setting and operation via front-face operating controls
- Adjustment of threshold values and switching hysteresis via direct reading scale
- Integrated and snap-fitted front-face marker
- Snap-on housing: The relays can be placed on a DIN rail tool-free - just snap it on or remove it tool-free
- Sealable transparent cover (accessory)

CM-E range: Economy

- Only 22.5 mm wide housing
- Output contacts: 1 c/o contact or 1 n/o contact
- One supply voltage range
- One monitoring function
- Cost-efficient solution for OEM applications
- Preset monitoring ranges

ABB‘s measuring and monitoring relays in a new housing

Benefits at a glance

Easy Connect Technology

New options:

Additionally to the existing well established screw connections a new innovative connection technology can be offered: Easy Connect Technology with push-in terminals.

Tool-free wiring:

The push-in terminals can be wired with rigid or fine stranded wires with wire end ferrules totally tool-free. The connection direction is exactly the same as the screw version.

Higher utility class:

The Easy Connect Technology provides excellent vibration resistance with gas tight push-in terminals – the right solution for harsh environment.

Extended features

Flammability:

The plastic housing material used meets the requirements for the highest flammability class. (UL94 V-0 rated)

Look and feel:

The new housing fits perfectly with ABB’s control products offer.

Measuring and monitoring relays
Benefits and advantages

Combination screws for CM-E range ①
Easy tightening and release of the connection screws with pozidrive, pan- or crosshead screwdriver.

Safety ②
The „real distance“ is hidden.
The clearance and the creepage distances of our products exceed international standards and substantially increase the safety of our products.

Easy Connect Technology ③
Tool-free wiring and excellent vibration resistance. Push-in terminals provide connection of wires up to 2 x 0.5 - 1.5 mm² (2 x 20 -16 AWG), rigid or fine-strand with or without wire end ferrules. The extended type designators for products with push-in terminals are indicated by a P following the extended type designator e.g. CM-xxS.xx**P**.

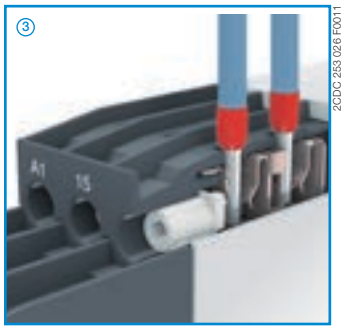
Double-chamber cage connection terminals ④
Double-chamber cage connection terminals provide connection of wires up to 2 x 0,5-2.5 mm² (2 x 20-14 AWG) rigid or fine-strand, with or without wire end ferrules. Potential distribution does not require additional terminals. The extended type designators for products with double-chamber cage connection terminals are indicated by a S following the extended type designator e.g. CM-xxS.xx**S**.

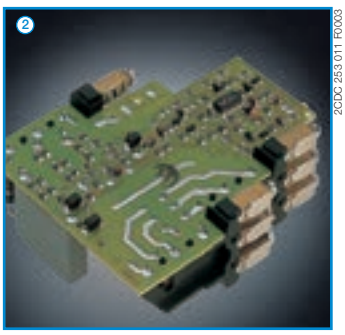
LED‘s for status indication ⑤
All actual operational states are displayed by front-face LEDs, thus simplifying commissioning and troubleshooting.

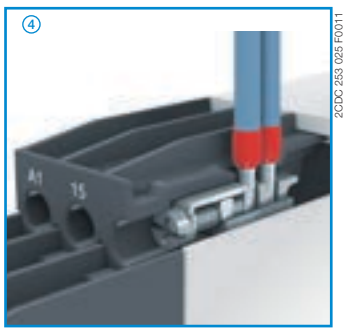
Integrated marker label ⑥
Integrated marker labels allow the product to be marked quickly and simply. No additional marker labels are required.

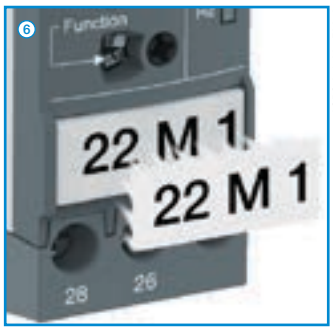
Sealable transparent cover ⑦
Protection against unauthorized changes of time and threshold values. Available as an accessory.

Snap-On housing ⑧
Tool-free DIN rail installation and deinstallation of the monitoring relay.



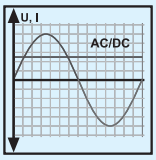






Measuring and monitoring relays
Monitoring features and application ranges

Single-phase current and voltage monitoring
- Over- or undercurrent monitoring CM-SRS and CM-SRS.M
- Over- and undercurrent monitoring CM-SFS
- Over- or undervoltage monitoring CM-ESS and CM-ESS.M
- Over- and undervoltage monitoring CM-EFS

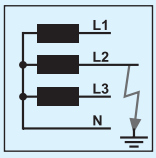


2CDC 252 025 F0004

Current monitoring
- Monitoring of motor current consumption
- Monitoring of lighting installations and heating circuits
- Monitoring of hoisting gear and transportation equipment overload
- Monitoring of locking devices, electromechanical brake gear and locked rotor

Voltage monitoring
- Speed monitoring of DC motors
- Monitoring of battery voltages and other supply networks
- Monitoring of upper and lower voltage threshold values

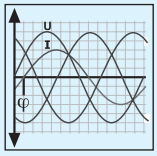
Insulation monitoring
- For electrically isolated AC systems: CM-IWS.2
- For electrically isolated AC, DC and mixed AC/DC systems: CM-IWS.1, CM-IWN.1 and especially for solar applications:
  ≤ 500 µF: CM-IWN.4
  ≤ 1000 µF: CM.IWN.5
  ≤ 2000 µF: CM-IWN.6



2CDC 252 027 F0004

- Monitoring of electrically isolated supply mains for insulation resistance failure
- Detection of initial faults
- Protection against earth faults

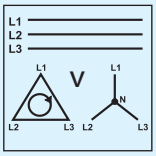
Motor load monitoring
CM-LWN monitoring relays load states of single- and three-phase asynchronous motors.



2CDC 252 028 F0004

- Detection of V-belt breaking
- Motor protection against overload
- Monitoring of filters for clogging
- Protection of pumps against dry running
- Detection of high pressure in conduit systems
- Monitoring for dulling blades in sawing and cutting machines

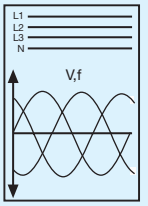
Three-phase monitoring
- Phase failure CM-PBE
- Over- and undervoltage CM-PVE
- Phase sequence and phase failure CM-PFE and CM-PFS
- Phase sequence and phase failure, over- and undervoltage CM-PSS.xx and CM-PVS.xx
- Phase sequence and phase failure, unbalance CM-PAS.xx
- Phase sequence and phase failure, unbalance, over- and undervoltage CM-MPS.xx and CM-MPN.xx
- Over- and undervoltage, over- and underfrequency CM-UFS.1



2CDC 252 026 F0004

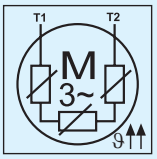
Three-phase voltage monitoring
- Voltage monitoring of mobile three-phase equipment
- Protection of personnel and installations against phase reversal
- Monitoring of the supply voltage to machines and installations
- Protection of equipment against damage caused by unstable supply voltage
- Switching to emergency or auxiliary supply
- Protection of motors against damage caused by unbalanced phase voltages and phase loss
- Automatic connection & disconnection of decentralised power stations to the grid

Grid feeding monitoring relays
The CM-UFx range monitors all voltage and frequency parameters in a grid and ensures the safe feeding of decentral produced eletrical energy into the grid.
- Monitoring of the voltage with up to 2 thresholds for over- and undervoltage
- Monitoring of the frequency with up to 2 thresholds for over- and underfrequency
- Optional ROCOF (rate of change of frequency) and vector shift
- Acc. to national grid feeding standards such as CEI 0-21, VDE AR-N 4105 etc.



2CDC 252 009 F0013

Thermistor motor protection
CM-MSE, CM-MSS and CM-MSN provide full protection of motors with integrated PTC resistor sensors.



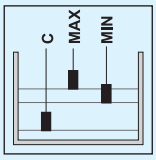
2CDC 252 029 F0004

- Protection of motors against thermal overload, e. g. caused by insufficient cooling, heavy load starting conditions, undersized motors, etc.

Measuring and monitoring relays
Monitoring features and application ranges

Liquid level monitoring and control

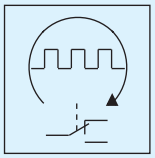
CM-ENE, CM-ENS and CM-ENN for control and regulation of liquid levels and ratios of mixtures of conductive fluids.



2CDC 252 030 F0004

- Protection of pumps against dry running
- Protection against container overflow
- Control of liquid levels
- Detection of leaks
- Control of mixing ratios

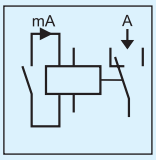
Cycle monitoring


2CDC 252 036 F0004

- External monitoring of the correct function of programmable logic controllers (plc) and industrial pcs (ipc)

Contact protection, sensor evaluation

The CM-KRN protects sensitive control contacts from excessive loads and can store switch positions. The CM-SIS supplies and evaluates NPN and PNP sensors.



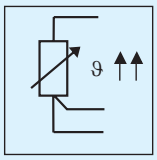
2CDC 252 031 F0004

- Storage of the switching states of bouncing contacts
- Amplification of the switch state information of sensitive contacts
- Supply and evaluation of NPN or PNP sensors

Temperature monitoring

Acquisition, messaging and regulation of temperatures of solid, liquid and gaseous media in processes and machines

- with CM-TCS via PT100 sensor
- with C512 and C513 with PT100, PT1000 KTY83, KTY84 or NTC sensors



2CDC 252 032 F0004

- Motor and system protection
- Control panel temperature monitoring
- Frost monitoring
- Temperature limits for process variables, e.g. in the packing or electroplating industry
- Control of systems and machines like heating, air-conditioning and ventilation systems, solar collectors, heat pumps or hot water supply systems
- Monitoring of servomotors with KTY sensors
- Bearing and gear oil monitoring
- Coolant monitoring

Measuring and monitoring relays
Approvals and marks

■ existing
□ pending

Approvals		Current and voltage monitoring, single-phase								Three-phase monitoring															
		CM-SRS.1xS/P	CM-SRS.2xS	CM.SRS.MS/P	CM-SFS.2S/P	CM-ESS.2xS	CM-ESS.MS/P	CM-EFS.2S/P		CM-PBE	CM-PVE	CM-PFE	CM-PFS.S/P	CM-PSS.x1S/P	CM-PVS.x1S/P	CM-PAS.x1S/P	CM-MPS.x1S/P	CM-MPS.x3S/P	CM-MPN.52S/P	CM-MPN.62S/P	CM-MPN.72S/P				
	UL 508, CAN/CSA C22.2 No.14	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■					
	GL	□	□	□	□	□	□	□					■	■	■	■	■	■	■	■	■				
	GOST	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]					■[1]	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]				
	EAC									■	■	■													
	CB scheme	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■				
	CCC	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■				
	RMRS	■	■	■	■	■	■	■		■	■	■		■	■	■	■	■	■	■	■				
	Rail applications [2]	■	■	■	■	■							■		■		■	■							
Marks																									
	CE	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■				
	C-Tick	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■				

■ existing
□ pending

Approvals		Insulation monitoring relays for ungrounded supply mains						Motor load monitoring			Tempera-ture monitoring				Contact pro-tection, sensor interface					Grid feeding monitoring relays				
		CM-IWS.2S/P	CM-IWS.1S/P	CM-IWN.1S/P	CM-IWN.4,5,6,S/P	CM-IVN.S/P		CM-LWN			CM-TCS.xS/P	C512	C513		CM-KRN	CM-SIS				CM-UFS.1	CM-UFD.M21	CM-UFD.M22		
	UL 508, CAN/CSA C22.2 No.14	■	■	■	■	■		■			■	■	■		■	■								
	GL	■	■	■		■		■			□				■									
	GOST	■[1]	■[1]	■[1]	■[1]	■[1]		■[1]			■[1]				■[1]	■[1]								
	CB scheme	■	■	■	■	■		■			■													
	CCC	■	■	■	■	■		■			■									■				
	RMRS	■	■	■	■			■							■	■								
	Rail applications [2]	■		■		■																		
	CEI 0-21																					■		
	VDE-AR-N 4105 „Erzeugungsan-lagen am Niederspannungsnetz“																				■			
	BDEW „Erzeugungsanlagen am Mittelspannungsnetz“																				■			
Marks																								
	CE	■	■	■	■	■		■			■	■	■		■	■					■	■		
	C-Tick	■	■	■	■	■		■			■					■								

■ existing
□ pending

Approvals		Cycle monitoring				Thermistor motor protection									Liquid level monitoring					
		CM-WDS				CM-MSE	CM-MSS (1)	CM-MSS (2)	CM-MSS (3)	CM-MSS (4)	CM-MSS (5)	CM-MSS (6)	CM-MSS (7)	CM-MSN	CM-ENE MIN	CM-ENE MAX	CM-ENS	CM-ENS UP/...	CM-ENN	CM-ENN UP/...
	UL 508, CAN/CSA C22.2 No.14	■				■	■	■	■	■	□	■	■	■	■	■	■	■	■	■
	GL						■	■	■	■	■	■	■	■			■[3]		■	
	GOST	■[1]					■[1]	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]	■[1]			■[1]	■[1]	■[1]	■[1]
	EAC					■									■	■				
	II (2) G D, PTB 02 ATEX 3080								■	■		■	■	■						
	CB scheme					■	■	■	■	■	■	■	■		■	■	■	■	■	■
	CCC					■	■	■	■	■	■	■	■		■	■	■	■	■	■
	RMRS	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Marks																				
	CE	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	C-Tick					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

[1] May have been replaced by EAC during the availability of this catalog edition.
[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 2CDC110084B0201.
[3] Version with protective separation without ⓤL approval

Measuring and monitoring relays
Notes

Current and voltage monitoring relays, single-phase
Product group picture

Current and voltage monitoring relays, single-phase
Table of contents

Current and voltage monitoring relays, single-phase
Benefits and advantages

Characteristics current and voltage monitoring relays

- Monitoring of DC and AC currents: 3 mA to 15 A [1)]
- Monitoring of DC and AC voltages from 3 - 600 V
- TRMS measuring principle
- One device includes 3 measuring ranges
- One device includes 4 measuring ranges: 3 - 30 V; 6 - 60 V; 30 - 300 V; 60 - 600 V
- Over- and undercurrent monitoring[1)]
- Over- and undervoltage monitoring[1)]
- ON or OFF-delay configurable[1)]
- Open- or closed-circuit principle configurable[1)]
- Threshold values for >U and/or <U adjustable[1)]
- Latching function configurable[1)]
- Thresholds for >I and/or <I adjustable[1)]
- Fixed hysteresis of 5 %[1)]
- Start-up delay T_v adjustable 0; 0.1 - 30 s[1)]
- Tripping delay T_v adjustable 0; 0.1 - 30 s[1)]
- 1 x 2 c/o contacts (common signal) or 2 x 1 c/o contact (separate signals for >I and <I) configurable [1)]
- 1 x 2 c/o contacts (common signal) or 2 x 1 c/o contact (separate signals for >U and <U) configurable[1)]
- 22.5 mm width
- 3 LEDs for the indication of operational states
- Approvals / Marks [2)] / CE

[1)] depending on device
[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 2CDC110084B0201.

Current monitoring, single-phase

The ABB current monitoring relays CM-SRS.xx reliably monitor the occurence of currents that exceed or fall below the selected threshold value. The functions overcurrent or undercurrent monitoring can be preselected. Single- and multifunction devices for the monitoring of direct or alternating currents from 3 mA to 15 A are available.

Current window monitoring (I_{min}, I_{max})

The window monitoring relay CM-SFS.2x is available if the application requires the simultaneous monitoring of over- and undercurrents.

Voltage monitoring, single-phase

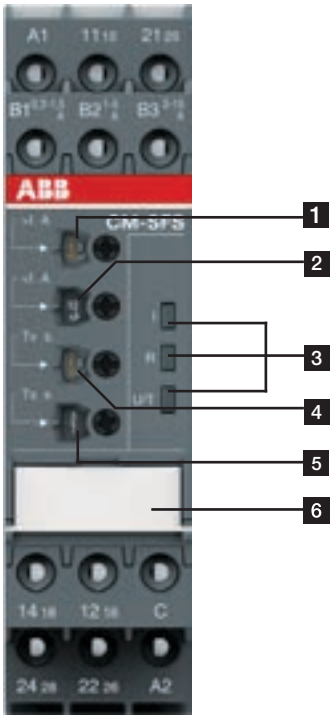
The ABB voltage monitoring relays CM-SRS.xx are used to monitor direct and alternating voltages within a range of 3-600 V. Over- or undervoltage detection can be preselected.

Voltage window monitoring (U_{min}, U_{max})

For the simultaneous detection of over- and undervoltages, the window monitoring relay CM-EFS.2 can be used.

Current and voltage monitoring relays, single-phase
Operating controls

Current monitoring relays



1 **Adjustment of the threshold value >I for overcurrent**

2 **Adjustment of the threshold value <I for undercurrent**

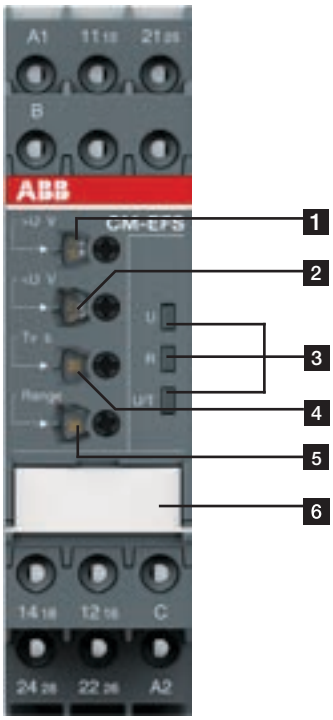
3 **Indication of operational states**
U/T: green LED – control supply voltage/timing
R: yellow LED – relay status
I: red LED – over- / undercurrent

4 **Adjustment of the tripping delay T_v**

5 **Adjustment of the start-up delay T_s**

6 **DIP switches (see DIP switch functions on page 2/20)**
ON-delay
OFF-delay
Closed-circuit principle
Open-circuit principle
Latching function activated
Latching function not activated
2x1 c/o (SPDT) contact
1x2 c/o (SPDT) contacts

Voltage monitoring relays



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

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

3 **Indication of operational states**
U/T: green LED – control supply voltage/timing
R: yellow LED – relay status
U: red LED – over- / undervoltage

4 **Adjustment of the tripping delay T_v**

5 **Adjustment of the measuring range**

6 **DIP switches (see DIP switch functions on page 2/20)**
ON-delay
OFF-delay
Closed-circuit principle
Open-circuit principle
Latching function activated
Latching function not activated
2x1 c/o (SPDT) contact
1x2 c/o (SPDT) contacts

Current and voltage monitoring relays, single-phase
Selection table - Current monitoring relays

	Order number	1SVR 730 840 R0200	1SVR 740 840 R0200	1SVR 730 841 R0200	1SVR 740 841 R0200	1SVR 730 841 R1200	1SVR 740 841 R1200	1SVR 730 840 R0300	1SVR 730 841 R0300	1SVR 730 841 R1300	1SVR 730 840 R0400	1SVR 740 840 R0400	1SVR 730 841 R0400	1SVR 740 841 R0400	1SVR 730 841 R1400	1SVR 740 841 R1400	1SVR 730 840 R0500	1SVR 730 841 R0500	1SVR 730 841 R1500	1SVR 730 840 R0600	1SVR 740 840 R0600	1SVR 730 840 R0700	1SVR 730 760 R0400	1SVR 740 760 R0400	1SVR 730 760 R0500
	Type	CM-SRS.11S	CM-SRS.11P	CM-SRS.11S	CM-SRS.11P	CM-SRS.11S	CM-SRS.11P	CM-SRS.12S			CM-SRS.21S	CM-SRS.21P	CM-SRS.21S	CM-SRS.21P	CM-SRS.21S	CM-SRS.21P	CM-SRS.22S			CM-SRS.M1S	CM-SRS.M1P	CM-SRS.M2S	CM-SFS.21S	CM-SFS.21P	CM-SFS.22S
Rated control supply voltage U_s																									
24 - 240 V AC/DC		■	■					■			■	■					■			■	■	■	■	■	■
110 - 130 V AC				■	■				■				■	■				■							
220 - 240 V AC						■	■			■					■	■			■						
Measuring ranges AC/DC																									
3 - 30 mA		■	■	■	■	■	■				■	■	■	■	■	■				■	■		■	■	
10 - 100 mA		■	■	■	■	■	■				■	■	■	■	■	■				■	■		■	■	
0.1 - 1 A		■	■	■	■	■	■				■	■	■	■	■	■				■	■		■	■	
0.3 - 1.5 A								■	■	■							■	■	■			■			■
1 - 5 A								■	■	■							■	■	■			■			■
3 - 15 A								■	■	■							■	■	■			■			■
Monitoring function																									
Over- or undercurrent		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Windows current monitoring																							■	■	■
Latching																				sel	sel	sel	sel	sel	sel
Open circuit or closed circuit principle																				sel	sel	sel	sel	sel	sel
Timing functions for tripping delay																									
ON delay, 0 or 0. 1 - 30 s											adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj			
ON or OFF delay																							sel	sel	sel
Output																									
c/o contact		1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Connection type																									
Push-in terminals			■		■		■					■		■		■					■			■	
Double-chamber cage connection terminals		■		■		■		■	■	■	■		■		■		■	■	■	■		■	■		■

adj: adjustable
sel: selectable

Current and voltage monitoring relays, single-phase
Selection table - Voltage monitoring relays

	Order number	1SVR 730 830 R0300	1SVR 740 830 R0300	1SVR 730 831 R0300	1SVR 740 831 R0300	1SVR 730 831 R1300	1SVR 740 831 R1300	1SVR 730 830 R0400	1SVR 740 830 R0400	1SVR 730 831 R0400	1SVR 740 831 R0400	1SVR 730 831 R1400	1SVR 740 831 R1400	1SVR 730 830 R0500	1SVR 740 830 R0500	1SVR 730 750 R0400	1SVR 740 750 R0400
	Type	CM-ESS.1S	CM-ESS.1P	CM-ESS.1S	CM-ESS.1P	CM-ESS.1S	CM-ESS.1P	CM-ESS.2S	CM-ESS.2P	CM-ESS.2S	CM-ESS.2P	CM-ESS.2S	CM-ESS.2P	CM-ESS.MS	CM-ESS.MP	CM-EFS.2S	CM-EFS.2P
Rated control supply voltage U_s																	
24 - 240 V AC/DC		■	■					■	■					■	■	■	■
110 - 130 V AC				■	■					■	■						
220 - 240 V AC						■	■					■	■				
Measuring ranges AC/DC																	
3 - 30 V		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6 - 60 V		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
30 - 300 V		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
60 - 600 V		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Monitoring function																	
Over- or undervoltage		■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Windows voltage monitoring																■	■
Latching														sel	sel	sel	sel
Open circuit or closed circuit principle														sel	sel	sel	sel
Timing functions for tripping delay																	
ON delay, 0 or 0.1 - 30 s								adj	adj	adj	adj	adj	adj	adj	adj		
ON or OFF delay																sel	sel
Output																	
c/o contact		1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
Connection type																	
Push-in terminals			■		■		■		■		■		■		■		■
Double-chamber cage connection terminals		■		■		■		■		■		■		■		■	

adj: adjustable
sel: selectable

Current and voltage monitoring relays, single-phase
Ordering details - Current monitoring relays

CM-SRS.22S

CM-SFS.22P

Overcurrent monitoring
Undercurrent monitoring
Without latching
With latching
1x2 c/o (SPDT) contacts
2x1 c/o (SPDT) contact

Description

The CM range current monitoring relays protect single-phase mains (DC or AC) from over- and undercurrent from 3 mA to 15 A. Two different terminal versions are available. You can choose between the proven screw connection technology (double-chamber cage connecting terminals) and the completely tool-free Easy Connect Technology (push-in terminals).

Ordering details

Rated control supply voltage	Function	Tripping delay T_v	Measuring range	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC					1SVR730840R0200		0.145 (0.320)
110-130 V AC				CM-SRS.11S	1SVR730841R0200		0.161 (0.355)
220-240 V AC					1SVR730841R1200		0.161 (0.355)
24-240 V AC/DC					1SVR740840R0200		0.137 (0.302)
110-130 V AC				CM-SRS.11P	1SVR740841R0200		0.153 (0.337)
220-240 V AC					1SVR740841R1200		0.153 (0.337)
24-240 V AC/DC					1SVR730840R0300		0.137 (0.302)
110-130 V AC				CM-SRS.12S	1SVR730841R0300		0.168 (0.370)
220-240 V AC					1SVR730841R1300		0.168 (0.370)
24-240 V AC/DC					1SVR730840R0400		0.152 (0.335)
110-130 V AC				CM-SRS.21S	1SVR730841R0400		0.179 (0.395)
220-240 V AC					1SVR730841R1400		0.179 (0.395)
24-240 V AC/DC					1SVR740840R0400		0.141 (0.311)
110-130 V AC				CM-SRS.21P	1SVR740841R0400		0.168 (0.370)
220-240 V AC					1SVR740841R1400		0.168 (0.370)
24-240 V AC/DC					1SVR730840R0500		0.144 (0.399)
110-130 V AC				CM-SRS.22S	1SVR730841R0500		0.181 (0.399)
220-240 V AC					1SVR730841R1500		0.181 (0.399)
24-240 V AC/DC				CM-SRS.M1S	1SVR730840R0600		0.153 (0.337)
				CM-SRS.M1P	1SVR740840R0600		0.142 (0.313)
24-240 V AC/DC				CM-SRS.M2S	1SVR730840R0700		0.155 (0.342)
24-240 V AC/DC				CM-SFS.21S	1SVR730760R0400		0.150 (0.331)
				CM-SFS.21P	1SVR740760R0400		0.139 (0.306)
24-240 V AC/DC				CM-SFS.22S	1SVR730760R0500		0.158 (0.348)

Function	Tripping delay T_v	Measuring range
	without	3-30 mA 10-100 mA 0.1-1 A
	without	0.3-1.5 A 1-5 A 3-15 A
	adjustable 0 or 0.1-30 s	3-30 mA 10-100 mA 0.1-1 A
	adjustable 0 or 0.1-30 s	0.3-1.5 A 1-5 A 3-15 A
	adjustable 0 or 0.1-30 s	3-30 mA 10-100 mA 0.1-1 A
	adjustable 0 or 0.1-30 s	0.3-1.5 A 1-5 A 3-15 A
	adjustable 0 or 0.1-30 s	3-30 mA 10-100 mA 0.1-1 A
1x2 c/o 2x1 c/o	adjustable 0 or 0.1-30 s	0.3-1.5 A 1-5 A 3-15 A

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

Current and voltage monitoring relays, single-phase
Ordering details - Voltage monitoring relays


2CDC 251 060 V0011

CM-ESS.MP


2CDC 251 059 V0011

CM-EFS.2

Description

The CM range voltage monitoring relays provide reliable monitoring of voltages as well as detection of phase loss in single-phase mains.

All devices are available with two different terminal versions. You can choose between the proven screw connection technology (double-chamber cage connecting terminals) and the completely tool-free Easy Connect Technology (push-in terminals).

Ordering details

Rated control supply voltage	Function	Tripping delay T_v	Measuring range	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC				CM-ESS.1S	1SVR730830R0300		0.135 (0.298)
110-130 V AC					1SVR730831R0300		0.164 (0.362)
220-240 V AC					1SVR730831R1300		0.164 (0.362)
24-240 V AC/DC				CM-ESS.1P	1SVR740830R0300		0.126 (0.278)
110-130 V AC					1SVR740831R0300		0.155 (0.342)
220-240 V AC					1SVR740831R1300		0.155 (0.342)
24-240 V AC/DC				CM-ESS.2S	1SVR730830R0400		0.153 (0.337)
110-130 V AC					1SVR730831R0400		0.181 (0.399)
220-240 V AC					1SVR730831R1400		0.181 (0.399)
24-240 V AC/DC				CM-ESS.2P	1SVR740830R0400		0.142 (0.313)
110-130 V AC					1SVR740831R0400		0.170 (0.375)
220-240 V AC					1SVR740831R1400		0.170 (0.375)
24-240 V AC/DC				CM-ESS.MS	1SVR730830R0500		0.154 (0.340)
				CM-ESS.MP	1SVR740830R0500		0.143 (0.320)
24-240 V AC/DC				CM-EFS.2S	1SVR730750R0400		0.157 (0.346)
				CM-EFS.2P	1SVR740750R0400		0.146 (0.322)

24-240 V AC/DC		without	3-30 V 6-60 V 30-300 V 60-600 V
24-240 V AC/DC		adjustable 0 or 0.1-30 s	3-30 V 6-60 V 30-300 V 60-600 V
24-240 V AC/DC		adjustable 0 or 0.1-30 s	3-30 V 6-60 V 30-300 V 60-600 V
24-240 V AC/DC		adjustable 0 or 0.1-30 s	3-30 V 6-60 V 30-300 V 60-600 V

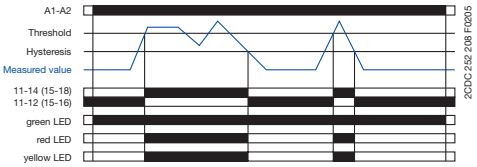
S: screw connection
P: push-in / easy connect

Overcurrent monitoring
Undercurrent monitoring
Without latching
With latching
1x2 c/o (SPDT) contacts
2x1 c/o (SPDT) contact

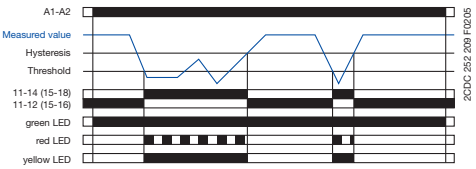
Current and voltage monitoring relays, single-phase
Function diagrams

Function diagrams - CM-SRS.1

Overcurrent monitoring

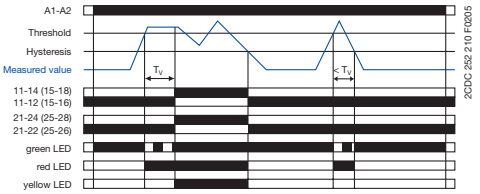


Undercurrent monitoring

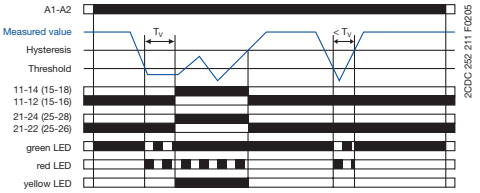


Function diagrams - CM-SRS.2

Overcurrent monitoring



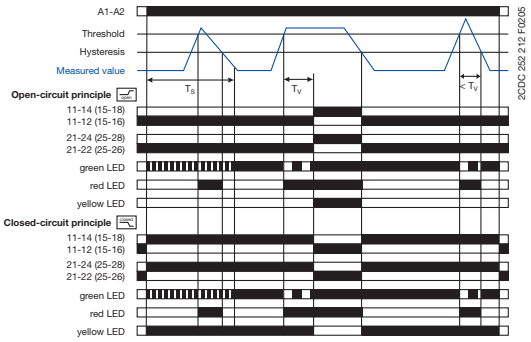
Undercurrent monitoring



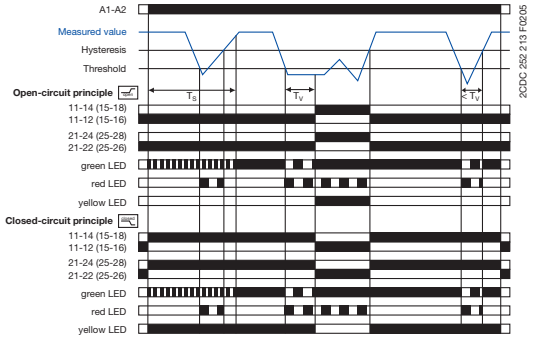
If the measured value exceeds resp. drops below the adjusted threshold value, the output relay(s) energize(s): on the CM-SRS.1 immediately, on the CM-SRS.2 after the set tripping delay T_V. If the measured value exceeds resp. drops below the threshold value plus resp. minus the adjusted hysteresis, the output relay(s) de-energize(s). The hysteresis is adjustable within a range of 3-30 % of the threshold value.

Function diagrams - CM-SRS.M

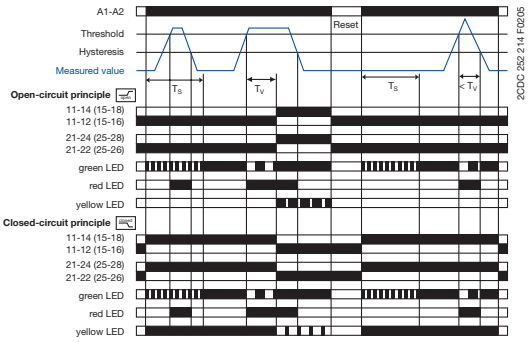
Overcurrent monitoring without latching



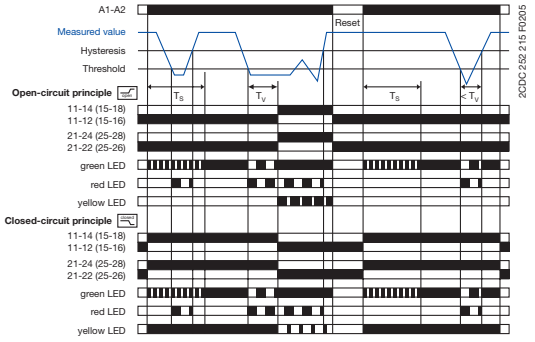
Undercurrent monitoring without latching



Overcurrent monitoring with latching



Undercurrent monitoring with latching



If the measured value exceeds resp. drops below the adjusted threshold value before the set start-up delay T_S is complete, the output relays do not change their actual state. If the measured value exceeds resp. drops below the adjusted threshold value when T_S is complete, the tripping delay T_V starts. If T_V is complete and the measured value is still exceeding resp. below the threshold value plus resp. minus the set hysteresis, the output relays energize / de-energize.

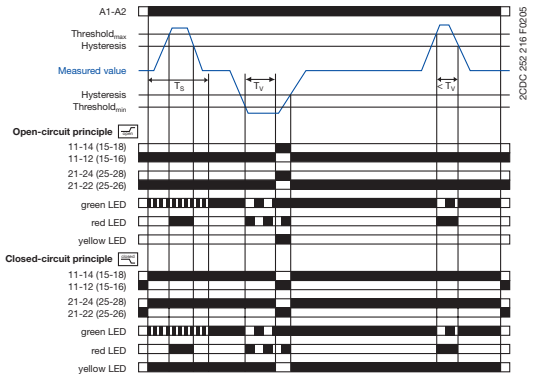
If the measured value exceeds resp. drops below the threshold value minus resp. plus the set hysteresis and the latching function is not activated, the output relays de-energize / energize. With activated latching function the output relays remain energized and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized and energize only, when the supply voltage is switched off and then again switched on = Reset.

The hysteresis is adjustable within a range of 3-30 % of the threshold value.

Current and voltage monitoring relays, single-phase
Function diagrams

Function diagrams - CM-SFS.2

Current window monitoring 1x2 c/o contact 1x2 c/o
ON-delayed ⊠ **without latching** ▭



ON-delayed ⊠ current window monitoring with parallel switching c/o contacts 1x2 c/o:

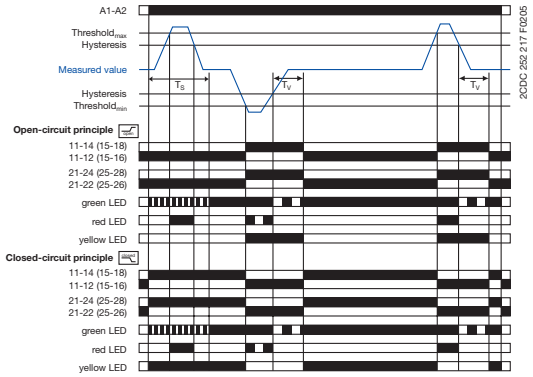
If the measured value exceeds resp. drops below the adjusted threshold value before the set start-up delay T_S is complete, the output relays do not change their actual state.

If the measured value exceeds resp. drops below the adjusted threshold value when T_S is complete, the tripping delay T_V starts, when ⊠ is configured. If T_V is complete and the measured value is still exceeding resp. below the threshold value minus resp. plus the fixed hysteresis (5%), the output relays energize ⎍ /de-energize ⎍.

If the measured value exceeds resp. drops below the threshold value plus resp. minus the hysteresis and the latching function is not activated ▭, the output relays de-energize ⎍ / energize ⎍. With activated latching function ⊠ the output relays remain energized ⎍ and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized ⎍ and energize only, when the supply voltage is switched off and then again switched on = Reset.

Further function diagrams see data sheet.

Current window monitoring 1x2 c/o contact 1x2 c/o
OFF-delayed ■ **without latching** ⊠



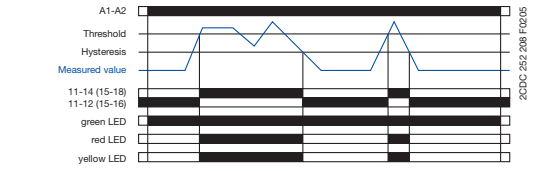
OFF-delayed ■ current window monitoring with parallel switching c/o contacts 1x2 c/o:

If the measured value exceeds resp. drops below the adjusted threshold value when the set start-up delay T_S is complete, the output relays energize ⎍ / de-energize ⎍, when ■ is configured, and remain in this position during the set tripping delay T_V. If the measured value exceeds resp. drops below the threshold value plus resp. minus the fixed hysteresis (5%) and the latching function is not activated ⊠, the tripping delay T_V starts. After completion of T_V, the output relays de-energize ⎍ / energize ⎍, provided that the latching function is not activated ⊠. With activated latching function ▭ the output relays remain energized ⎍ and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized ⎍ and energize only, when the supply voltage is switched off and then again switched on = Reset. When 2x1 c/o is adjusted on the device, the functionality is equivalent to the one described above. There is only to consider that in this case, instead of both output relays, only one output relay each will be switched.

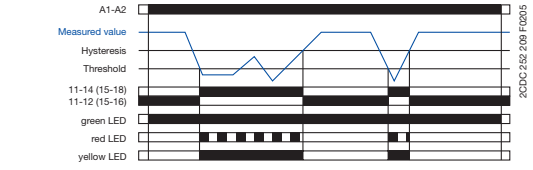
“>I“ = 11_{15}-12_{16}/14_{18} ; “<I“ = 21_{25}-22_{26}/24_{28}

Function diagrams - CM-ESS.1

Overvoltage monitoring ⎍

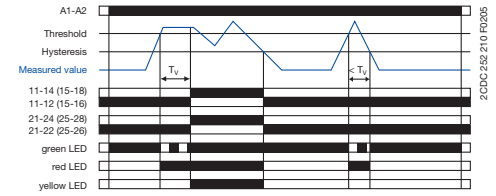


Undervoltage monitoring ⎍

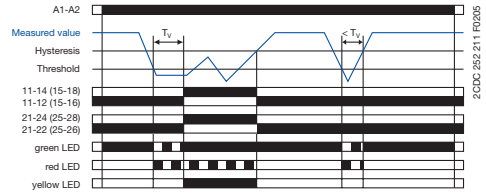


Function diagrams - CM-ESS.2

Overvoltage monitoring ⎍



Undervoltage monitoring ⎍

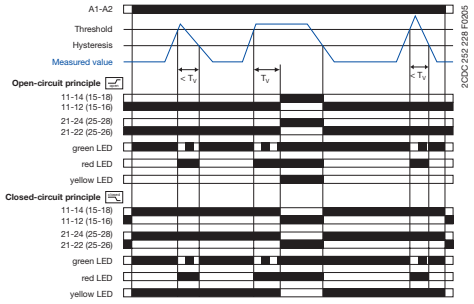


Depending on the configuration, the voltage monitoring relays **CM-ESS.1** and **CM-ESS.2** can be used for over- ⎍ or undervoltage monitoring ⎍ in single-phase AC and/or DC systems. The voltage to be monitored (measured value) is applied to terminals B-C. The devices work according the open-circuit principle. If the measured value exceeds resp. drops below the adjusted threshold value, the output relay(s) energize(s): on the CM-ESS.1 immediately, on the CM-ESS.2 after the set tripping delay T_V If the measured value exceeds resp. drops below the threshold value plus resp. minus the adjusted hysteresis, the output relay(s) de-energize(s). The hysteresis is adjustable within a range of 3-30 % of the threshold value.

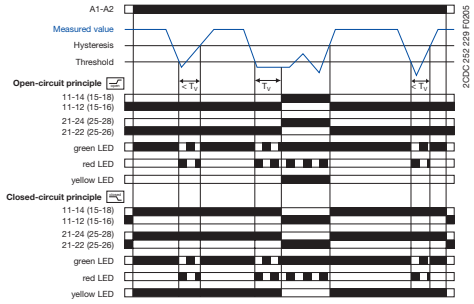
Current and voltage monitoring relays, single-phase
Function diagrams

Function diagrams - CM-ESS.M

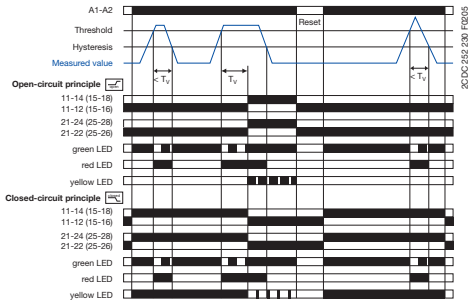
Overvoltage monitoring without latching



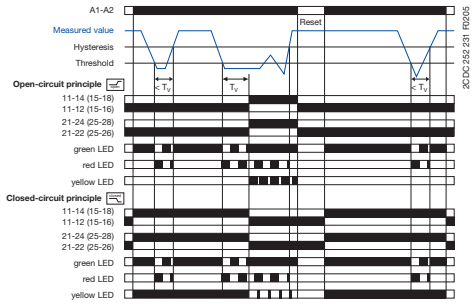
Undervoltage monitoring without latching



Overvoltage monitoring with latching



Undervoltage monitoring with latching

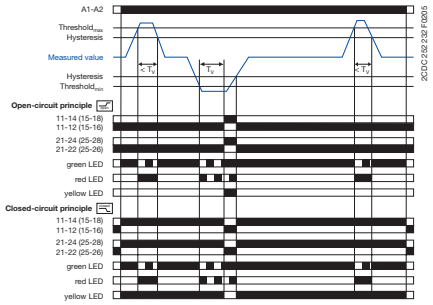


If the measured value exceeds resp. drops below the adjusted threshold value, the tripping delay T_V starts. If T_V is complete and the measured value is still exceeding resp. below the threshold value plus resp. minus the set hysteresis, the output relays energize / de-energize.

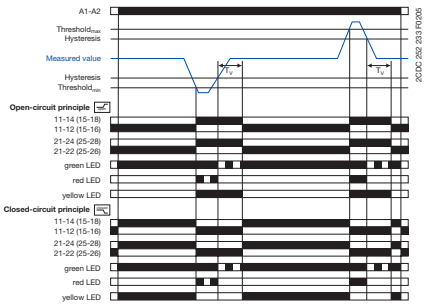
If the measured value exceeds resp. drops below the threshold value plus resp. minus the set hysteresis and the latching function is not activated, the output relays de-energize / energize. With activated latching function the output relays remain energized and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized and energize only, when the supply voltage is switched off and then again switched on = Reset. The hysteresis is adjustable within a range of 3-30 % of the threshold value.

Further function diagrams see data sheet.

Voltage window monitoring 1x2 c/o contact
ON-delayed without latching



Voltage window monitoring 1x2 c/o contact
OFF-delayed without latching



ON-delayed voltage window monitoring with parallel switching c/o contacts:

If the measured value exceeds resp. drops below the adjusted threshold value, the tripping delay T_V starts, when is configured. If T_V is complete and the measured value is still exceeding resp. below the threshold value minus resp. plus the fixed hysteresis (5%), the output relays energize / de-energize.

If the measured value exceeds resp. drops below the threshold value plus resp. minus the hysteresis and the latching function is not activated, the output relays de-energize / energize. With activated latching function the output relays remain energized and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized and energize only, when the supply voltage is switched off and then again switched on = Reset.

OFF-delayed voltage window monitoring with parallel switching c/o contacts:

If the measured value exceeds resp. drops below the adjusted threshold value, the output relays energize / de-energize, when is configured, and remain in this position during the set tripping delay T_V.

If the measured value exceeds resp. drops below the threshold value plus resp. minus the fixed hysteresis (5%) and the latching function is not activated, the tripping delay T_V starts.

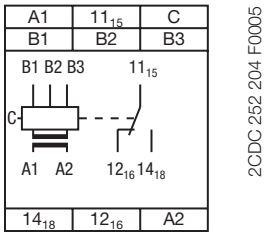
After completion of T_V, the output relays de-energize / energize, provided that the latching function is not activated. With activated latching function the output relays remain energized and de-energize only, when the supply voltage is interrupted / the output relays remain de-energized and energize only, when the supply voltage is switched off and then again switched on = Reset.

When 2x1 c/o is adjusted on the device, the functionality is equivalent to the one described above. There is only to consider that in this case, instead of both output relays, only one output relay each will be switched.

">U" = 11_{15}-12_{16}/14_{18} ; "<U" = 21_{25}-22_{26}/24_{28}

Current and voltage monitoring relays, single-phase
Connection diagrams, DIP switches

Connection diagram CM-SRS.1, CM-SRS.2



2CDC 252 204 F0005

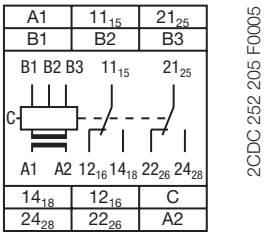
A1-A2 Control supply voltage

B1-C Measuring range 1: 3-30 mA or 0.3-1.5 A

B2-C Measuring range 2: 10-100 mA or 1-5 A

B3-C Measuring range 3: 0.1-1 A or 3-15 A

11_{15}-12_{16}/14_{18} Output contacts - open-circuit principle



2CDC 252 205 F0005

A1-A2 Control supply voltage

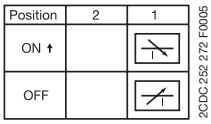
B1-C Measuring range 1: 3-30 mA or 0.3-1.5 A

B2-C Measuring range 2: 10-100 mA or 1-5 A

B3-C Measuring range 3: 0.1-1 A or 3-15 A

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

DIP switch functions CM-SRS.1, CM-SRS.2

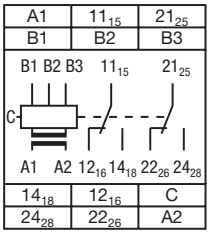


2CDC 252 272 F0005

1 ON Undercurrent monitoring
OFF Overcurrent monitoring

OFF = Default

Connection diagram CM-SRS.M



2CDC 252 205 F0005

A1-A2 Control supply voltage

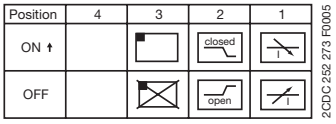
B1-C Measuring range 1: 3-30 mA bzw. 0.3-1.5 A

B2-C Measuring range 2: 10-100 mA bzw. 1-5 A

B3-C Measuring range 3: 0.1-1 A bzw. 3-15 A

11_{15}-12_{16}/14_{18} 21_{25}-22_{26}/24_{28} Output contacts - open-or closed circuit principle

DIP switch functions CM-SRS.M



2CDC 252 273 F0005

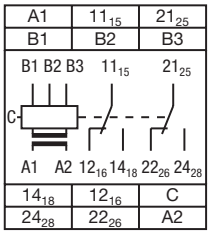
1 ON Undercurrent monitoring
OFF Overcurrent monitoring

2 ON Closed-circuit principle
OFF Open-circuit principle

3 ON Latching function activated
OFF Latching function not activated

OFF = Default

Connection diagram CM-SFS.2



2CDC 252 205 F0005

A1-A2 Control supply voltage

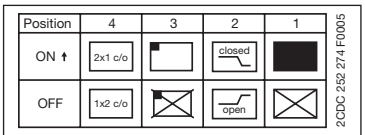
B1-C Measuring range 1: 3-30 mA or 0.3-1.5 A

B2-C Measurign range 2: 10-100 mA or 1-5 A

B3-C Measuring range 3: 0.1-1 A or 3-15 A

11_{15}-12_{16}/14_{18} 21_{25}-22_{26}/24_{28} Output contacts - open-or closed circuit principle

DIP switch function CM-SFS.2



2CDC 252 274 F0005

1 ON OFF-delay
OFF ON-delay

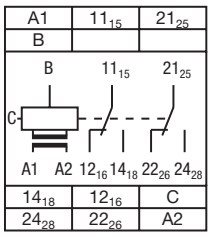
2 ON Closed-circuit principle
OFF Open-circuit principle

3 ON Latching function activated
OFF Latching function not activated

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

OFF = Default

Connection diagram CM-ESS.M



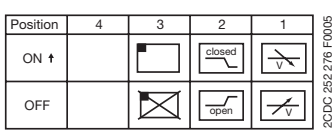
2CDC 252 207 F0005

A1-A2 Control supply voltage

B-C Measuring ranges: 3-30 V; 6-60 V; 30-300 V; 60-600 V

11_{15}-12_{16}/14_{18} 21_{25}-22_{26}/24_{28} Output contacts - Open- or closed circuit principle

DIP switch functions CM-ESS.M



2CDC 252 276 F0005

1 ON Undervoltage monitoring
OFF Overvoltage monitoring

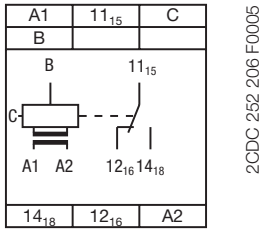
2 ON Closed-circuit principle
OFF Open-circuit principle

3 ON Latching function activated
OFF Latching function not activated

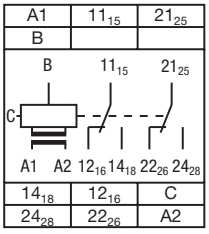
OFF = Default

Current and voltage monitoring relays, single-phase
Connection diagrams, DIP switches

Connection diagram CM-ESS.1, CM-ESS.2



2CDC 252 206 F0005

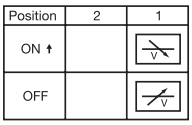


2CDC 252 207 F0005

A1-A2 Control supply voltage
B-C Measuring ranges:
3-30 V; 6-60 V;
30-300 V; 60-600 V
11_{15}-12_{16}/14_{18} Output contacts -
open-circuit principle

A1-A2 Control supply voltage
B-C Measuring ranges:
3-30 V; 6-60 V;
30-300 V; 60-600 V
11_{15}-12_{16}/14_{18}
21_{25}-22_{26}/24_{28} Output contacts -
open-circuit principle

DIP switch functions CM-ESS.1, CM-ESS.2

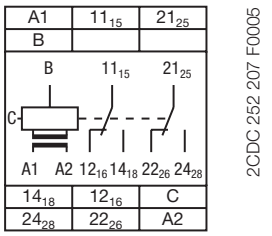


2CDC 252 275 F0005

1 ON Undervoltage monitoring
OFF Overvoltage monitoring

OFF = Default

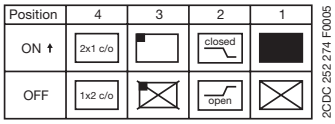
Connection diagram CM-EFS.2



2CDC 252 207 F0005

A1-A2 Control Supply voltage
B-C Measuring ranges:
3-30 V; 6-60 V;
30-300 V; 60-600 V
11_{15}-12_{16}/14_{18}
21_{25}-22_{26}/24_{28} Output contacts -
open- or closed circuit principle

DIP switch functions CM-EFS.2



2CDC 252 274 F0005

1 ON ON-delay
OFF OFF-delay

2 ON Closed-circuit principle
OFF Open-circuit principle

3 ON Latching function activated
OFF Latching function not activated

4 2 x 1 c/o contact
1 x 2 c/o contacts

OFF = Default

Current monitoring relays, single-phase
Technical data - Current monitoring relays

Type			CM-SRS.1	CM-SRS.2	CM-SRS.M	CM-SFS.2
Input circuit - Supply circuit			A1-A2			
Rated control supply voltage U_s		A1-A2	110-130 V AC			
		A1-A2	220-240 V AC			
		A1-A2	24-240 V AC/DC			
Rated control supply voltage U_s tolerance			-15...+10 %			
Rated frequency		AC versions	50/60 Hz			
		AC/DC versions	50/60 Hz or DC			
Current / power consumption			see data sheets			
Power failure buffering time			20 ms			
Transient overvoltage protection			Varistors			
Input circuit - Measuring circuit			B1/B2/B3-C			
Monitoring function			over- or undercurrent monitoring configurable			over- and under-current monitoring
Measuring method			True RMS measuring principle			
Measuring inputs			CM-SxS.x1			CM-SxS.x2
		Terminal connection	B1-C	B2-C	B3-C	B1-C	B2-C	B3-C
		Measuring ranges AC/DC	3-30 mA	10-100 mA	0.1-1 A	0.3-1.5 A	1-5 A	3-15 A [2]
		Input resistance	3.3 Ω	1 Ω	0.1 Ω	0.05 Ω	0.01 Ω	0.0025 Ω
		Pulse overload capacity t < 1 s	500 mA	1 A	10 A	15 A	50 A	100 A
		Continous capacity	50 mA	150 mA	1.5 A	2 A	7 A	17 A
Threshold value(s)			adjustable within the indicated measuring range			
Setting accuracy of threshold value			10 %			
Repeat accuracy (constant parameters)			0.07 % of full scale			
Hysteresis related to the threshold value			3-30 % adjustable			5 % fixed
Measuring signal frequency range			DC / 15 Hz - 2 kHz			
Rated measuring signal frequency range			DC / 50-60 Hz			
Maximum response time			AC: 80 ms / DC: 120 ms			
Accuracy within the control supply voltage tolerance			ΔU ≤ 0.5 %			
Accuracy within the temperature range			ΔU ≤ 0.06 % / °C			
Timing circuit						
Start-up delay T_S			none		0 or 0.1-30 s adjustable	
Tripping delay T_V			none	0 or 0.1-30 s adjustable		
Repeat accuracy (constant parameters)			±0.07 % of full scale			
Accuracy within the control supply voltage tolerance			-	Δt ≤ 0.5 %		
Accuracy within the temperature range			-	Δt ≤ 0.06 % / °C		
Indication of operational states						
Control supply voltage		U/T: green LED	⎍: control supply voltage applied, ⎍⎍⎍: start-up delay T_S active, ⎍⎵⎍: tripping delay T_V active			
Measured value		I: red LED	⎍: overcurrent, ⎍⎵⎍: undercurrent			
Relay status		R: yellow LED	⎍: relay energized, no latching function ⎍⎍⎍: relay energized, active latching function ⎍⎵⎵⎍: relay de-energized, active latching function			
Output circuits			11(15)-12(16)/14(18), 21(25)-22(26)/24(28) - Relays			
Kind of output			1 c/o contact	2 c/o contacts		1x2 c/o contacts or 2x1 c/o contact configurable
Operating principle			open-circuit principle [1]		open- or closed-circuit principle configurable [1]	
Contact material			AgNi			
Rated operational voltage U_e		IEC/EN 60947-1	250 V			
Minimum switching voltage / minimum switching current			24 V / 10 mA			
Maximum switching voltage / maximum switching current			250 V AC / 4 A AC			
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) at 230 V	4 A			
		AC15 (inductive) at 230 V	3 A			
		DC12 (resistive) at 24 V	4 A			
		DC13 (inductive) at 24 V	2 A			
AC rating (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 (Make/Break) at B 300		3600/360 VA			
Mechanical lifetime			30x10⁶ switching cycles			
Electrical lifetime (AC12, 230 V, 4 A)			0.1x10⁶ switching cycles			
Max. fuse rating to achieve short-circuit protection		n/c contact	6 A fast-acting	10 A fast-acting		6 A fast-acting
		n/o contact	10 A fast-acting			

[1] Open-circuit principle: output relay energizes if the measured value exceeds ⧄ / falls below ⧅ the adjusted threshold value
Closed-circuit principle: output relay de-energizes if measured value exeeds ⧄ / falls below ⧅ the adjusted threshold value

[2] In case of measured currents > 10 A, lateral spacing has to be min. 10 mm

Current monitoring relays, single-phase
Technical data - Current monitoring relays

Type		CM-SRS.1	CM-SRS.2	CM-SRS.M	CM-SFS.2
General data					
MTBF		on request			
Duty time		100%			
Dimensions (W x H x D)	product dimensions	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)			
	packaging dimensions	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)			
Weight	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		10mm (0.39in) at measured current > 10 A [2)]			
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 range	operation / storage	-20...+60 °C / -40...+85 °C			
Damp heat (IEC 60068-2-30)		55 °C, 6 cycles			
Vibration (sinusoidal) (IEC/EN 60255-21-1)		Class 2			
Shock (IEC/EN 60255-21-2)		Class 2			
Isolation data					
Rated insulation voltage (VDE 0110, IEC 60947-1, IEC/EN 60255-5)	supply / measuring circuit / output	600 V			
	supply / output 1/2	250 V			
Rated impulse withstand voltage U_{imp} (IEC/EN 60947-1, IEC/EN 60255-5)	supply / measuring circuit / output	6 kV 1.2/50 µs			
	supply / output 1/2	4 kV 1.2/50 µs			
Pollution degree (VDE 0110, IEC 664, IEC/EN 60255-5)		3			
Overvoltage category (VDE 0110, IEC 664, IEC/EN 60255-5)		III			
Standards					
Product standard		IEC/EN 60255-6			
Low Voltage Directive		2006/95/EC			
EMC Directive		2004/108/EC			
Electromagnetic compatibility					
Interference immunity to		IEC/EN 61000-6-2			
electrostatic discharge	IEC/EN 61000-4-2	Level 3			
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3			
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3			
surge	IEC/EN 61000-4-5	Level 3			
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 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			

Voltage monitoring relays, single-phase
Technical data - Voltage monitoring relays

Type		CM-ESS.1	CM-ESS.2	CM-ESS.M	CM-EFS.2
Input circuit - Supply circuit		A1-A2			
Rated control supply voltage U_s	A1-A2	110-130 V AC			
	A1-A2	220-240 V AC			
	A1-A2	24-240 V AC/DC			
Rated control supply voltage U_s tolerance		-15...+10 %			
Rated frequency	AC versions	50/60 Hz			
	AC/DC versions	50/60 Hz or DC			
Current / power consumption		see data sheet			
Power failure buffering time		20 ms			
Transient overvoltage protection		Varistors			
Input circuit - Measuring circuit		B-C			
Monitoring function		over- or undervoltage monitoring configurable			over- and undervoltage monitoring configurable
Measuring method		True RMS measuring principle			
Measuring inputs		CM-ExS			
	Terminal connection	B-C	B-C	B-C	B-C
	Measuring range AC/DC	3-30 V	6-60 V	30-300 V	60-600 V
	Input resistance	600 kΩ	600 kΩ	600 kΩ	600 kΩ
	Pulse overload capacity t < 1 s	800 V	800 V	800 V	800 V
	Continous capacity	660 V	660 V	660 V	660 V
Threshold value(s)		adjustable within the indicated measuring range			
Setting accuracy of threshold value		10 %			
Repeat accuracy (constant parameters)		±0.07 % of full scale			
Hysteresis related to the threshold value		3-30 % adjustable			5 % fixed
Measuring signal frequency range		DC / 15 Hz - 2 kHz			
Rated measuring signal frequency range		DC / 50-60 Hz			
Maximum response time		AC: 80 ms / DC: 120 ms			
Accuracy within the control supply voltage tolerance		ΔU ≤ 0.5 %			
Accuracy within the temperature range		ΔU ≤ 0.06 % / °C			
Transient overvoltage protection		Varistors			
Timing circuit					
Delay time T_V		none	0 or 0.1-30 s adjustable		
Repeat accuracy (constant parameters)		±0.07 % of full scale			
Accuracy within the control supply voltage tolerance		-	Δt ≤ 0.5 %		
Accuracy within the temperature range		-	Δt ≤ 0.06 % / °C		
Indication of operational states					
Control supply voltage	U/T: green LED	⎍⎍: control supply voltage applied ⎍⎍: tripping delay T_V active			
Measured value	U: red LED	⎍⎍: overvoltage, ⎍⎍: undervoltage			
Relay status	R: yellow LED	⎍⎍: relay energized, no latching function ⎍⎍: relay energized, active latching function ⎍⎍: relay de-energized, active latching function			
Output circuits					
Kind of output		1 c/o contact	2 c/o contacts		1x2 c/o contacts or 2x1 c/o contact configurable
Operating principle		open-circuit principle [1]		open- or closed-circuit principle configurable [1]	
Contact material		AgNi			
Rated operational voltage U_e	IEC/EN 60947-1	250 V			
Minimum switching voltage / minimum switching current		24 V / 10 mA			
Maximum switching voltage / maximum switching current		250 V AC / 4 A AC			
Rated operational current I_e (IEC/EN 60947-5-1)	AC12 (resistive) at 230 V	4 A			
	AC15 (inductive) at 230 V	3 A			
	DC12 (resistive) at 24 V	4 A			
	DC13 (inductive) at 24 V	2 A			

[1] Open-circuit principle: output relay energizes if the measured value exceeds ⊠ / falls below ⊠ the adjusted threshold value
Closed-circuit principle: output relay de-energizes if measured value exeeds ⊠ / falls below ⊠ the adjusted threshold value

Voltage monitoring relays, single-phase
Technical data - Voltage monitoring relays

Type			CM-ESS.1	CM-ESS.2	CM-ESS.M	CM-EFS.2
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 (Make/Break) at B 300		3600/360 VA			
Mechanical lifetime			$30x10^6$ switching cycles			
Electrical lifetime (AC12, 230 V, 4 A)			$0.1x10^6$ switching cycles			
Max. fuse rating to achieve short-circuit protection		n/c contact	6 A fast-acting	10 A fast-acting		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		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 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)		-	
Isolation data						
Rated insulation voltage (VDE 0110, IEC 60947-1, IEC/EN 60255-5)		supply / measuring circuit / output	600 V			
		supply / output 1/2	250 V			
Rated impulse withstand voltage U_{imp} (IEC/EN 60947-1, IEC/EN 60255-5)		supply / measuring circuit / output	6 kV 1.2/50 µs			
		supply / output 1/2	4 kV 1.2/50 µs			
Pollution degree (VDE 0110, IEC 664, IEC/EN 60255-5)			3			
Overvoltage category (VDE 0110, IEC 664, IEC/EN 60255-5)			III			
Standards						
Product standard			IEC/EN 60255-6			
Low Voltage Directive			2006/95/EC			
EMC Directive			2004/108/EC			
Electromagnetic compatibility						
Interference immunity to			IEC/EN 61000-6-2			
electrostatic discharge		IEC/EN 61000-4-2	Level 3			
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	Level 3			
electrical fast transient / burst		IEC/EN 61000-4-4	Level 3			
surge		IEC/EN 61000-4-5	Level 3			
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 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			

Current and voltage monitoring relays, single-phase
Notes

Three-phase monitoring relays
Product group picture

Three-phase monitoring relays
Table of contents

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

[2)]

[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 2CDC110084B0201.

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

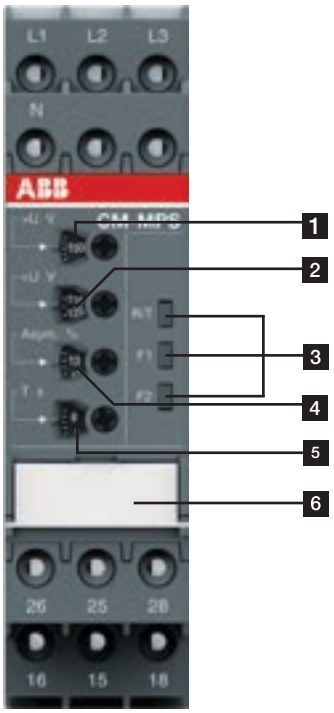
1	110, 115, 120, 127 V supply systems (phase-neutral)
2	220, 230, 240 V supply systems (phase-neutral)
3	200, 208, 220, 230, 240, 257, 260 V supply systems (phase-phase)
4	440, 460 V supply systems (phase-phase)
5	480, 500 V supply systems (phase-phase)
6	575, 600 V supply systems (phase-phase)
7	660,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

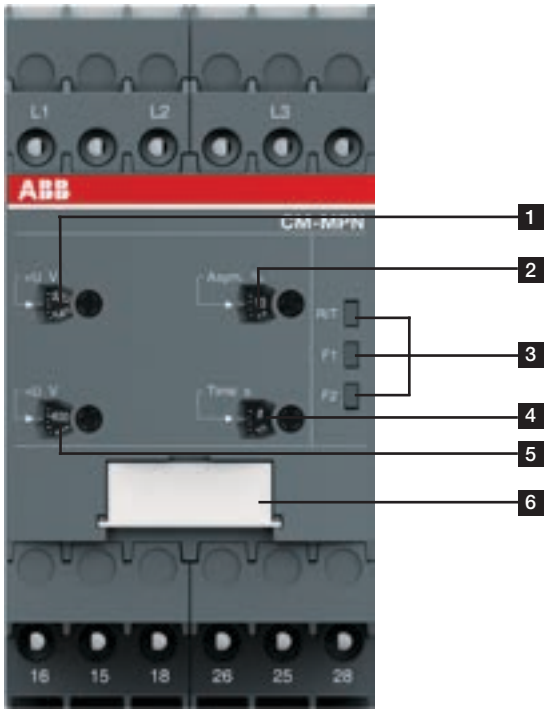
3 **Indication of operational states**
R/T: red LED – Relay status / timing
F1: yellow LED – Fault message
F2: yellow LED – Fault message

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

	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
Rated control supply voltage U_s	**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

CM-PBE

Description

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

Ordering details

Rated control supply voltage = measuring voltage	Monitoring function	Neutral monitoring	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
3x380-440 V AC, 220-240 V AC	Phase failure detection (Single- and three-phase)	■	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

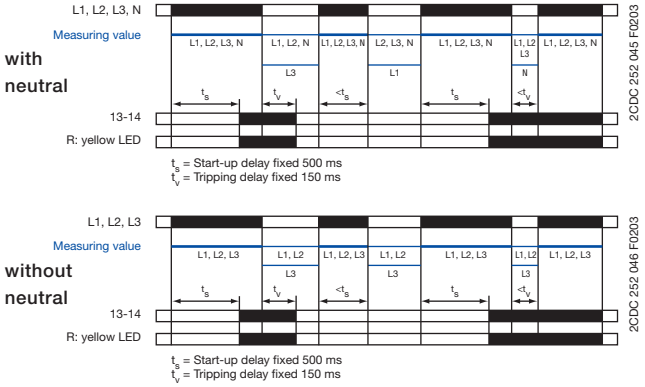
Rated control supply voltage = measuring voltage	DIP switch	Monitoring function	Neutral monitoring	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
90-170 V AC	⊠ ■ ⟳ ⟳̸	Multifunctional (Three-phase phase failure detection, Phase sequence monitoring, overvoltage, undervoltage, Phase unbalance)	■	CM-MPS.11S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

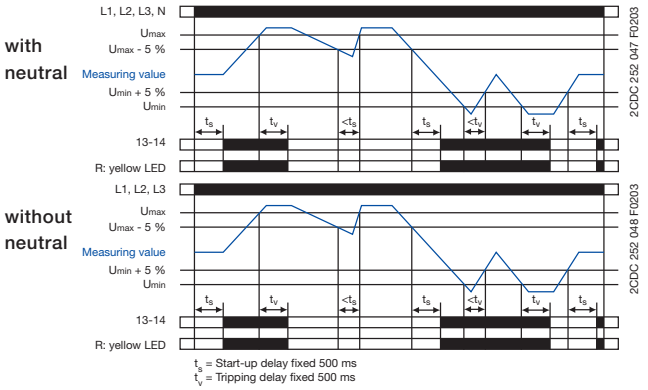
Three-phase monitoring relays
Function diagrams

Function diagrams - Phase failure detection CM-PBE



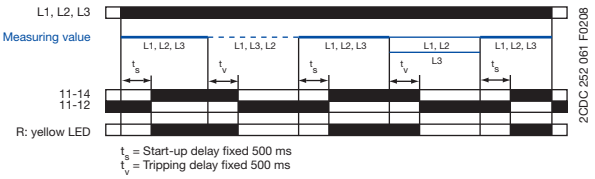
If all phases (and the neutral) are present, the output relay energizes after the start-up delay t_s is complete. If a phase failure occurs, the tripping delay t_v starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of t_s starts.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

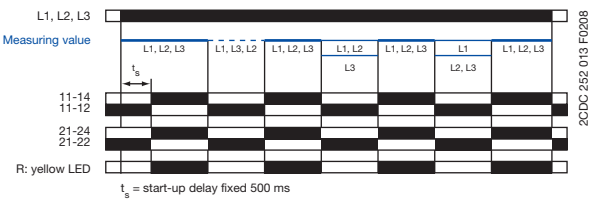
Function diagram - Phase failure detection, phase sequence monitoring CM-PFE



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

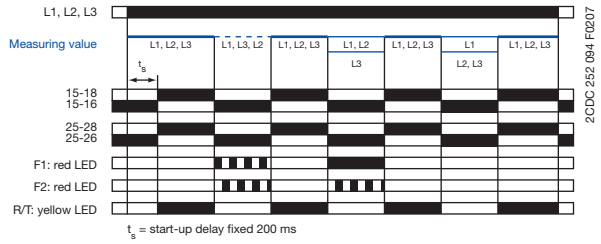
Applying control supply voltage begins the fixed start-up delay t_S. When t_S is complete and all phases are present with correct voltage, the output relays energize and the yellow LED R/T glows.

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.



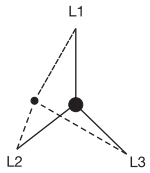
CM-MPS.11, CM-MPS.21, CM-MPS.23
Interrupted neutral monitoring

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



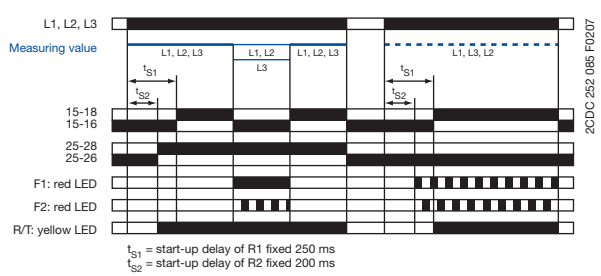
CM-MPS.x3, CM-MPN.x2
Automatic phase sequence correction

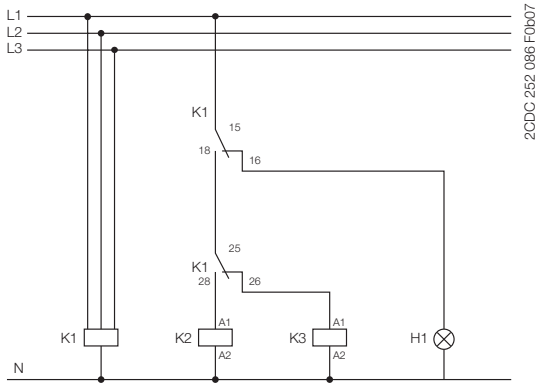
This function can be selected only if phase sequence monitoring is activated and operating mode 2x1 c/o (SPDT) contact 1x2 c/o is selected.

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.

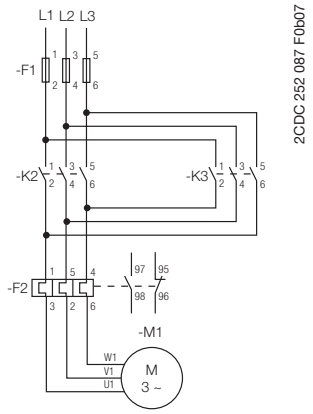
If the voltage to be monitored exceeds or falls below the set threshold values for phase unbalance, over- or undervoltage or if a phase failure occurs, output relay R1 de-energizes and the LEDs F1 and F2 indicate the fault.

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.





Control circuit diagram (K1 = CM-MPS.xx 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]

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.

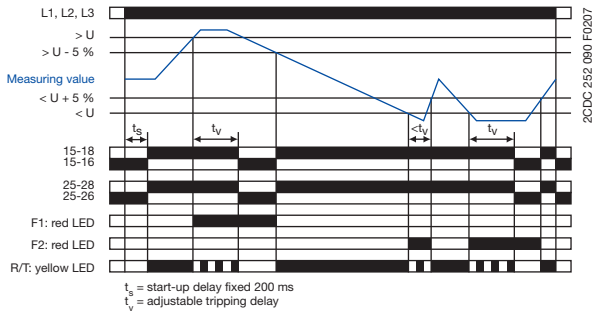
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 % and the LED R/T glows.

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.

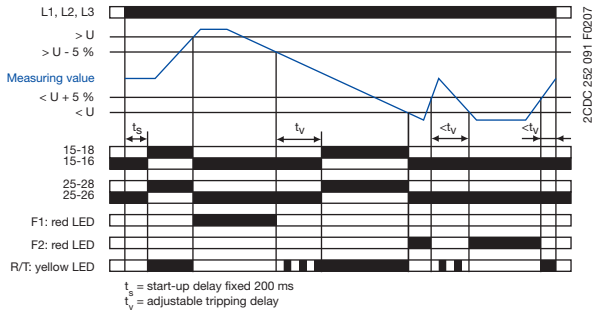
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize automatically after the set tripping delay t_V is complete. The LED R/T flashes during timing and turns steady when timing is complete.

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.

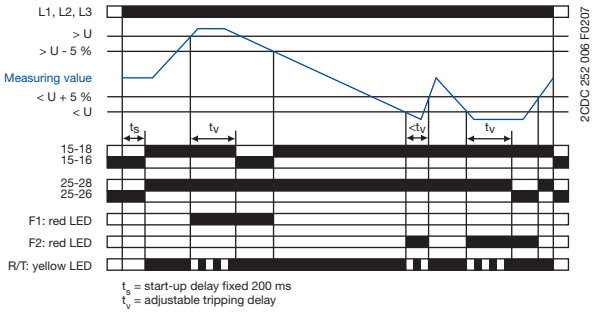
The corresponding output relay re-energizes automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %.

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.

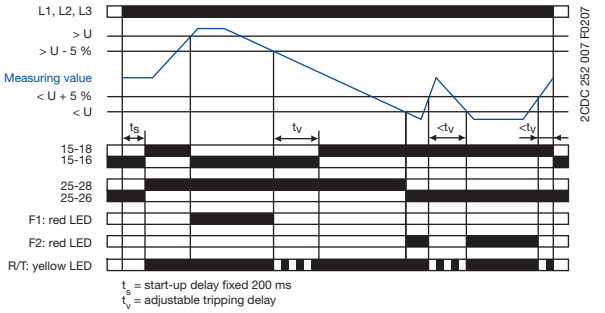
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the corresponding output relay re-energizes automatically after the set tripping delay t_V is complete. The LED R/T flashes during timing.

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

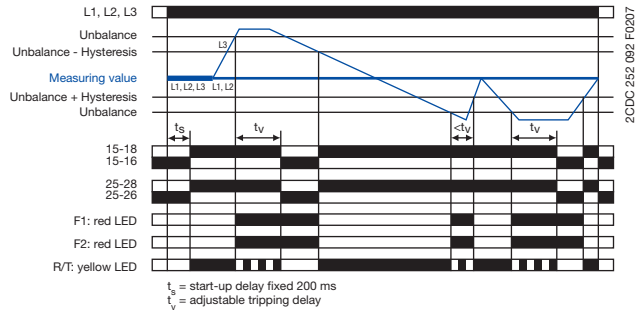
Applying control supply voltage begins the fixed start-up delay t_S. When t_S is complete and all phases are present with correct voltage and with correct phase sequence, the output relays energize and the yellow LED R/T glows.

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 ⊠

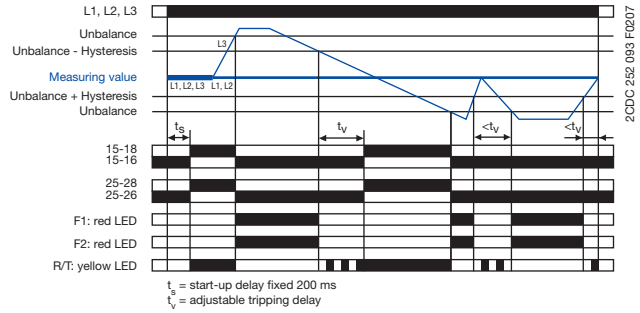


Type of tripping delay = OFF-delay

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

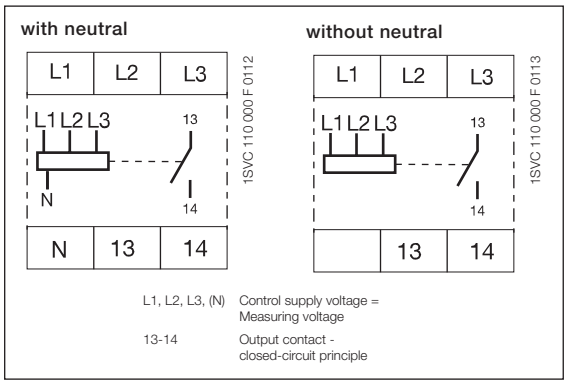
The type of tripping delay ⊠ / ■ can be adjusted via a rotary (CM-PxS.xx) or a DIP switch (CM-MPx.xx).

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

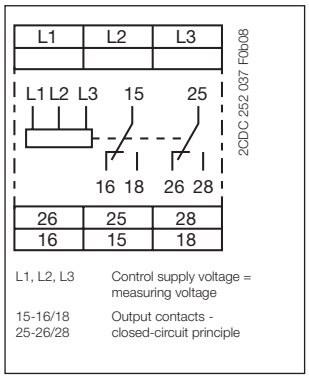
Connection diagrams CM-PBE, CM-PVE



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

13-14 Output contact - closed-circuit principle

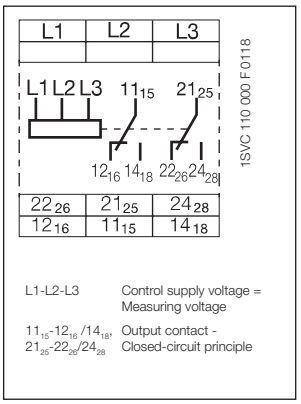
Connection diagram CM-PVS.x1, CM-PSS.x1, CM-PAS.x1



L1, L2, L3 Control supply voltage = measuring voltage

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

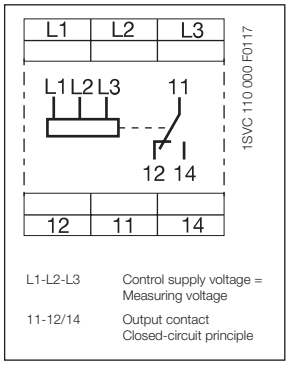
Connection diagram CM-PFS



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

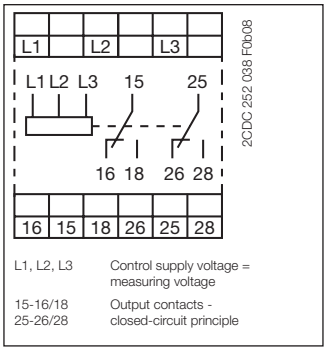
Connection diagram CM-PFE



L1-L2-L3 Control supply voltage = Measuring voltage

11-12/14 Output contact Closed-circuit principle

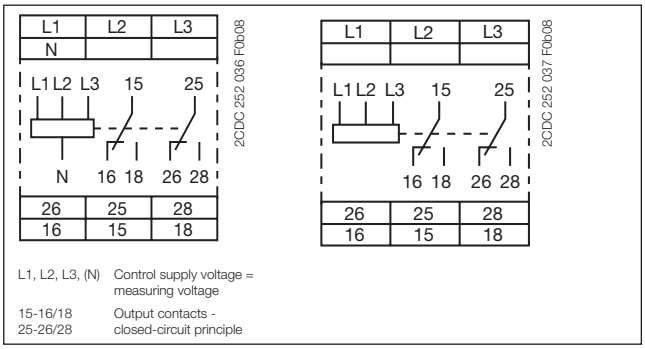
Connection diagram CM-MPN.x2



L1, L2, L3 Control supply voltage = measuring voltage

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

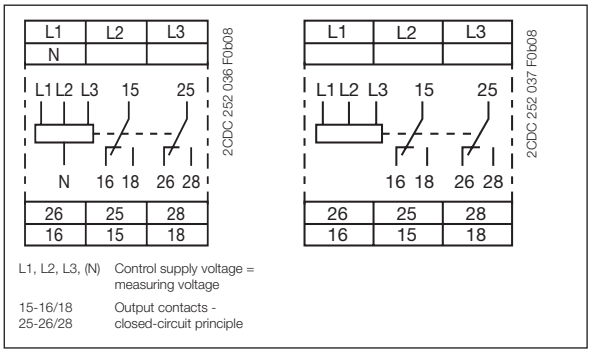
Connection diagram CM-MPS.x1



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

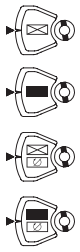


L1, L2, L3, (N) Control supply voltage = measuring voltage

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

Three-phase monitoring relays
DIP switches, Rotary switches

Rotary switch "Function" CM-PVS



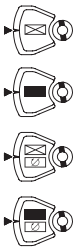
ON-delay
with phase sequence monitoring

OFF-delay
with phase sequence monitoring

ON-delay
without phase sequence monitoring

OFF-delay
without phase sequence monitoring

Rotary switch "Function" CM-PSS



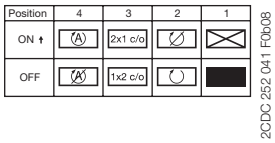
ON-delay
with phase sequence monitoring

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

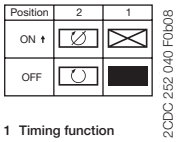
2 Phase sequence monitoring
ON deactivated
OFF activated

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

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

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 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 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

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

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				

Grid feeding monitoring relays - Voltage and frequency monitoring functions

Product group picture

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Table of contents

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Benefits and advantages, Applications

Characteristics CM-UFD.M22

- Monitoring of voltage and frequency in single- and three-phase mains 2-wire, 3-wire or 4-wire
- Type tested in accordance to CEI 0-21
- Over- and undervoltage, 10 minutes average value as well as over- and underfrequency monitoring
- Two-level threshold settings for over-/undervoltage and frequency
- ROCOF (rate of change of frequency) monitoring configurable
- Integrated management of redundancy function (acc. CEI 0-21, mandatory in plants with P>20 kW)
- Measured values, thresholds and settings shown on the display
- All threshold values adjustable as absolute values
- Default setting according to CEI 0-21
- True RMS measuring principle
- High measurement accuracy
- 3 control inputs for remote trip, feedback signal, and external signal
- Tripping delay for each threshold adjustable
- Interrupted neutral detection
- Error memory for up to 99 entries (incl. cause of error, measured value, relative timestamp)
- Autotest function
- Password setting protection
- 3 c/o (SPDT) contacts
- LEDs for the indication of operational states

Characteristics CM-UFS.1

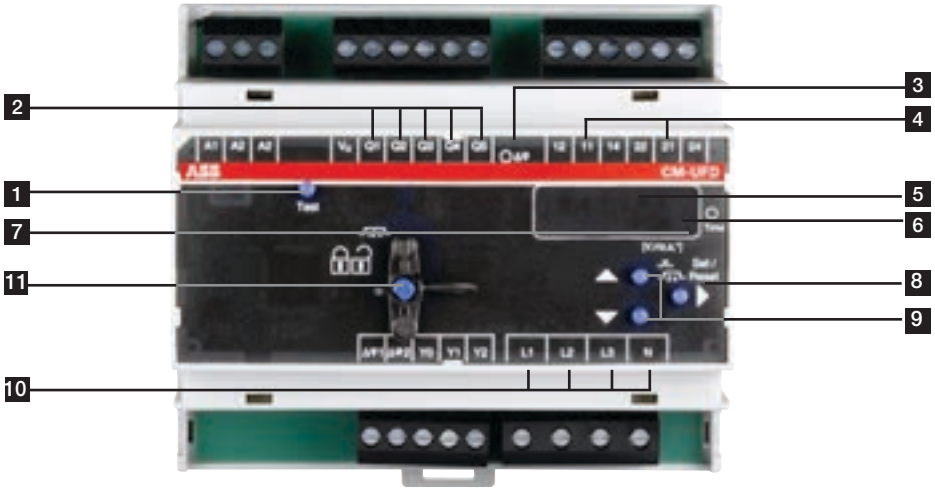
- Monitoring of three-phase mains for grid feeding
- Type-tested in accordance with DIN V VDE V 0126-1-1: February 2006
- Neutral conductor connection configurable
- Can also be used to monitor single-phase mains
- Threshold value for the 10 minutes average value adjustable (110-115% of U_s)
- Start-up delay t_{S1} prior to first grid connection and after a short-term interruption, 30 s fixed
- Restart delay t_{S2}, 30 s fixed
- Powered by the measuring circuit
- True RMS measuring principle
- 2 c/o (SPDT) contacts
- 3 LEDs for the indication of operational states

Characteristics CM-UFD.M21

- Monitoring of three-phase mains for grid feeding
- Type-tested in accordance with VDE AR-N 4105
- Two-channel measuring circuit and two processors to ensure single-fault tolerance
- Over- and undervoltage, 10 minutes average value as well as over- and underfrequency monitoring
- Two-level threshold settings for over-/undervoltage/-frequency configurable according to 'BDEW guideline for generating plants connected to the medium voltage grid'
- Vector shift detection configurable
- Measured values, thresholds and settings shown on the display
- All threshold values adjustable as absolute values
- Default setting according to VDE AR-N 4105
- True RMS measuring principle
- 2 control inputs for feedback signal of subsequent section switch
- Monitoring of subsequent section switch configurable
- Tripping delay (0.05-130.00 s) for each single threshold adjustable
- Alarm memory for up to 99 entries (incl. cause of alarm, measured value, relative timestamp)
- Test function
- Simulation mode
- Code lock and mechanical sealing possible
- 5 digital outputs (transistor outputs) for signalling the cause of alarm to a superior control system
- 2 c/o (SPDT) contacts
- 105 mm (4.13 in) width
- LEDs for the indication of operational states
- Standby mode
- Optimized for use with generators
- Automatic restart after a failure in the feedback loop

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Operating controls - CM-UFD.Mxx

CM-UFD.M21



1 **Button Test**

2 **Indication of operational states**
Q1: red LED - overvoltage
Q2: red LED - undervoltage
Q3: red LED - overfrequency
Q4: red LED - underfrequency
Q5: red LED - error, if Pr 1 or Pr2 activated [1)]

3 **Δφ: red LED - vector shift**

4 **11: yellow LED - 1st c/o (SPDT) contact energized**
21: yellow LED - 2nd c/o (SPDT) contact energized

5 **Display (4-digits)**
Voltage, 10 minutes average value, frequency or vector shift value, alarm and error messages

6 **Indication of time**
Time: yellow LED - a time delay is displayed

7 **Indication of device mode**

8 **Button Set / Reset ▶**

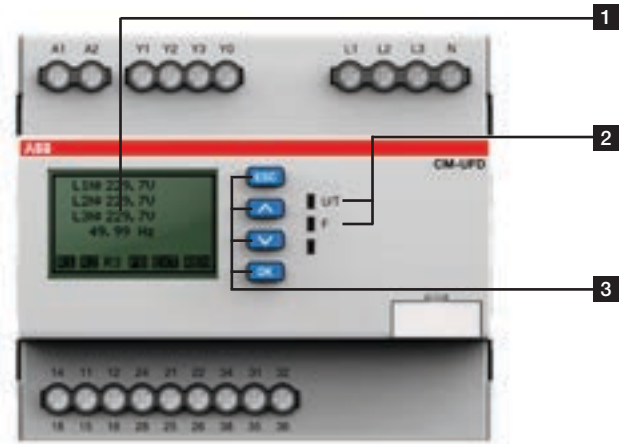
9 **Button Up / Down ▲▼**

10 **Indication of operational states**
L1: yellow LED - kind of measured value
L2: yellow LED - kind of measured value
L3: yellow LED - kind of measured value
N: yellow LED - kind of measured value

11 **Status indication of device locking and sealable lock button**
Red LED - device is locked

[1)] if Pr3 or Pr4 activated, 2nd threshold referring to LED Q1-Q4.

CM-UFD.M22



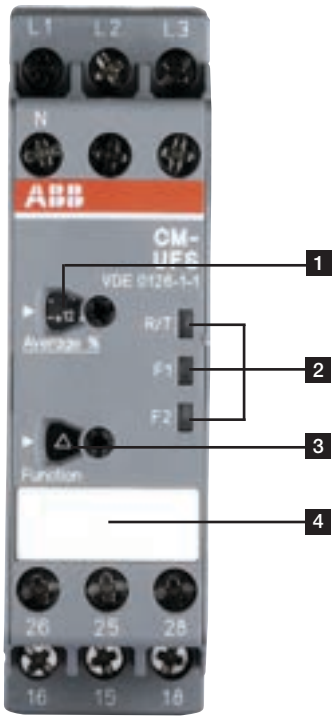
1 **Display**
R1 R2 R3 - relay status; in this case R3 is de-energized
FB - status feedback loop Y0-Y1; in this case FB is closed
EXT – status input external signal; in this case input is closed
REM – status remote trip input; in this case input is closed

2 **Indication of operational states**
U/T: green LED – supply voltage applied / flashing = timing active
F: red LED - failure

3 **Keypad**
ESC: escape / return to previous menu
Λ: up / value increase
V: down / value decrease
OK: enter / confirm selection

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Operating controls - CM-UFS.1

CM-UFS.1



1 **Adjustment of the threshold value for the 10 minutes average value**

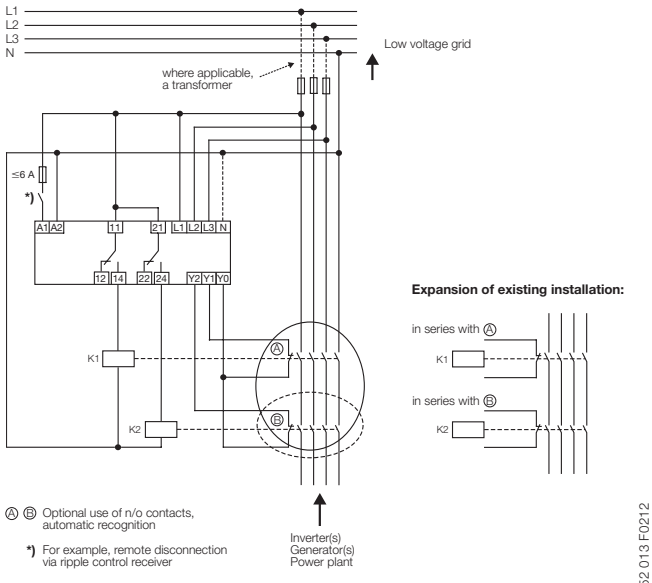
2 **Indication of operational states**
R/T: yellow LED - relay status, timing
F1: red LED - fault message
F2: red LED - fault message

3 **Selection of neutral conductor, connected or not**

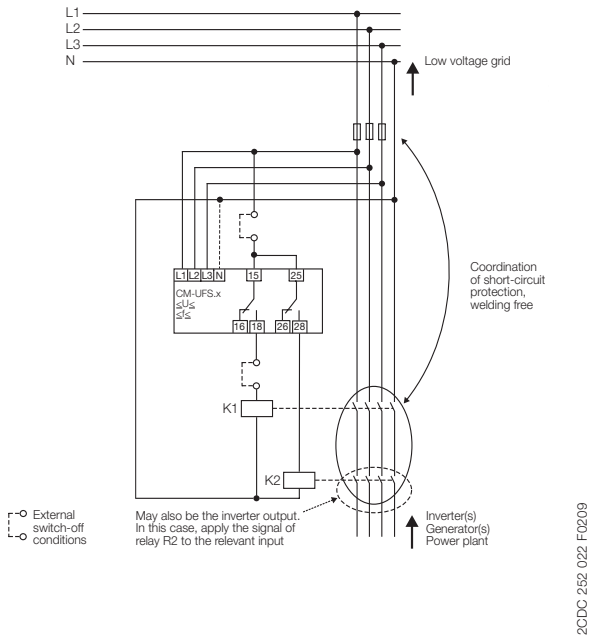
4 **Marker label**

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Applications

Example of application - CM-UFD.M21

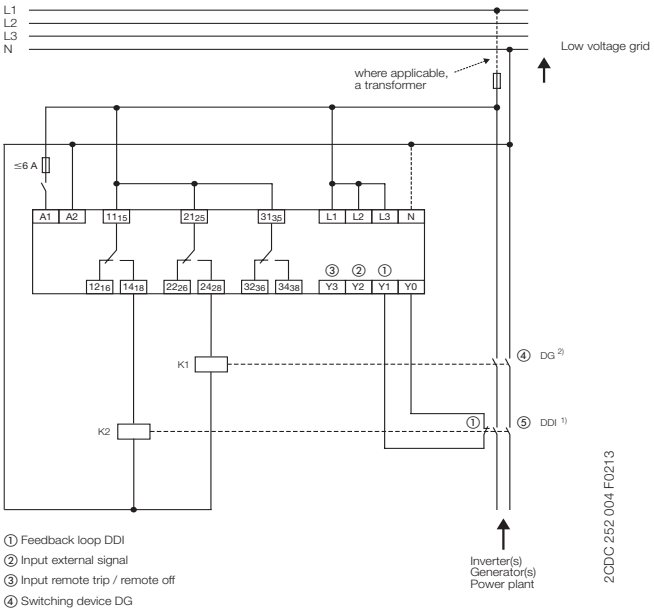


Example of application - CM-UFS



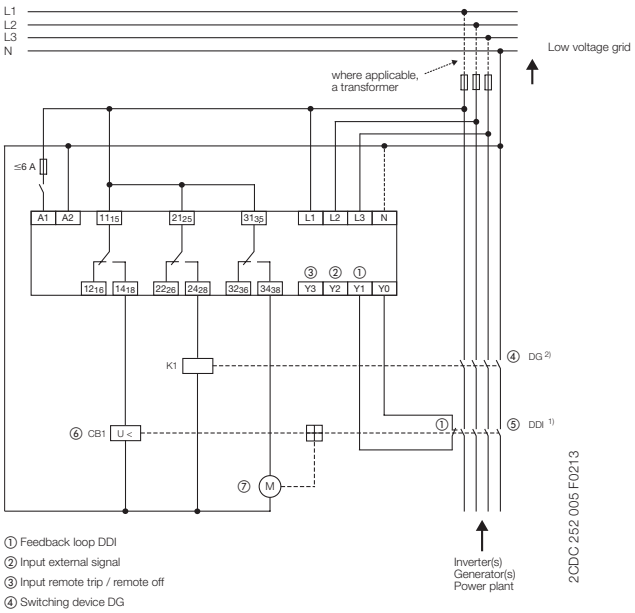
Example of single-phase application CM-UFD.M22

Contactor as DDI [1]



Example of three-phase application CM-UFD.M22

Contactor as DDI [1], breaker as DG [2]



[1] DDI acc. to CEI 0-21
[2] DG acc. to CEI 0-21

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Ordering and selection


2CDC 251 003 S0012

CM-UFD.M21


2CDC 251 005 S0013

CM-UFD.M22


2CDC 251 014 S0009

CM-UFS.1

Description

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

Ordering details

Rated control supply voltage = measuring voltage	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC	CM-UFD.M21	1SVR510730R0300		0.225 (0.496)
24-240 V AC/DC	CM-UFD.M22	1SVR560730R3400		0.283 (0.624)
3 x 400 V AC (L-L) / 230 V AC (L-N)	CM-UFS.1	1SVR630736R0300		0.14 (0.31)

	Order number	1SVR 510 730 R0300	1SVR 560 730 R3400	1SVR 630 736 R0300
	Type	CM-UFD.M21	CM-UFD.M22	CM-UFS.1
Rated control supply voltage U_s				
24-240 V AC/DC		■	■	
3 x 400 V AC (L-L) / 230 V AC (L-N)				■
Rated frequency				
DC and 50/60 Hz respectively		■		
50 Hz				■
DC or 50 Hz			■	
Suitable for monitoring				
Single-phase mains			■	
Three-phase mains		■	■	■
Monitoring function				
Over-/undervoltage		■	■	■
Over-/underfrequency		■	■	■
ROCOF (rate of change of frequency)			■	
10 minutes average value		■	■	■
Phase failure				■
Vector shift		■		
Thresholds		adj	adj	adj

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Function diagrams - CM-UFS.1

Function of the yellow LED

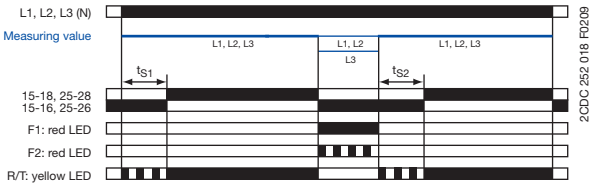
The yellow LED is flashing during timing and turns steady as soon as the output relays are energized.

Phase failure monitoring

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

They de-energize instantaneously if a phase failure occurs. The fault is indicated by LEDs.

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



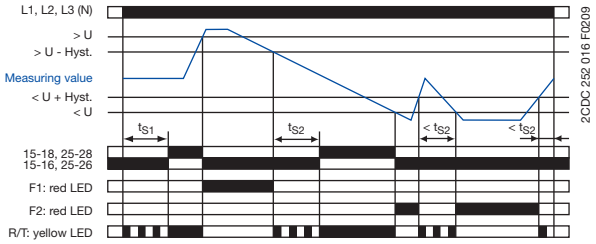
t_{S1} = Start-up delay prior to first grid connection and after a short-term interruption, 30 s fixed
t_{S2} = Restart delay, 30 s fixed

Over- and undervoltage monitoring

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

If the voltage to be monitored exceeds or falls below the fixed threshold value, the output relays de-energize instantaneously. The fault type is indicated by LEDs.

As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the output relays re-energize after the fixed restart delay t_{S2} is complete.



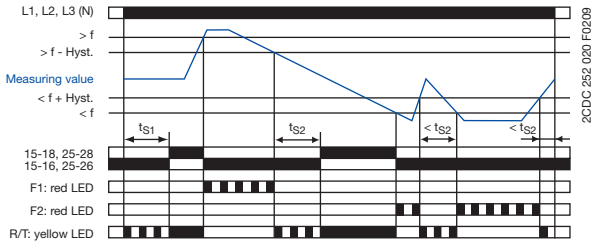
t_{S1} = Start-up delay prior to first grid connection and after a short-term interruption, 30 s fixed
t_{S2} = Restart delay, 30 s fixed

Over- and underfrequency monitoring

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

If the frequency to be monitored exceeds or falls below the fixed threshold value, the output relays deenergize instantaneously. The fault type is indicated by LEDs.

As soon as the frequency returns to the tolerance range, taking into account a fixed hysteresis, the output relays re-energize after the fixed restart delay t_{S2} is complete.



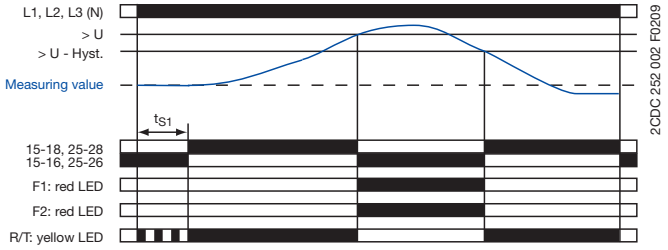
t_{S1} = Start-up delay prior to first grid connection and after a short-term interruption, 30 s fixed
t_{S2} = Restart delay, 30 s fixed

10 minutes average value monitoring

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

The voltages of the individual phases are measured over a period of 10 minutes and the average value is calculated. If the 10 minutes average value of a phase exceeds the set threshold value, the output relays de-energize instantaneously. The fault is indicated by LEDs.

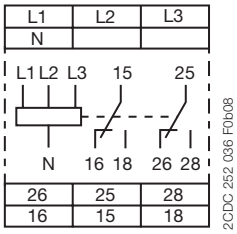
As soon as the 10 minutes average value drops again below the set threshold value, the output relays reenergize instantaneously.



t_{S1} = Start-up delay prior to first grid connection and after a short-term interruption, 30 s fixed

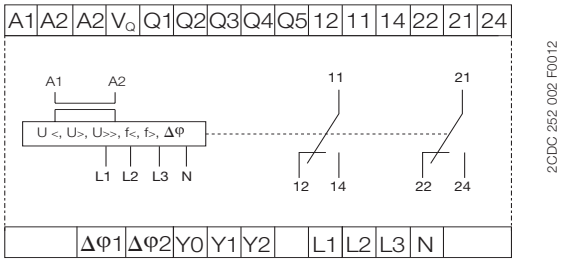
Grid feeding monitoring relays - Voltage and frequency monitoring functions
Connection diagrams

Electrical connection - CM-UFS.1



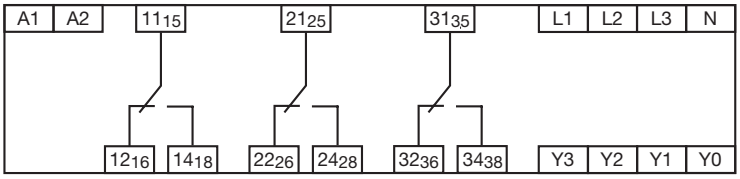
L1, L2, L3, N	Control supply voltage = Measuring voltage
15-16/18	Output contacts -
25-26/28	closed-circuit principle

Electrical connection - CM-UFD.M21



A1-A2	Control supply voltage
L1, L2, L3, N	Measuring input
11-12/14	1st c/o (SPDT) contact
21-22/24	2nd c/o (SPDT) contact
Y0-Y1	1st input contact for feedback signal
Y0-Y2	2nd input contact for feedback signal
Dj1-Dj2	Vector shift detection
	Jumper = vector shift detection disabled
VQ	Supply voltage of digital outputs
Q1	Digital output for overvoltage
Q2	Digital output for undervoltage
Q3	Digital output for overfrequency
Q4	Digital output for underfrequency
Q5	Digital output for:
	error, if Pr 1 or Pr2 activated
	if Pr3 or Pr4 activated, 2nd threshold referring to LED Q1-Q4

Electrical connection - CM-UFD.M22



A1-A2	Control supply voltage
Y0-Y1	Control input for feedback signal
Y0-Y2	Control input for external signal
Y0-Y3	Control input for remote trip
L1, L2, L3, N	Measuring input
11_{15}-12_{16}/14_{18}	1st c/o (SPDT) contact
21_{25}-22_{26}/24_{28}	2nd c/o (SPDT) contact
31_{35}-32_{36}/34_{38}	3rd c/o (SPDT) contact

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Technical data - CM-UFD.Mxx

Technical data

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

Type		CM-UFD.M21	CM-UFD.M22
Input circuit - Supply circuit		A1-A2	
Rated control supply voltage U_s		24-240 V AC/DC	
Rated control supply voltage U_s tolerance		-15...+20 %	-15...+10 %
Rated frequency		DC and 50/60 Hz respectively	DC or 50 Hz
Frequency range AC		40-70 Hz	40-60 Hz
Typical current / power consumption	24 V DC	92 mA / 2.2 W	64 mA / 1.5 W
	230 V AC	25 mA / 5.7 VA	6.4 mA / 1.5 VA
Power failure buffering time		5 ms	200 ms, according to LVFRT (Low Voltage Fault Ride Through)
Measuring circuit		**L1, L2, L3 (N)**	**L1-N, L2-N, L3-N or L-L**
Monitoring functions	over-/undervoltage U¯¯, U¯ / U_, U__	yes, can be switched off	-
	over-/underfrequency F¯¯, F¯ / F_, F__	yes, can be switched off	-
	10 minutes average value per phase UΠ	yes, can be switched off	-
	vector shift ϖδr	yes, can be switched off	-
	overvoltage av. (59 S1)	-	■
	overvoltage (59 S2)	-	■
	undervoltage (27 S1)	-	■
	undervoltage (27 S2)	-	■
	overfrequency (81>S1)	-	■
	underfrequency (81<S1)	-	■
	overfrequency (81>S2)	-	■
	underfrequency (81<S2)	-	■
	ROCOF	-	■ configurable
	Neutral	-	■ activated, if L-N
Measuring ranges	over-/undervoltage U¯¯, U¯ / U_, U__	10-310 V AC (L1, L2, L3, N)	-
		15-530 V AC (L1, L2, L3)	-
		-	-
	over-/underfrequency F¯¯, F¯ / F_, F__	40-70 Hz	-
	vector shift ϖδr	0...+45°	-
	voltage (4-wire system L1, L2, L3-N)	-	0-312 V AC
	(3-wire system L1,L2,L3)	-	0-540 V AC
	(2-wire system L-N)	-	0-312 V AC
	frequency	-	40-60 Hz
Threshold values	over-/undervoltage, 10 minutes average value U¯¯, U¯ / U_, U__, UΠ	15-300 V AC, adjustable in 0.1 V steps (< 100 V) / in 1 V steps (> 100 V) (L1, L2, L3, N)	-
		15-520 V AC, adjustable in 0.1 V steps (< 100 V) / in 1 V steps (> 100 V) (L1, L2, L3)	-
			-
	over-/underfrequency F¯¯, F¯ / F_, F__	45-65 Hz, adjustable in 0.01 Hz steps	-
	vector shift ϖδr	2-20 °, adjustable in 0.1° steps	-
	overvoltage med. (59 S1)	CM-UFD.M22: adjustable, 1.00-1.30 * Us in 0.01 * Us steps	
	overvoltage (59 S2)	CM-UFD.M22: adjustable, 1.00-1.20 * Us in 0.01 * Us steps	
	undervoltage (27 S1)	CM-UFD.M22: adjustable, 0.20-1.00 * Us in 0.01 * Us steps	
	undervoltage (27 S2)	CM-UFD.M22: adjustable, 0.05-1.00 * Us in 0.01 * Us steps	
	overfrequency (81>S1)	CM-UFD.M22: adjustable, 50-54 Hz in 0.1 Hz steps	
	underfrequency (81<S1)	CM-UFD.M22: adjustable, 46-50 Hz in 0.1 Hz steps	
	overfrequency (81>S2)	CM-UFD.M22: adjustable, 50-54 Hz in 0.1 Hz steps	
	underfrequency (81<S2)	CM-UFD.M22: adjustable, 46-50 Hz in 0.1 Hz steps	
	ROCOF	adjustable, 0.1-1 Hz/s, in 0.1 Hz/s steps	
Hysteresis related to the threshold value	over-/undervoltage, 10 minutes average value H¯¯, H¯ / H_, H__, HΠ	1.0-99.9 V, adjustable in 0.1 V steps	-
	over-/underfrequency H¯¯, H¯ / H_, H__	0.05-10.00 Hz, adjustable in 0.05 Hz steps	-
	Overvoltage	-	0.95-0.97 * U_s
	Undervoltage	-	1.03-1.05 * U_s
	Overfrequency	-	0.997-0.999 * f_n
	underfrequency	-	1.001-1.003 * f_n
Accuracy of measurements	voltage measurement L1,L2,L3,N	± 0.6 % of measured value	-
	voltage measurement L1,L2,L3	± 0.8 % of measured value	-
	frequency measurement	± 0.04 Hz ± 1 digit	-
	Voltage	-	≤ 2 %
	Frequency	-	± 20 mHz
	Delay times	-	≤ 5 % ± 20 ms
Display accuracy		> 100 V: ± 1 digit (1 V)	-
		< 100 V: ± 1 digit (0.1 V)	-
Rated frequency of measuring signal		50/60 Hz	50 Hz
Frequency range of the measuring signal		40-70 Hz	40-60 Hz

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Technical data - CM-UFD.Mxx

Type		CM-UFD.M21	CM-UFD.M22
Measuring principle		True RMS	
	overvoltage U▔▔, U▔	< 65 ms	adjustable, 0.05-600 s in 0.05 steps, ±3 % ±20 ms
	undervoltage U_, U_▔	< 65 ms	
	overfrequency F▔▔, F▔	< 65 ms	
	underfrequency F_, F_▔	< 65 ms	
	10 minutes average value per phase UΠ	depending on the voltage jump	-
	vector shift uSr	< 50 ms	-
Measuring cycle at 50 Hz	ROCOF	-	640 ms
Reaction time neutral interruption		-	< 150 ms
Accuracy within the rated control supply voltage tolerance		ΔU ≤ 0.1 %	-
Accuracy within the temperature range		ΔU ≤ 0.15 % / °C	ΔU ≤ 0.02 % / °C

Input circuit - Feedback circuits		Y10-Y11, Y20-Y21, Y30-Y31	Y0, Y1, Y2, Y3
Number		2	3
Kind of inputs	(Y0-Y1)	feedback contact of section switch 1	DDI feedback, trip and release monitoring times adjustable
	(Y0-Y2)	feedback contact of section switch 2	external signal
	(Y0-Y3)	-	remote trip
Electrical isolation	from supply voltage	yes	
	from the measuring circuit	no	
	from the relay outputs	yes	
Type of triggering		volt-free triggering	
Max. switching current in the control circuit		4 mA	6 mA
Max. cable length at the control input		5 m	10 m
No-load voltage at the control inputs		< 35 V DC	22-26 V DC (V0-V1, V2, V3)
Feedback time section switch		0.5-99 s, adjustable in steps of 0.1 s	20 ms

Control circuit vector shift detection (only CM-UFD.M21)		Δφ1-Δφ2
Type of triggering		volt-free triggering
Electrical isolation	from the supply voltage	yes
	from the measuring circuit	no
	from the relay outputs	yes
	from the transistor outputs	yes
Control input, control function		jumpered = vector shift detection de-activated open = vector shift detection activated (additional configuration in the software is necessary)
Max. switching current in the control circuit		4 mA
Max. cable length at the control input		5 m
No-load voltage at the control inputs		< 35 V DC

Timing circuits		CM-UFD.M21	CM-UFD.M22
Start-up delay (prior to first grid connection)		see 'adjustable OFF-delay' doF	-
Start-up delay, R1 (prior to first grid connection or re-connection after interruption)		-	adjustable, 1.00-600.00 s in 0.05 s steps
Restart delay (after a short-term interruption <3 s)		5 s (fixed)	-
Restart delay, R1		-	adjustable, 0.05-600.00 s in 0.05 s steps
Start-up delay, R2 (prior to first grid connection or re-connection after interruption)		-	1 s, fixed
ON-delay, R3		-	adjustable, 0.00-10.00 s in 0.05 s steps
On-time, R3		-	adjustable, 0.05-10.00 s in 0.05 s steps
Trip window, feedback loop Y1		-	adjustable, 0.05-0.50 s in 0.05 s steps
Release window, feedback loop Y1		-	adjustable, 0.05-10.00 s in 0.05 s steps
Tripping delay		ON-and/or OFF-delay confi-gurable	adjustable, 0.05-600.00 s in 0.05 s steps
ROCOF error time		-	adjustable, 0.05-600.00 s in 0.05 s steps
Adjustment range of the ON-delay	over-/undervoltage, over-/underfrequency dAL	0.05-130.00 s, adjustable in 0.01 s steps	-
Tolerance of the ON-delay		0.1 % ± 5 ms	-
Adjustment range of the OFF-delay	over-/undervoltage, over-/underfrequency doF	0 (>200 ms)-999 s, adjustable in 1 s steps	-
	vector shift doF	3-240 s, adjustable in 1 s steps	-
Tolerance of the OFF-delay		0.1 % ± 105 ms	-
Delayed activation of the vector shift detection dEon		2-20 s, adjustable in 1 s steps (Delay is effective just once after switching on or restart)	-
Accuracy within the rated control supply voltage tolerance		Δt ≤ 0.01 %	Δt ≤ 0.5 % ± 20 ms
Accuracy within the temperature range		Δt ≤ 0.0001 % / °C	Δt ≤ 1 % ± 20 ms

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Technical data - CM-UFD.Mxx

Relay outputs			
Kind of outputs	11-12/14	Relay, 1st c/o (SPDT) contact	-
	21-22/24	Relay, 2nd c/o (SPDT) contact	-
		2 x 1 c/o (SPDT) contact	-
	11-12/14 (15-16/18)	-	relay, 1st c/o (SPDT) contact, trip delay for DDI
	21-22/24 (25-26/28)	-	relay, 2nd c/o (SPDT) contact, redundancy relay for DG
	31-32/34 (35-36/38)	-	relay, 3rd c/o (SPDT) contact, closing commander for breaker motor, also sync. with relay 1
Operating principle	11-12/14	closed-circuit principle	
	21-22/24	-	open- or closed-circuit principle configurable
	31-32/34	-	
Contact material		AgNi	AgNi allow, Cd free
Rated operational voltage U_e (IEC/EN 60947-1)		250 V AC	
Minimum switching voltage / minimum switching current		12 V / 10 mA	
Maximum switching voltage / maximum switching current		400 V AC / 6A	see load limit curves
Rated operational current I_e (IEC/EN 60947-5-1)	AC12 (resistive) 230 V	6 A	4 A
	AC15 (inductive) 230 V	1.5 A	3 A
	DC12 (resistive) 24 V	6 A	4 A
	DC13 (inductive) 24 V	2 A	2 A
Mechanical lifetime		30 x 10^6 switching cycles	
Electrical lifetime	at AC12, 230 V AC, 6 A	1 x 10^6 switching cycles	50 x 10^3 switching cycles
Maximum fuse rating to achieve short-circuit protection	n/c contact	6 A, operating class gG/gL	10 A fast tripping
	n/o contact	6 A, operating class gG/gL	10 A fast tripping
Conventional thermal current I_{th} (IEC/EN 60947-1)		6 A	5 A

Transistor outputs (only CM-UFD.M21)		
Number		5
Rated operational voltage U_e		24 V DC
Operational voltage range		4.5-27 V DC
Residual ripple		5 %
Current	state "0"	max. 0.1 mA / output
	state "1"	max. 20 mA / output
Electrical isolation	from the supply voltage	yes
	from the measuring circuit	yes
	from the relay outputs	yes
	from the inputs of the feedback contacts	yes
Maximum fuse rating to achieve short-circuit protection		100 mA fast-acting

General data		CM-UFD.M21	CM-UFD.M22
MTBF		on request	
Repeat accuracy (constant parameters)		-	< ±0.5 %
Duty time		100%	
Dimensions (W x H x D)	product dimensions	105 x 90 x 69 mm (4.13 x 3.54 x 2.72 in)	108 x 90 x 67 mm (4.25 x 3.54 x 2.64 in)
	packaging dimensions	175 x 107 x 130 mm (6.89 x 4.21 x 5.12 in)	121 x 99 x 71 mm (4.76 x 3.90 x 2.80 in)
Weight	net weight	0.225 kg (0.496 lb)	0.283 kg (0.624 lb)
	gross weight	0.343 kg (0.756 lb)	0.334 kg (0.736 lb)
Mounting		DIN rail (IEC/EN 60715) TH 35-7.5 and TH 35-15, snap-on mounting without any tool	
Mounting position		any	
Minimum distance to other units	vertical	not necessary	
	horizontal	not necessary	
Material of housing		-	PA666FR
Degree of protection	housing / terminals	IP30 / IP20	IP20

Electrical connection		CM-UFD.M21	CM-UFD.M22
Wire size	fine-strand with wire end ferrule	1 x 0.5 - 2.5 mm² (1 x 20 - 14 AWG)	1 x 0.25-4 mm² (1 x 24-12 AWG), 2 x 0.25-0.75 mm² (2 x 24-18 AWG)
	fine-strand without wire end ferrule	1 x 0.5 - 2.5 mm² (1 x 20 - 14 AWG)	1 x 0.2-4 mm² (1 x 24-12 AWG), 2 x 0.2-1.5 mm² (2 x 24-16 AWG)
	rigid	1 x 0.5 - 4 mm² (1 x 20 - 12 AWG)	1 x 0.2-0.6 mm² (1 x 24-10 AWG), 2 x 0.2-1.5 mm² (2 x 24-16 AWG)
Stripping length		7 mm (0.28 in)	8 mm (0.314 in)
Tightening torque		0.5 Nm (4.42 lb.in)	0.5-0.6 Nm (4.4-5.3 lb.in)

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Technical data - CM-UFD.Mxx

Isolation data			
Rated insulation voltage U_i (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply / measuring / output circuits	300 V	600 V
	output 1 / output 2 / output 3	300 V	300 V
Rated impulse withstand voltage U_{imp} (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply / measuring / output circuits	4 kV	6 kV; 1.2/50 µs
	output 1 / output 2 / output 3	4 kV	4 kV; 1.2/50 µs
Basic insulation acc. rated control supply voltage (IEC/EN 60664-1, VDE 0110-1)	supply / measuring / output circuits	300 V	600 V
	output 1 / output 2 / output 3	300 V	300 V
Protective seperation acc. rated voltage (VDE 0106 part 101 and 101/A1; IEC/EN 61440)	supply / measuring / output circuits	-	250 V
	output 1 / output 2 / output 3	-	250 V
Test voltage, routine test (IEC/EN 60255-5, IEC/EN 61010-1)	supply / measuring / output circuits	3.82 kV DC	2.2 kV, 50 Hz, 1s
	output 1 / output 2 / output 3	3.82 kV DC	2.2 kV, 50 Hz, 1s
Test voltage, type test (CEI 0-21)	supply / measuring / output circuits	-	5 kV, 50 Hz, 1s
	output 1 / output 2 / output 3	-	4 kV, 50 Hz, 1s
Pollution degree (IEC/EN 60664-1, VDE 0110-1)		2	3
Overvoltage category (IEC/EN 60664-1, VDE 0110-1)		II	IV
Environmental data			
Ambient temperature ranges	operation	-20...+55 °C	-20...+60 °C
	storage	-20...+70 °C	-20...+80 °C
	transport	-20...+70 °C	-20...+80 °C
Damp heat, cyclic (IEC 60068-2-30)		55 °C, 6 cycles	6 x 24 h cycle, 55 °C, 95 % RH
Climatic category (EN 50178)		3K3	3K5 (w/o condensation, w/o icing)
Vibration, sinusoidal (IEC/EN 60255-21-1)		Class 1	Class 2
Shock (IEC/EN 60255-21-2)		Class 1	Class 2
Standards / Directives			
Product standard		IEC/EN 60255	IEC/EN 60255-1
Application standards		VDE-AR-N 4105, BDEW	CEI 0-21: 2012-06 + CEI 0-12; V1: 2012-12 + A70 Terna
Low Voltage Directive		2006/95/EC	
EMC Directive		2004/108/EC	
RoHS Directive		2002/95/EC	2011/65/EC

Electromagnetic compatibility			
Interference immunity to		IEC/EN 61000-6-1, IEC/EN 61000-6-2. CM-UFD.M22: CEI 0-21 Tab.11	
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV / 8 kV	
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	CM-UFD.M22: Level 3, 10 V/m CM-UFD.M21: Level 3, 10 V/m (80-1000 MHz) Level 2, 3 V/m (1400-2000 MHz) Level 1, 1 V/m (2000-2700 MHz)	
electrical fast transient / burst	IEC/EN 61000-4-4	Level 4, 4 kV / 5 kHz	Level 3, 2 kV / 5 kHz
surge	IEC/EN 61000-4-5	Level 3, 1 kV L-L, 2kV L-earth	Level 3, installation class 3, supply and measuring input 1 kV L-L, 2 kV L-earth
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3, 10 V	
Interference emission		IEC/EN 61000-6-3, IEC/EN 61000-6-4	
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B	
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B	

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Technical data - CM-UFS.1

Type			CM-UFS.1	
Input circuit - Supply circuit			**L1, L2, L3**	**L-N**
Rated control supply voltage U_s = measuring voltage			3 x 400 V AC	3 x 230 V AC
Rated control supply voltage tolerance U_s			-20...+20 %	
Control supply voltage range			3 x 300-500 V AC	3 x 180-280 V AC
Rated frequency			50 Hz	
Frequency range			45-55 Hz	
Typical current / power consumption			23 mA / 16 VA	
Power failure buffering time			min. 20 ms	
Input circuit - Measuring circuit				
Monitoring functions		Phase failure	■	
		Over-/ undervoltage	■	
		Over-/ underfrequency	■	
		10 minutes average value	■	
Measuring range		Voltage range	3 x 320-460 V AC	3 x 184-264.5 V AC
		Frequency range	45-55 Hz	
Thresholds		Overvoltage	115 % of U_s, fixed	
		Undervoltage	80 % of U_s, fixed	
		Overfrequency	50.2 Hz fixed	
		Underfrequency	47.5 Hz fixed	
		10 minutes average value	110-115% of U_s, adjustable	
Hysteresis related to the threshold value		Over-/ undervoltage	5 % fixed	
		Over-/ underfrequency	20 mHz fixed	
Rated frequency of the measuring signal			50 Hz	
Frequency range of the measuring signal			45-55 Hz	
Maximum measuring cycle time			50 ms	
Maximum reaction time (time between fault detection and change of switching status of the relay)		Over-/ undervoltage	< 120 ms	
		Over-/ underfrequency	< 100 ms	
		10 minutes average value	without delay	
Accuracy within the rated control supply voltage tolerance			$\Delta U \leq 0.5$ %	
Accuracy within the temperature range			$\Delta U \leq 0.06$ % / °C	
Measuring method			True RMS	
Timing circuit				
Start-up delay t_{S1} prior to grid connection after a short interruption			30 s fixed	
Restart delay t_{S2}			30 s fixed	
Accuracy within the rated control supply voltage tolerance			$\Delta t \leq 0.5$ %	
Accuracy within the temperature range			$\Delta t \leq 0.06$ % / °C	
Indication of operational states			1 yellow LED, 2 red LEDs Details see operation mode and function description/diagrams	
Output circuits			**15-16/18, 25-26/28**	
Kind of output			Relay, 1 x 2 c/o (SPDT) contacts	
Operation principle			closed-circuit principle [1]	
Contact material			AgNi alloy, Cd free	
Rated operational voltage U_e (IEC/EN 60947-1)			250 V	
Minimum switching voltage / switching current			24 V / 10 mA	
Maximum switching voltage / switching current			see load limit curve	
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) 230 V	4 A	
		AC15 (inductive) 230 V	3 A	
		DC12 (resistive) 24 V	4 A	
		DC13 (inductive) 24 V	2 A	
Mechanical lifetime			30 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

Grid feeding monitoring relays - Voltage and frequency monitoring functions
Technical data - CM-UFS.1

Type		CM-UFS.1	
General data			
MTBF		on request	
Duty time		100%	
Repeat accuracy (constant parameters)		< ± 50	
Dimensions (W x H x D)	product dimensions	22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in)	
Weight	gross weight	0.140 kg (0.31 lb)	
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	
Degree of protection	housing / terminals	IP50 / IP20	
Electrical connection			
Wire size	fine-strand with(out) wire end ferrule	2 x 0.75 - 2.5 mm² (2 x 18-14 AWG)	
	rigid	2 x 0.5 - 4 mm² (2 x 20-12 AWG)	
Stripping length		7 mm (0.28 in)	
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)	
Environmental data			
Ambient temperature range	operation / storage	-25...+60 °C / -40...+85 °C	
Damp heat, cyclic (IEC/EN 60068-2-30)		2 x 12 h cycle, 55 °C, 95 % RH	
Climatic category (IEC/EN 60721-3-1)		3K3	
Vibration (sinusoidal) (IEC/EN 60255-21-1)		Class 2	
Shock (IEC/EN 60255-21-2)		Class 2	
Isolation data			
Rated impulse withstand voltage U_i	input circuit / output circuit	600 V	
	output circuit 1 / 2	300 V	
Rated impulse withstand voltage U_{imp} (VDE 0110, IEC/EN 60664)	input circuit	6 kV; 1.2/50 µs	
	output circuit	4 kV; 1.2/50 µs	
Test voltage between all isolated circuits (routine test)		2.5 kV, 50 Hz, 1 s	
Basic insulation	input circuit / output circuit	600 V	
Protective separation (VDE 0160 Part 101 and 101/A, IEC/EN 61140)	input circuit / output circuit	yes	
Pollution degree (VDE 0110, IEC/EN 60664)		3	
Overvoltage category (VDE 0110, IEC 60664)		III	
Standards			
Product standard		IEC/EN 60255-6, DIN V VDE V 0126-1-1: February 2006	IEC/EN 60255-6, Guideline for connections to ENEL distribution network Ed. 2.1, January 2011
Further standards		EN 50178, EN 61727	
Low Voltage Directive		2006/95/EC	
EMV-Directive		2004/108/EC	
RoHS-Directive		2002/95/EC	
Electromagnetic compatibility			
Interference immunity to		IEC/EN 61000-6-1, IEC/EN 61000-6-2	
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)	
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)	
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3 (2 kV / 2 kHz)	
surge	IEC/EN 61000-4-5	Level 4 (2 kV L-L, L-N)	
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 (10 V)	
harmonics and interharmonics	IEC/EN 61000-4-13	Class 3	
Interference emission		IEC/EN 61000-6-3, IEC/EN 61000-6-4	
high-frequency radiated	IEC/CISPR 22, EN 50022	Class B	
high-frequency conducted	IEC/CISPR 22, EN 50022	Class B	

Grid feeding monitoring relays - Voltage and frequency monitoring functions

Notes

Insulation monitoring relays for unearthed supply systems
Product group picture

Insulation monitoring relays for unearthed supply systems
Table of contents

Insulation monitoring relays for unearthed supply systems
Benefits and advantages

CM-IWS.2

CM-IWS.1

CM-IWN.1

Insulation monitoring relays for unearthed pure AC systems:
Characteristics

- For monitoring the insulation resistance of unearthed IT systems: up to U_n = 400 V AC
- According to IEC/EN 61227-8 "Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems"
- Rated control supply voltage 24–240 V AC/DC
- Superimposed DC signal
- One measuring range 1–100 kΩ
- Precise adjustment of the threshold value in 1 kΩ steps
- Interrupted wire detection
- Fault storage/latching configurable by control input
- 1 c/o (SPDT) contact, closed-circuit principle
- 22.5 mm [0.89 in] width
- 3 LEDs for status indication

Insulation monitoring relays for unearthed AC, DC or mixed AC/DC systems:
Characteristics

- For monitoring the insulation resistance of unearthed IT systems up to U_n= 250 V AC and 300 V DC or U_n= 400 V AC and 600 V DC
- According to IEC/EN 61227-8 "Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems"[1)]
- CM-IWN.4,5,6: Specifically for applications with high system leakage capacitances, for example in photovoltaic environments
- Rated control supply voltage 24-240 V AC/DC
- Prognostic measuring principle with superimposed square wave signal
- 1 or 2 measuring ranges (1-100 kΩ or 1-100 kΩ + 2-200 kΩ)
- 1 or 2 (configurable) c/o contacts[1)]
- Precise adjustmemt of the measuring value in 1 or 2 kΩ steps
- (non-volatile) fault storage, configurable latching, interrupted wire protection, open- or closed-circuit principle selectable[1)]
- 22.5 or 45 mm width
- 3 LEDs for status indication

[1)] depending on devices

Additional characteristics for CM-IWN.1,4,5,6:

- One (1 x 2 c/o) or two (2 x 1 c/o) threshold values R_{an}1/R1[1)] (final switch-off) and R_{an}2/R2[2)] (prewarning) configurable[3)]
- Precise adjustment of the threshold values in 1 kΩ steps (R1) and 2 kΩ steps (R2)
- Interrupted wire detection configurable
- Non-volatile fault storage configurable
- Open- or closed-circuit principle configurable

[1)] CM-IWN.6 does not meet the requirements of IEC/EN 61557-8 regarding the response time t_{an}.
[2)] term acc. to IEC/EN 61557-8
[3)] R2 only active with 2 x 1 c/o configuration

Insulation monitoring relays for unearthed supply systems
Benefits and advantages, Applications

Application / monitoring function CM-IWx

The CM-IWx serve to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems, IT AC sytems with galvanically connected DC circuits, or unearthed IT DC systems. The insulation resistance between system lines and system earth is measured. If this falls below the adjustable threshold values, the output relay(s) energize or de-energize. The CM-IWS.x can monitor control circuits (single-phase) and main circuits (3-phase). Supply systems with voltages U_n = 0-400 V AC (45-65 Hz), U_n=0-250 V AC (15-400 Hz) or 0-300 V DC can be directly connected. For systems with voltages above 400 V AC the insulation monitoring relay with or without the coupling unit CM-IVN can be used.

Application / monitoring function CM-IWN.x

The CM-IWN.x serves to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems, IT AC systems with galvanically connected DC circuits, or unearthed IT DC systems. The insulation resistance between system lines and system earth is measured. If this falls below the adjustable threshold values, the output relays switch into the fault state. The device can monitor control circuits (single-phase) and main circuits (3-phase). Supply systems with voltages U_n = 0-400 V AC (15-400 Hz) or 0-600 V DC can be directly connected to the measuring inputs and their insulation resistance being monitored. For systems with voltages above 400 V AC and 600 V DC the coupling unit CM-IVN can be used for the expansion of the CM-IWN.x voltage range.

Expansion of assortment for the requirements of decentral eletrical energy sources

ABB‘s insulation monitoring relays from the CM-IWN range provide higher system leakage capacitances which are necessary especially for solar applications. This expanded product range covers the requirements of decentral eletrical sources (e.g. photovoltaic systems).
The range of system leakage capacitances is 20 - 2000 µF.

Application / monitoring function CM-IVN

The coupling unit CM-IVN is designed to extend the nominal voltage range of the insulation monitoring relay CM-IWN.1 up to 690 V AC and 1000 V DC. The coupling unit can be connected to the system to be monitored by means of the terminals VL+ and VL-. The terminal Vw has to be connected to the earth potential. The terminals L+, V1+, L-, V1-, VS and VE have to be connected to the CM-IWN.1 as shown in the connection diagrams below. Supply systems with voltages Un = 0-690 V AC (15-400 Hz) or 0-1000 V DC can be connected.

Measuring principle CM-IWS.2

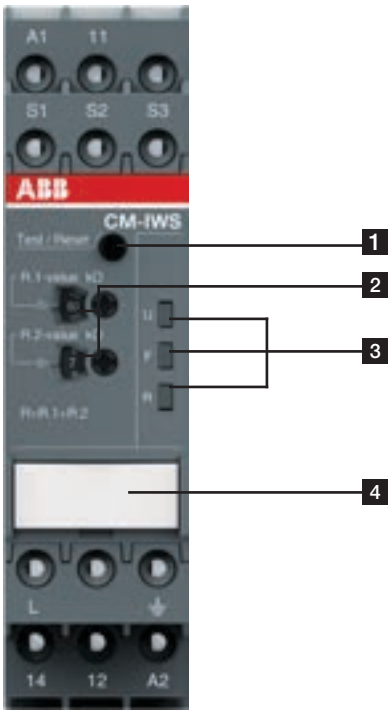
A superimposed DC measuring signal is used for measurement. From the superimposed DC measuring voltage and its resultant current the value of the insulation resistance of the system to be monitored is calculated.

Measuring principle CM-IWN.x, CM-IWS.1

A pulsating measuring signal is fed into the system to be monitored and the insulation resistance is calculated. This pulsating measuring signal alters its form depending on the insulation resistance and system leakage capacitance. From this altered form the change in the insulation resistance is forecast. When the forecast insulation resistance corresponds to the insulation resistance calculated in the next measurement cycle and is smaller than the set threshold value, the output relay de-energizes. This measuring princiiple is also suitable for the detection of symmetrical insulation faults.




Insulation monitoring relays for unearthed supply systems
Operating controls

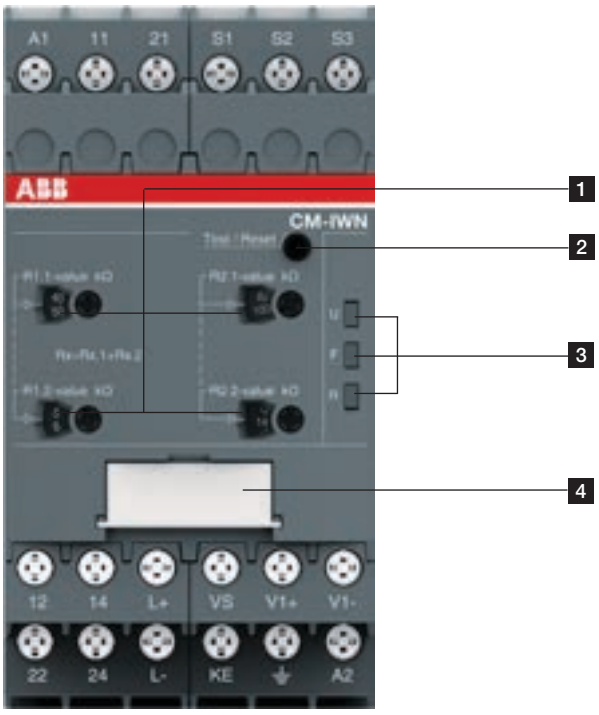


1 **Test and reset button**

2 **Configuration and setting**
Front-face rotary switches for threshold value adjustment:
R.1 for R1 tens figures:
0, 10, 20, 30, 40, 50, 60, 70, 80, 90 kΩ in ten kΩ steps
R.2 for R1 units figures:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 kΩ in one kΩ steps

3 **Indication of operational states**
U: green LED - control supply voltage
F: red LED - fault message
R: yellow LED - relay status

4 **Marker label for devices without DIP switches**



1 **Front-face rotary switches to adjust the threshold value:**
R1.1 for R1 tens figure:
0, 10, 20, 30, 40, 50, 60, 70, 80, 90 kΩ in ten kΩ steps
R1.2 for R1 units figure:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 kΩ in one kΩ steps
R2.1 for R2 tens figure:
0, 20, 40, 60, 80, 100, 120, 140, 160, 180 kΩ in twenty kΩ steps
R2.2 for R2 units figure:
2, 4, 6, 8, 10, 12, 14, 16, 18, 20 kΩ in two kΩ steps

2 **Test and reset button**

3 **Indication of operational states**
U: green LED – control supply voltage
F1: red LED – fault message
F2: yellow LED – relay status

4 **DIP switches (see DIP switch functions)**

Insulation monitoring relays for unearthed supply systems
Insulation monitoring in IT systems

In electricity supply systems, an earthing system defines the electrial potential of the conductors relative to that of the earth's conductive surface. The choice of earthing system has implications for the safety and electromagnetic compatibility of the power supply. Note that regulations for earthing (grounding) systems vary considerably among different countries.

The international standard IEC 60364 distinguishes three families of earthing arrangements, using the two-letter codes TN, TT and IT.

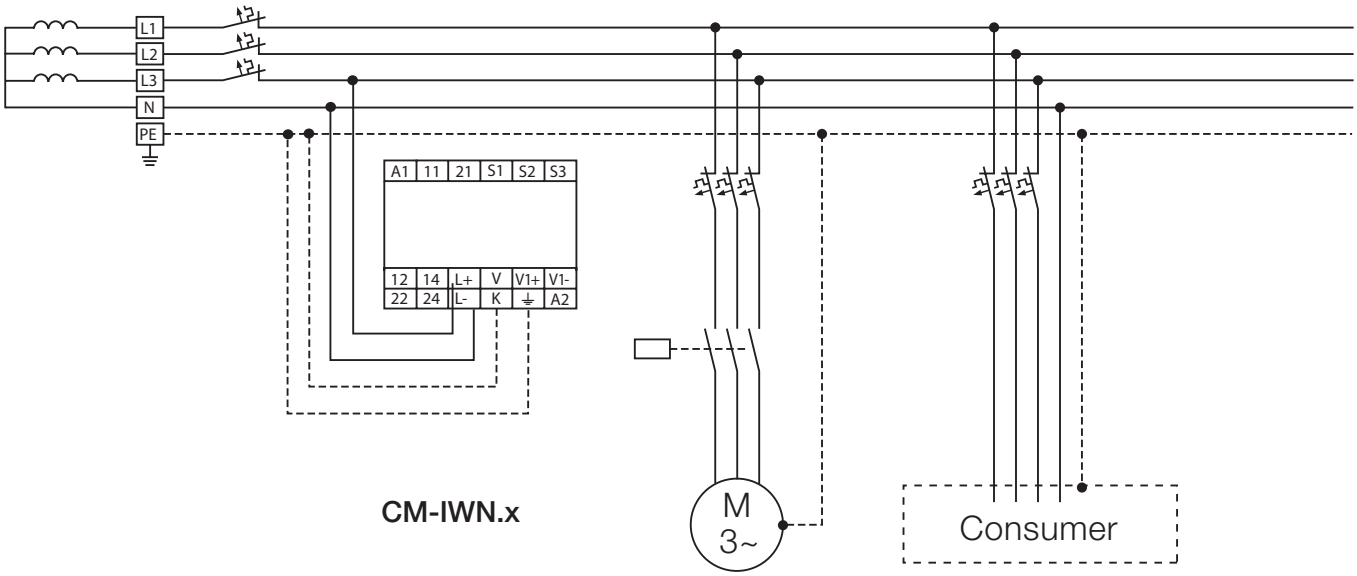
The first letter indicates the connection between earth and the power-supply equipment (generator or transformer):
T: direct connection of a point with earth (Latin: terra)
I: no point is connected with earth (insulation),
except perhaps via a high impendance

The second letter indicates the connection between earth and the electrical device being supplied:
T: direct connection of a point with earth
N: direct connection to neutral at the origin of installation,
which is connected to the earth

IT supply systems

The IT system is supplied either by an isolation transformer or a voltage source, such as battery or a generator.
In this system no active conductor is directly connected to earth potential. The advantage of this is that only a small fault current can flow in case of an insulation fault. This current is essentially caused by the leakage capacitance of the system.
The fuse of the system or MCB does not respond, thus maintaining the voltage supply and therefore operation even in case of a phase-to-earth fault.

The high reliability of an IT system is guaranteed thanks to continous insulation monitoring.
The insulation monitoring device recognizes insulation faults as they develop, and immediately reports that the value has fallen below the minimum. This prevents operational interruptions caused by a second more severe insulation fault.



Insulation monitoring relays for unearthed supply systems
Selection table

	Order number	1SVR 730 670 R0200	1SVR 740 670 R0200	1SVR 730 660 R0100	1SVR 740 660 R0100	1SVR 750 660 R0200	1SVR 760 660 R0200	1SVR 750 660 R0300	1SVR 760 660 R0300	1SVR 750 660 R0400	1SVR 760 660 R0400	1SVR 750 660 R0500	1SVR 760 660 R0500
	Type	CM-IWS.2S	CM-IWS.2P	CM-IWS.1S	CM-IWS.1P	CM-IWN.1S	CM-IWN.1P	CM-IWN.4S	CM-IWN.4P	CM-IWN.5S	CM-IWN.5P	CM-IWN.6S	CM-IWN.6P
Rated control supply voltage U_s													
24 - 240 VAC/DC		■	■	■	■	■	■	■	■	■	■	■	■
Measuring voltages													
250 V AC (L-PE)				■	■								
400 V AC (L-PE)		■	■			■	■	■	■	■	■	■	■
690 V AC (L-PE)						■ [1]	■ [1]	■ [1]	■ [1]	■ [1]	■ [1]	■ [1]	■ [1]
300 V DC (L-PE)				■	■								
600 V DC (L-PE)						■	■	■	■	■	■	■	■
1000 V DC (L-PE)						■ [1]	■ [1]	■ [1]	■ [1]	■ [1]	■ [1]	■ [1]	■ [1]
Measuring range													
1 - 100 kΩ		■	■	■	■	■	■	■	■	■	■	■	■
2 - 200 kΩ						■	■	■	■	■	■	■	■
System leakage capacitance, max.													
10 µF		■	■	■	■								
20 µF						■	■						
500 µF								■	■				
1000 µF										■	■		
2000 µF												■	■
Output													
1 c/o		■	■	■	■								
1 x 2 c/o or 2 x 1 c/o						■	■	■	■	■	■	■	■
Operating principle													
Open-circuit principle		■	■	■	■								
Open- or closed-circuit principle adjustable						■	■	■	■	■	■	■	■
Test													
Front face button or control input		■	■	■	■	■	■	■	■	■	■	■	■
Reset													
Front-face button or control input		■	■	■	■	■	■	■	■	■	■	■	■
Fault storage / latching configurable		■	■	■	■	■	■	■	■	■	■	■	■
Non volatile storage configurable		■	■	■	■	■	■	■	■	■	■	■	■
Interrupted wire detection						■	■	■	■	■	■	■	■
Threshold values configurable		1	1	1	1	2	2	2	2	2	2	2	2

[1] With coupling unit CM-IVN	screw version	CM-IVN.S: 1SVR750669R9400
	push-in version	CM-IVN.P: 1SVR760669R9400

Insulation monitoring relays for unearthed supply systems
Ordering details

CM-IWS.2

Description

The high reliability of an IT system is guaranteed thanks to continuous insulation monitoring. An insulation monitoring device recognizes insulation faults as they develop, and immediately reports that the value has fallen below the minimum. This prevents operational interruption caused by a second, more severe insulation fault.
ABB developed a totally new range of insulation monitors for AC, DC or mixed AC/DC IT Systems up to 690 V AC or 1000 V DC. With only 4 devices most standard applications can be served. Additionally a version for solar applications with increased earth leakage capacitance has been added.

CM-IWS.1

CM-IWN.1

CM-IVN

Ordering details

Rated control supply voltage = measuring voltage	Nominal voltage U_n of the distribution system to be monitored	System leakage capacitance, max.	Adjustment range of the specified response value R_{an} (threshold)	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC	0-250 V AC / 0-300 V DC	10 µF	1-100 kΩ	CM-IWS.1S	1SVR730660R0100		0.148 (0.326)
				CM-IWS.1P	1SVR740660R0100		0.137 (0.302)
24-240 V AC/DC	0-400 V AC	10 µF	1-100 kΩ	CM-IWS.2S	1SVR730670R0200		0.141 (0.311)
				CM-IWS.2P	1SVR740670R0200		0.130 (0.287)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	20 µF	1-100 kΩ 2-200 kΩ (activated / de-activated by DIP-switch)	CM-IWN.1S	1SVR750660R0200		0.241 (0.531)
				CM-IWN.1P	1SVR760660R0200		0.217 (0.478)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	500 µF		CM-IWN.4S	1SVR750660R0300		0.241 (0.531)
				CM-IWN.4P	1SVR760660R0300		0.217 (0.478)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	1000 µF		CM-IWN.5S	1SVR750660R0400		0.241 (0.531)
				CM-IWN.5P	1SVR760660R0400		0.217 (0.478)
24-240 V AC/DC	0-400 V AC / 0-600 V DC	2000 µF		CM-IWN.6S	1SVR760660R0500		0.241 (0.531)
				CM-IWN.6P	1SVR760660R0500		0.217 (0.478)

Ordering details - Coupling unit

Rated control supply voltage = measuring voltage	Nominal voltage U_n of the distribution system to be monitored	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
Passive device, no control supply voltage needed	0-690 V AC / 0-1000 V DC	CM-IVN.S	1SVR750669R9400		0.179 (0.395)
		CM-IVN.P	1SVR760669R9400		0.165 (0.364)

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

Insulation monitoring relays for unearthed supply systems
Operating state indication, Connection diagrams, DIP switches

LEDs, status information and fault messages CM-IWN.x

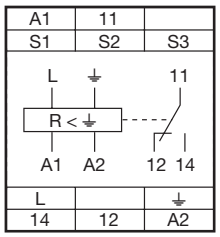
Operational state	LED U (green)	LED F (red)	LED R (yellow)
Start-up		OFF	OFF
No fault		OFF	[1]
Prewarning			
Insulation fault (below threshold value)			[1]
KE/⏚ wire interruption			[1]
L+/L- wire interruption during system start-up / test function	/		[1]
System leakage capacitance too high / invalid measurement result			[1]
Internal system fault	[1]		[1]
Setting fault [2]			
Test function		OFF	[1]
No fault after fault storage [3]		[4]	

LEDs, status information and fault messages CM-IWS.x

Operational state	LED U (green)	LED F (red)	LED R (yellow)
Start-up		OFF	OFF
No fault		OFF	
Insulation fault (below threshold value)			OFF
Invalid measuring result			OFF
KE/⏚ wire interruption (only CM-IWS.1)			OFF
CM-IWS.1: System leakage capacitance too high / invalid measurement result			OFF
CM-IWS.2: Invalid measurement result			OFF
Internal system fault	OFF		OFF
Test function		OFF	OFF
No fault after fault storage [3]		[4]	

[1] Depending on the configuration.
[2] Possible faulty setting: The threshold value for final switch-off is set at a higher value than the threshold value for prewarning
[3] The device has triggered after an insulation fault. The fault has been stored and the insulation resistance has returned to a higher value than the threshold value plus hysteresis.
[4] Depending on the fault

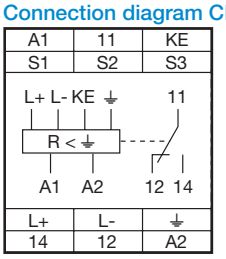
Connection diagram CM-IWS.2



2CDC 252 102 F0009

A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L	Measuring circuit/input, system connection
⏚	Measuring circuit/input, earth connections
11-12/14	Output relay, closed-circuit principle

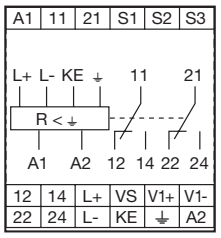
Connection diagram CM-IWS.1



2CDC 252 103 F0009

A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L+, L–	Measuring circuit/input, system connection
⏚, KE	Measuring circuit/input, earth connections
11-12/14	Output relay, closed-circuit principle

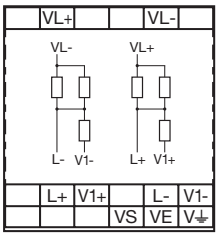
Connection diagram CM-IWN.1, 4, 5, 6



2CDC 252 104 F0009

A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L+, L–	Measuring circuit/input, system connection
⏚, KE	Measuring circuit/input, earth connections
VS, V1+, V1-	Measuring circuit/input, earth connections
11-12/14	Connections for the coupling unit (if used)
21-22/24	Output relay 1, open- or closed-circuit principle
	Output relay 2, open- or closed-circuit principle

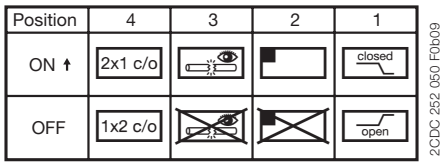
Connection diagram CM-IVN



2CDC 252 010 F0013

VE	Connection to CM-IWN.x - ⏚
VS	Connection to CM-IWN.x - VS
L+	Connection to CM-IWN.x - L+
V1+	Connection to CM-IWN.x - V1+
L-	Connection to CM-IWN.x - L-
V1-	Connection to CM-IWN.x - V1-
VL+, VL-	Measuring circuit / Measuring input Connection to the system
V⏚	Measuring circuit / Measuring input Connection to earth

DIP switches of CM-IWN.1, 4, 5, 6



2CDC 252 050 F0b09

	ON	OFF (default)
DIP switch 1 Operating principle of the output relays	Closed-circuit principle If closed-circuit principle is selected, the output relays de-energize in case a fault is occuring. In non-fault state the relays are energized.	Open-circuit principle If open-circuit principle is selected, the output relays energize in case a fault is occuring. In non-fault state the relays are de-energized.
DIP switch 2 Non-volatile fault storage	Fault storage activated (latching) If the fault storage function is activated, the output relays remain in tripped position until a reset is done either by the front-face button or by the remote reset connection S2-S3. This function is non-volatile.	Fault storage de-activated (non latching) If the fault storage function is de-activated, the output relays switch back to their original position as soon as the insulation fault no longer exists.
DIP switch 3 Interrupted wire detection	Interrupted wire detection activated With this configuration, the CM-IWN.1 monitoring relays the wires connected to ⏚ and KE for interruptions.	Interrupted wire detection de-activated With this configuration the inter-rupted wire detection is de-activated.
DIP switch 4 2 x 1 c/o, 1 x 2 c/o	2 x 1 c/o (SPDT) contact If operating principle 2 x 1 c/o contact is selected, the output relay R1 (11-12/14) reacts to threshold value R1 (final switch-off) and the output relay R2 (21-22/24) reacts to threshold value R2 (prewarning)	1 x 2 c/o (SPDT) contacts If operating principle 1 x 2 c/o contacts is selected, both output relays R1 (11-12/14) and R2 (21-22/24) react synchronously to threshold value R1. Settings of the threshold value R2 have no effect on the operation.

Insulation monitoring relays for unearthed supply systems
Technical data

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

		CM-IWS.2	CM-IWS.1	CM-IWN.1, 4, 5, 6
Input circuit - Supply circuit		A1 - A2		
Rated control supply voltage U_s		24-240 V AC/DC		
Rated control supply voltage tolerance		-15...+10 %		
Typical current / power consumption	24 V DC	30 mA / 0.7 VA	35 mA / 0.9 VA	55 mA / 1.3 VA
	115 V AC	12 mA / 1.4 VA	17 mA / 2.0 VA	20 mA / 2.3 VA
	230 V AC	12 mA / 2.8 VA	14 mA / 3.2 VA	15 mA / 3.5 VA
Rated frequency f_s		DC or 15-400 Hz		
Frequency range AC		13.5-440 Hz		
Power failure buffering time	min.	20 ms		
Input circuit - Measuring circuit		L, ⏚	L+, L-, ⏚, KE	L+, L-, ⏚, KE
Monitoring function		insulation resistance monitoring of IT systems (IEC/EN 61557-8)		
Measuring principle		superimposed DC voltage	prognostic measuring principle with superimposed square wave signal	
Nominal voltage U_n of the distribution system to be monitored		0-400 V AC	0-250 V AC / 0-300 V DC	400 V AC / 0-600 V DC
Voltage range of the distribution system to be monitored		0-460 V AC (tolerance +15 %)	0-287.5 V AC / 0-345 V DC (tolerance +15 %)	0-460 V AC / 0-690 V DC (tolerance +15 %)
Rated frequency f_N of the distribution system to be monitored		50-60 Hz	DC or 15-400 Hz	DC or 15-400 Hz
System leakage capacitance C_e	max.	10 µF		CM-IWN.1: 20 µF CM-IWN.4: 500 µF CM-IWN.5 1000 µF CM-IWN.6: 2000 µF
Tolerance of the rated frequency f_N		45-65 Hz	13.5-440 Hz	13.5-440 Hz
Extraneous DC voltage U_{fg} (when connected to an AC system)	max.	none	290 V DC	460 V DC
Number of possible response / threshold values		1		2
Adjustment range of the specified response value R_{an} (threshold)	min.-max.	1-100 kΩ		–
	min.-max. R1	–		1-100 kΩ
	min.-max. R2	–		2-200 kΩ (activated / de-activated by DIP-switch)
Adjustment resolution		1 kΩ		
	R1	1 kΩ		1 kΩ
	R2	–		2 kΩ
Tolerance of the adjusted threshold value / Relative percentage uncertainty A at -5...+45 °C, U_n = 0-115 %, U_s = 85-110 %, f_N, f_s, C_e = 1µF	at 1-10 kΩ R_F	±0.5 kΩ		–
	at 10-100 kΩ R_F	±6 %		–
	at 1-15 kΩ R_F	–		±1 kΩ*
	at 15-200 kΩ R_F	–		±8 %
Hysteresis related to the threshold value		25 %; min. 2 kΩ		
Internal impedance Z_i	at 50 Hz	135 kΩ	100 kΩ	155 kΩ
Internal DC resistance R_i		185 kΩ	115 kΩ	185 kΩ
Measuring voltage U_m		15 V	22 V	24 V
Tolerance of measuring voltage U_m		+10 %		
Measuring current I_m	max.	0.1 mA	0.3 mA	0.15 mA
Response time t_{an}				
pure AC system	0.5 x R_{an} and C_e = 1 µF	max. 10 s		
DC system or AC system with connected rectifiers		–	max. 15 s	
Repeat accuracy (constant parameters)		< 0.1 % of full scale		
Accuracy of R_a (measured value) within the rated control supply voltage tolerance		< 0.05 % of full scale		
Accuracy of R_a (measured value) within the operation temperature range	at 1-10 kΩ R_F	5 W / K		
	at 10-100 kΩ R_F	0.05 % / K		–
	at 10-200 kΩ R_F	–		0.05 % / K
Transient overvoltage protection (⏚ - terminal)		Z-diode	avalanche diode	
Input circuit - Control circuits		S1 - S2 - S3		
Control inputs - volt free	S1-S3	remote test		
	S2-S3	remote reset		
Maximum switching current in the control circuit		1 mA		
Maximum cable length to the control inputs		50 m - 100 pF/m [164 ft - 30.5 pF/ft]		
Minimum control pulse length		150 ms		
No-load voltage at the control input		≤ 24 V ± 5 %	≤ 24 V DC	

*in combination with CM-IVN ±1.5 kΩ

Insulation monitoring relays for unearthed supply systems
Technical data

		CM-IWS.2	CM-IWS.1	CM-IWN.1, 4, 5, 6
Indication of operational states				
Control supply voltage		LED U (green)		
Fault message		LED F (red)		
Relay status		LED R (yellow)		
Output circuits				
Kind of output		relay, 1 c/o (SPDT) contact		2 x 1 or 1 x 2 c/o (SPDT) contacts configurable
Operating principle		closed-circuit principle [1]		open- or closed circuit principle [1] configurable
Contact material		AgNi alloy, Cd free		
Rated voltage (VDE 0110, IEC 60947-1)		250 V AC / 300 V DC		
Min. switching voltage / Min. switching current		24 V / 10 mA		
Max. switching voltage / Max. switching current		see data sheet		
Rated operational current I_e (IEC/EN 60947-5-1)	AC12 (resistive) at 230 V	4 A		
	AC15 (inductive) at 230 V	3 A		
	DC12 (resistive) at 24 V	4 A		
	DC13 (inductive) at 24 V	2 A		
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300, pilot duty general purpose (250 V, 4 A, cos ϕ 0.75)		
	max. rated operational voltage	250 V AC		
	max. continuous thermal current at B 300	4 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		
Conventional thermal current I_{th} (IEC/EN 60947-1)		4 A		
General data				
Duty time		100 %		
Dimensions (W x H x D)				
	product dimension	22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)		45 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)
	packaging dimenesion	97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)		97 x 109 x 30 mm (3.82 x 4.29 x 1.18 in)
Weight	grossweight	CM-IWS.2P: 0.130 kg (0.287 lb) CM-IWS.2S: 0.141 kg (0.311 lb)	CM-IWS.1P: 0.137 kg (0.302 lb) CM-IWS.1S: 0.148 kg (0.326 lb)	CM-IWN.xP: 0.217 kg (0.478 lb) CM-IWN.xS: 0.241 kg (0.531 lb)
	netweight	CM-IWS.2P: 0.155 kg (0.342 lb) CM-IWS.2S: 0.166 kg (0.366 lb)	CM-IWS.1P: 0.162 kg (0.357 lb) CM-IWS.1S: 0.173 kg (0.381 lb)	CM-IWN.xP: 0.246 kg (0.542 lb) CM-IWN.xS: 0.270 kg (0.595 lb)
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool		
Mounting position		any		
Minimum distance to other units	vertical	not necessary		
	horizontal	10 mm (0.39 in) at U_n > 240 V	not necessary	10 mm (0.39 in) at U_n > 400 V
Material of housing		UL 94 V-0		
Degree of protection	housing / terminal	IP50 / IP20		

Electrical connection		**Screw connection technology**	**Easy Connect Technology (Push-in)**
Wire size	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)	

[1] Closed-circuit principle: Output relay(s) de-energize(s) if a fault is occuring
Open-circuit principle: Output relay(s) energize(s) if a fault is occuring

Insulation monitoring relays for unearthed supply systems
Technical data

		CM-IWS.2	CM-IWS.1	CM-IWN.1, 4, 5, 6
Environmental data				
Ambient temperature ranges	operation / storage / transport	-25...+60 °C/-40...+85 °C/-40...+85 °C		
Climatic category	IEC/EN 60721-3-3	3K5 (no condensation, no ice formation)		
Damp heat, cyclic	IEC/EN 60068-2-30	6 x 24 h cycle, 55 °C, 95 % RH		
Vibration, sinusoidal	IEC/EN 60255-21-1	Class 2		
Shock, half-sine	IEC/EN 60255-21-2	Class 2		
Isolation data				
Rated impulse withstand voltage U_{imp} between all isolated circuits (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply / measuring circuit	6 kV		
	supply / output circuit	6 kV		
	measuring / output circuit	6 kV		
	output 1 / output circuit 2			4 kV
Pollution degree (IEC/EN 60664-1, VDE 0110-1)		3		
Overvoltage category (IEC/EN 60664-1, VDE 0110-1)		III		
Rated insulation voltage U_i (IEC/EN 60947-1, IEC/EN 60664-1, VDE 0110-1)	supply / measuring circuit	400 V	300 V	600 V
	supply / output circuit	300 V		
	supply / measuring circuit	400 V	300 V	600 V
	output 1 / output circuit 2	-	-	300 V
Basis isolation for rated control supply voltage (IEC/EN 60664-1, VDE 0110-1)	supply / measuring circuit	400 V AC / 300 V DC	250 V AC / 300 V DC	400 V AC / 600 V DC
	supply / output circuit	250 V AC / 300 V DC		
	measuring / output circuit	400 V AC / 300 V DC	250 V AC / 300 V DC	400 V AC / 600 V DC
	output 1 / output 2	250 V AC / 300 V DC		
Protective separation (IEC/EN 61140)	supply / output circuit	250 V AC / 250 V DC		
	supply / measuring circuit	250 V AC / 250 V DC		
	measuring / output circuit	250 V AC / 250 V DC		
Test voltage between all isolated circuits, routine test (IEC/EN 60255-5, IEC/EN 61010-1)	supply / output circuit	2.32 kV, 50 Hz, 2 s		
	supply / measuring circuit	2.32 kV, 50 Hz, 2 s		
	measuring / output circuit	2.2 kV, 50 Hz, 1 s		2.53 kV, 50 Hz, 1 s
Standards				
Product standard		IEC/EN 61557-8, IEC/EN 60255-6		
Other standards		EN 50178		
Low Voltage Directive		2006/95/EC		
EMC Directive		2004/108/EC		
RoHS Directive		2002/95/EC		
Electromagnetic compability				
Interference immunity to		IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61326-2-4		
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV / 8 kV		
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3, 10 V/m (1 GHz) / 3 V/m (2 GHz) / 1 V/m (2.7 GHz)		
electrical fast transient/burst	IEC/EN 61000-4-4	Level 3, 2 kV / 5 kHz		
surge	IEC/EN 61000-4-5	Level 3, installation class 3, supply circuit and measuring circuit 1 kV L-L, 2 kV L-earth		
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 emissions		IEC/EN 61000-6-3, IEC/EN 61000-6-4		
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B		
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B		

Insulation monitoring relays for unearthed supply systems
Technical data CM-IVN

Input circuit - Measuring circuit		VL+, VL-, V⏚
Function		expansion of the nominal voltage range of the insulation monitoring relay CM-IWN to 690 V AC or 1000 V DC, max. length of connection cable 40 cm
Measuring principle		see CM-IWN
Nominal voltage U_n of the distribution system to be monitored		0-690 V AC / 0-1000 V DC
Voltage range of the distribution system to be monitored		0-793.5 V AC / 0-1150 V DC (tolerance +15 %)
Rated frequency f_N of the distribution system to be monitored		DC or 15-400 Hz
Tolerance of the rated frequency f_N		13.5-440 Hz
System leakage capacitance C_e	max.	identical to that of the insulation monitoring relay used
Extraneous DC voltage U_{fg} (when connected to an AC system)	max.	793.5 V DC
Tolerance of the adjusted threshold value / Relative percentage uncertainty A at -5...+ 45 °C, U_n = 0-115 %, U_s = 85-110 %, f_N, f_s, C_e = 1 µF	at 1-15 kΩ R_F	±1.5 kΩ
	at 15-200 kΩ R_F	±8 %
Internal impedance Z_i	at 50 Hz	195 kΩ
Internal DC resistance R_i		200 kΩ
Measuring voltage U_m		24 V
Tolerance of measuring voltage U_m		+10 %
Measuring current I_m		0.15 mA
General data		
MTBF		on request
Duty time		100 %
Dimensions (W x H x D)		45 x 78 x 100 mm (1.78 x 3.07 x 3.94 in)
Weight	gross weight	0.200 kg (0.441 lb)
	net weight	0.169 kg (0.373 lb)
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool
Mounting position		any
Minimum distance to other units	vertical	not necessary
	horizontal	10 mm (0.39 in) at U_n > 600 V
Degree of protection		IP50 / IP20
Electrical connection		
Wire size	fine-strand with(out) wire end ferrule	2 x 0.75-2.5 mm² (2 x 18-14 AWG)
	rigid	2 x 0.5-4 mm² (2 x 20-12 AWG)
Stripping length		7 mm (0.28 in)
Tightening torque		0.6-0.8 Nm (5.31-7.08 lb.in)
Max. length of connection cable to CM-IWN		40 cm
Environmental data		
Ambient temperature ranges	operation / storage / transport	-25...+60 °C / -40...+85 °C / -40...+85 °C
Climatic category	IEC/EN 60721-3-3	3K5 (no condensation, no ice formation)
Damp heat, cyclic	IEC/EN 60068-2-30	6 x 24 h cycle, 55 °C, 95 % RH
Vibration, sinusoidal	IEC/EN 60255-21-1	Class 2
Shock, half-sine	IEC/EN 60255-21-2	Class 2
Isolation data		
Rated impulse withstand voltage U_{imp} between all isolated circuits IEC/EN 60947-1, IEC/EN 60664-1,VDE 0110-1)	input circuit / PE	8 kV
Pollution degree (IEC/EN 60664-1, VDE 0110-1)		3
Overvoltage category (IEC/EN 60664-1, VDE 0110-1)		III
Rated insulation voltage U_i (IEC/EN 60947-1, IEC/EN 60664-1,VDE 0110-1)	input circuit / PE	1000 V
Test voltage between all isolated circuits, routine test (IEC/EN 60255-5, IEC/EN 61010-1)	input circuit / PE	3.3 kV, 50 Hz, 1 s
Standards		
Product standard		IEC/EN 61557-8, IEC/EN 60255-6
Other standards		EN 50178
Low Voltage Directive		2006/95/EC
EMC Directive		2004/108/EC
RoHS Directive		2002/95/EC
Electromagnetic compability		
Interference immunity to		IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61326-2-4
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV / 8 kV
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3, 10 V/m (1 GHz) / 3 V/m (2 GHz) / 1 V/m (2.7 GHz)
electrical fast transient/burst	IEC/EN 61000-4-4	Level 3, 2 kV / 5 kHz
surge	IEC/EN 61000-4-5	Level 3, installation class 3, supply circuit and measuring circuit 1 kV L-L, 2 kV L-earth
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	Level 3
harmonics and interharmonics	IEC/EN 61000-4-13	Level 3
Interference emission		IEC/EN 61000-6-3, IEC/EN 61000-6-4
high-frequency radiated	IEC/CISPR 22, EN 50022	Class B
high-frequency conducted	IEC/CISPR 22, EN 50022	Class B

Insulation monitoring relays for unearthed supply systems
Notes

Motor load monitoring relays
Product picture

Motor load monitoring relays
Table of contents

Motor load monitoring relays
Fields of application

The motor load monitor relay monitors the load states of single-phase and three-phase asynchronous motors.
The evaluation of the phase angle between current and voltage allows a very precise monitoring of the load states.

Compared with other conventional measuring principles (e.g. pressure transducers, current measurement), cos φ monitoring is a more precise and economical alternative.
The motor is used as a sensor for its own load status.

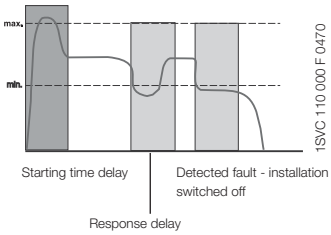
2

Main applications

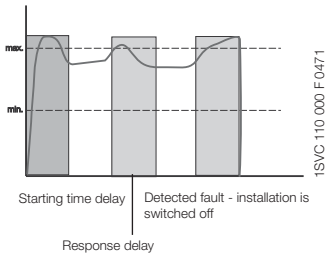
- Pump monitoring
  - Dry-running protection (underload)
  - Closed valves (overload)
  - Pipe break (overload)
- Heating, air-conditioning, ventilation
  - Monitoring of filter pollution
  - V-belt breakage (underload)
  - Closed shutters/valves (overload)
  - Air ventilating volume
- Agitating machines
  - High consistency within the tank (overload)
  - Pollution of the tank (overload)
- Transport/Conveyance
  - Congested conveyor belts (overload)
  - Jamming of belts (overload)
  - Material accumulation in spiral conveyors (overload)
  - Lifting platforms
- Machine installation
  - Wear of tools, e.g. worn saw blades in circular saws, etc. (overload)
  - Tool breakage (underload)
  - V-belt drives (breakage underload)

Pump control

Dry-running protection

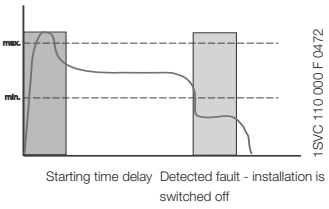


Filter pollution

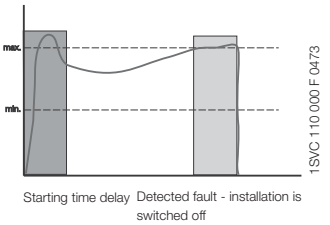


Ventilator monitoring

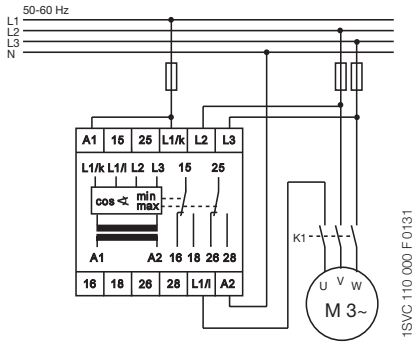
V-belt monitoring

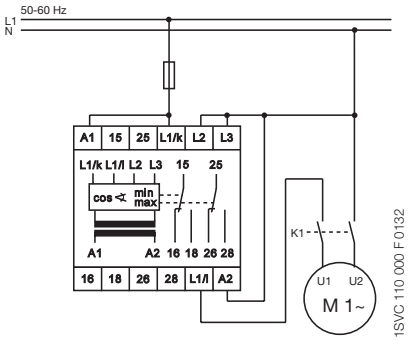


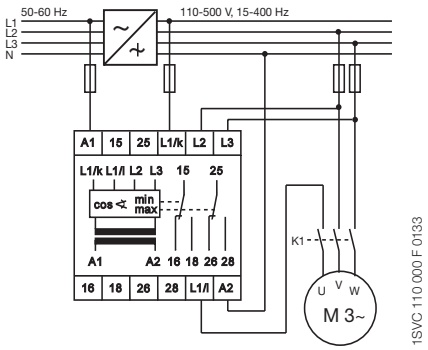
Filter pollution

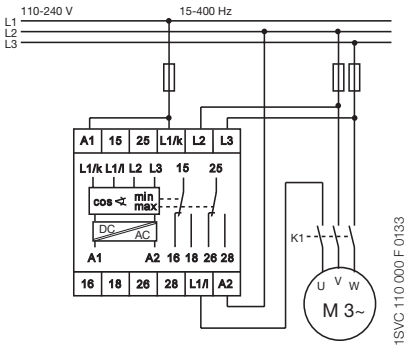


Wiring examples (for motor currents ≤ 20 A)

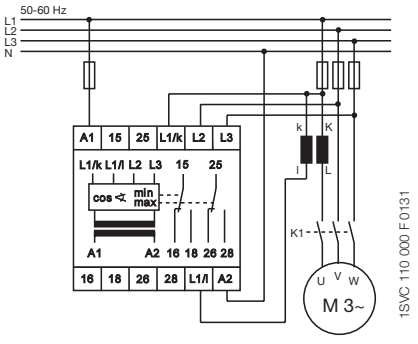


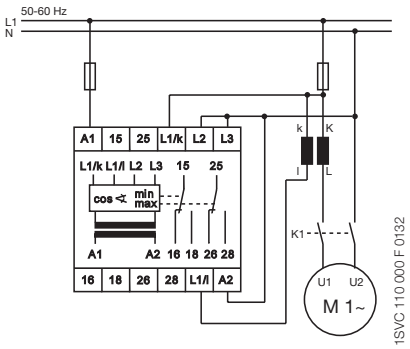






Wiring examples (for motor currents ≥ 20 A)





• Current transformers 2/103

Motor load monitoring relays
Ordering details

CM-LWN

Description

The motor load monitor CM-LWN monitors the load of single-phase and three-phase asynchronous motors. The evaluation of the phase angle between current and voltage (cos φ monitoring) allows a very precise monitoring of the load status.

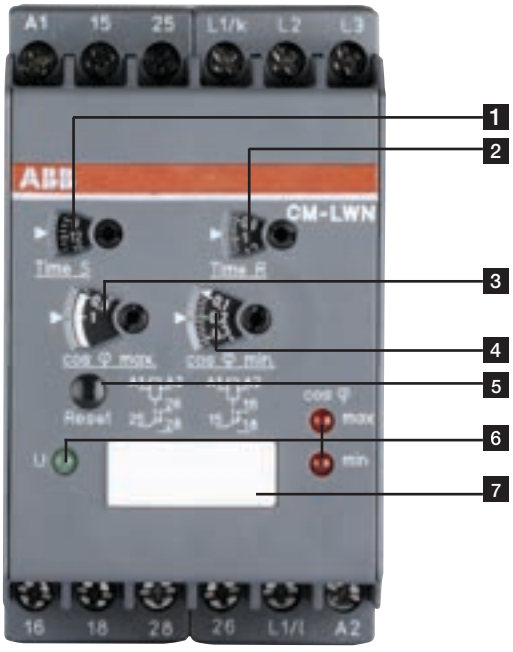
Ordering details

Rated control supply voltage = measuring voltage	Current range	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC	0.5-5 A	CM-LWN	1SVR450335R0000		0.30 (0.66)
110-130 V AC			1SVR450330R0000		0.30 (0.66)
220-240 V AC			1SVR450331R0000		0.30 (0.66)
380- 440 V AC			1SVR450332R0000		0.30 (0.66)
480-500 V AC			1SVR450334R0000		0.30 (0.66)
24-240 V AC/DC	2-20 A		1SVR450335R0100		0.30 (0.66)
110-130 V AC			1SVR450330R0100		0.30 (0.66)
220-240 V AC			1SVR450331R0100		0.30 (0.66)
380- 440 V AC			1SVR450332R0100		0.30 (0.66)
480-500 V AC			1SVR450334R0100		0.30 (0.66)

Current transformers see page 2/132.

Characteristics

- Pump monitoring
- Under- and overload monitoring cos φ in one unit
- Adjustable starting delay 0.3-30 s
- Direct measurement of currents up to 20 A
- Adjustable response time delay 0.2-2 s
- Single-phase or three-phase monitoring
- 2 x 1 c/o contact, closed-circuit principle
- 3 LEDs for status indication



1 **Starting delay „Time S“**
2 **Response delay „Time R“**
3 **Threshold for load limit cos φ_{max}**
4 **Threshold for load limit cos φ_{min}**
5 **Reset button**
6 **Indication of operational states**
U: green LED – control supply voltage
cos φ_{max}: red LED – cos φ_{max} exceeded
cos φ_{min}: red LED – below cos φ_{min}
7 **Marker label**

Motor load monitoring relays
Technical information

The **CM-LWN** module monitors the load status of inductive loads.

The primary application is the monitoring of single- or three-phase asynchronous motors (squirrel cage) under varying load conditions. The measuring principle is based on the evaluation of the phase shift (φ) between the voltage and the current in one phase.

The phase difference is nearly inversely proportional to the load. Therefore, cos φ, measured relatively from 0 to 1, measures the relationship of effective power to apparent power. A value towards 0 indicates low load and a value towards 1 indicates high load.

Threshold values can be set individually for cos φ_{max} and cos φ_{min} If the set threshold value is reached, a LED lights up and the relay is de-energized.

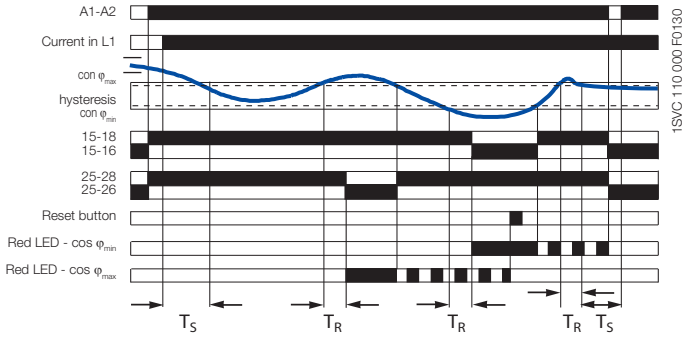
If cos φ returns to the acceptable limits (taking into account the hysteresis), the relay is reset to its original state and the LED flashes permanently to indicate the occurrence of the trip event. This message can be deleted using the reset button or by switching off the supply.

A time delay (Time S) of 0.3 to 30 s can be set for the starting phase of the motor. It is also possible to set a response delay time (Time R) of 0.2 to 2 s to suppress unwanted tripping due to unavoidable short load changes during normal operation.

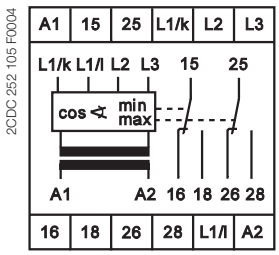
To guarantee correct operation of the response delay (Time R), the adjusted value for cos φ_{max} has to be higher than the value for cos φ_{min} plus the hysteresis. Consequently, the overload and underload indication must not be active at the same time.

Due to the internal electrical isolation of the supply circuit and the measuring circuit, it is also possible to use the device in systems with different supply voltages.

Function diagram - CM-LWN



Connection diagram CM-LWN



A1-A2	Rated control supply voltage
L1/K-L1/L	Measuring current
L1/K-L2-L3	Measuring voltage
15-16/18	Output contacts - underload (cos φ_{min})
25-26/28	Output contacts - overload (cos φ_{max}) closed-circuit principle

Motor load monitoring relays
Technical data

Type			CM-LWN
Input circuit - Supply circuit			**A1-A2**
Rated control supply voltage U_s - power consumption		A1-A2	24-240 V AC/DC approx. 8.4 VA/W
		A1-A2	110-130 V AC approx. 3.6 VA
		A1-A2	220-240 V AC approx. 3.6 VA
		A1-A2	380-440 V AC approx. 3.6 VA
		A1-A2	480-500 V AC approx. 3.6 VA
Rated control supply voltage U_s tolerance			-15 %...+10 %
Rated frequency		AC versions	50-60 Hz
		AC/DC versions	15-400 Hz or DC
Duty time			100 %
Measuring circuit			**L1/L-L1/K-L2-L3**
Monitoring function			Motor load monitoring by cos φ
Voltage range		L1/K-L2-L3	110-500 V AC single-phase or three-phase
Current range		L1/L-L1/K	0.5-5 A version 2-20 A version
Permissible overload of current input			25 A for 3 s 100 A for 3 s
Thresholds			cos φ_{min} and cos φ_{max} adjustable from 0 to 1
Hysteresis (related to phase angle φ in °)			4°
Frequency of measuring voltage			15-400 Hz
Response time			300 ms
Timing circuits			**indication of over- and undervoltage fault**
Start-up time (Time S)			0.3-30 s, adjustable
Response delay (Time R)			0.2-2 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			
Control supply voltage			U: green LED
below cos φ_{min}			cos φ_{min}: red LED
cos φ_{max} exceeded			cos φ_{max}: red LED
Output circuits			**15-16/18, 25-26/28**
Kind of output			2 x 1 c/o contact
Operational principle			closed-circuit principle [1]
Contact material			AgCdO
Rated voltage (VDE 0110, IEC 664-1, IEC 947-1)			250 V
Max. switching voltage			400 V AC, 300 V DC
Rated operational current I_e (IEC/EN 60947-1)		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		at AC12, 230 V, 4 A	0.1 x 10^6 switching cycles
Max. fuse rating to achieve short-circuit protection		n/c / n/o contact	10 A fast-acting / 10 A fast-acting
General data			
Dimensions (W x H x D)			45 mm x 78 mm x 100 mm (1.77 inch x 3.07 inch x 3.94 inch)
Mounting position			any
Degree of protection		housing / terminals	IP50 / IP20
Ambient temperature range		operation / storage	-25...+65 °C / -40...+85 °C
Mounting			DIN rail (IEC/EN 60715)
Electrical connection			
Wire size		fine-strand with wire end ferrule	2 x 2.5 mm² (2 x 14 AWG)
Standards			
Product standard			IEC 255-6, EN 60255-6
Low Voltage Directive			2006/95/EC
EMC Directive			2004/108/EC, 91/263/EEC, 92/31/EEC, 93/68/EEC, 93/67/EEC
Electromagnetic compatibility			**EN 61000-6-2, EN 61000-6-4**
electrostatic discharge		IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	Level 3 (10 V/m)
electrical fast transient / burst		IEC/EN 61000-4-4	Level 3 (2 kV / 5 kHz)
surge		IEC/EN 61000-4-5	Level 4 (2 kV L-L)
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 3 (10 V)
Operational reliability (IEC 68-2-6)			5 g
Mechanical resistance (IEC 68-2-6)			10 g
Environmental testing (IEC 68-2-30)			24 h cycle time, 55 °C, 93 % rel., 96 h
Isolation data			
Rating (HD 625.1 S1, VDE 0110, IEC 664-1, IEC 60255-5)			
Rated insulation voltage between supply-, measuring- and output circuit			250 V, 400 V, 500 V depending on the version
Rated impulse withstand voltage between all isolated circuits			4 kV / 1.2 - 50 µs
Test voltage between all isolated circuits			2,5 kV, 50 Hz, 1 min.
Pollution category			3
Overvoltage category			III

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

Motor control and protection
Product group picture

Motor control and protection
Table of contents

Motor control and protection
Benefits and advantages

UMC100-FBP is a flexible, modular and expandable motor management system for constant-speed low-voltage range motors.
It's most important tasks include motor protection, prevention of plant standstills and the reduction of down time. This is made possible by early information relating to possible motor problems which avoids unplanned plant standstills. Even if a motor trips, quick diagnosis of the cause of the fault serves to reduce downtime.

UMC100-FBP combines in a very compact unit:

Motor protection
- Overload, underload
- Overvoltage, undervoltage
- Blocked rotor, low / high current
- Phase failure, imbalance, phase sequence
- Earth leakage
- Thermistor protection
- Limitation of starts per time
- One single version with integrated measuring system covers the rated motor current from 0,24 to 63 A

Motor control
- Integrated and easy to parametrize motor starter functions like direct, reverse, star-delta,...
- Additionally free programmable logic for application specific control functions
- Expansion modules DX111, DX122 for more I/Os
- Expansion modules VI150, VI155 for 3-phase voltage measuring

Motor diagnostics
- Quick and comprehensive access to all relevant data via fieldbus and/or operator panel
- Current, thermal load
- Phase voltages
- Power factor
- Energy

Communication
- Communication-independent basic device
- Freely selectable fieldbus protocol with FieldBusPlug
- Profibus DP
- DeviceNet
- Modbus RTU
- Ethernet Modbus TCP
- CANopen

Typical application segments
- Oil & gas
- Cement
- Paper
- Mining
- Steel
- Chemical industry

Further information

UMC & FBP Catalog	2CDC 190 022 C0205
UMC & FBP Brochure	2CDC 135 011 B0203

Motor control and protection
Technical data

Basic device UMC100-FBP

UMC100-FBP allows the connection of one I/O-expansion module DX111 or DX122, and one voltage module VI150 or VI155. Expansion modules are connected via 2-wire bus, the max. distance to UMC100-FBP is 3 m.

Main power	
Voltage	max 1000 V AC
Frequency	45 to 65 Hz
Rated motor current	0.24 to 63 A, without accessories
	Greater currents with transformer
Transformer diameter	11 mm (max 25 mm²)
Tripping classes	5, 10, 20, 30, 40 in accordance with EN/IEC 60947-4-1
Short-circuit protection	Separate fuse on network side

Control unit	
Supply voltage	24 V DC
Reverse polarity protection	yes
Inputs	6 digital inputs 24 V DC
	1 PTC input
Outputs	3 relay outputs relay
	1 digital output transistor
Interfaces	1 for ABB FieldBusPlug
	1 for UMC100-PAN control station
	1 for expansion module
Parametric assignment	via fieldbus, control station and / or software
Addressing	Control station or addressing set
LEDs	3 LEDs: green, yellow, red

Environment and mechanical data	
Fastening	on DIN busbar (EN50022-35) or with 4 screws x M4
Dimensions (W x H x D)	70 x 105 x 110 mm (incl. FieldBusPlug and control panel)
Weight	0.39 kg
Terminal cross-section	max. 2.5 mm² or 2 x 1.5 mm²

I/O-expansion modules DX111 / DX122

Expansion modules to increase the number of I/Os of a UMC100-FBP. Easy use of inputs by parametrizing for fault or warning; individual message on operator panel configurable.

Supply voltage		24 V DC
Inputs	DX111	8 digital inputs 24 V DC
	DX122	8 digital inputs 110/230 V AC
Outputs		4 relay outputs relay 1 analogue output, 0/4 to 20 mA / 0 to 10 V configurable
Fastening		on DIN busbar (EN50022-35)
Dimensions (W x H x D)		45 x 77 x 100 mm (without terminal block)

Motor control and protection
Technical data

Voltage expansion modules

Measures the 3 phase voltages of a motor. Different versions for use in grounded and ungrounded networks.

Supply voltage		24 V DC
Inputs	VI150	3 analogue inputs 150 - 690 V AC
		For use in grounded networks
		Maximum operation altitude 2000 m
	VI155	3 analogue inputs 150 - 690 V AC
		For use in all networks
		Maximum operation altitude > 2000 m
Outputs		1 relay output
Fastening		on DIN busbar (EN50022-35)
Dimensions (W x H x D)		22.5 x 77 x 100 mm (without terminal block)

Ethernet-Modbus TCP interface MTQ22-FBP

Ethernet connectivity for up to four UMC100. Supports all network topologies.

Supply voltage	24 V DC (+30 % ... -20 %) (19.2 ... 31.2 V DC) including ripple
Current consumption	Max. 180 mA (at 19.2 ... 31.2 V DC)
Pollution degree terminals	3
Total power dissipation	max. 3.5 W
Short-circuit protection at port 1 ... 4	PTC resistor
Reverse polarity protection of supply inputs	Yes

Motor control and protection
Notes

Thermistor motor protection relays
Product group picture

Thermistor motor protection relays
Table of contents

Thermistor motor protection relays
Benefits and advantages, Applications

Operating principle and fields of application for thermistor motor protection relays

The CM range of thermistor motor protection relays are used to control motors equipped with PTC temperature sensors. The PTC temperature sensors are incorporated in the motor windings to measure the motor heating. This enables direct control and evaluation of the following operating conditions:

2

- heavy duty starting
- increased switching frequency
- single-phase operation
- high ambient temperature
- insufficient cooling
- break operation
- unbalance

The relay is independent of the rated motor current, the insulation class and the method of starting.

The PTC sensors are connected in series to the terminals T_a and T_b (or T_a and T_{bx} without short-circuit detection). The number of possible PTC sensors per measuring circuit is limited by the sum of the individual PTC sensor resistances: $R_G = R_1 + R_2 + R_N \leq 1.5\ k\Omega$.

Under normal operating conditions the resistance is below the response threshold. If only one of the PTC resistors heats up excessively, the output relay de-energizes. If the autoreset function is configured, the output relay energizes automatically after cooling down.

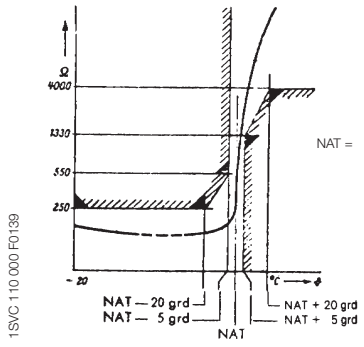
Devices with manual (push button on front-side) or remote reset configuration have to be controlled via the control input by the required signal.

Further applications:

Temperature monitoring of equipment with PTC sensors integrated, such as:

- machine rolling bearings,
- hot-air ventilators,
- oil,
- air,
- heating installations, etc.

Resistance characteristic
for one single temperature sensor acc. to DIN 44 081.



CM-MSE

- Auto reset
- Connection of several sensors (max. 6 sensors conn. in series)
- Monitoring of bimetals
- 1 n/o contact
- Excellent cost / performance ratio

CM-MSS (1), 1 c/o contact

- Auto reset
- Connection of several sensors
- Monitoring of bimetals
- 1 c/o contact
- 2 LEDs for status indication

CM-MSS (2), 2 c/o contacts

- Fault storage can be switched off
- Auto reset configurable
- Reset button
- Remote reset
- Monitoring of bimetals
- 2 c/o contacts
- 2 LEDs for status indication

CM-MSS (3), 2 c/o contacts, short-circuit monitoring configurable

- Fault storage can be switched off
- Auto reset configurable
- Reset button
- Remote reset
- Monitoring of bimetals
- Short-circuit monitoring of the sensor circuit configurable
- 2 c/o contacts
- 2 LEDs for status indication

CM-MSS (4) + CM-MSS (5), 1-channel

- Short-circuit monitoring of the sensor circuit
- Wide supply voltage range: 24-240 V AC/DC
- Non-volatile fault storage selectable
- Reset and test button
- Remote reset
- Auto reset configurable
- Output contacts: 1 n/c and 1 n/o or 2 c/o contacts
- 2 LEDs for status indication

CM-MSS (6), 2-channel, single evaluation

- Short-circuit monitoring for the sensor circuits
- Wide supply voltage range: 24-240 V AC/DC
- 2 separate sensor circuits for monitoring of two motors or one motor with 2 sensor circuits (prewarning and final switch off)
- Reset button
- Auto reset configurable
- Output contacts: 2 x 1 c/o contact
- 3 LEDs for status indication

CM-MSS (7), 3 sensor circuits, accumulative evaluation

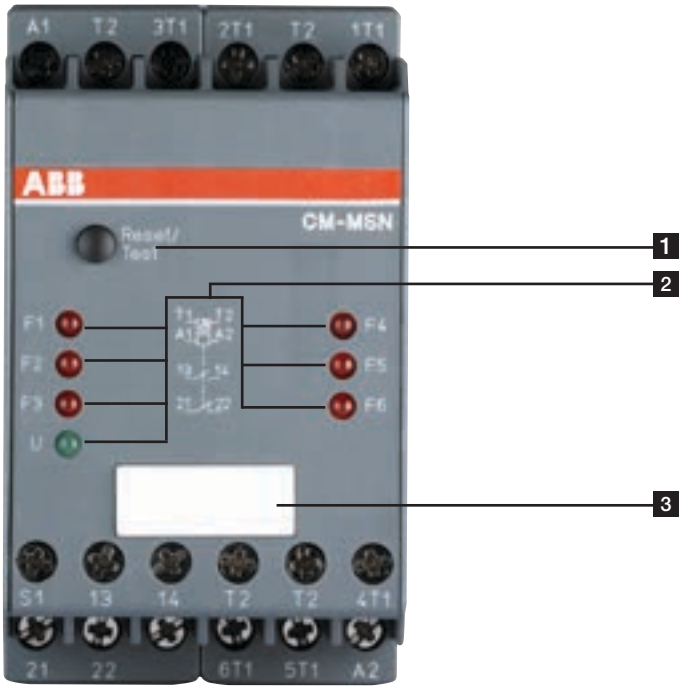
- Short-circuit monitoring for the sensor circuits
- Wide supply voltage range 24-240 V AC/DC
- Non-volatile fault storage configurable
- Remote reset
- Auto reset configurable
- Reset and test button
- Output contacts: 1 n/c and 1 n/o contact
- 4 LEDs for status indication

CM-MSN, 6 sensor circuits, accumulative evaluation

- Short-circuit monitoring of the sensor circuit
- Wide supply voltage range: 24-240 V AC/DC
- Non-volatile fault storage configurable
- Remote reset
- Auto reset configurable
- Reset and test button
- Output contacts: 1 n/c, 1 n/o contact
- 7 LEDs for status indication

accumulative evaluation = if any input exeeds the threshold, the output relay will trip

Thermistor motor protection relays
Operating controls



1 **Reset / Test button**

2 **Indication of operational states**
U: green LED – control supply voltage
F: red 1-6 LED – fault message

3 **Marker label**

Thermistor motor protection relays
Selection table thermistor motor protection relays

	Order number	1SVR 550 805 R9300	1SVR 550 800 R9300	1SVR 550 801 R9300	1SVR 430 800 R9100	1SVR 430 800 R9100	1SVR 430 811 R9300	1SVR 430 811 R9300	1SVR 430 811 R0300	1SVR 430 811 R1300	1SVR 430 710 R9300	1SVR 430 711 R0300	1SVR 430 711 R1300	1SVR 430 711 R2300	1SVR 430 720 R0400	1SVR 430 720 R0300	1SVR 430 710 R0200	1SVR 430 720 R0500	1SVR 450 025 R0100
	Type	CM-MSE			CM-MSS (1)		CM-MSS (2)				CM-MSS (3)				CM-MSS (4)	CM-MSS (5)	CM-MSS (6)	CM-MSS (7)	CM-MSN
Function																			
Number of sensor circuits		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	6
Wire break monitoring		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Short-circuit detection [1]											■	■	■	■	■	■	■	■	■
Non-volatile fault storage [2]															■	■		■	■
Operation / Reset																			
Auto reset		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Manual reset							■	■	■	■	■	■	■	■	■	■	■	■	■
Remote reset							■	■	■	■	■	■	■	■	■	■	■	■	■
Test button															■	■	■	■	■
Output contacts																			
Operational principle		Closed-circuit principle																	
1 n/o		■	■	■															
1 c/o					■	■													
2 c/o							■	■	■	■	■	■	■	■		■			
1 n/o + 1 n/c															■				
1 c/o per sensor circuit																	■		
1 n/o + 1 n/c accumulative evaluation																		■	■
Width of housing																			
22.5 mm		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
45 mm																			■
Supply voltages																			
24 V AC		■					■												
24 V AC/DC					■			■			■								
110-130 V AC			■						■			■							
220-240 V AC				■		■				■			■						
380-440 V AC														■					
24-240 V AC/DC															■	■	■	■	■

[1] For CM-MSS (3): configurable via terminals
[2] Auto reset without non-volatile fault storage configurable by permanent jumpering of connection terminals S1-T2 or S1/X1-S2/X2

Thermistor motor protection relays
Ordering details


2CDC 251 012 F0003

CM-MSE


2CDC 251 047 F0004

CM-MSS (5)


1SVR 450 025 F0400

CM-MSN

Description

The thermistor motor protection relays CM-MSE, CM-MSS and CM-MSN are used to control motors equipped with PTC temperature sensors. The PTC temperature sensors are incorporated in the motor windings to measure the motor heating. This enables direct control and evaluation of various operating conditions. Depending on the products also ATEX approvals for use in hazardous areas are availabe.
ABB also offers PTC temperature sensors C011 (according to DIN 44081) which are suitable for embedding in motor windings.

Ordering details

Rated control supply voltage = measuring voltage	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24 V AC	CM-MSE	1SVR550805R9300		0.11 (0.24)
110-130 V AC		1SVR550800R9300		0.11 (0.24)
220-240 V AC		1SVR550801R9300		0.11 (0.24)
24 V AC/DC [1]	CM-MSS (1)	1SVR430800R9100		0.15 (0.33)
220-240 V AC		1SVR430801R1100		0.15 (0.33)
24 V AC/DC [1]	CM-MSS (2)	1SVR430810R9300		0.15 (0.33)
24 V AC		1SVR430811R9300		0.15 (0.33)
110-130 V AC		1SVR430811R0300		0.15 (0.33)
220-240 V AC		1SVR430811R1300		0.15 (0.33)
24 V AC/DC [1]	CM-MSS (3) [4]	1SVR430710R9300		0.15 (0.33)
110-130 V AC		1SVR430711R0300		0.15 (0.33)
220-240 V AC		1SVR430711R1300		0.15 (0.33)
380-440 V AC		1SVR430711R2300		0.15 (0.33)
24-240 V AC/DC	CM-MSS (4) [2] [4]	1SVR430720R0400		0.15 (0.33)
	CM-MSS (5) [3] [4]	1SVR430720R0300		0.15 (0.33)
	CM-MSS (6) [4]	1SVR430710R0200		0.15 (0.33)
	CM-MSS (7) [4]	1SVR430720R0500		0.15 (0.33)
	CM-MSN [4]	1SVR450025R0100		0.23 (0.51)

[1] Not electrically isolated
[2] CM-MSS (4): 1-channel 1 n/c, 1 n/o
[3] CM-MSS (5): 1-channel 2 c/o
[4] Ex

Thermistor motor protection relays
Ordering details - PTC temperature sensors C011

Description

The PTC temperature sensors (temperature-dependent with positive temperature coefficient) are selected by the manufacturer of the motor depending on:

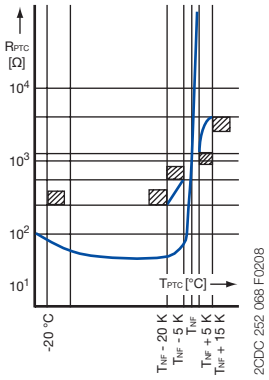
- the motor insulation class according to IEC/EN 60034-11,
- the special characteristics of the motor, such as the conductor cross-section of the windings, the permissible overload factor etc.
- special conditions prescribed by the user, such as the permissible ambient temperature, risks resulting from locked rotor, extent of permitted overload etc.

One temperature sensor must be embedded in each phase winding. For instance, in case of three-phase squirrel cage motors, three sensors are embedded in the stator windings. For pole-changing motors with one winding (Dahlander connection), 3 sensors are also sufficient. Pole-changing motors with two windings, however, require

The sensors are suitable for embedding in motor windings with rated operating voltages of up to 600 V AC. Conductor length: 500 mm per sensor. A 14 V varistor can be connected in parallel to protect the sensors from overvoltage. Due to their characteristics, the thermistor motor protection relays can also be used with PTC temperature sensors of other manufacturers which comply with DIN 44 081 and DIN 44 082 6 sensors.

If an additional warning is required before the motor is switched off, separate sensors for a correspondingly lower temperature must be embedded in the winding. They have to be connected to a second control unit.

Temperature sensor characteristics



Ordering details

Rated response temperature T_{NF}	Color coding	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
70 °C	white-brown	C011-70[1]	GHC0110003R0001		0.02 (0.044)
80 °C	white-white	C011-80[1]	GHC0110003R0002		0.02 (0.044)
90 °C	green-green	C011-90[1]	GHC0110003R0003		0.02 (0.044)
100 °C	red-red	C011-100[1]	GHC0110003R0004		0.02 (0.044)
110 °C	brown-brown	C011-110[1]	GHC0110003R0005		0.02 (0.044)
120 °C	gray-gray	C011-120[1]	GHC0110003R0006		0.02 (0.044)
130 °C	blue-blue	C011-130[1]	GHC0110003R0007		0.02 (0.044)
140 °C	white-blue	C011-140[1]	GHC0110003R0011		0.02 (0.044)
150 °C	black-black	C011-150[1]	GHC0110003R0008		0.02 (0.044)
160 °C	blue-red	C011-160[1]	GHC0110003R0009		0.02 (0.044)
170 °C	white-green	C011-170[1]	GHC0110003R0010		0.02 (0.044)
150 °C	black-black	C011-3-150[2]	GHC0110033R0008		0.05 (0.11)

[1] Temperature sensor C011, standard version acc. to DIN 44081
[2] Triple temperature sensor C011-3

Technical data

Characteristic data	Sensor type C011
Cold-state resistance	50 -100 Ω at 25 °C
Warm-state resistance ± 5 up to 6 K of rated response temperature T_{NF}	10 000 Ω
Thermal time constant, sensor open [1]	< 5 s
Permitted ambient temperature	+180 °C

Rated response temperature ± tolerance $T_{NF} \pm \Delta T_{NF}$	PTC resistance R from -20 °C to T_{NF} - 20 K	PTC resistance R[2] at PTC temperatures of: $T_{NF} - \Delta T_{NF}$ (UPTC ≤ 2.5 V)	$T_{NF} + \Delta T_{NF}$ (UPTC ≤ 2.5 V)	T_{NF} + 15 K (UPTC ≤ 7.5 V)
70 ±5 °C	≤ 100 Ω	≤ 570 Ω	≥ 570 Ω	-
80 ±5 °C				
90 ±5 °C		≤ 550 Ω	≥ 1330 Ω	≥ 4000 Ω
100 ±5 °C				
110 ±5 °C				
120 ±5 °C				
130 ±5 °C				
140 ±5 °C				
150 ±5 °C				
160 ±5 °C				
170 ±7 °C		≤ 570 Ω	≥ 570 Ω	-

[1] Not embedded in windings. [2] For triple temperature sensor take values x 3.

Thermistor motor protection relays
Technical data

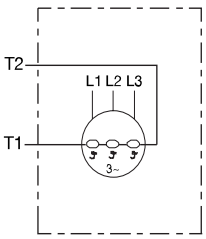
Type			CM-MSE	CM-MSS	CM-MSN
Input circuit					
Rated control supply voltage U_s power consumption		A1-A2	24 V AC approx. 1.5 VA		
		A1-A2	24 V AC/DC approx. 1.1 VA / 0.6 W		
		A1-A2	110-130 V AC approx. 1.5 VA		
		A1-A2	220-240 V AC approx. 1.5 VA		
		A1-A2	380-440 V AC approx. 1.7 VA		
		A1-A2	24-240 V AC/DC approx. 1.4-1.7 W / approx. 3.5-5.7 VA		
Rated control supply voltage U_s tolerance			-15 % ... +10 %		
Rated frequency			AC: 50-60 Hz / 24-240 V AC/DC versions: 15-400 Hz		
Duty time			100 %		
Measuring circuit			**T1-T2**	**T1-T2/T2x, 1T1...6T1-T2**	**1T1...6T1-T2**
Monitoring function			temperature monitoring by means of PTC sensors		
Number of senor circuits			1	1, 2 oder 3 (see order. details)	6
Short-circuit monitoring			-	see ordering details	yes
Non-volatile fault storage			-	see ordering details	configurable
Test function			-	see ordering details	yes
Sensor circuit					
Temperature threshold (relay de-energizes)			2.7-3.7 kΩ	CM-MSS (1+2): 3050±550 Ω CM-MSS (3-7): 3.6 kΩ ±5 %	3.6 kΩ ±5 %
Temperature hysteresis (relay energizes)			1.7-2.3 kΩ	CM-MSS (1+2): 1900±400 Ω CM-MSS (3-7): 1.6 kΩ ±5 %	1.6 kΩ ±5 %
Short-circuit threshold (relay de-energizes)			<18 Ω		
Short-circuit hysteresis (relay energizes)			>45 Ω		
Maximum total resistance of sensors connected in series (cold state)			≤1.5 kΩ		
Maximum sensor cable length for short-circuit detection			2 x 100 m at 0.75 mm², 2 x 400 m at 2.5 mm²		
Response time			<100 ms		
Control circuit for storage and hysteresis function					
Remote reset		S1-T2 or S1/X1-S2/X2	-	n/o contact	
Maximum no-load voltage			-	approx. 25 V, 24-240 V; AC/DC versions: 5.5 V	
Maximum cable length			-	≤ 50 m, 100-200 m if shielded	
Indication of operational states					
Control supply voltage		U: green LED	-	⎍: control supply voltage applied	
Fault indication		F: red LED	-	⎍: output relay de-energized	
Output circuits			**13-14**	**11-12/14, 21-22/24, 13-14, 21-22**	**13-14, 21-22**
Kind of output			1 n/o contact	CM-MSS (1): 1 c/o contact CM-MSS (2,3,5): 2 c/o contacts CM-MSS (4, 7): 1 n/o + 1 n/c CM-MSS (6): 2x1 c/o contact	1 n/o + 1 n/c contact
Operational principle			closed-circuit principle (output relay de-energizes if the measured value exceeds/drops below the adjusted threshold)		
Contact material			AgCdO	CM-MSS (1+2+6): AgCdO CM-MSS (3+4+5+7): AgNi	AgNi
Rated voltage		(VDE 0110, IEC 664-1, IEC 60947-1)	250 V		
Maximum switching voltage			250 V		
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) at 230 V	4 A		
		AC15 (inductive) at 230 V	3 A		
		DC12 (resistive) at 24 V	4 A		
		DC13 (resistive) at 24 V	2 A (1.5 A - n/c contact[1)])		
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)				
	max. rated operational voltage		300 V AC		
	max. continuous thermal current at B 300		5 A		
	max. making/breaking apparent power at B300		3600/360 VA		
Mechanical lifetime			30 (10 [1)]) x 10⁶ switching cycles		
Electrical lifetime (AC12, 230 V, 4 A)			0.1 x 10⁶ switching cycles		
Max. fuse rating to achieve short-circuit protection		n/c contact	10 A fast-acting	4 A (10 A[1)]) fast-acting	10 A fast-acting
		n/o contact	10 A fast-acting	6 A (10 A[1)]) fast-acting	10 A fast-acting
General data					
Dimensions (W x H x D)			22.5 x 78 x 78.5 mm (0.89 x 3.07 x 3.09 in)	22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in)	45 x 78 x 100 mm (1.77 x 3.07 x 3.94 in)
Weight			approx. 0.11 kg (0.24 lb)	approx. 0.15 kg (0.33 lb)	approx. 0.23 kg (0.51 lb)
Mounting position			any		
Degree of protection		housing / terminals	IP50 / IP20		
Ambient temperature range		operation	-20...+60 °C		-25...+65 °C
		storage	-40...+85 °C		
Mounting			DIN rail (IEC/EN 60715)		

[1)] 1SVR 430 710 R 0200, 1SVR 430 8xx R xxxx

Thermistor motor protection relays
Technical data,

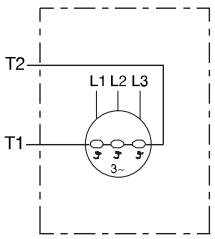
Type		CM-MSE	CM-MSS	CM-MSN
Electrical connection				
Wire size	fine strand with wire end ferrule	2 x 1.5 mm² (2 x 16 AWG)	2 x 2.5 mm² (2 x 14 AWG)	
	fine strand without wire end ferrule	2 x 0.75-1.5 mm² (2 x 18-16 AWG)	2 x 0.75-2.5 mm² (2 x 18-14 AWG)	
	rigid	2 x 1-1.5 mm² (2 x 18-16 AWG)	2 x 0.5-4 mm² (2 x 20-12 AWG)	
Stripping length		2 x 0.75-1.5 mm² (2 x 18-16 AWG)	2 x 0.5-4 mm² (2 x 20-12 AWG)	
Tightening torque		10 mm (0.39 inch)	7 mm (0.28 inch)	
Standards				
Product standard		IEC 255-6, EN 60255-6		
Low Voltage Directive		2006/95/EC		
EMC Directive		2004/108/EC, 91/263/EEC, 92/31/EEC, 93/68/EEC, 93/67/EEC		
Electromagnetic compatibility		**EN 61000-6-2, EN 61000-6-4**		
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)		
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)		
electrical fast transient /burst	IEC/EN 61000-4-4	Level 3 (2 kV / 5 kHz)		
surge	IEC/EN 61000-4-5	Level 3/4 (1/2 kV)		
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 (10 V)		
Operational reliability (IEC 68-2-6)		6 g	4 g	5 g
Resistance to vibration (IEC 68-2-6)		10 g	6 g	10 g
Environmental testing (IEC 68-2-30)		24 h cycle time, 55 °C, 93 % rel., 96 h		
Isolation data				
Rated voltage between supply, measuring and output circuit		250 V		
Rated impulse withstand voltage between all isolated circuits		4 kV / 1.2 - 50 µs		
Test voltage between all isolated circuits		2.5 kV, 50 Hz, 1 min.		
Pollution degree		3		
Overvoltage category		III		

CM-MSE



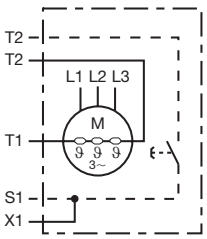
1SVC 110 000 F0141

CM-MSS(1)



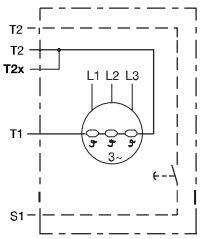
1SVC 110 000 F0141

CM-MSS(2)



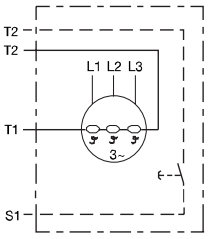
2CDC 252 123 F0607

CM-MSS(3)



1SVC 110 000 F0144

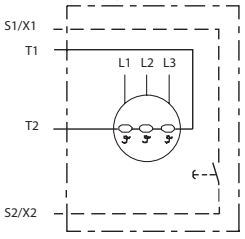
CM-MSS (4)



1SVC 110 000 F0145

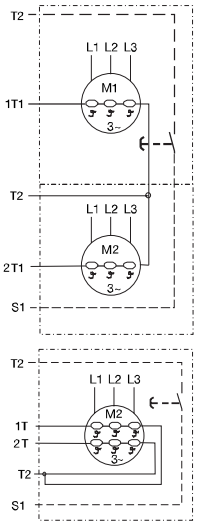
jumper = no storage

CM-MSS (5)



2CDC 252 044 F0004

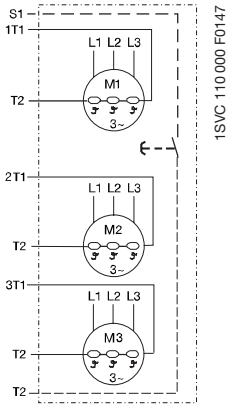
CM-MSS(6)



1SVC 110 000 F0146

S1-T2 jumpered = no storage

CM-MSS(7)

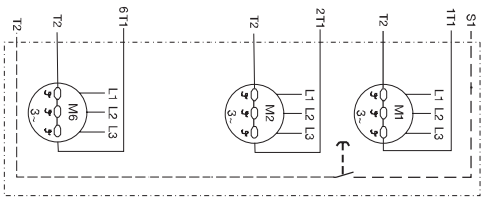


1SVC 110 000 F0147

1T1-T2 Sensor circuits
2T1-T2
3T1-T2

S1-T2 Remote reset jumpered = no storage

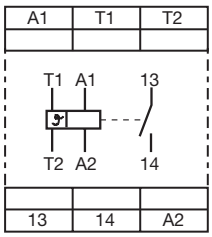
CM-MSN



1SVC 110 000 F0521

Thermistor motor protection relays
Connection diagrams

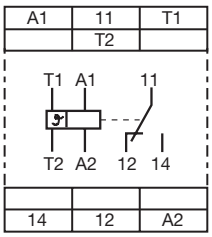
CM-MSE



1SVC 110 000 F0140

A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
13-14 Output contact - Closed-circuit principle

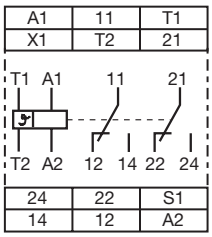
CM-MSS(1)



1SVC 110 000 F0142

A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
11-12/14 Output contact - Closed-circuit principle

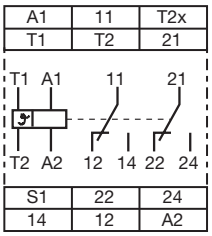
CM-MSS(2)



1SVC 110 000 F519

A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
S1-T2 Remote reset X1-T2 jumper = no storage
11-12/14
21-22/24 Output contacts - Closed-circuit principle

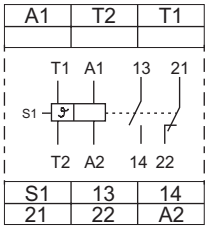
CM-MSS(3)



1SVC 110 000 F0143

A1-A2 Rated control supply voltage
S1-T2 Remote reset jumper = without storage
T1-T2x measuring circuit without short-circuit monitoring
T1-T2 measuring circuit with short-circuit monitoring
11-12/14
21-22/24 Output contacts - Closed-circuit principle

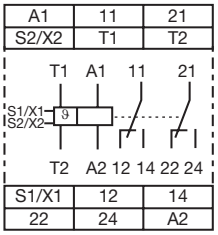
CM-MSS (4)



2CDC 252 016 F0004

A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
S1-T2 Remote reset
13-14
21-22 Output contacts - Closed-circuit principle

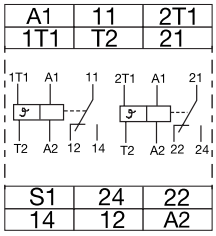
CM-MSS (5)



2CDC 252 147 F0b06

A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
S1/X1-S2/X2 Reset
11-12/14
21-22/24 Output contacts - Closed-circuit principle

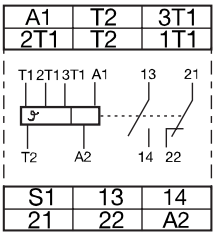
CM-MSS(6)



1SVC 110 000 F0148

A1-A2 Rated control supply voltage
11-12/14,
21-22/24 Output contacts - Closed-circuit principle
1T1-T2
2T1-T2 Sensor circuit

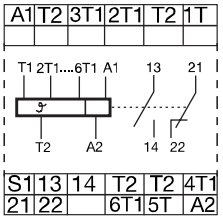
CM-MSS(7)



1SVC 110 000 F0149

A1-A2 Rated control supply voltage
13-14
21-22 Output contacts - Closed-circuit principle

CM-MSN



1SVC 110 000 F0150

A1-A2 Rated control supply voltage
13-14
21-22 Output contacts - Closed-circuit principle

Temperature monitoring relays
Product group picture

Temperature monitoring relays
Table of contents

Temperature monitoring relays
Benefits and advantages, Applications

Overview

The temperature monitoring relays can be used for temperature measurement in solid, liquid and gaseous media. The temperature is acquired by the sensor in the medium, evaluated by the device and monitored to determine whether it is within an operating range (range monitoring function) or has exceeded or fallen below a threshold.

Functional description

The temperature monitoring relays CM-TCS monitor overtemperature, undertemperature, or temperatures between two threshold values (window monitoring) with PT100 sensor. As soon as the temperature falls below or exceeds the threshold value the output relays change their positions according to the configured functionality and the front-face LEDs display the current status. Regardless of the selected configuration, the device is monitoring its measuring circuit for interrupted wires or short-circuits.

Characteristics CM-TCS

- Adjustable sensor type: PT100
- Functionality like overtemperature monitoring, undertemperature monitoring, temperature window monitoring configurable
- All configurations and adjustments by front-face operating elements
- Precise adjustment with direct reading scales
- One or two threshold values
- Hysteresis 2...20 % adjustable
- Operating temperature range -40...+60 °C
- 1 x 2 c/o or 2 x 1 c/o configurable
- Open- or closed-circuit principle configurable
- Short-circuit monitoring and interrupted wire detection
- 22.5 mm (0.89 in) width
- LEDs for status indication

Characteristics C512 + C513

- Adjustable sensor types: PT100, PT1000, KTY83, KTY84, NTC-B57227-K333-A1
- Measuring principle for 2-wire and 3-wire sensors
- Temperature monitor for 1-3 sensor circuits
- Adjustable over-, undertemperature monitoring or range monitoring function
- 2 thresholds
- Hysteresis for both thresholds (1-99 Kelvin)
- Adjustable time delay from 0-999 s affects to both thresholds
- Storage function selectable via external signal (Y1-Y2)
- Non volatile storage of parameter settings
- 1 n/o (for wire-break and short-circuit detection) and 2 c/o
- Multifunctional digital display
- 3 LEDs for status indication
- Open- or closed-circuit principle selectable
- 45 mm wide housing with 24 terminals

C512

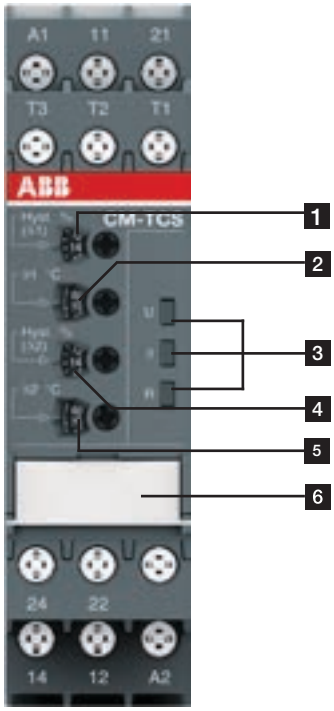
- Temperature monitor for 1 sensor circuit

C513

- Temperature monitor for 1-3 sensor circuits
- In the 3-sensor version the status of the single sensors is displayed if the temperature exceeds or falls below the threshold. This way it can be easily determined which one of the connected sensors has exceeded or dropped below either one or both threshold values.

Temperature monitoring relays
Operating controls

S-Range Housing



1 **Adjustment of the hysteresis for threshold value ϑ1**

2 **Adjustment of the threshold value ϑ1**

3 **Indication of operational states**
U: green LED – status indication of control supply voltage
ϑ: red LED – fault message, state of measuring input
R: yellow LED – status indication of the output relays

4 **Adjustment of the hysteresis for threshold value ϑ2**

5 **Adjustment of the threshold value ϑ2**

6 **DIP switch functions / marker label (on page 2/108)**
Overtemperature monitoring
Undertemperature monitoring
Temperature window monitoring activated
Temperature window monitoring de-activated
Closed-circuit principle
Open-circuit principle
2 x 1 c/o (SPDT) contact
1 x 2 c/o (SPDT) contacts

Temperature monitoring relays
Selection

New range																		
Order number	1SVR 730 740 R9100	1SVR 740 740 R9100	1SVR 730 740 R0100	1SVR 740 740 R0100	1SVR 730 740 R9200	1SVR 740 740 R9200	1SVR 730 740 R0200	1SVR 740 740 R0200	1SVR 730 740 R9300	1SVR 740 740 R9300	1SVR 730 740 R0300	1SVR 740 740 R0300		1SAR 700 016 R0005	1SAR 700 016 R0010	1SAR 700 016 R0010
Type	CM-TCS.21S	CM-TCS.21P	CM-TCS.11S	CM-TCS.11P	CM-TCS.22S	CM-TCS.22P	CM-TCS.12S	CM-TCS.12P	CM-TCS.23S	CM-TCS.23P	CM-TCS.13S	CM-TCS.13P		C512-24	C512-W	C513-W
Rated control supply voltage U_s																
24 V AC/DC	■	■			■	■			■	■				■		
24-240 V AC/DC			■	■			■	■			■	■			■	■
Technology																
analogue	■	■	■	■	■	■	■	■	■	■	■	■				
digital														■	■	■
Sensor circuits (2 or 3 wire)																
number of temperature sensors	1	1	1	1	1	1	1	1	1	1	1	1		1	1	3
number of thresholds	2	2	2	2	2	2	2	2	2	2	2	2		2	2	3
Sensor type																
PT100	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
PT100, KTY83, KTY84, NTC, PT1000														■	■	■
Measuring temperature range																
-50...+50 °C	■	■	■	■												
0...+100 °C					■	■	■	■								
0...+200 °C									■	■	■	■				
-50...+500 °C														■	■	■
Monitoring function																
overtemperature	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
undertemperature	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
window temperature	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Operating principle																
open or closed principle	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Output contacts																
n/o														1	1	1
c/o	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2

Temperature monitoring relays
Ordering details

Description

Acquisition, messaging and regulation of temperatures of solid, liquid and gaseous media in processes and machines via PT100, PT1000, KTY83, KTY84 or NTC sensors.
ABB offers different temperature monitoring relays to meet the needs of your application:

CM-TCS

Ordering details - Temperature monitoring relays PT100 sensors, 2 or 3 wire connection, 2 thresholds adjustable

Rated control supply voltage	Measuring range	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24-240 V AC/DC	-50...+50 °C	CM-TCS.11S	1SVR730740R0100		0.151 (0.333)
		CM-TCS.11P	1SVR740740R0100		0.140 (0.309)
	0...+100 °C	CM-TCS.12S	1SVR730740R0200		0.151 (0.333)
		CM-TCS.12P	1SVR740740R0200		0.140 (0.309)
	0...+200 °C	CM-TCS.13S	1SVR730740R0300		0.151 (0.333)
		CM-TCS.13P	1SVR740740R0300		0.140 (0.309)
24 V AC/DC	-50...+50 °C	CM-TCS.21S	1SVR730740R9100		0.138 (0.304)
		CM-TCS.21P	1SVR740740R9100		0.127 (0.280)
	0...+100 °C	CM-TCS.22S	1SVR730740R9200		0.138 (0.304)
		CM-TCS.22P	1SVR740740R9200		0.127 (0.280)
	0...+200 °C	CM-TCS.23S	1SVR730740R9300		0.138 (0.304)
		CM-TCS.23P	1SVR740740R9300		0.127 (0.280)

C512, C513

Ordering details - Temperature monitoring relays C51x range with display and digital setup

Rated control supply voltage	Measuring range	Type [2]	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24 V AC/DC	-50...+500 °C [1]	C512-24	1SAR700100R0005		0.32 (0.71)
24-240 V AC/DC		C512-W	1SAR700100R0010		0.33 (0.73)
24-240 V AC/DC		C513-W	1SAR700110R0010		0.34 (0.75)

[1] The measuring range depends on the used sensor type:

- PT100: -50...+500 °C
- PT1000: -50...+500 °C
- NTC: +80...+160 °C

(Typ Siemens Matsushita B57272-A333-A1 - 100 °C: 1,8 kΩ, 25 °C: 32,762 kΩ)

- KTY84: -40...+300 °C
- KTY83: -50...+175 °C

[3] PT100 sensors, PT1000, KTY83, KTY84, NTC-B57227-K333-A1, 2 or 3 wire connection, 2 thresholds, multifunctional display Open- or closed-circuit principle adjustable, 1 n/o, 2 c/o contacts

Ordering details - Replaceable cover marking for digital devices

Use for	Language	Type	Order code	Price 5 pces	Weight (1 pce) kg (lb)
C512	German	C512-D	1SVR700101R0100		
C512	English	C512-E	1SVR700102R0100		
C513	German	C513-D	1SVR700111R0100		
C513	English	C513-E	1SVR700112R0100		

Temperature monitoring relays
Function diagrams

CM-TCS - Overtemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

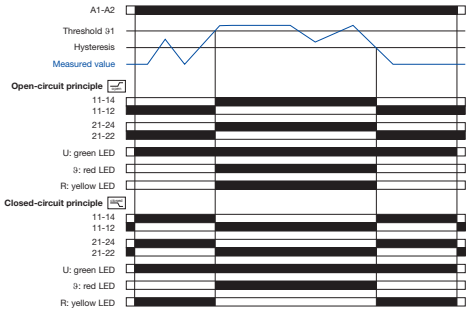
With this configuration, settings via ϑ2 have no influence on the operating function (ϑ2 disabled).

Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value ϑ1, the output relays energize. If the measured value drops again below the adjusted threshold value ϑ1 minus the adjusted hysteresis, the output relays de-energize.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 008 F0209

Undertemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

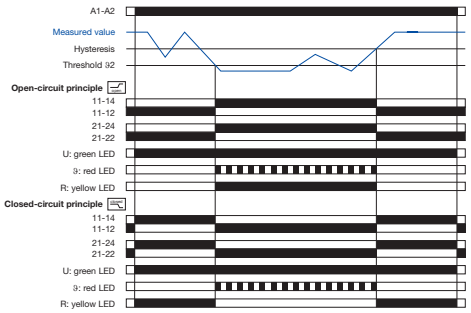
With this configuration, settings via ϑ1 have no influence on the operating function (ϑ1 disabled).

Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value drops below the adjusted threshold value ϑ2, the output relays energize. If the measured value exceeds again the adjusted threshold value ϑ2 plus the adjusted hysteresis, the output relays de-energize.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 010 F0209

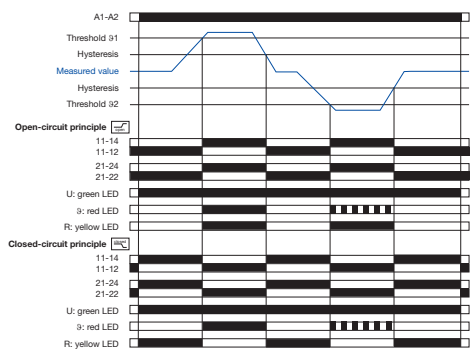
Temperature window monitoring, 1 x 2 c/o contacts 1x2 c/o

Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value ϑ1 or drops below the adjusted threshold value ϑ2, the output relays energize. If the measured value drops again below the adjusted threshold value t_v minus the adjusted hysteresis or exceeds again the adjusted threshold value ϑ2 plus the adjusted hysteresis, the output relays de-energize.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 012 F0209

Overtemperature monitoring, 2 x 1 c/o contact 2x1 c/o

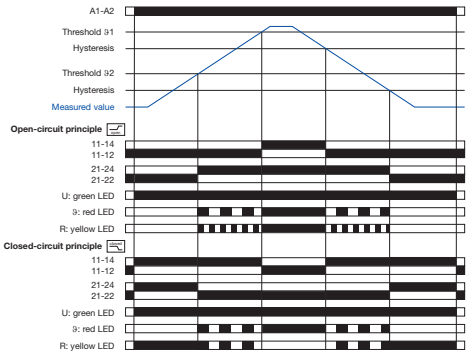
Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value ϑ2, output relay R2 (prewarning) energizes. If the measured value exceeds the adjusted threshold value ϑ1, output relay R1 (final switch-off) energizes.

If the measured value drops again below the adjusted threshold value ϑ1 minus the adjusted hysteresis, output relay R1 (final switch-off) de-energizes. If the measured value drops below the adjusted threshold value ϑ2 minus the adjusted hysteresis, output relay R2 (prewarning) de-energizes.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 009 F0209

Undertemperature monitoring, 2 x 1 c/o contact 2x1 c/o

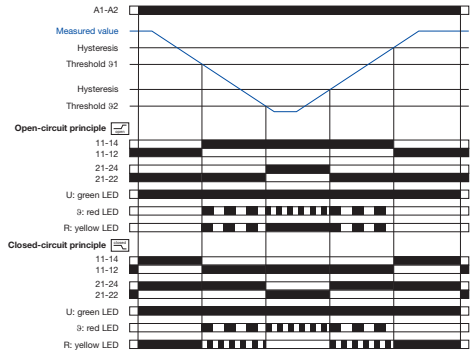
Open-circuit principle:

If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value drops below the adjusted threshold value ϑ1, output relay R1 (prewarning) energizes. If the measured value drops below the adjusted threshold value ϑ2, output relay R2 (final switch-off) energizes.

If the measured value exceeds again the adjusted threshold value ϑ2 plus the adjusted hysteresis, output relay R2 (final switch-off) de-energizes. If the measured value exceeds the adjusted threshold value ϑ1 plus the adjusted hysteresis, output relay R1 (prewarning) de-energizes.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 011 F0209

Temperature window monitoring, 2 x 1 c/o contact 2x1 c/o

Open-circuit principle:

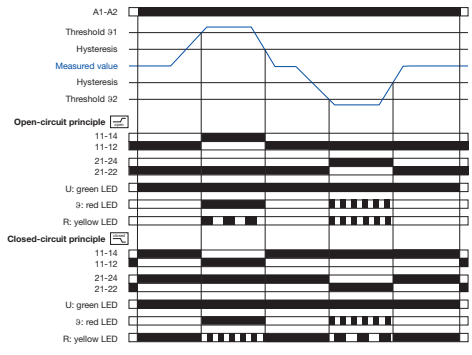
If the measured value is correct, the output relays remain de-energized when control supply voltage is applied.

If the measured value exceeds the adjusted threshold value ϑ1 or drops below the adjusted threshold value ϑ2, output relay R1 (> ϑ1) or R2 (< ϑ2) respectively energizes.

If the measured value drops again below the adjusted threshold value ϑ1 minus the adjusted hysteresis or exceeds again the adjusted threshold value ϑ2 plus the adjusted hysteresis, output relay R1 (>ϑ1) or R2 (<ϑ2) respectively de-energizes.

Closed-circuit principle:

The behavior is inverse to the one with open-circuit principle.



2CDC 252 013 F0209

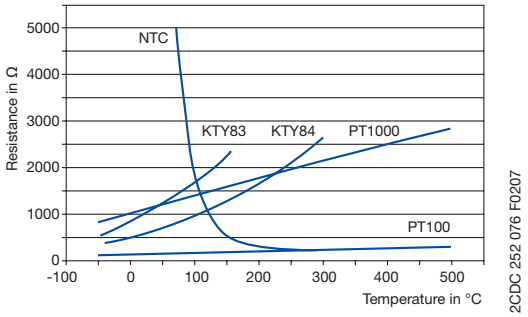
Temperature monitoring relays
Overview, Functional description and diagrams

Functional description

Digital tripping devices

Once the temperature has reached the set threshold of υ1, output relay K1 changes its switching state after the set time delay t has elapsed (K2 reacts in the same way for υ2).

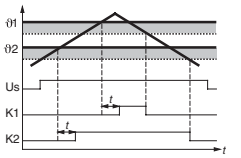
Characteristic curves of resistance sensors



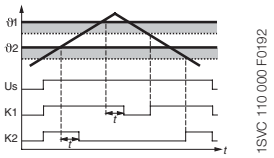
Function diagrams

Overtemperature - C512/C513

Open-circuit principle

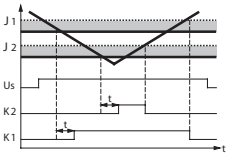


Closed-circuit principle

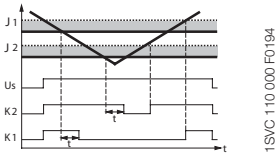


Undertemperature - C512/C513

Open-circuit principle

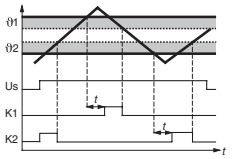


Closed-circuit principle

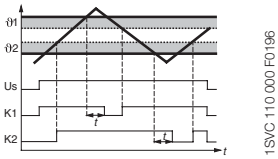


Range monitoring - C512/C513

Open-circuit principle

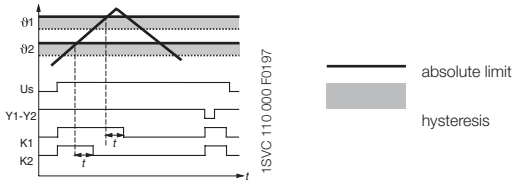


Closed-circuit principle



Function principle with storage function - C512/C513

using overtemperature with closed-circuit principle as an example



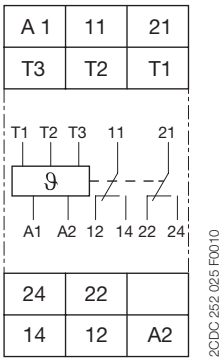
DIP switches CM-TCS

Position	4	3	2	1
ON ↑	2x1 c/o	closed		
OFF	1x2 c/o	open		

	ON	OFF (default)
DIP switch 1 Monitoring principle	Overtemperature monitoring If overtemperature monitoring is selected, the CM-TCS recognizes temperatures above the selected threshold and trips the output relay according to the selected operating principle.	Undertemperature monitoring If undertemperature monitoring is selected, the CM-TCS recognizes temperatures below the selected threshold and trips the output relay according to the selected operating principle.
DIP switch 2 Temperature window monitoring	Temperature window monitoring activated If temperature window monitoring is selected, the CM-TCS monitors over- and undertemperature. If temperature window monitoring is activated, DIP switch 1 is disabled.	Temperature window monitoring de-activated Temperature window monitoring is de-selected.
DIP switch 3 Operating principle of the output relays	Closed-circuit principle If closed-circuit principle is selected, the output relays are energized. They de-energize if a fault is occuring.	Open-circuit principle If open-circuit principle is selected, the output relays are deenergized. They energize if a fault is occuring.
DIP switch 4 2 x 1 c/o contact, 1 x 2 c/o contacts	2 x 1 c/o (SPDT) contact If operating principle 2 x 1 c/o contact is selected, the output relay R1 (11-12/14) reacts to threshold value t_1 and the output relay R2 (21-22/24) reacts to threshold value t_2.	1 x 2 c/o (SPDT) contacts If operating principle 1 x 2 c/o contacts is selected, both output relays R1 (11-12/14) and R2 (21-22/24) react synchronously to one threshold value. Overtemperature monitoring: Settings of the threshold value t_2 have no effect on the operation. Undertemperature monitoring: Settings of the threshold values t_2 have no effect on the operation.

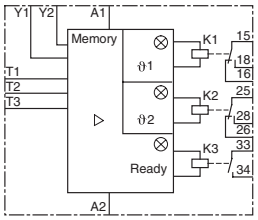
Temperature monitoring relays
Connection diagrams, Resistance thermometer sensors

Connection diagrams



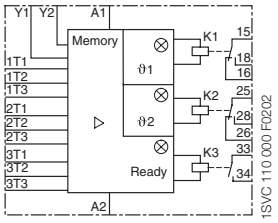
CM-TCS

A1-A2 Control supply voltage
11-12/14 Output relay R1
21-22/24 Output relay R2
T1, T2, T3 Measuring input, connection PT100



C512

A1-A2 Rated control suppy voltage
15-16/18 Output contacts
25-26/28
33-34
T1-T3 Sensor connection
Y1-Y2 Connection for storage bridge



C513

A1-A2 Rated control suppy voltage
15-16/18 Output contacts
25-26/28
33-34
1T1-1T3 Sensor connection 1
2T1-2T3 Sensor connection 2
3T1-3T3 Sensor connection 3
Y1-Y2 Connection for storage bridge

Connection of resistance thermometer sensors

2-wire measurement

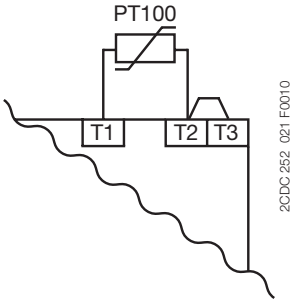
When using 2-wire temperature sensors the sensor resistance and the wire resistance are added together.

The resulting systematic errors must be taken into account when adjusting the tripping device.

A jumper must be connected between the terminals T2 and T3.

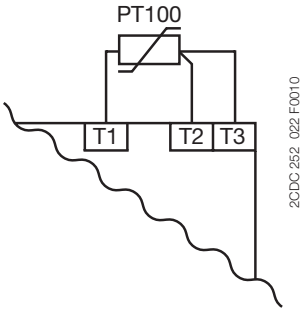
The following table can be used for PT100 sensors to determine the temperature errors caused by the line length.

When using resistance sensors with two-wire connection a bridge must be inserted between terminals T2 and T3.



3-wire measurement

To minimize the influence of the wire resistance, a three-wire connection is usually used.
By means of the additional wire two measuring circuits are created. One of these two circuits is used for reference. This way, the tripping device can calculate and take into account the wire resistance automatically.



Error caused by the line

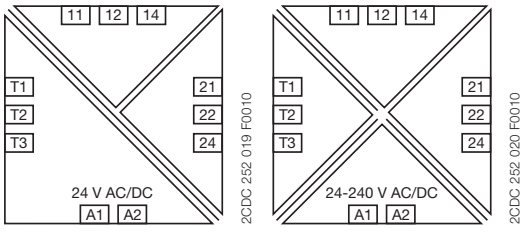
The error resulting from the line resistance amounts to approx. 2.5 Kelvin/Ohm. If the resistance of the line is not known and it is not possible to measure it, the error caused by the line can be estimated using the following table.

Temperature error

(depending on the line length and conductor cross section for PT100 sensors at an ambient temperature of 20 °C, in K)

Line length in m	Wire size mm²			
	0.50	0.75	1	1.5
0	0.0	0.0	0.0	0.0
10	1.8	1.2	0.9	0.6
25	4.5	3.0	2.3	1.5
50	9.0	6.0	4.5	3.0
75	13.6	9.0	6.8	4.5
100	18.1	12.1	9.0	6.0
200	36.3	24.2	18.1	12.1
500	91.6	60.8	45.5	30.2

Electrical isolation



Electrical isolation

Protective searation acc. to IEC/EN 61140; EN 50178

Temperature monitoring relays
Technical data - CM-TCS.xx

Type			CM-TCS.11/12/13	CM-TCS.21/22/23
Input circuit				
Rated control supply voltage U_s		A1-A2	24-240 V AC/DC	24 V AC/DC
Rated control supply voltage U_s tolerance			-15...+10 %	
Typical current / power / consumption		24 V DC	33 mA / 0.8 VA	18 mA / 0.45 VA
		115 V AC	12.5 mA / 1.5 VA	n/a
		230 V AC	13 mA / 2.9 VA	n/a
Rated frequency		AC	15-400 Hz	50/60 Hz
Frequency range		AC	13.5-440 Hz	45-65 Hz
Power failure buffering time		min.	20 ms	
Measuring circuit			**T1, T2, T3**	
Sensor type			PT100	
Connection of the sensor		2-wire	yes, jumper between T2-T3	
		3-wire	yes, use terminal T1, T2, T3	
Monitoring function			overtemperature, undertemperature or window monitoring	
Threshold values adjustable within the measuring range		CM-TCS.x1	-50...+50 °C	
		CM-TCS.x2	0...+100 °C	
		CM-TCS.x3	0...+200 °C	
Number of possible thresholds			2	
Tolerance of the adjusted threshold value			typ. ±5 % of the range end value	
Hysteresis related to the threshold value			2-20 % of threshold value, min. 1 °C	
Measuring principle			continuous current	
Typical current in the sensor circuit			0.8 mA	
Maximum current in sensor circuit			0.9 mA	
Interrupted wire detection			yes, indicated via LED status	
Short-circuit detection			yes, indicated via LED status	
Accuracy within the rated control supply voltage tolerance			< 0.2 °C / or < 0.01 %/K	
Accuracy within the temperature range			< 0.2 °C / or < 0.01 %/K	
Repeat accuracy (constant parameters)			< 0.2 % of full scale	
Maximum measuring cycle			320 ms	
Output circuit				
Kind of output			2 x 1 or 1 x 2 c/o (SPDT) contacts configurable	
Operating principle			open- or closed-circuit principle configurable [1]	
Contact material			AgNi alloy, Cd free	
Rated operational voltage (IEC/EN 60947-1)			250 V AC / 300 V DC	
Minimum switching voltage / Minimum switching current			24 V / 10 mA	
Maximum switching voltage / Maximum switching current			see 'Load limit curves'	
Rated operating current I_e (IEC/EN 60947-1-5)		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 (UL508)		utilization category	B 300, pilot duty general purpose (250 V, 4 A, cos φ 0.75)	
		maximum rated operational voltage	250 V AC	
		maximum continuous thermal current at B 300	4 A	
		maximum 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	
Maximum fuse rating to achieve short-circuit protection		n/c contact	6 A fast-acting	
		n/o contact	10 A fast-acting	
Conventional thermal current I_{th} acc. IEC/EN 60947-1			4 A	
General data				
Dimensions (W x H x D)			22.5 x 85.6 x 103.7 mm (0.89 x 3.37 x 4.08 in)	
Mounting position			any	
			Screw connection technology	**Easy Connect Technology (push-in)**
Weight	net weight	CM-TCS.1x	0.151 kg (0.333 lb)	0.140 kg (0.309 lb)
		CM-TCS.2x	0.138 kg (0.304 lb)	0.127 kg (0.280 lb)
	gross weight	CM-TCS.1x	0.176 kg (0.388 lb)	0.165 kg (0.364 lb)
		CM-TCS.2x	0.163 kg (0.360 lb)	0.152 kg (0.335 lb)
Degree of protection		enclosure / terminals	IP50 / IP20	
Ambient temperature range		operation	-40...+60 °C	
		storage/transport	-40...+85 °C	
Mounting			DIN rail (IEC/EN 60715), snap-on mounting without any tool	

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

Temperature monitoring relays
Technical data - CM-TCS.xx

Type			CM-TCS.11/12/13[1]	CM-TCS.21/22/23
Electrical connection				
Wire size			Screw connection technology	Easy Connect Technology (Push-in)
	fine-strand without wire end ferrule	A1, A2, 11, 12, 14, 21, 22, 24	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) connection with lever
		T1, T2, T3	1 x 0.2-2.5 mm² (1 x 24-14 AWG) 2 x 0.2-1.5 mm² (2 x 24-16 AWG)	2 x 0.2-1.5 mm² (2 x 24-16 AWG) connection with lever
	fine-strand with wire end ferrule	A1, A2, 11, 12, 14, 21, 22, 24	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) connection: push-in
		T1, T2, T3	1 x 0.2-2.5 mm² (1 x 24-14 AWG) 2 x 0.2-1.5 mm² (2 x 24-16 AWG)	2 x 0.2-1.5 mm² (2 x 24-16 AWG) insulated ferrule (DIN 46228-4-E): connection: push-in ferrule (DIN 46228-1-A): < 0.5 mm², connection with lever ≥ 0.5 mm², connection: push-in
	rigid	A1, A2, 11, 12, 14, 21, 22, 24	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) connection: push-in
		T1, T2, T3	1 x 0.2-4 mm² (1 x 24-12 AWG) 2 x 0.2-2.5 mm² (2 x 24-14 AWG)	2 x 0.2-1.5 mm² (2 x 24-16 AWG) < 0.5 mm², connection with lever ≥ 0.5 mm², connection: push-in
Stripping length			8 mm (0.32 in)	
Tightening torque		< 0.5 mm²	0.5 Nm (4.43 lb.in)	-
		≥ 0.5 mm²	0.6 - 0.8 Nm (5.31 - 7.08 lb.in)	-
Standards				
Product standard			IEC/EN 60255-6: 2008	
Other standards			EN 50178, IEC/EN 60204	
Low Voltage Directive			2006/95/EC	
EMC Directive			2004/108/EC	
RoHS Directive			2002/95/EC	
Environmental data				
Ambient temperature ranges		operation/storage/ transport	-40...+60°C/-40...+85°C/-40...+85°C	
Climatic category			3K5 (no condensation, no ice formation)	
Damp heat, cyclic			6 x 24 h cycle, 55 °C, 95 % RH	
Vibration, sinusoidal			Class 2	
Shock			Class 2	
Isolation data				
Rated impulse withstand voltage U_{imp} between all isolated circuits (IEC/EN 60947-1, IEC/EN 60664-1)		supply circuit / measuring circuit	4 kV	-
		supply circuit / output circuits	4 kV	
		measuring circuit / output circuits	4 kV	
		output circuit 1 / output circuit 2	4 kV	
Pollution degree (IEC/EN 60664-1)			3	
Overvoltage category (IEC/EN 60664-1)			III	
Rated insulation voltage U_i (IEC/EN 60947-1, IEC/EN 60664-1)		supply circuit / measuring circuit	300 V	-
		supply circuit / output circuits	300 V	
		measuring circuit / output circuits	300 V	
		output circuit 1 / output circuit 2	300 V	
Basis isolation for rated control supply voltage (IEC/EN 60664-1)		supply circuit / measuring circuit	250 V AC / 300 V DC	-
		supply circuit / output circuits	250 V AC / 300 V DC	
		measuring circuit / output circuits	250 V AC / 300 V DC	
		output circuit 1 / output circuit 2	250 V AC / 300 V DC	
Protective separation (IEC/EN 61140, EN 50178)		supply circuit / measuring circuit	250 V AC / 250 V DC	-
		supply circuit / output circuits	250 V AC / 300 V DC	250 V AC / 250 V DC
		measuring circuit / output circuits	250 V AC / 300 V DC	250 V AC / 250 V DC
Test voltage between all isolated circuits, routine test (IEC/EN 60255-5, IEC/EN 61010-1)		supply circuit / measuring circuit	2.0 kV, 50 Hz, 1 s	-
		supply circuit / output circuits	2.0 kV, 50 Hz, 1 s	
		measuring circuit / output circuits	2.0 kV, 50 Hz, 1 s	
Test voltage between all isolated circuits, type test (IEC/EN 60255-5)		supply circuit / measuring circuit	4.0 kV, 50 Hz, 1 s	-
		supply circuit / output circuits	4.0 kV, 50 Hz, 1 s	
		measuring circuit / output circuits	4.0 kV, 50 Hz, 1 s	
Electromagnetic compatibility				
Interference immunity to			IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61326-2-4	
electrostatic discharge		IEC/EN 61000-4-2	Level 3, 6 kV / 8 kV	
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	Level 3, 10 V/m (1 GHz) / 3 V/m (2 GHz) / 1 V/m (2.7 GHz)	
electrical fast transient/burst		IEC/EN 61000-4-4	Level 3, 2 KV / 5 kHz	
surge		IEC/EN 61000-4-5	Level 3, installation class 3, supply circuit and measuring circuit 1 kV L-L, 2 kV L-earth	
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 3, 10 V	
voltage dips, short interruptions and voltage variations		IEC/EN 61000-4-11	Class 3	
harmonics and interharmonics		IEC/EN 61000-4-13	Class 3	
Interference emission			EN 61000-6-3, EN 61000-6-4	
high-frequency radiated		IEC/CISPR 22, EN 55022	Class B	
high-frequency conducted		IEC/CISPR 22, EN 55022	Class B	

Temperature monitoring relays
Technical data - C51x

Type		C512	C513
Input circuit			
Rated control supply voltage U_s	A1-A2	24 V AC/DC	-
	A1-A2	24-240 V AC/DC	
Power consumption	AC	< 7 VA	
	DC	< 4 W	
Rated control supply voltage U_S tolerance		-15...+10 %	
Rated frequency	AC		
Sensor circuit			
Sensor type		PT100, PT1000, KTY83, KTY84, NTC	
Sensor current	PT100	typ. 1 mA	
	PT1000, KTY83, KTY84, NTC	typ. 0.2 mA	
Wire-break detection		yes (not for NTC)	
Short-circuit detection		yes	
3-wire connection		yes (2-wire connection of sensors with terminals T2 and T3 bridged)	
Measuring circuit			
Setting accuracy at T_a = 20 °C (T_{20})		< ±2 K ± 1 digit	
Accuracy within the temperature range		0.05 °C / °C deviation from T_{20}	
Response time		500 ms	
Hysteresis settings	temperature 1	1-99 kelvin	
	temperature 2	1-99 kelvin	
Tripping delay		0-999 s	
Output circuit			
Kind of output		2 c/o + 1n/o	2 c/o + 1 n/o
Rated operating current I_e (IEC/EN 60947-1-5)	AC12 (resistive) 230 V	n/a	
	AC15 (inductive) 230 V	3 A	
	DC12 (resistive) 24 V	1 A	
	DC13 (inductive) 24 V	0.1 A	
Mechanical lifetime		30 x 10^6 switching cycles	
Electrical lifetime (AC15 at 3 A)		0.1 x 10^5 switching cycles	
Max. fuse rating to achieve short-circuit protection		4 A, operating class gL/gG	
General data			
Dimensions (W x H x D)		45 x 105.9 x 86 mm (1.77 x 4.17 x 3.39 in)	
Tightening torque		0.8-1.2 Nm	
Mounting position		any	
Degree of protection	enclosure / terminals	IP 40 / IP 20	
Ambient temperature range	operation	-25...+60 °C	
	storage	-40...+80 °C	
Mounting		DIN rail (IEC/EN 60715)	
Electrical connection			
Wire size	rigid	1 x 4 mm² (1 x 12 AWG), 2 x 2.5 mm² (2 x 14 AWG)	
	fine-strand with wire end ferrule	1 x 2.5 mm² (1 x 14 AWG), 2 x 1.5 mm² (2 x 16 AWG)	
Standards			
Environmental conditions		IEC 60721-3-3	
Low Voltage Directive		IEC 60947-5-1, VDE 0660	
Electromagnetic compatibility	Interference immunity	EN 61000-6-2	
	Interferenece emission	EN 61000-6-4	
Vibration resistance (IEC 68-2-6)		5-26 Hz / 0.75 mm	
Shock resistance (IEC 68-2-27)		15 g / 11 ms	
Isolation data			
Rated insulation voltage		300 V AC	
Pollution degree		3	

Liquid level monitors and controls
Product group picture

2

Liquid level monitors and controls
Table of contents

Liquid level monitors and controls
Benefits and advantages

CM-ENE MIN/MAX
- Monitoring of pump systems for dry running (ENE MIN) and overflow (ENE MAX)
- Connection of 2 electrodes possible at C and MIN/MAX
- 3 supply voltage versions
- Optimal price/performance ratio
- 1 n/o contact: Open-circuit principle for CM-ENE MIN, Closed-circuit principle for CM-ENE MAX
- LED for status indication

CM-ENS
- Monitoring and control of liquid levels (when draining or filling liquids in tanks)
- Monitoring and control of mixture ratios (conductivity of liquids)
- Adjustable response sensitivity 5-100 kΩ
- 4 supply voltage versions 24 - 415 V AC
- Version with protective separation acc. to VDE 0160
- Cascadable
- 1 c/o contact or 1 n/o and 1 n/c contact
- 2 LEDs for status indication

CM-ENS UP/DOWN
- Monitoring and control of liquid levels
- Selectable function "fill" or "drain"
- Adjustable response sensitivity 5-100 kΩ
- Cascadable
- 1 c/o contact
- 2 LEDs for status indication

CM-ENN
- Monitoring and control of liquid levels (when emptying or filling liquids in tanks)
- Monitoring and control of mixture ratios (conductivity of liquids)
- 3 response sensitivities from 250 Ω - 500 kΩ in one unit
- 5 supply voltage versions 24 V AC/DC - 415 V AC
- Selectable ON- or OFF-delay 0.1-10 s
- 2 c/o contacts
- 2 LEDs for status indication

CM-ENN UP/DOWN
- Liquid level relay with 5 electrode inputs
- Level control with integrated overflow and dry-running protection
- Adjustable response sensitivity 5-100 kΩ
- Cascadable
- 1 c/o contact and 2 n/c contacts as alarm outputs
- 4 LEDs for status indication

Liquid level monitors and controls
Operating controls

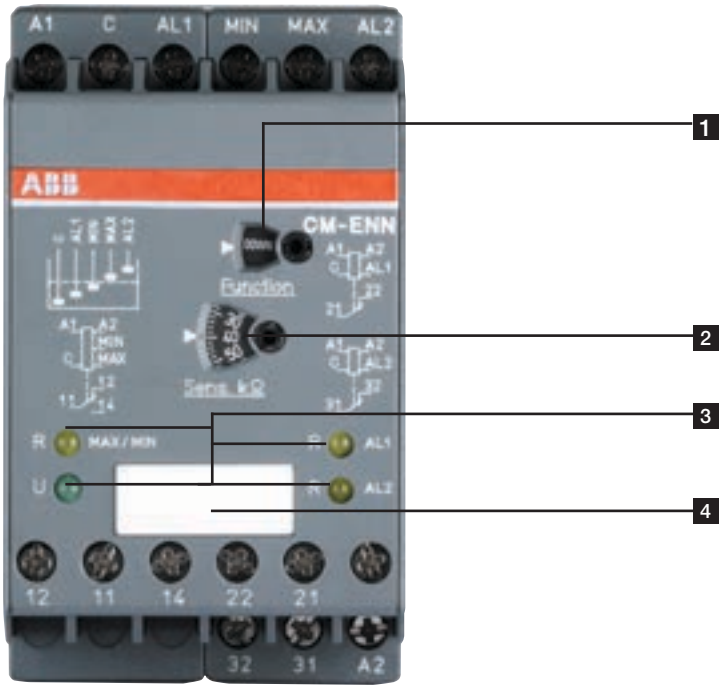
CM-ENS

1 **„Sens.“ - sensitivity potentiometer for adjusting the response sensitivity**

2 **Indication of operational states**
R: yellow LED - relay status
U: green LED -control supply voltage

3 **Marker label**

CM-ENN



1 **„Function.“ - function selector switch:**
„UP“- fi ll
„DOWN“ - drain

2 **„Sens.“ - potentiometer for adjusting the response sensitivity**

3 **Indication of operational states**
R: MIN/MAX: yellow LED - relay status MIN/MAX
U: green LED - control supply voltage
R AL1: yellow LED - relay status AL1
R AL2: yellow LED - relay status AL2

4 **Marker label**

Liquid level monitors and controls
Ordering details

CM-ENE MIN

CM-ENE MAX

CM-ENS

CM-ENN

Description

ABB‘s liquid level monitoring relays for regulation and control of liquid levels and ratios of mixtures of conductive fluids.
The assortment includes single function and multifunction monitoring relays which can be used for overflow and dry-running protection, for filling and draining applications, for max and min alarm or any combination of such functions. Furthermore a wide range of accessories is available

Ordering details

Rated control supply voltage	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24 V AC	CM-ENE MIN	1SVR550855R9500		0.15 (0.33)
110-130 V AC		1SVR550850R9500		0.15 (0.33)
220-240 V AC		1SVR550851R9500		0.15 (0.33)
24 V AC	CM-ENE MAX	1SVR550855R9400		0.15 (0.33)
110-130 V AC		1SVR550850R9400		0.15 (0.33)
220-240 V AC		1SVR550851R9400		0.15 (0.33)
24 V AC	CM-ENS	1SVR430851R9100		0.15 (0.33)
110-130 V AC		1SVR430851R0100		0.15 (0.33)
220-240 V AC		1SVR430851R1100		0.15 (0.33)
380-415 V AC		1SVR430851R2100		0.15 (0.33)
220-240 V AC [1]		1SVR430851R1300		0.15 (0.33)
24 V AC	CM-ENS UP/DOWN	1SVR430851R9200		0.15 (0.33)
110-130 V AC		1SVR430851R0200		0.15 (0.33)
220-240 V AC		1SVR430851R1200		0.15 (0.33)
24-240 V AC/DC	CM-ENN	1SVR450055R0000		0.30 (0.66)
24 V AC		1SVR450059R0000		0.30 (0.66)
110-130 V AC		1SVR450050R0000		0.30 (0.66)
220-240 V AC		1SVR450051R0000		0.30 (0.66)
380-415 V AC		1SVR450052R0000		0.30 (0.66)
24 V AC	CM-ENN UP/DOWN	1SVR450059R0100		0.15 (0.33)
110-130 V AC		1SVR450050R0100		0.15 (0.33)
220-240 V AC		1SVR450051R0100		0.15 (0.33)
380-415 V AC		1SVR450052R0100		0.15 (0.33)

[1] Version with protective separation acc. to VDE 0160, 1 n/o, 1 n/c

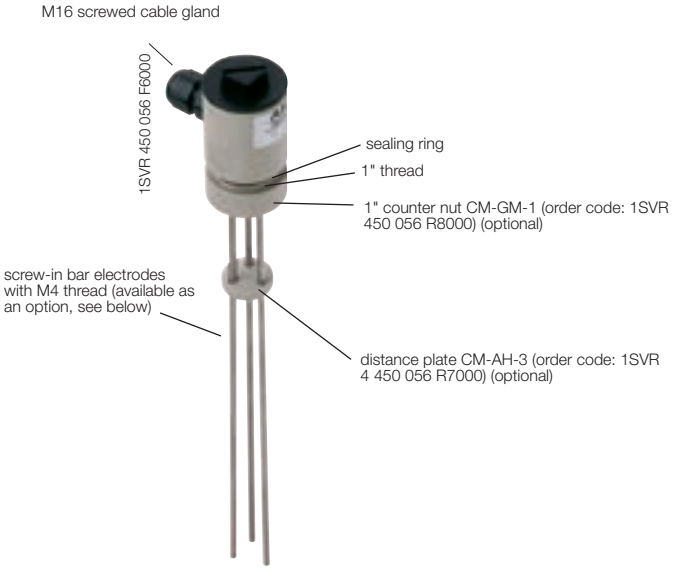
Liquid level monitors are

Suitable for		Not suitable for	
spring water	acids, bases	chemically pure water	ethylene glycol
drinking water	liquid fertilizers	fuel	concentrated alcohol
sea water	milk, beer, coffee	oils	paraffin
sewage	non-concentrated alcohol	explosive areas (liquid gas)	lacquers

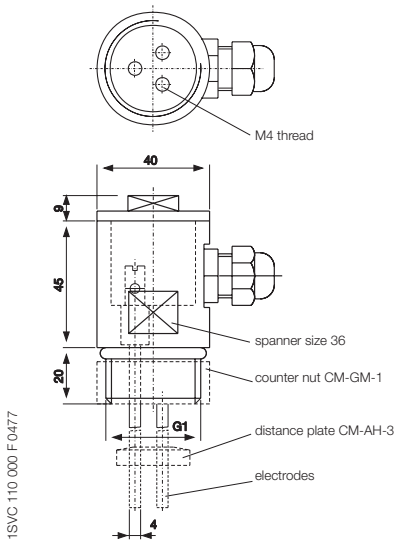
Liquid level monitors and controls
Ordering details - Accessories

Compact support CM-KH-3 for 3 bar electrodes

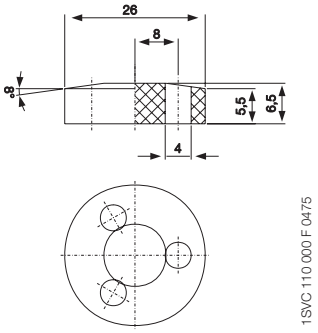
- Ideally suited for use with liquid level relays CM-ENS and CM-ENN
- Wire connection by screw terminals
- Pull relief by M16 screwed cable glands
- Temperature range up to 90 °C
- Food safe material (PPH)
- Screw-in electrodes (M4 thread)
- Distance plate (CM-AH-3) and locking nut (CM-GM-1) optionally available as an accessory



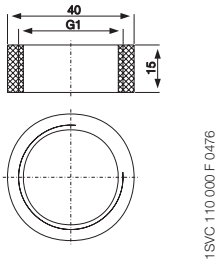
Compact support CM-KH-3 (Dimensions in mm)



Distance plate CM-AH-3



Counter nut CM-GM-1

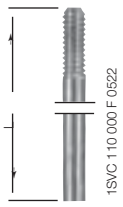


Technical data compact support

Type of mounting:	G 1" thread
Mounting position:	any
Enclosure material:	PPH
Sealing:	NBR 70
Temperature range:	90 °C max.
Pressure:	10 bar max. (60 °C)

Description	Type	Order code	Price	Pkg qty	Weight (1 pce) kg (lb)
Compact support for 3 bar electrodes	CM-KH-3	1SVR450056R6000		1	0.06 (0.132)
Distance plate for 3 bar electrodes	CM-AH-3	1SVR450056R7000			0.06 (0.132)
Counter nut for 1“ thread	CM-GM-1	1SVR450056R8000			0.06 (0.132)

Screw-in bar electrodes for compact support CM-KH-3



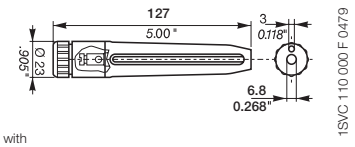
Thread M4

Material: stainless steel 304, high-grade steel 14301

During project engineering the compatibility of the electrode material with the medium to be supervised is to be examined!

Suspension electrode CM-HE

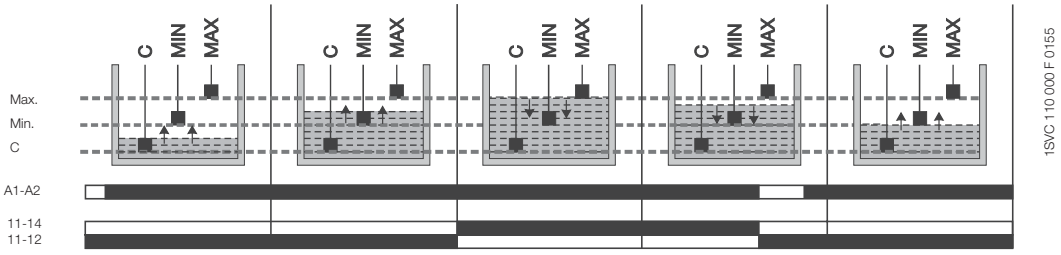
Steel electrode (X14CrMoS17) with sleeve (Hostalen GC 7260) suitable up to 60°C max.



Lenght	Type	Order code	Price	Pkg qty	Weight (1 pce) kg (lb)
300 mm	CM-SE-300	1SVR450056R0000		1	0.08 (0.176)
600 mm	CM-SE-600	1SVR450056R0100			0.08 (0.176)
1000 mm	CM-SE-1000	1SVR450056R0200			0.08 (0.176)
CM-HE	CM-HE	1SVR402902R0000			0.08 (0.176)

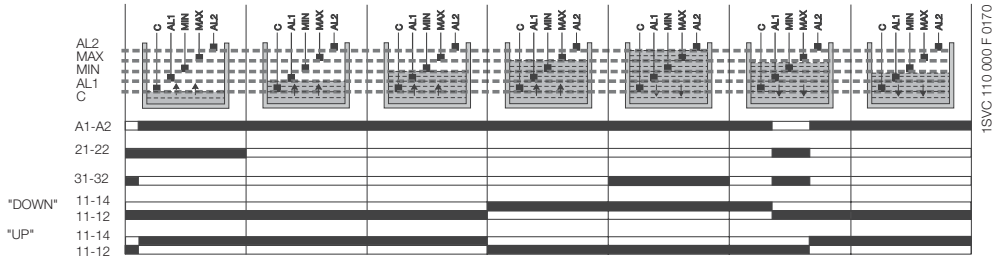
Liquid level monitors and controls
Function diagrams

Function diagram - CM-ENS



The CM-ENS monitors levels of conductive liquids and is used for example for liquid level control in pump systems. It can be used for filling or draining tanks for example. It is also suitable for monitoring the conductivity of liquids. The measuring principle is based on the resistance change sensed by single-pole electrodes. After the supply voltage is applied to the terminals A1 and A2, the output relay is de-energized. The probes must be connected to C, MAX, MIN. The output relay energizes if the liquid exceeds the maximum level (C and MAX wet) and de-energizes if the liquid level is below the minimum level (MAX and MIN dry). Basedau m on the measuring circuit there will be a response delay of approx. 250 ms at maximum sensitivity. Different levels in one tank can be controlled by up to 5 CM-ENS without interfering with each other.

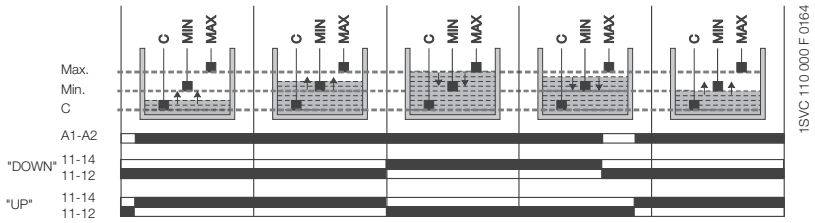
Function diagram - CM-ENN UP/DOWN



If a metal tank is used, the ground reference electrode C is not required. In this case the cable can be connected directly to the metal surface of the tank.

The CM-ENN UP/DOWN monitors levels of conductive liquids and media and is used e.g. for liquid level control in pump systems. The measuring principle is based on the resistance change sensed by single-pole electrodes. The function of the output relay 11-12/14 can be selected by a selector switch on the front of the unit to fill "UP" or drain "DOWN". If the "UP" function is selected, the output relay is energized until the MAX electrode becomes wet. Then it is de-energized and not re-energized until the MIN electrode becomes dry.If the "DOWN" function is selected, the output relay is energized as soon as the MAX electrode becomes wet. It remains energized until the liquid level has dropped below the MIN electrode. The electrode inputs AL1 and AL2 energize/de-energize the correspopnding output relays RAL1 (21-22) and RAL2 (31-32). AL1 opens if contact RAL1 (21-22) is wet. AL2 closes if contact RAL2 (31-32) is wet. This way, two additional alarm outputs for exceeding or dropping below the normal level can be implemented in addition to the filling levels MAX and MIN.

Function diagram - CM-ENS UP/DOWN



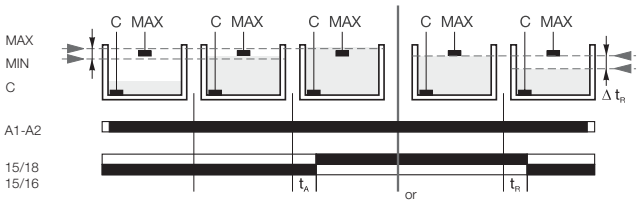
The CM-ENS UP/DOWN monitors levels of conductive liquids and other media, and is used e.g. for liquid level control in pump systems.

The measuring principle is based on the resistance change sensed by single-pole electrodes. The output relay functions fill (UP) or drain (DOWN) can be selected on a front-face selector switch. If the "UP" function is selected, the output relay is energized until the MAX electrode becomes wet. Then it is de-energized and not re-energized until the MIN electrode becomes dry. If the "DOWN" function is selected, the output relay is energized as soon as the MAX electrode becomes wet. It remains energized until the liquid level has dropped below the MIN electrode. The electrodes can be connected to more than one CM-ENS unit without interference.

Liquid level monitors and controls
Function diagrams

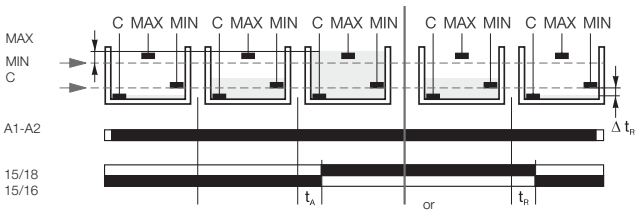
Function diagrams - CM-ENN

Circuit with 2 electrodes



1SVC 110 000 F 0167

Circuit with 3 electrodes



1SVC 110 000 F 0168

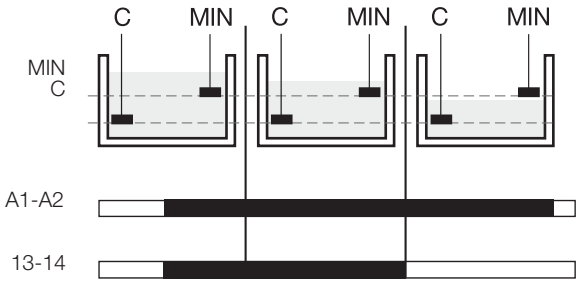
t_A = ON-delay, t_R = OFF-delay

The CM-ENN monitors levels of conductive liquids and is used for example for liquid level monitoring in pump control systems, for dry-running protection of submersible pumps or overflow monitoring of tanks. It is also suitable for conductivity monitoring of liquids. The measuring principle is based on the resistance change sensed by single-pole electrodes (wet or dry).

Instead of electrodes, other sensors or transducers can also be used if their output quantities are different resistance values. The measuring, output and supply circuits are electrically isolated for potential separation and to prevent electrical interference.

Due to the integrated ON- or OFF-delay, it is possible to set up time-dependent liquid controls using only two electrodes (C, MAX). Different liquid levels in one tank can be controlled by up to 5 CM-ENN (AC version) without mutual interference.

Function diagram - CM-ENE MIN



1SVC 110 000 F 0151

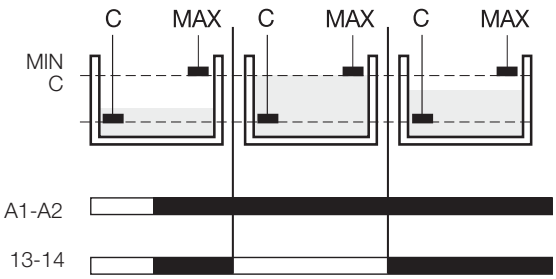
The liquid level relays CM-ENE MIN and CM-ENE MAX are used to monitor levels of conductive liquids, for example in pump control systems for dry-running or overflow monitoring.

The measuring principle is based on the occurring resistance change when moisting single-pole electrodes. The single-pole electrodes (see also section Accessories) are connected to the terminals C and MIN or MAX.

If the supply voltage is applied to A1-A2 and the electrodes are wet, the output relay of the CM-ENE MIN is energized and the output relay of the CM-ENE MAX is de-energized.

The output relay of the CM-ENE MIN de-energizes if the electrodes are no longer wet. The output relay of the CM-ENE MAX energizes if the electrodes are no longer wet.

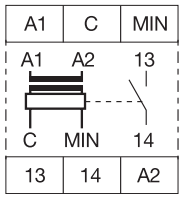
Function diagram CM-ENE MAX



1SVC 110 000 F 0152

Liquid level monitors and controls
Connection diagrams

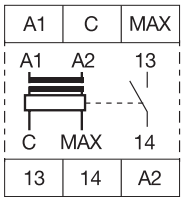
Connection diagram CM-ENE MIN



1SVC 110 000 F 0153

A1-A2 Rated control supply voltage
C Ground reference electrode
MIN Minimum level
13-14 Output contact -open-circuit principle

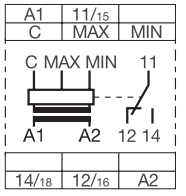
Connection diagram CM-ENE MAX



1SVC 110 000 F 0154

A1-A2 Rated control supply voltage
C Ground reference electrode
MAX Max. level
13-14 Output contact -closed-circuit principle

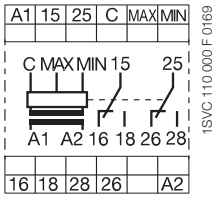
Connection diagram CM-ENS



1SVC 110 000 F 0158

A1-A2 Rated control supply voltage
C Ground reference electrode
MAX Maximum level
MIN Minimum level
11_{15}-12_{16}/14_{18} Output contacts - open-circuit principle

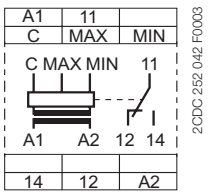
Connection diagram CM-ENN



1SVC 110 000 F 0169

A1-A2 Rated control supply voltage
C Ground reference electrode
MIN Min. level electrode
MAX Max. level electrode
15-16/18 Output contacts -
25-26/28 open-circuit principle

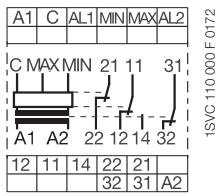
Connection diagram CM-ENS UP/DOWN



2CDC 252 042 F0003

A1 - A2 Rated control supply voltage
C Ground reference electrode
MAX Maximum level
MIN Minimum level
11-12/14 Output contacts - open-circuit or closed-circuit principle selectable

Connection diagram CM-ENN UP/DOWN



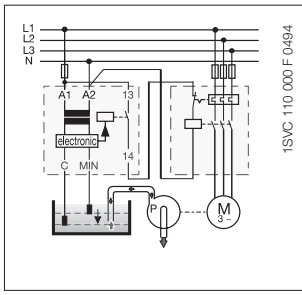
1SVC 110 000 F 0172

A1-A2 Rated control supply voltage
C Ground reference electrode
MIN Minimum level electrode
MAX Maximum level electrode
AL1 Alarm electrode 1
AL2 Alarm electrode 2
11-12/14 Output contacts -
21-22 open-circuit or closed-circuit
31-32 principle selectable

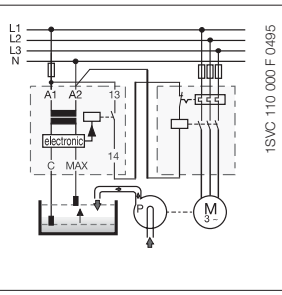
Liquid level monitors and controls
Application examples

Application examples CM-ENE MIN/MAX

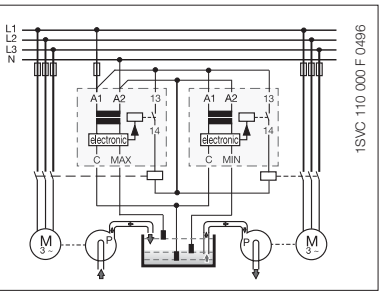
CM-ENE MIN



CM-ENE MAX

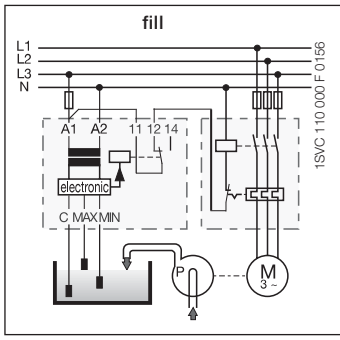


CM-ENE MIN und CM-ENE MAX

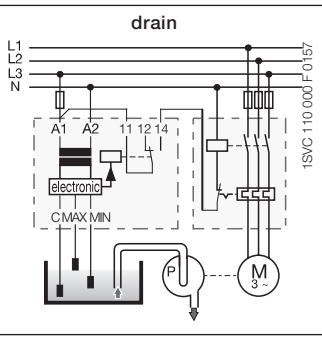


Application examples CM-ENS

fill

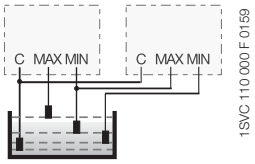


drain



Cascading

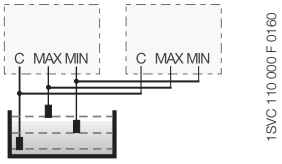
The electrode inputs can be interconnected as required, which ensures simple monitoring of different liquid levels.



Redundancy

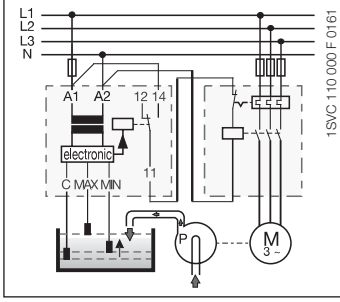
Redundant liquid level monitoring or control can be implemented by connecting the electrodes to two units.

This makes the application much safer.

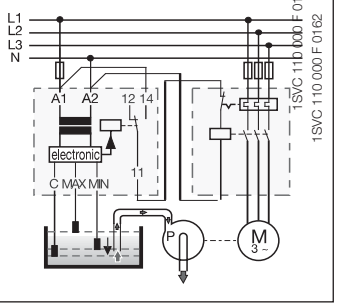


Application examples CM-ENS UP/DOWN

Liquid level control - fill - switch position "UP"

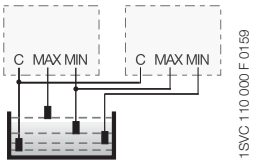


Liquid level control - drain - switch position "DOWN"



Cascading of electrodes

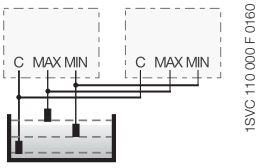
The electrode inputs can be interconnected as required, which ensures simple monitoring of different liquid levels.



Redundancy

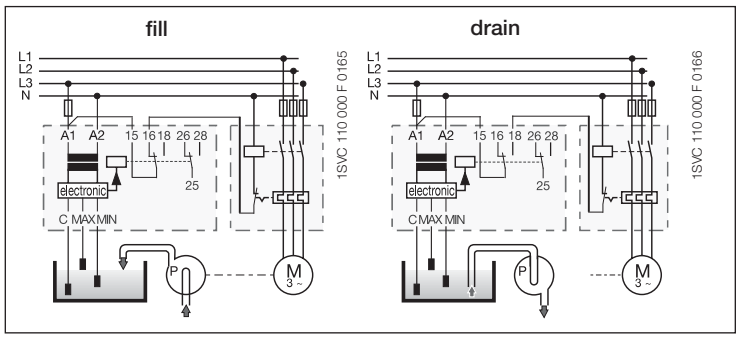
Redundant liquid level monitoring or control can be implemented by connecting the electrodes to two units.

This makes the application much safer.



Liquid level monitors and controls
Application examples

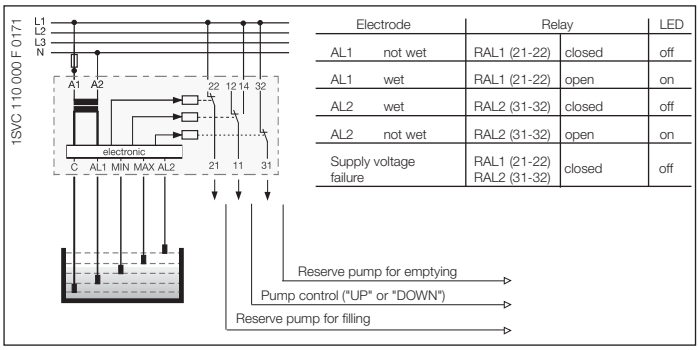
Application examples CM-ENN



For commissioning, set both potentiometers (response sensitivity = R value and ON-delay = time value) to the minimum value (5) and select a suitable resistance range (sector). After all electrodes have been wetted by the liquid being monitored, turn the sensitivity potentiometer towards maximum value (100) until the relay energizes. If the relay does not energize, select a higher **Ω** value (sector) on the device and proceed as before. Then it has to be checked if the relay de-energizes properly as soon as the electrodes C and MIN are no longer wet. Liquid levels higher than the maximum level electrode can be obtained by setting an ON-delay (TA = 0.1...10 s).

Liquid levels lower than the minimum level electrode can be obtained by setting an OFF-delay time (TR = 0.1...10 s), e.g. for emptying tanks.

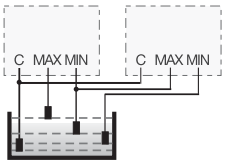
Application example CM-ENN UP/DOWN



Electrode		Relay		LED
AL1	not wet	RAL1 (21-22)	closed	off
AL1	wet	RAL1 (21-22)	open	on
AL2	wet	RAL2 (31-32)	closed	off
AL2	not wet	RAL2 (31-32)	open	on
Supply voltage failure		RAL1 (21-22) RAL2 (31-32)	closed	off

Cascading of electrodes

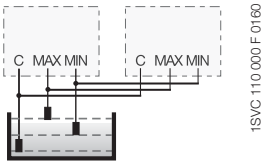
The electrode inputs can be interconnected as required, which ensures simple monitoring of different liquid levels.



Redundancy

Redundant liquid level monitoring or control can be implemented by connecting the electrodes to two units.

This makes the application much safer.



Liquid level monitors and controls
Technical data

Type			CM-ENE MIN	CM-ENE MAX
Supply circuit				
Rated control supply voltage U_S - power consumption		A1-A2	24 V AC	approx. 1.5 VA
		A1-A2	110-130 V AC	approx. 1.2 VA
		A1-A2	220-240 V AC	approx. 1.4 VA
Rated control supply voltage U_S tolerance			-15...+15 %	
Rated frequency			50-60 Hz	
Duty time			100 %	
Measuring circuit			MIN-C, MAX-C	
Monitoring function			dry-running protection	overflow protection
Response sensitivity			0-100 kΩ, not adjustable	
Maximum electrode voltage			30 V AC	
Maximum electrode current			1.5 mA	
Electrode supply line		max. cable capacity	3 nF	
		max. cable length	30 m	
Timing circuit				
Time delay			-	
Tripping delay			fixed approx. 200 ms	
Indication of operational states				
Output relay energized			R: yellow LED	
Output circuits			13-14	
Kind of output			1 n/o contact	
Operational principle [1]			open-circuit principle	closed-circuit principle
Contact material			AgCdO	
Rated operational voltage U_e		(IEC/EN 60947-1)	250 V	
Mininimum switching voltage / minimum switching current			- / -	
Maximum switching voltage			250 V	
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)			0.3 x 10^6 switching cycles	
Max. fuse rating to achieve short-circuit protection		n/c contact	-	
		n/o contact	10 A fast-acting	
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)	
Mounting position			any	
Degree of protection		enclosure / terminals	IP50 / IP20	
Ambient temperature range		operation / storage	-20...+60 °C / -40...+85 °C	
Mounting			DIN rail (IEC/EN 60715)	
Electrical connection				
Wire size		fine-strand with wire-end ferrule	2 x 0.75-1.5 mm² (2 x 18-16 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)	
Stripping length			10 mm (0.39 inch)	
Tightening torque			0.6-0.8 Nm	
Standards				
Product standard			IEC 255-6, EN 60255-6	
Low Voltage Directive			2006/95/EC	
EMC Directive			2004/108/EC	
Electromagnetic compatibility			EN 61000-6-2, EN 61000-6-4	
electrostatic discharge		IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)	
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	Level 3 (10 V/m)	
electrical fast transient / burst		IEC/EN 61000-4-4	Level 3 (2 kV / 5 kHz)	
surge		IEC/EN 61000-4-5	Level 4 (2 kV L-L)	
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 3 (10 V)	
Resistance to vibration (IEC 68-2-6)			6 g	
Mechanical resistance (IEC 68-2-6)			10 g	
Isolation data				
Rat. insulation volt. betw. supply, meas. & output circuit (VDE 0110, IEC 60947)			250 V	
Rated impulse withstand voltage between all isolated circuits (VDE0 110, IEC 664)			4 kV / 1.2-50 µs	
Test voltage between all isolated circuits			2.5 kV, 50 Hz, 1 min.	
Pollution category (VDE 0110, IEC 664, IEC 255-5)			3 / C	
Overvoltage category (VDE 0110, IEC 664, IEC 255-5)			III / C	
Environmental testing (IEC 68-2-30)			24 h cycle time, 55 °C, 93 % rel., 96 h	

[1] Open-circuit principle: Output relay energizes if the measured value exceeds/drops below the adjusted threshold.
Closed-circuit principle: Output relay de-energizes if the measured value exceeds/drops below the adjusted threshold.

Liquid level monitors and controls
Technical data

Type			CM-ENS	CM ENS UP/DOWN
Supply circuit				
Rated control supply voltage U_S - power consumption		A1-A2	24 V AC	24 V AC
		A1-A2	110-130 V AC approx. 1.5 VA	110-130 V AC approx. 4 VA
		A1-A2	220-240 V AC approx. 1.5 VA	220-240 V AC approx. 4 VA
		A1-A2	380-415 V AC approx. 1.5 VA	
Rated control supply voltage U_S tolerance			-15...+10 %	
Rated frequency			50-60 Hz	
Duty time			100 %	
Measuring circuit			MAX-MIN-C	
Monitoring function			liquid level control	
Response sensitivity			5-100 kΩ, adjustable	
Maximum electrode voltage			30 V AC	
Maximum electrode current			1 mA	
Electrode supply line		max. cable capacity	10 nF	
		max. cable length	100 m	
Timing circuit				
Time delay			-	
Tripping delay			approx. 250 ms	
Indication of operational states				
Control supply voltage			U: green LED	
Output relay energized			R MAX/MIN: yellow LED	
Alarm relay AL1			-	R AL1: yellow LED
Alarm relay AL2			-	R AL2: yellow LED
Output circuits			11-12/14, 21-22, 31-32	
Kind of output			1 c/o contact, 1 n/o + 1 n/c contact [2]	
Operational principle [1]			open-circuit principle	open- and closed-circuit principle
Contact material			AgCdo	
Rated operational voltage U_e		(IEC/EN 60947-1)	250 V	
Minimum switching voltage / minimum switching current			- / -	
Maximum switching voltage			250 V	
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 106 switching cycles	
Electrical lifetime (AC12, 230 V, 4 A)			0.3 x 106 switching cycles	
Max. fuse rating to achieve short-circuit protection	n/c / n/o contact			10 A fast-acting / 10 A fast-acting
General data				
Dimensions (W x H x D)			22.5 x 70 x 100 mm (0.89 x 3.07 x 3.94 in)	
Mounting position			any	
Degree of protection	enclosure / terminals		IP50 / IP20	
Ambient temperature range	operation / storage		-20...+60 °C / -40...+85 °C	
Mounting			DIN rail (IEC/EN 60715)	
Electrical connection				
Wire size	fine-strand with wire end ferrule		2 x 2.5 mm2 (2 x 14 AWG)	
Standards				
Product standard			IEC 255-6, EN 60255-6	
Low Voltage Directive			2006/95/EC	
EMC Directive			2004/108/EC	
Electromagnetic compatibility			-	
electrostatic discharge	IEC/EN 61000-4-2		Level 3 (6 kV / 8kV)	
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3		Level 3 (10 V/m)	
electrical fast transient / burst	IEC/EN 61000-4-4		Level 3 (2 kV / 5 kHz)	
surge	IEC/EN 61000-4-5		Level 4 (2 kV L-L)	
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6		Level 3 (10 V)	
Resistance to vibration (IEC 68-2-6)			4 g	
Mechanical resistance (IEC 68-2-6)			6 g	
Isolation data				
Rated insulation voltage between supply, measuring and output circuit (VDE 0110, IEC 60947)			250 V	
Rated impulse withstand voltage between all isolated circuits (VDE0 110, IEC 664)			4 kV / 1.2 - 50 µs	
Test voltage between all isolated circuits			2,5 kV, 50 Hz, 1 min.	
Pollution category (VDE 0110, IEC 664, IEC 255-5)			3 / C	
Overvoltage category (VDE 0110, IEC 664, IEC 255-5)			III / C	
Environmental testing (IEC 68-2-30)			24 h cycle time, 55 °C, 93 % rel., 96 h	

[1] Open-circuit principle: Output relay energizes if the measured value exceeds/drops below the adjusted threshold.
Closed-circuit principle: Output relay de-energizes if the measured value exceeds/drops below the adjusted threshold.

[2] 1SVR 430 851 R1300 (version with safe isolation)

Liquid level monitors and controls
Technical data

Type			CM-ENN UP/DOWN	CM-ENN		
Supply circuit						
Rated control supply voltage U_S - power consumption		A1-A2	24 V AC	24 V AC		
		A1-A2	110-130 V AC approx. 1.5 VA	110-130 V AC approx. 2.5 VA		
		A1-A2	220-240 V AC approx. 1.5 VA	220-240 V AC approx. 3 VA		
		A1-A2	380-415 V AC approx. 1.5 VA	380-415 V ACapprox. 4 VA		
		A1-A2		24-240 V AC/DC approx. 2 VA/W		
Rated control supply voltage U_S tolerance			-15...+10 %			
Rated frequency			50-60 Hz	50-60 Hz oder DC		
Duty time			100 %			
Measuring circuit			MAX-MIN-C			
Monitoring function			liquid level control			
Response sensitivity			adjustable	adjustable		
			5-100 kΩ	250 Ω - 5 kΩ	2.5-50 kΩ	25-500 kΩ
Maximum electrode voltage			30 V AC	20 V AC		
Maximum electrode current			1 mA	8 mA	2 mA	0.5 mA
Electrode supply line		max. cable capacity	10 nF	200 nF	20 nF	4 nF
		max. cable length	100 m	1000 m	100 m	20 m
Timing circuit						
Time delay			-	0.1-10 s, adjustable, ON- or OFF-delay		
Tripping delay			approx. 250 ms	-		
Indication of operational states						
Control supply voltage			U: green LED			
Output relay energized			R MAX/MIN: yellow LED	R: yellow LED		
Output circuits			11-12/14, 21-22, 31-32	15-16/18, 25-26/28		
Kind of output			1 c/o + 2 n/c contacts	2 c/o contacts		
Operational principle [1]			open-circuit principle	open- and closed-circuit principle		
Contact material			AgCdO			
Rated operational voltage U_e	IEC/EN 60947-1		250 V	400 V		
Minimum switching voltage / minimum switching current			- / -			
Maximum switching voltage			250 V	400 V		
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) 230 V	4 A	5 A		
		AC15 (inductive) 230 V	3 A			
		DC12 (resistive) 24 V	4 A	5 A		
		DC13 (inductive) 24 V	2 A	2.5 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)			0.3 x 10^6 switching cycles	0.1 x 10^6 switching cycles		
Max. fuse rating to achieve short-circuit protection	n/c / n/o contact		4 A fast-acting / 6 A fast-acting			
General data						
Diemensions (W X H X D)			45 x 78 x 100 mm (1.77 x 3.07 x 3.94 in)			
Mounting position			any			
Degree of protection	enclosure / terminals		IP50 / IP20			
Ambient temperature range	operation / storage		-25...+65 °C / -40...+85 °C			
Mounting			DIN rail (IEC/EN 60715)			
Electrical connection						
Wire size	fine-strand with wire end ferrule		2 x 2.5 mm² (2 x 14 AWG)			
Standards						
Product standard			IEC 255-6, EN 60255-6			
Low Voltage Directive			2006/95/EC			
EMC Directive			2004/108/EC			
Electromagnetic compatibility			-			
electrostatic discharge	IEC/EN 61000-4-2		Level 3 (6 kV / 8kV)			
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3		Level 3 (10 V/m)			
electrical fast transient / burst	IEC/EN 61000-4-4		Level 3 (2 kV / 5 kHz)			
surge	IEC/EN 61000-4-5		Level 4 (2 kV L-L)			
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6		Level 3 (10 V)			
Resistance to vibration (IEC 68-2-6)			5 g			
Mechanical resistance (IEC 68-2-6)			10 g			
Isolation data						
Rated insulation voltage between supply, measuring and output circuit (VDE 0110, IEC 60947)			250 V	500 V		
Rated impulse withstand voltage between all isolated circuits (VDE0 110, IEC 664)			4 kV / 1.2 - 50 µs			
Test voltage between all isolated circuits			2,5 kV, 50 Hz, 1 min.			
Pollution category (VDE 0110, IEC 664, IEC 255-5)			3 / C			
Overvoltage category (VDE 0110, IEC 664, IEC 255-5)			III / C			
Environmental testing (IEC 68-2-30)			24 h cycle time, 55 °C, 93 % rel., 96 h			

[1] Open-circuit principle: Output relay energizes if the measured value exceeds/drops below the adjusted threshold.
Closed-circuit principle: Output relay de-energizes if the measured value exceeds/drops below the adjusted threshold.

Contact protection relays
Product group picture

2

Contact protection relays
Table of contents

Contact protection relays
Benefits and advantages, Operating controls

Characteristics CM-KRN

- Protects and reduces load from sensitive control contacts
- Adjustable ON-delay 0.05-30 s
- Acts as two-position switch
- Stores switch positions
- Electrically isolated circuits
- 2 c/o contacts
- 2 LEDs for status indication

1 **Connection diagram**

2 **Indication of operational states**
R: yellow LED - relay status
U: green LED - control supply voltage

3 **Marker label**

Contact protection relays
Ordering details

CM-KRN

Description

Contact protection relay:

The CM-KRN protects sensitive control contacts from excessive load. It can be used with latching function or without. Bounce time of control contacts can be bypassed by the adjustable response delay time. Use for contact protection.

Ordering details

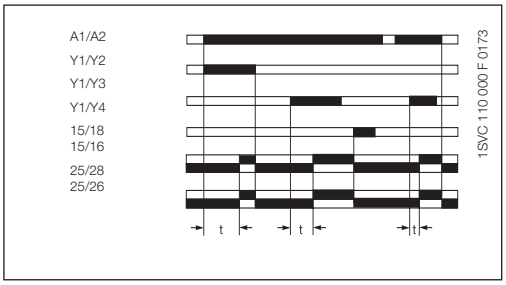
Rated control supply voltage	Timing circuit	Type	Order code	Price	Weight (1 pce) kg (lb)
24 V AC	0.05-30 s	CM-KRN	1SVR450089R0000		0.30 (0.66)
110-130 V AC			1SVR450080R0000		0.30 (0.66)
220-240 V AC			1SVR450081R0000		0.30 (0.66)
380-415 V AC			1SVR450082R0000		0.30 (0.66)
24 V AC			1SVR450099R0000		0.30 (0.66)
110-130 V AC			1SVR450090R0000		0.30 (0.66)
220-240 V AC			1SVR450091R0000		0.30 (0.66)
24 V AC/DC[1)]			1SVR450099R1000		0.30 (0.66)

[1)] Not electrically isolated

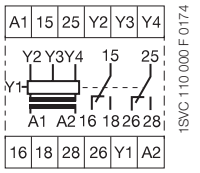
Contact protection relays
Technical information

Use for contact protection. The contact to be protected is connected to terminals Y1 and Y2. Use for contact protection with latching capacity The output relay energizes after contact Y1-Y3 has been closed for at least 20 ms. It remains energized until contact Y1-Y4 closes. The switching positions are stored. The relay is suitable for load reduction purposes for devices with minimum and maximum contacts. The CM-KRN can be operated via 3-wire proximity sensors for switching of higher power. The supply circuit, the control circuit and the output circuit are electrically isolated against each other

Function diagram - CM-KRN

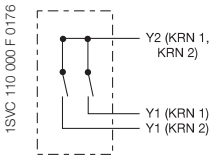


Connection diagram CM-KRN



A1-A2	Rated control supply voltage
Measuring circuits:	
Y1-Y2	"On-Off" input (max. switch-on resistance 6-10 kΩ, min. switch-off resistance 15-20 kΩ)
Y1-Y3 "	Set" input (max. switch-on resistance 6-10 kΩ)
Y1-Y4	"Reset" input (max. switch-off resistance 15-20 kΩ)
15-16/18	Output contacts -
25-26/28	open-circuit principle

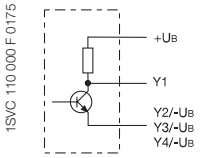
Use, applications



Actuators with 2 contacts and one common point can be connected to 2 separate CM-KRN units.

Connect the common point of contacts to terminals Y2 of the two CM-KRN units.

Operation via 3-wire proximity sensors NPN



On; relay energizes, Y1/Y3 or Y2

Off; relay de-energizes, Y1/Y4 or Y2

Contact protection relays
Technical data

Type			CM-KRN
Supply circuit			**A1-A2**
Rated control supply voltage U_S - power consumption		A1-A2	24 V AC - approx. 3.5 VA
		A1-A2	24 V AC/DC - approx. 3.5 VA
		A1-A2	110-130 V AC - approx. 3,5 VA
		A1-A2	220-240 V AC - approx. 3.5 VA
		A1-A2	380-415 V AC - approx. 3.5 VA
Rated control supply voltage U_S tolerance			-15...+10 %
Rated frequency			50-60 Hz
Duty time			100 %
Timing circuit			
ON-delay time			0.05-1 s, 1.5-30 s
OFF-delay time			max. 50 ms
Measuring circuit / contact circuit			**Y1-Y2/Y3/Y4**
Measuring input		contact protection without latching	Y1-Y2
		contact protection with latching	Y1-Y3/Y4
Threshold		Y1-Y2/Y3	6-10 kΩ
Threshold-Hysteresis		Y1-Y2/Y4	15-20 kΩ
No-load voltage at the measuring input			≤ 10 V DC
Contact time for latching (CM-KRN without timing circuit)			min. 20 ms
Switching current at the measuring input			3 mA
Maximum applied voltage at the measuring input			≤ ±30 V (contact voltage)
Indication of operational states			
Control supply voltage		U: green LED	⎍: control supply voltage applied
Relay status		R: yellow LED	⎍: output relay energized
Output circuit			15-16/18, 25-26/28
Kind of output			relay, 2 c/o contacts
Operating principle [1]			open-circuit principle
Rated operational voltage (VDE 0110, IEC 60947-5-1)			400 V
Rated switching voltage			400 V AC
Rated operational current I_e (IEC/EN 60947-5-1)		AC12 (resistive) 230 V	5 A
		AC15 (inductive) 230 V	3 A
		DC12 (resistive) 24 V	5 A
		DC13 (inductive) 24 V	2.5 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 lifeteime (AC12, 230 V, 5 A)			0.1 x 10^6 switching cycles
Max. fuse rating to achieve short-circuit protection		n/c / n/o contact	10 A fast-acting / 10 A fast-acting
General data			
Dimensions (W x H x D)			45 x 78 x 100 mm (1.77 x 3.07 x 3.94 in)
Mounting position			any
Degree of protection		enclosure / terminals	IP20 / IP50
Ambient temperature range		operation / storage	-25...+65 °C / -40...+85 °C
Mounting			DIN rail (IEC/EN 60715)
Electrical connection			
Wire size		fine-strand with wire end ferrule	2 x 2.5 mm^2 (2 x 14 AWG)
Standards			
Product standard			IEC 255-6, EN 60255-6
Low Voltage Directive			2006/95/EC
EMC Directive			2004/108/EC
Electromagnetic compatibility			
Interference immunity to			
electrostatic discharge		IEC/EN 61000-4-2	6 kV / 8 kV
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	10 V/m
electrical fast transient / burst		IEC/EN 61000-4-4	2 kV / 5 kHz
surge		IEC/EN 61000-4-5	2 kV symmetrical
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	10 V
Isolation data			
Rated insulation voltage (IEC 60947-1)			400 V
Rated impulse withstand voltage U_{imp} (IEC 644-6)			4 kV
Pollution category (IEC 255-5, IEC 664)			3
Overvoltage category (IEC 255-5, IEC 664)			III

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

Sensor interface relays
Product group picture

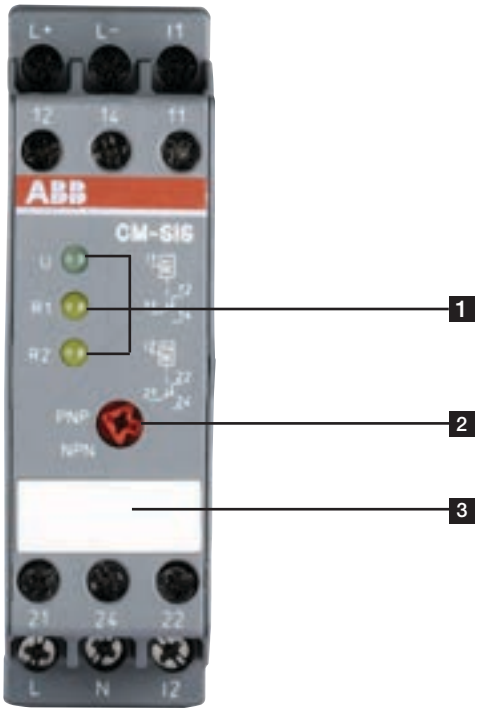
2

Sensor interface relays
Table of contents

Sensor interface relays
Benefits and Advantages, Operating controls

Characteristics CM-SIS

- High efficiency
- Low heating
- Wide range of supply voltage
- Constant output voltage 24 V DC
- Protective separation acc. to EN 50178 (VDE 0160)
- Short-circuit and overload proof
- Input protected by internal fuse
- 2 x 1 c/o contact
- 3 LEDs for status indication



1 **Indication of operational states**
U: green LED - control supply voltage
R1: red LED - relay status R1
R2: red LED - relay status R2

2 **Rotary switch for sensor type selection**

3 **Marker label**

Sensor interface relays
Ordering details

CM-SIS

Description

Senior interface relay:

The CM-SIS is used to supply 2- or 3-wire NPN or PNP sensors with power and to evaluate their switching signals. Two sensors of the types NPN or PNP can be connected simultaneously. Selection is done via the front-face rotary switch.

Ordering details

Rated control supply voltage	Type	Order code	Price	Weight (1 pce) kg (lb)
110-240 V AC / 105-260 V DC[1)]	CM-SIS	1SVR430500R2300		0.22 (0.48)

[1)] Protective separation, short circuit and overload proof

Sensor interface relays
Technical information

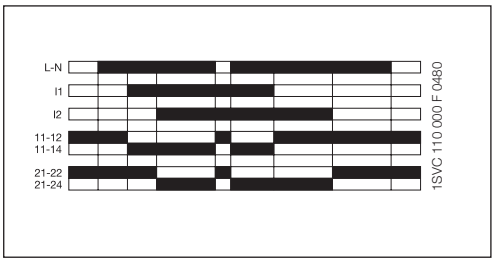
The CM-SIS (terminals L+, L-) supplies the connected sensors with voltage (24 V DC), the maximum power supply current is 0.5 A. The supply voltage and the sensor inputs are electrically isolated from the supply circuit. To ensure maximum safety when using these sensors, the principle of protective separation has been included.

Each sensor input signal energizes the corresponding output relay without delay. The relay is energized as soon as a threshold current is exceeded at input I1 or I2. Sensor leakage currents of up to 8 mA don`t affect the evaluation. The threshold value is about 9 mA. If the threshold value at input I1 or I2 is exceeded the corresponding relay R1 or R2 energizes and the corresponding LED lights up.

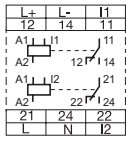
The wide-range supply voltage input of CM-SIS allows its application in nearly all supply systems.

The CM-SIS is also suitable for other applications, for example it is also possible to connect PTC or NTC resistors instead of PNP or NPN sensors or to operate the SIS directly by switching contacts.

Function diagram - CM-SIS

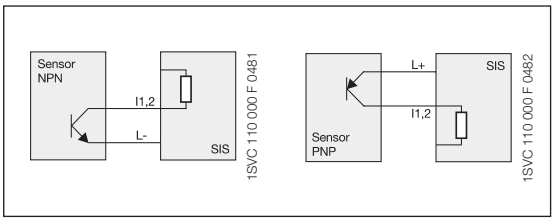


Connection diagram CM-SIS

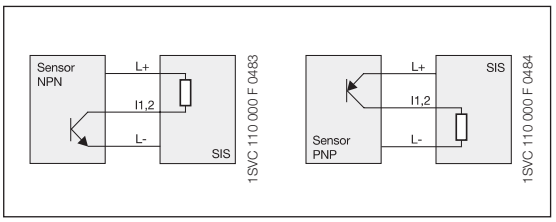


L - N	Rated control supply voltage
I1	Sensor input 1
I2	Sensor input 2
L+ - L-	Output voltage 24 V DC / 0.5 A
11-12/14	Output contacts -
21-22/24	Open-circuit principle

Connection of 2-wire sensors



Connection of 3-wire sensors



Sensor interface relays
Technical data

Type			CM-SIS
Input circuit			
Supply voltage	L-N	AC	110-240 V AC (-15...+10 %)
		DC	110-240 V (max. 105-260 V DC)
Frequency, AC supply			47-440 Hz
Supply voltage failure bridging time			10 ms min. at 100 % load
Current consumption		max.	0.35 A
		at 115 V AC	0.27 A
		at 230 V AC	0.14 A
Inrush current at 25°C (≤ 2 ms)			33 A
Internal input fuse			800 mA slow-acting
Measuring circuit			**L+, L- / I1, I2**
Sensor voltage		L+ L-	24 V DC ± 3%
Sensor current / power			max. 0.5 A / 12 W
Residual ripple			max. 100 mV_{pp}
Deviation with		load change statical	max. ± 0.5 %
		load change dynamical 10-90 %	max. .5 %
		change of the input voltage	max. ± 0.5 %
Short-circuit protection			overcurrent switch-off with automatic restart
Overload protection			excess temperature and overcurrent switch-off
Reset after thermal overload switch-off			automatic reset after cooling down
Sensor type connection possibilities		I1, I2	2- or 3-wire connection, NPN or PNP selectable by front-face switch
Input resistance			approx. 2.5 kΩ
Threshold value for relays R1, R2			$U_{emitter-collector}$ < 2,3 V (I1, I2 > 8 mA)
Maximum switching frequency			approx. 20 Hz
Output circuit			**11-12/14, 21-22/24**
Kind of output			2 relays, 1 c/o contact each
Operating principle			open-circuit principle [1]
Rated operational voltage			250 V
Maximum switching voltage			250 V AC
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			10 x 10^6 switching cycles
Electrical lifetime			0.1 x 10^6 switching cycles
Max. fuse rating to achieve short-circuit protection		n/c / n/o contact	6 A fast-acting / 10 A fast-acting
Indication of operational states			
Control supply voltage		U: green LED	⎍: control supply voltage applied
Relay status R1		R1: yellow LED	⎍: threshold value at input I1 exceeded
Relay status R2		R2: yellow LED	⎍: threshold value at input I2 exceeded
General data			
Efficiency at rated load			approx. 84 % (at 230 V AC)
Ambient temperature range		operation / storage	0...+55 °C / -25...+75 °C
Dimensions (W x H x D)			22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in)
Mounting position			horizontally
Mounting			DIN rail (IEC/EN 60715)
Minimum distance to other units			left-hand side 10 mm (0.39 in), vertical distance 50 m (1.97 in)
Electrical connection			
Wire size			2 x 2,5 mm^2 (2 x 14 AWG)
Standards			
Product standard			IEC 255-6, EN 60255-6
Electrical safety			IEC(EN) 60255-5, EN 50178 (VDE 0160), EN60950, UL 508, CSA 22.2
Electrical isolation			protective separation between L+,L-, I1,I2, and L,N,11,12,14,21,22,24
Electromagnetic compatibility			
Interference immunity to			EN 61000-6-2
electrostatic discharge		IEC/EN 61000-4-2	Level 3 (6 / 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 4 (4 kV)
surge		IEC/EN 61000-4-5	Inst. class 3 (2 kV)
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	Level 3 (10 V)
Interference immunity to		EN 50081-2	radiated noise EN 55011, class B
Input current harmonics			no limitation
Isolation data			
Insulation testing			2.5 kV AC (routine test), 3 kV AC (type test)
Degree of pollution			2
Overvoltage category			II

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

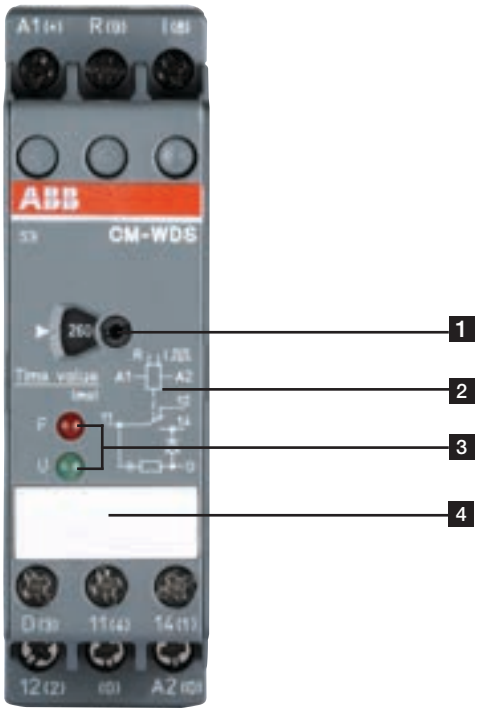
Cycle monitoring relay with watchdog function
Product group picture

Cycle monitoring relay with watchdog function
Table of contents

Cycle monitoring relay with watchdog function
Benefits and Advantages, Operating controls

Characteristics

- Cycle monitor for monitoring the function of programmable logic controllers or industrial pcs
- 4 selectable cycle monitoring time ranges from 0.5 to 1000 ms
- 24 V DC supply
- 1 c/o contact
- 2 LEDs for status indication



1 **Setting the lower threshold value of cycle monitoring time**

2 **Connection diagram**

3 **Indication of operational states**
F: red LED - cycle error
U: green LED - control supply voltage

4 **Marker label**

Cycle monitoring relay with watchdog function
Ordering details

CM-WDS

Description

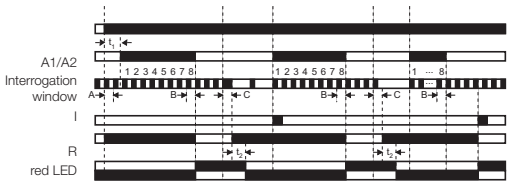
The cycle monitoring relay CM-WDS (watchdog) observes if a regularly intermittent pulse is applied to its pulse input “I“. It is, for example, possible to connect the output of a programmable logic controller (plc), which is set and reset regularly (e. g. once each cycle). The connected cycle pulse must be generated by suitable programming of the plc/ipc. Now, the CM-WDS monitors if the cycle time of the plc/ipc program is smaller than the cycle monitoring time setted by means of the front-face selector switch “time value (ms)“.
The output relay 11-12/14 of the CM-WDS energizes and the red LED is switched off, if there are minimum 8 successive regular pulses on input “I“. When the pulse signal stays out or is not regular, the output relay de-energizes and the red LED is illuminated.
In case the monitoring time is too short or too long, this can be adjusted by a modified programming of the plc/ips or by modified setting of the monitoring time “time value (ms)“.
A fault recognized and stored with the CM-WDS can be reset by an H-impulse (0-1-transition) on the reset input “R(9)“, so that the cycle monitoring is again released. The reset impulse can be generated by means of a reset button or by suitable programming of the controller (plc/ipc).

Ordering details

Rated control supply voltage	Type	Order code	Price 1 pce	Weight (1 pce) kg (lb)
24 V DC	CM-WDS	1SVR430896R000		0.15 (0.33)

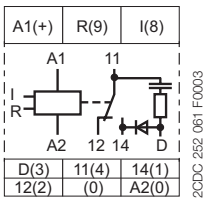
Cycle monitoring relay with watchdog function
Technical information

Function diagram - CM-WDS



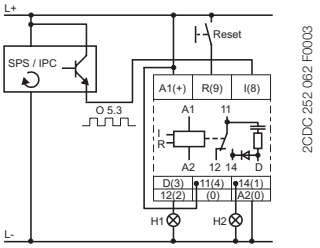
A	=	Cycle monitor
B	=	Cycle is correct, no cycle error
C	=	Cycle failure 1: pulse > monitoring window Cycle failure 2: pulse stays out
t	=	300 ms

Connection diagram CM-WDS



A1/A2	Rated control supply voltage
I	Cycle pulse input
R	Reset input
11-12/14	Output relay
D	Protected output (freewheeling diode)

Example of application - circuit diagram



Application

The CM-WDS is designed for the external monitoring of the correct function of programmable logic controllers (plc) and industrial pcs (ipc).

Cycle monitoring relay with watchdog function
Technical data

Type		CM-WDS
Input circuit		A1-A2
Rated control supply voltage U_S - power consumption		24 V DC - approx. 1 W
Tolerance of the rated control supply voltage U_S		-30 % - +30 %
Duty time		100 %
Measuring circuit		I
Monitoring function		cycle monitoring
Measuring voltage		24 V DC
Current consumption at the measuring input		approx. 5 mA
Setting range of cycle monitoring time		selectable: 0.5-150 ms, 0.5-260 ms, 0.5-500 ms, 0.5-1000 ms
Response time		approx. 0.5-1000 ms
Accuracy within the supply voltage tolerance		$\Delta U \leq 0.5$ %
Accuracy within the temperature range		$\Delta U \leq 0.06$ % / °C
Timing circuit		
ON-delay		approx. 2.2-10 s
Indication of operational states		
Control supply voltage		U: green LED
Output relay de-energized / cycle error		F: red LED
Output circuit		11-12/14
Kind of output		1 c/o
Operating principle		Closed-circuit principle [1]
Contact material		AgCdo
Rated operational voltage U_e	IEC/EN 60947-1	250 V
Minimum switching voltage / Minimum switching current		
Maximum switching voltage		250 V AC, 250 V DC
Rated operational current I_e (IEC/EN 60947-5-1)	AC12 (resistive) 230 V	4 A
	AC15 (inductive) 230 V	3 A
	DC12 (resistive) 24 V	4 A
	DC13 (inductive) 24 V	2 A
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		10 x 10^6 switching cycles
Electrical lifeteime (AC12, 230 V, 4 A)		0.1 x 10^6 switching cycles
Max. fuse rating to achieve short-circuit protection	n/c / n/o contacts	10 A fast-acting / 10 A fast-acting
General data		
Dimensions (W x H x D)		22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in)
Mounting position		any
Degree of protection	enclosure / terminals	IP50 / IP20
Ambient temperature range	operation / storage	-20...+60 °C / -40...+85 °C
Mounting		DIN rail (IEC/EN 60715)
Electrical connection		
Wire size	fine-strand with wire end ferrule	2 x 2.5 mm^2 (2 x 14 AWG)
Standards		
Product standard		IEC 255-6, EN 60255-6
Low Voltage Directive		2006/95/EC
EMC Directive		2004/108/EC
Operational reliability (IEC 68-2-6)		4 g
Mechanical shock resistance (IEC 68-2-6)		6 g
Electromagnetic compatibility		
Interference immunity to		EN 61000-6-2
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3 (2 kV / 5 kHz)
surge	IEC/EN 61000-4-5	Level 3 (2 kV L-L)
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 (10 V)
Interference emission		EN 61000-6-4
Isolation data		
Rated insulation voltage between supply-, control- and output circuit (VDE 0110, IEC 60947-1)		250 V
Rated impulse withstand between all isolated circuits (VDE 0110, IEC 664)		4 kV / 1.2-50 µs
Test voltage between all isolated circuits		2.5 kV, 50 Hz, 1 min
Pollution degree (VDE 0110, IEC 664, IEC 255-5)		3/C
Overvoltage category (VDE 0110, IEC 664, IEC 255-5)		III
Environmental tests (IEC 68-2-30)		24 h cycle, 55 °C, 93 % rel. 96 h

[1] Closed-circuit principle: Output relay de-energizes if a cycle error occurs

Notes

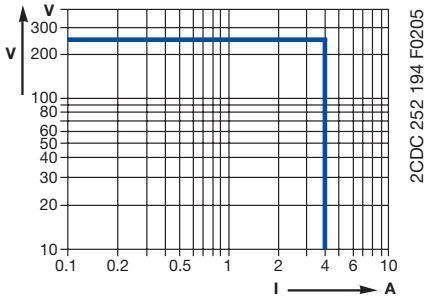
General technical data, Accessories, Current transformers
Table of contents

General technical data, Accessories, Current transformers
Technical diagrams - CM-range

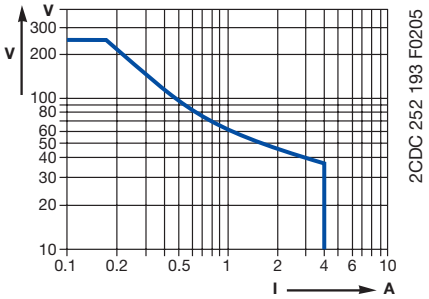
Load limit curves

CM-S (22.5 mm), CM-E (22.5 mm), CM-UFD.M22

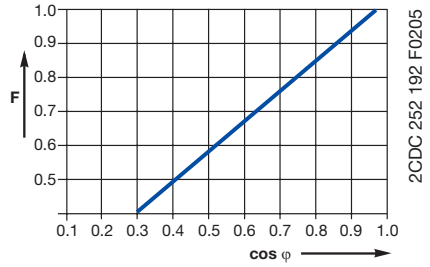
AC load (resistive)



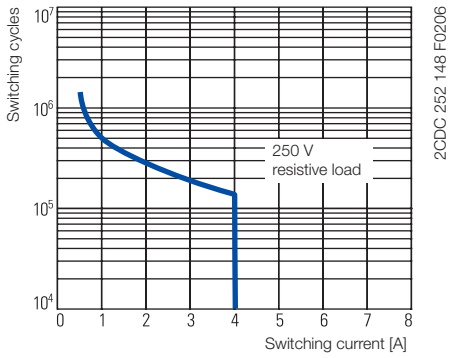
DC load (resistive)



Derating factor F for inductive AC load

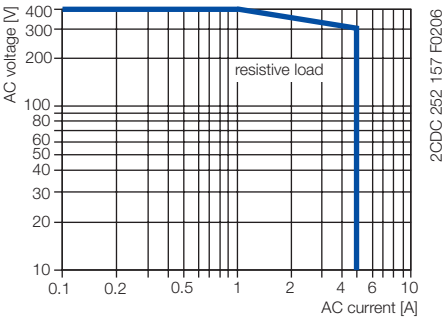


Contact lifetime

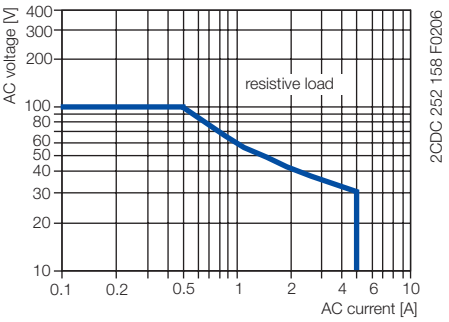


CM-N (45 mm)

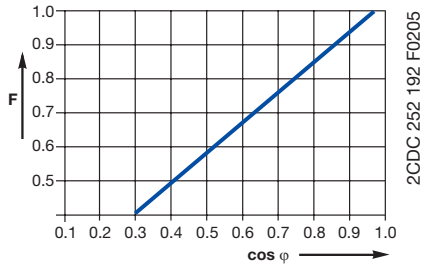
AC load (resistive)



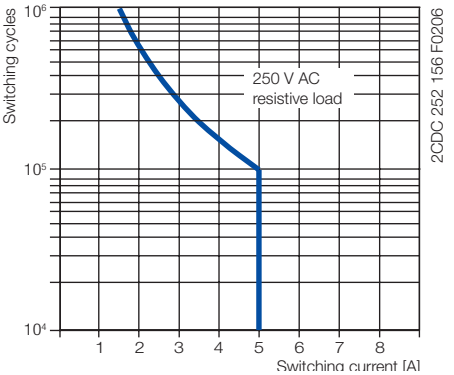
DC load (resistive)



Derating factor F for inductive AC load

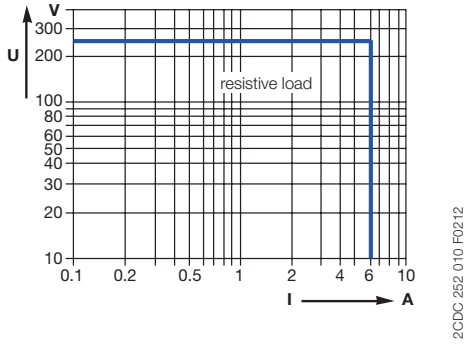


Contact lifetime

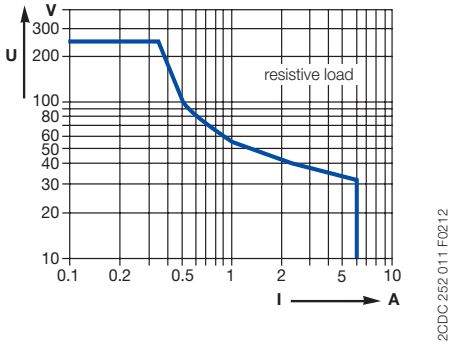


Technical diagrams - CM-range

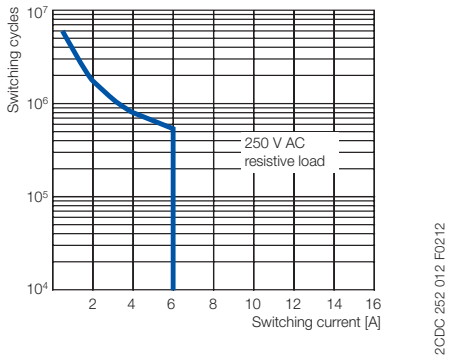
Load limit curves CM-UFD.M21



AC load (resistive)



DC load (resistive)

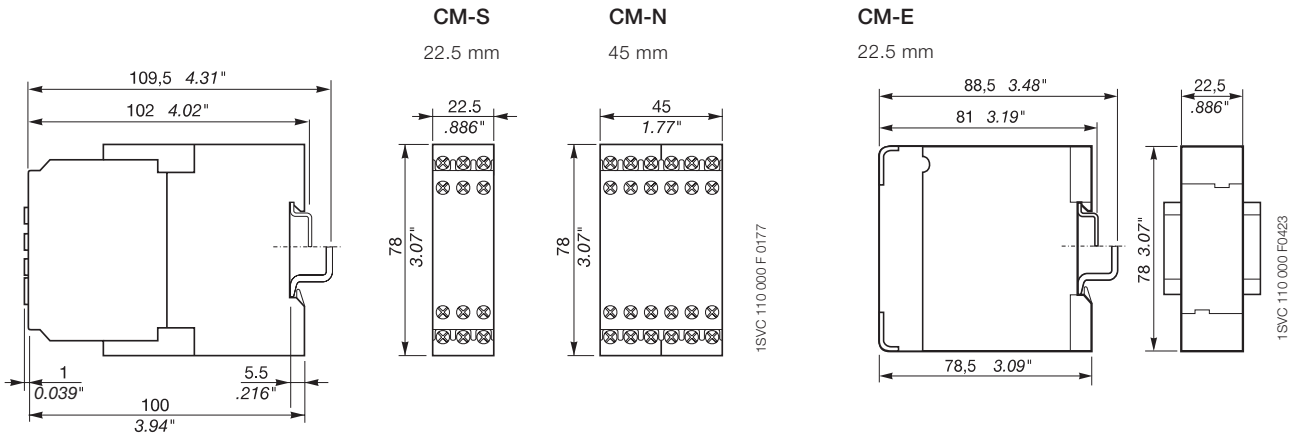


Contact lifetime

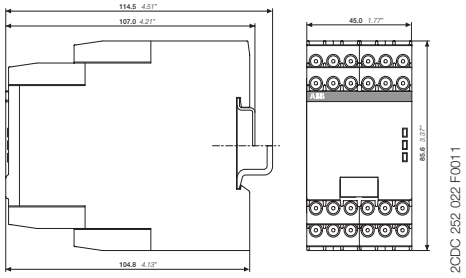
General technical data, Accessories, Current transformers
Dimensional drawings

Measuring and monitoring relays CM range old housing

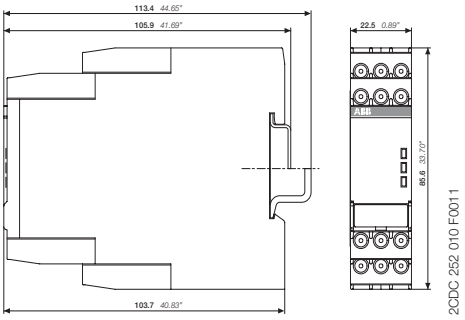
Dimensions in mm



Measuring and monitoring relays CM range new housing

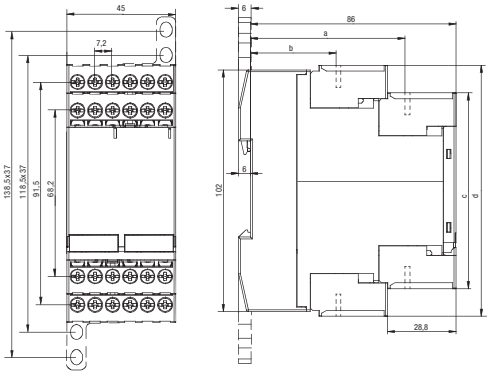


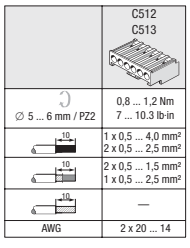
CM-xxN 1SVR 750 xxx xxx, 1SVR 760 xxx xxx
45 mm



CM-xxS 1SVR 730 xxx xxx, 1SVR 740 xxx xxx
22.5 mm

Temperature monitoring relays



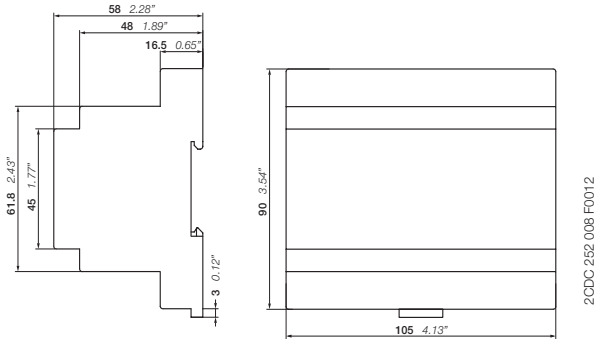


	a	b	c	d
C512, C513	65	36	82,6	105,9

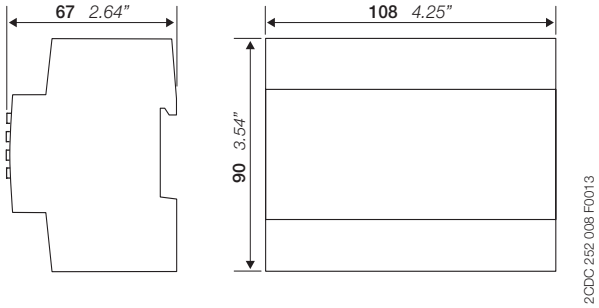
C512/C513
45 mm

General technical data, Accessories, Current transformers
Dimensional drawings

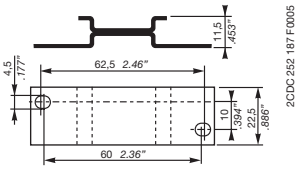
Dimensional drawing CM-UFD.M21



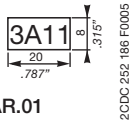
Dimensional drawing CM-UFD.M22



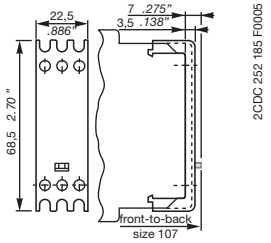
General technical data, Accessories, Current transformers
Ordering details - CM-range accessories



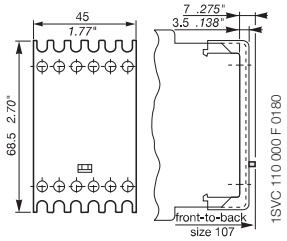
ADP.01



MAR.01



Sealable cover COV.01



Sealable cover COV.02

Accessories

Ordering details

Description	For type	Width in mm	for devices	Type	Order code	Price pce	Pkg qty	Weight (1 pce) g (oz)
Adapter for screw mounting	CM-S CM-S.S/P	22.5		ADP.01	1SVR430029R0100		1	18.4 (0.65)
	CM-N CM-N.S/P	45		ADP.02	1SVR440029R0100		1	36.7 (1.30)
Marker label	CM-S, CM-N CM-S.S/P CM-N.S/P		without DIP switches	MAR.01	1SVR366017R0100		10	0.19 (0.007)
	CM-S, CM-N		with DIP switches	MAR.02	1SVR430043R0000		10	0.13 (0.005)
	CM-S.S/P CM-N.S/P		with DIP switches	MAR.12	1SVR730006R0000		10	0.152 (0.335)
Sealable transparent cover	CM-S	22.5		COV.01	1SVR430005R0100		1	5.2 (0.18)
	CM-N	45		COV.02	1SVR440005R0100		1	7.7 (0.27)
	CM-S.S/P	22.5		COV.11	1SVR730005R0100		1	4.0 (0.129)
	CM-N.S/P	45		COV.12	1SVR750005R0100		1	7 (0.247)

Ordering details - CM-range accessories

2CDC 251 002 F0005

CM-CT

2CDC 251 003 F0005

CM-CT
with mounted accessories

2CDC 251 159 F0b06

CM-CT-A
mounted on DIN rail

Plug-in current transformers CM-CT

Without primary conductor though with foot angle, insulating protective cap and bar fastening screws
Primary / rated current from 50 A to 600 A
Secondary current of 1 A or 5 A
Class 1

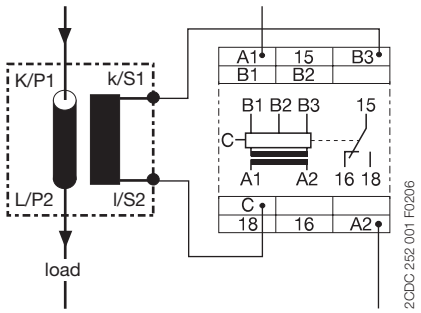
Ordering details

Rated primary current	Secondary current	Burden class	Type	Order code	Price pce	Weight (1 pce) g (oz)
50 A	1 A	1 VA / 1	CM-CT 50/1	1SVR450116R1000		0.31 (0.683)
75 A		1.5 VA / 1	CM-CT 75/1	1SVR450116R1100		0.31 (0.683)
100 A		2.5 VA / 1	CM-CT 100/1	1SVR450116R1200		0.276 (0.608)
150 A		2.5 VA / 1	CM-CT 150/1	1SVR450116R1300		0.32 (0.705)
200 A		2.5 VA / 1	CM-CT 200/1	1SVR450116R1400		0.222 (0.489)
300 A		5 VA / 1	CM-CT 300/1	1SVR450117R1100		0.29 (0.639)
400 A		5 VA / 1	CM-CT 400/1	1SVR450117R1200		0.27 (0.595)
500 A		5 VA / 1	CM-CT 500/1	1SVR450117R1300		0.29 (0.639)
600 A		5 VA / 1	CM-CT 600/1	1SVR450117R1400		0.24 (0.529)
50 A	5 A	1 VA / 1	CM-CT 50/5	1SVR450116R5000		0.3 (0.661)
75 A		1.5 VA / 1	CM-CT 75/5	1SVR450116R5100		0.31 (0.683)
100 A		2.5 VA / 1	CM-CT 100/5	1SVR450116R5200		0.31 (0.683)
150 A		2.5 VA / 1	CM-CT 150/5	1SVR450116R5300		0.28 (0.617)
200 A		5 VA / 1	CM-CT 200/5	1SVR450116R5400		0.29 (0.639)
300 A		5 VA / 1	CM-CT 300/5	1SVR450117R5100		0.252 (0.556)
400 A		5 VA / 1	CM-CT 400/5	1SVR450117R5200		0.26 (0.573)
500 A		5 VA / 1	CM-CT 500/5	1SVR450117R5300		0.208 (0.459)
600 A		5 VA / 1	CM-CT 600/5	1SVR450117R5400		0.21 (0.463)

Ordering details - Accessories

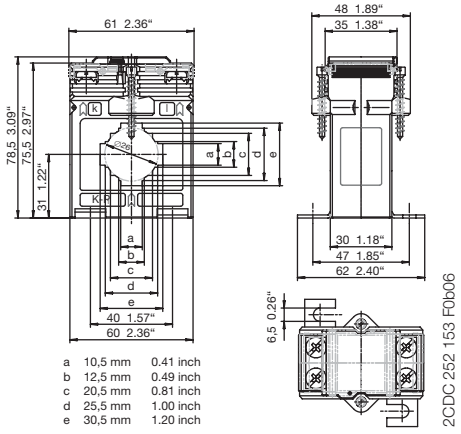
Description	Type	Order code	Price 10 pces	Weight (1 pce) g (oz)
Snap-on fastener for DIN rail mounting of CM-CT	CM-CT A	1SVR450118R1000		0.009 (0.02)

Operating principle / circuit diagram



2CDC 252 001 F0206

Dimensional drawing



2CDC 252 153 F0b06