CATALOG

Measuring and monitoring relays

- Excellent vibration resistance with the Easy Connect Technology: push-in terminals – the right solution for harsh environments
- Suitable for railway applications: selected products comply to the latest standards
- Current actual operational states are indicated by LEDs on the front, simplifying commissioning and troubleshooting

No matter what measuring or monitoring function is needed – physical or electrical – ABB protects your equipment and ensures processes run smoothly.

Choose from a large range of products that provide reliable protection, cost savings and maximum availability for processes and equipment. No matter what the environment, ABB's high quality products are built and tested to give you uninterrupted monitoring.

Measuring and monitoring relays
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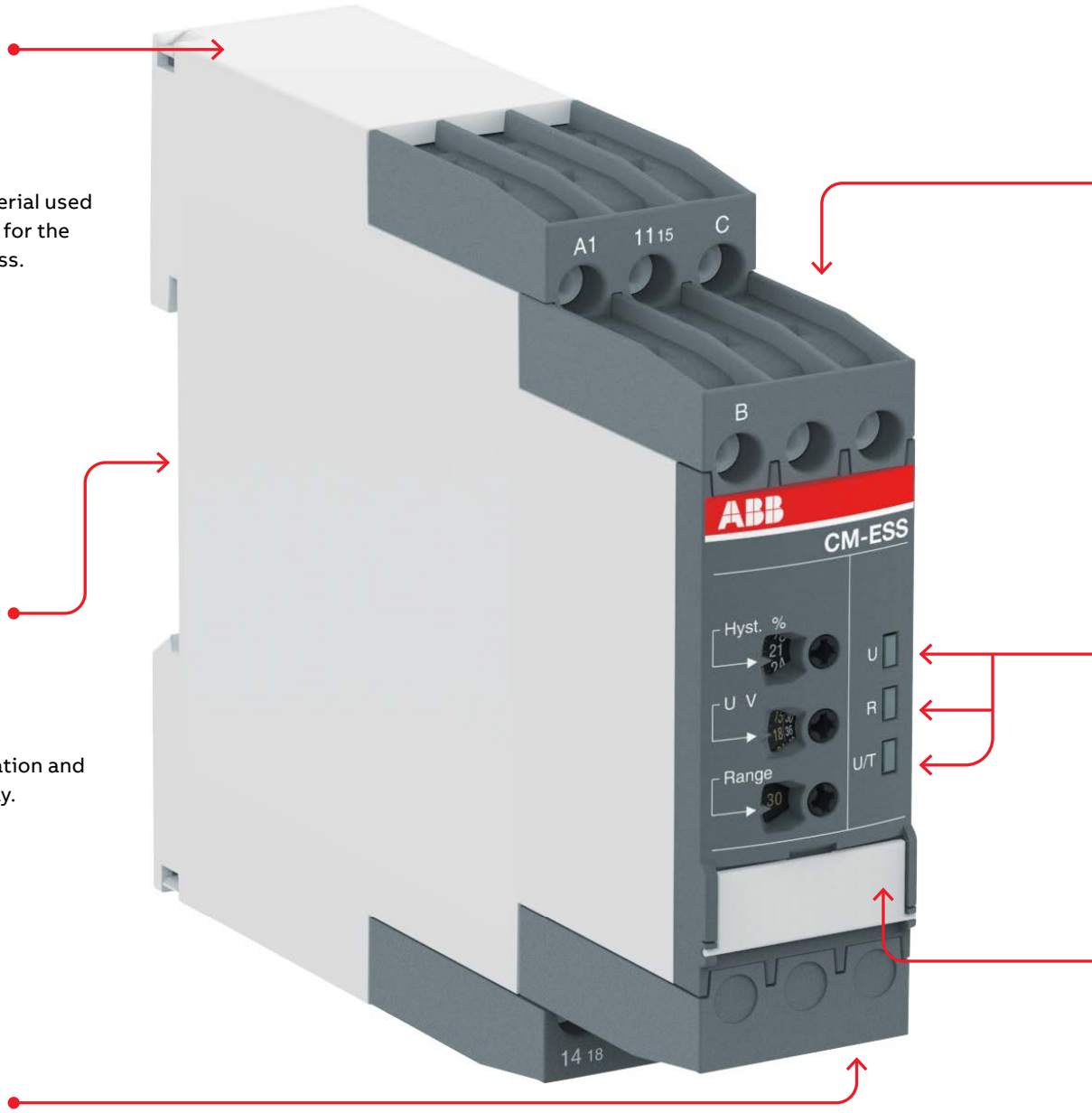
Measuring and monitoring relays
Benefits and advantages

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

Snap-on housing
Tool-free DIN rail installation and deinstallation of the relay.

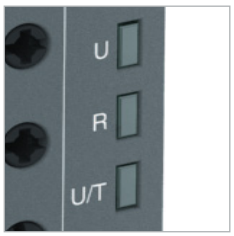
Sealable transparent cover
Protection against unauthorized changes of time and threshold values.



Measuring and monitoring relays
Benefits and advantages

Easy Connect technology
- 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.
- Excellent vibration resistance – the right solution for harsh environments.

Double-chamber cage connection terminals
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.

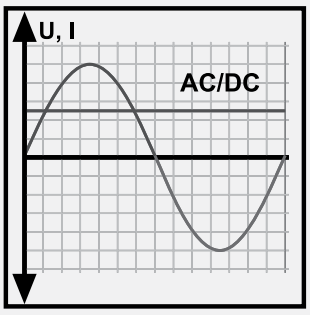


LEDs for status indication
All actual operational states are displayed by front-face LEDs, simplifying commissioning and troubleshooting.

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

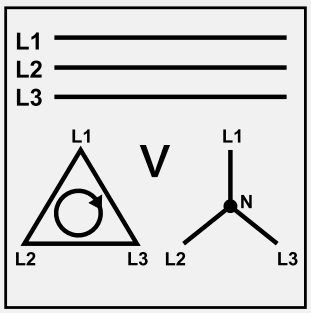
Measuring and monitoring relays
Offer overview

Measuring and monitoring relays monitor and detect operating conditions with regard to phase, current, voltage, frequency, temperature, liquid level or insulation faults. The relays inform users about abnormal conditions and allow them to take necessary corrective actions before severe and costly failures can occur. Depending on the product model, measuring and monitoring relays are categorized into seven product families.

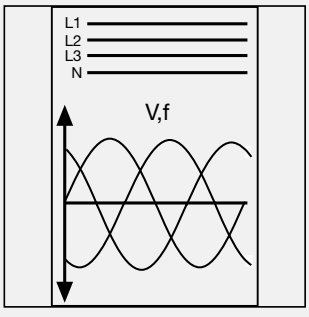


Single-phase current monitoring relays
- Monitoring of motor current consumption
- Monitoring of lighting installations and heating circuits
- Monitoring of transportation equipment overload
- Monitoring of locking devices, electromechanical brake gear and locked rotors

Single-phase voltage monitoring relays
- Speed monitoring of DC motors
- Monitoring of battery voltages and other supply networks



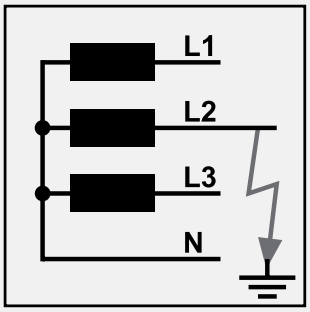
Three-phase monitoring relays
- Voltage monitoring of mobile three-phase equipment
- Protection of personnel and installations against phase reversal
- Monitoring of the supply voltage of machines and installations
- Protection of equipment against damage caused by unstable supply voltage
- Switching to emergency or auxiliary supply
- Protection of motors against damage caused by unbalanced phase voltages and phase loss
- Suitable for HVAC applications



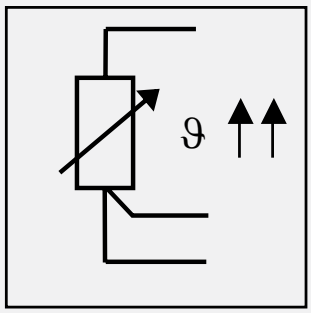
Grid feeding monitoring relays

The CM-UFD.M* range monitors all voltage and frequency parameters in a grid and ensures the safe feeding of decentrally produced electrical 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 under-frequency
- ROCOF (rate of change of frequency) and vector shift detection
- In compliance with several local standards

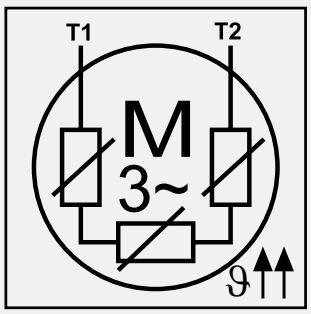
Measuring and monitoring relays
Offer overview



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

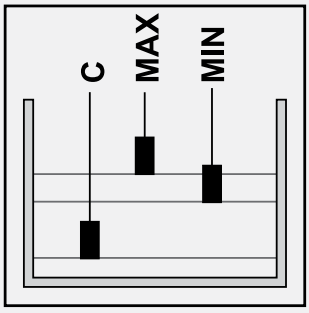


Temperature monitoring relays
Acquisition, messaging and regulation of temperatures of solid, liquid and gaseous media in processes and machines
- Motor and system protection
- Control panel temperature monitoring
- Frost monitoring
- Temperature limits for process variables, e.g. in the packing or electroplating industry
- Control of systems and machines like heating, air-conditioning and ventilation systems, solar collectors, heat pumps or hot water supply systems
- Bearing, gear oil and coolant monitoring



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

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



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

Measuring and monitoring relays
Offer overview

CM-N range: Multifunctional range
- 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 range
- 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 range
- 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

CM-TCN and CM-TCS: Smart temperature monitoring relays
- 45 mm or 22.5 mm wide housing
- Output contacts: 3 c/o contact
- Wide supply voltage range (24-240 V AC/DC)
- A wide range of settings, that can be adjusted flexibly
- NFC parametrization via smartphone app
- Back-lit LCD for easy reading and parametrization
- Embedded Modbus RTU communication interface with CM-TCN.012

Measuring and monitoring relays
Applications

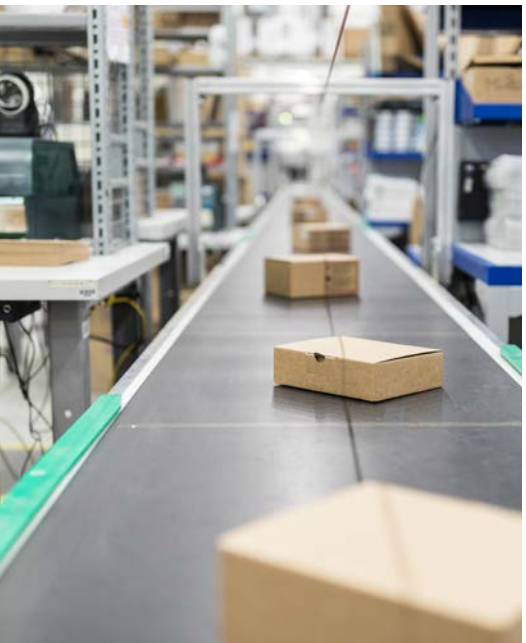
ABB offers a wide selection of measuring and monitoring relays to suit a wide range of applications for businesses worldwide. Excellent vibration resistance with the Easy Connect terminal technology and railway certifications for selected products ensure the operability, even in harsh environments.

Automation panels
- Textile industry - measuring and monitoring of motor voltage and current overload of, for example, looms.
- Packaging industry - measuring and monitoring of motor voltage and current overload of, for example, conveyor belts.

Infrastructure
- Water and wastewater applications - monitoring the liquid level of water tanks and wastewater recycling plants.
- Lifts - status monitoring of the three phase mains of, for example, construction lifts, passenger lifts and escalators.
- Hoisting applications - construction cranes, harbor cranes.
- Railway.

Renewable energy
- Solar - monitoring of the insulation resistance and the frequency and voltage of the public grid to keep electrical grids stable and meet local requirements.
- Wind - temperature, current and voltage supervision of automation panels and electrical motors.

Buildings
- Lifts - status monitoring of the three phase mains of, for example, construction lifts, passenger lifts and escalators.
- HVAC - monitoring of grid parameters, control and protection of loads.




A1
11 15
C
B
ABB
CM-ESS
Hyst. %
U V
Range
U
R
U/T
14 18
B1 0.3-1.5 A
B2 1-5 A
B3 3-15 A
CM-SRS
Hyst. %
I A
I
R
U/T
14 18
21 25
CM-EFS
>U V
<U V
Tv s
Range
U
R
U/T
24 28
14 18
12 16
C

Single-phase monitoring relays
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Single-phase monitoring relays
Benefits and advantages

For the monitoring of currents and voltages in single-phase AC/DC systems, ABB's CM-range contains a wide selection of powerful and compact devices, all in an only 22.5 mm wide housing. This product range includes current and voltage monitoring relays for over- and undercurrent and voltage protection – from 3 mA to 15 A, and from 3 V to 600 V.

Continuous operation

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

Reliable in harsh conditions

All relays work reliably in environments with low temperatures down to -20 °C. Additionally, the housing fulfills the UL 94 V-0 flammability standard requirements. Together with the vibration resistant push-in terminals, the relay is not only reliable, no matter the environment temperature, but is also durable to shock and vibration. Save time as retightening is no longer needed, and enhance the reliability and safety of the equipment.

Easy installation

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

Single-phase monitoring relays
Benefits and advantages

Characteristics current and voltage monitoring relays[1)]

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

[1)] depending on device

Applications

- Protection of electronic or electromechanical devices against over- and under voltage or over- and under current
- DC motor speed control
- Battery monitoring
- Monitoring of AC or DC supplies
- Monitoring of heating or lighting circuits

Current monitoring, single-phase
The ABB current monitoring relays CM-SRS.xx reliably monitor the occurrence 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.

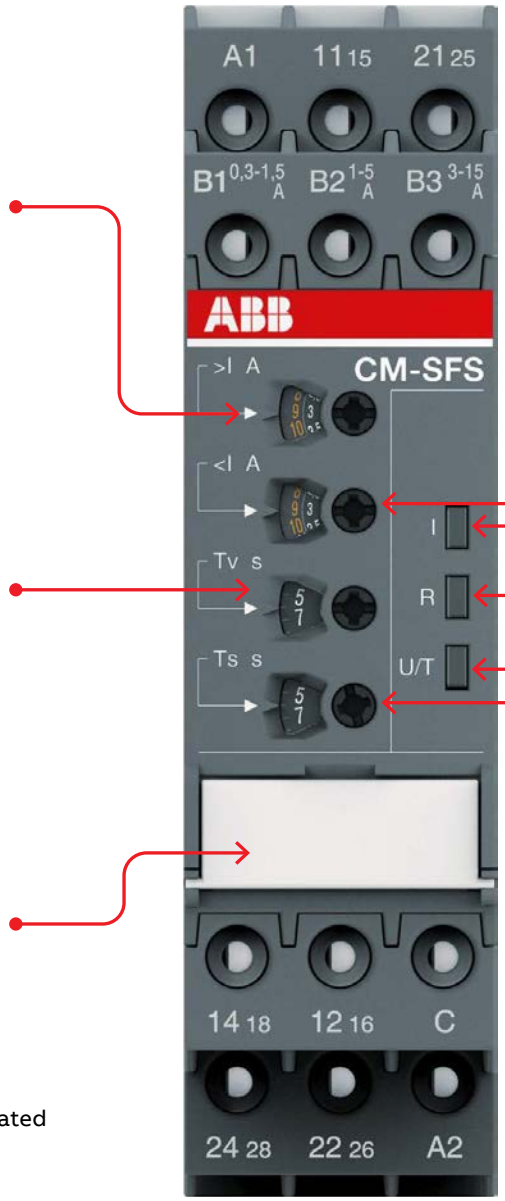
Current window monitoring (I_{min}, I_{max})
The window monitoring relay CM-SFS.2x is available if the application requires the simultaneous monitoring of over- and undercurrents.

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.

Single-phase monitoring relays
Operating controls

Current monitoring relays



Adjustment of the threshold value >I for overcurrent

Adjustment of the tripping delay T_v

DIP switches
- 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

Adjustment of the threshold value <I for undercurrent

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

Adjustment of the start-up delay T_s

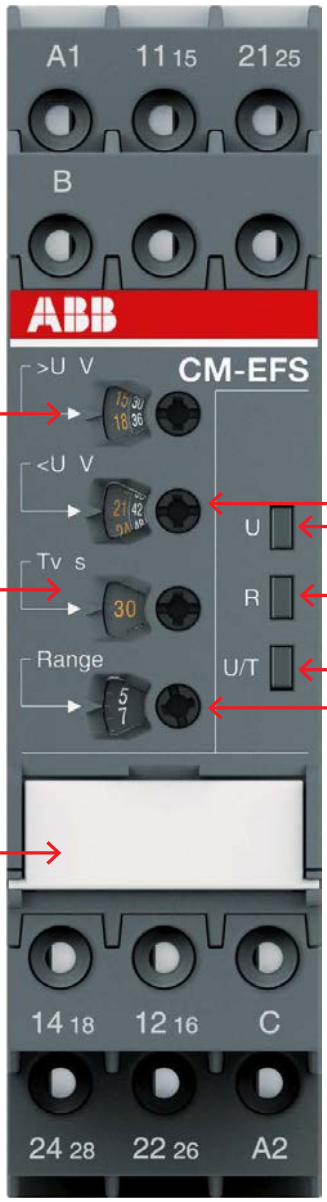
Single-phase monitoring relays
Operating controls

Voltage monitoring relays

Adjustment of the threshold value >U for overvoltage

Adjustment of the tripping delay T_v

DIP switches
- 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



Adjustment of the threshold value <U for undervoltage

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

Adjustment of the measuring range

Single-phase current monitoring relays

Selection table

	Order number	1SVR730840R0200	1SVR740840R0200	1SVR730841R0200	1SVR740841R0200	1SVR730841R1200	1SVR740841R1200	1SVR730840R0300	1SVR730841R0300	1SVR730841R1300	1SVR730840R0400	1SVR740840R0400	1SVR730841R0400	1SVR740841R0400	1SVR730841R1400	1SVR740841R1400	1SVR730840R0500	1SVR730841R0500	1SVR730841R1500	1SVR730840R0600	1SVR740840R0600	1SVR730840R0700	1SVR730760R0400	1SVR740760R0400	1SVR730760R0500
	Type	CM-SRS.11S	CM-SRS.11P	CM-SRS.11S	CM-SRS.11P	CM-SRS.11S	CM-SRS.11P	CM-SRS.12S	CM-SRS.12S	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.22S	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		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Window 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, 0.1 - 30 s											adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj			
ON- or OFF-delay, 0.1 - 30 s																							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

Single-phase current monitoring relays
Ordering details


2CDC 251 054 V0011

CM-SRS.22S


2CDC 251 056 V0011

CM-SFS.22P

Description

The CM range current monitoring relays protect single-phase mains (DC or AC) from over- and undercurrent from 3 mA to 15 A.

Ordering details

Description	Type	Order code	Weight (1 pc) kg (lb)
See selection table	CM-SRS.11S	1SVR730840R0200	0.145 (0.320)
		1SVR730841R0200	0.161 (0.355)
		1SVR730841R1200	0.161 (0.355)
	CM-SRS.11P	1SVR740840R0200	0.137 (0.302)
		1SVR740841R0200	0.153 (0.337)
		1SVR740841R1200	0.153 (0.337)
	CM-SRS.12S	1SVR730840R0300	0.137 (0.302)
		1SVR730841R0300	0.168 (0.370)
		1SVR730841R1300	0.168 (0.370)
	CM-SRS.21S	1SVR730840R0400	0.152 (0.335)
		1SVR730841R0400	0.179 (0.395)
		1SVR730841R1400	0.179 (0.395)
	CM-SRS.21P	1SVR740840R0400	0.141 (0.311)
		1SVR740841R0400	0.168 (0.370)
		1SVR740841R1400	0.168 (0.370)
	CM-SRS.22S	1SVR730840R0500	0.144 (0.399)
		1SVR730841R0500	0.181 (0.399)
		1SVR730841R1500	0.181 (0.399)
	CM-SRS.M1S	1SVR730840R0600	0.153 (0.337)
	CM-SRS.M1P	1SVR740840R0600	0.142 (0.313)
	CM-SRS.M2S	1SVR730840R0700	0.155 (0.342)
	CM-SFS.21S	1SVR730760R0400	0.150 (0.331)
	CM-SFS.21P	1SVR740760R0400	0.139 (0.306)
	CM-SFS.22S	1SVR730760R0500	0.158 (0.348)

S: screw connection
P: push-in connection

Single-phase voltage monitoring relays

Selection table

	Order number	1SVR730830R0300	1SVR740830R0300	1SVR730831R0300	1SVR740831R0300	1SVR730831R1300	1SVR740831R1300	1SVR730830R0400	1SVR740830R0400	1SVR730831R0400	1SVR740831R0400	1SVR730831R1400	1SVR740831R1400	1SVR730830R0500	1SVR740830R0500	1SVR730750R0400	1SVR740750R0400
	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, 0.1 - 30 s								adj	adj	adj	adj	adj	adj	adj	adj		
ON- or OFF-delay, 0.1 - 30 s																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

Single-phase voltage monitoring relays
Ordering details

CM-ESS.MP

CM-EFS.2

Description

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

Ordering details

Description	Type	Order code	Weight (1 pc) kg (lb)
See selection table	CM-ESS.1S	1SVR730830R0300	0.135 (0.298)
		1SVR730831R0300	0.164 (0.362)
		1SVR730831R1300	0.164 (0.362)
	CM-ESS.1P	1SVR740830R0300	0.126 (0.278)
		1SVR740831R0300	0.155 (0.342)
		1SVR740831R1300	0.155 (0.342)
	CM-ESS.2S	1SVR730830R0400	0.153 (0.337)
		1SVR730831R0400	0.181 (0.399)
		1SVR730831R1400	0.181 (0.399)
	CM-ESS.2P	1SVR740830R0400	0.142 (0.313)
		1SVR740831R0400	0.170 (0.375)
		1SVR740831R1400	0.170 (0.375)
	CM-ESS.MS	1SVR730830R0500	0.154 (0.340)
	CM-ESS.MP	1SVR740830R0500	0.143 (0.320)
	CM-EFS.2S	1SVR730750R0400	0.157 (0.346)
	CM-EFS.2P	1SVR740750R0400	0.146 (0.322)

S: screw connection
P: push-in connection

Single-phase current monitoring relays

Technical data

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[1)]
	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
	Continuous 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		6 % of full-scale value			
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		$\Delta U \leq 0.5$ %			
Accuracy within the temperature range		$\Delta U \leq 0.06$ % / °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		-	$\Delta t \leq 0.5$ %		
Accuracy within the temperature range		-	$\Delta t \leq 0.06$ % / °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			

Single-phase current monitoring relays

Technical data

Type		CM-SRS.1	CM-SRS.2	CM-SRS.M	CM-SFS.2
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 [2]		open- or closed-circuit principle configurable [2]	
Contact material		AgNi			
Minimum switching voltage / minimum switching current		24 V / 10 mA			
Maximum switching voltage / maximum switching current		250 V AC / 4 A AC			
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) at 230 V	4 A			
	AC-15 (inductive) at 230 V	3 A			
	DC-12 (resistive) at 24 V	4 A			
	DC-13 (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		$30x10^6$ switching cycles			
Electrical lifetime (AC-12, 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			

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

[2] 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 exceeds ⊿ / falls below ⊾ the adjusted threshold value

Single-phase current monitoring relays
Technical data

Type		CM-SRS.1	CM-SRS.2	CM-SRS.M	CM-SFS.2
General data					
MTBF		on request			
Duty cycle		100 %			
Dimensions		see dimensional drawings			
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool			
Mounting position		any			
Minimum distance to other units		10 mm (0.39 in) at measured current > 10 A			
Material of housing		UL 94 V-0			
Degree of protection	housing / terminals	IP50 / IP20			
Electrical connection					
Connecting capacity		**Screw connection technology**		**Easy Connect Technology (Push-in)**	
	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm² (1 x 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)		2 x 0.5-1.5 mm² (2 x 18-16 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 (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)		class 2			
Shock		class 2			
Isolation data					
Rated insulation voltage	supply / measuring circuit / output	600 V			
	supply / output 1/2	250 V			
Rated impulse withstand voltage U_{imp}	supply /measuring circuit / output	6 kV 1.2/50 µs			
	supply / output 1/2	4 kV 1.2/50 µs			
Pollution degree		3			
Overvoltage category		III			
Standards / Directives					
Standards		IEC/EN 60255-27, IEC/EN 60947-5-1			
Low Voltage Directive		2014/35/EU			
EMC Directive		2014/30/EU			
RoHS Directive		2011/65/EU			
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			

Single-phase voltage monitoring relays

Technical data

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 under-voltage 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
	Continuous capacity	660 V	660 V	660 V	660 V
Threshold value(s)		adjustable within the indicated measuring range			
Tolerance of the adjusted threshold value		6 % of full-scale value			
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		$\Delta U \leq 0.5$ %			
Accuracy within the temperature range		$\Delta U \leq 0.06$ % / °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 value			
Accuracy within the 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/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			

Single-phase voltage monitoring relays

Technical data

Type		CM-ESS.1	CM-ESS.2	CM-ESS.M	CM-EFS.2
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			
Minimum switching voltage / minimum switching current		24 V / 10 mA			
Maximum switching voltage / maximum switching current		250 V AC / 4 A AC			
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) at 230 V	4 A			
	AC-15 (inductive) at 230 V	3 A			
	DC-12 (resistive) at 24 V	4 A			
	DC-13 (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		$30x10^6$ switching cycles			
Electrical lifetime	AC-12, 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			

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 exceeds ⊿ / falls below ⊾ the adjusted threshold value

Single-phase voltage monitoring relays

Technical data

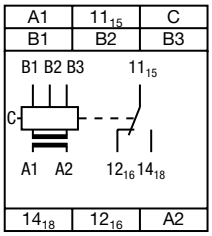
Type		CM-ESS.1	CM-ESS.2	CM-ESS.M	CM-EFS.2
General data					
MTBF		on request			
Duty cycle		100%			
Dimensions		see dimensional drawings			
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool			
Mounting position		any			
Minimum distance to other units	vertical / horizontal	not necessary / not necessary			
Material of housing		UL 94 V-0			
Degree of protection	housing / terminals	IP50 / IP20			
Environmental data					
Ambient temperature ranges	operation	-20...+60 °C			
	storage	-40...+85 °C			
Damp heat, cyclic (IEC/EN 60068-2-30)		55 °C, 6 cycle			
Vibration, sinusoidal		class 2			
Shock		class 2			
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 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)		2 x 0.5-1.5 mm² (2 x 18-16 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 (7.08 lb.in)		-	
Isolation data					
Rated insulation voltage	supply / measuring circuit / output	600 V			
	supply / output 1/2	250 V			
Rated impulse withstand voltage U_{imp}	supply / measuring circuit / output	6 kV 1.2/50 µs			
	supply / output 1/2	4 kV 1.2/50 µs			
Pollution degree		3			
Overvoltage category		III			
Standards / Directives					
Product standard		IEC/EN 60255-27, IEC/EN 60947-5-1			
Low Voltage Directive		2014/35/EU			
EMC Directive		2014/30/EU			
RoHS Directive		2011/65/EU			
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			

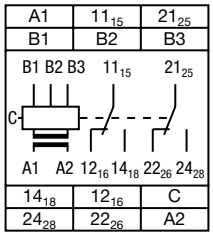
Single-phase current monitoring relays

Technical diagrams

Connection diagram

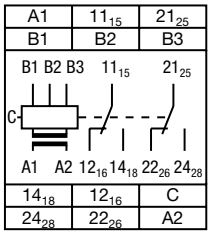
CM-SRS.1x, CM-SRS.2x





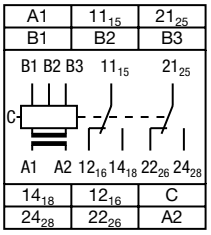
A1-A2	Control supply voltage
B1-C	Measuring range 1: 3-30 mA or 0.3-1.5 A
B2-C	Measuring range 2: 10-100 mA or 1-5 A
B3-C	Measuring range 3: 0.1-1 A or 3-15 A
11_{15}-12_{16}/14_{18} 21_{25}-22_{26}/24_{28}	Output contacts - open-circuit principle

CM-SRS.Mx



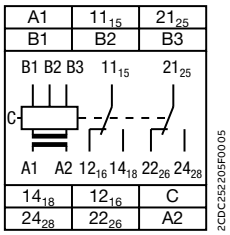
A1-A2	Control supply voltage
B1-C	Measuring range 1: 3-30 mA or 0.3-1.5 A
B2-C	Measuring range 2: 10-100 mA or 1-5 A
B3-C	Measuring range 3: 0.1-1 A or 3-15 A
11_{15}-12_{16}/14_{18} 21_{25}-22_{26}/24_{28}	Output contacts - open- or closed circuit principle

CM-SFS.2x



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- or closed circuit principle

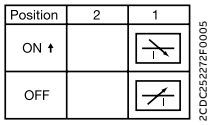
CM-SRS.2x



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- or closed circuit principle

DIP switch functions

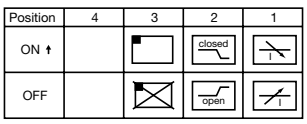
CM-SRS.1x, CM-SRS.2x



1	ON	Undercurrent monitoring
	OFF	Overcurrent monitoring

OFF = Default

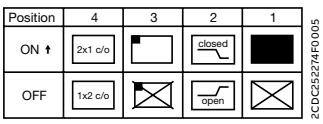
CM-SRS.Mx



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

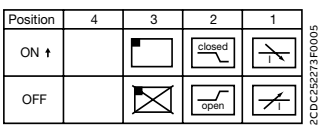
CM-SFS.2x



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

CM-SRS.2x



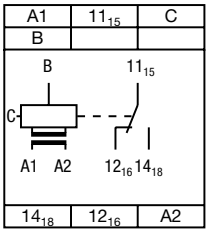
1	ON	Undercurrent monitoring
	OFF	Overcurrent monitoring
2	ON	Closed-circuit principle
	OFF	Open-circuit principle
3	ON	Latching function activated
	OFF	Latching function not activated

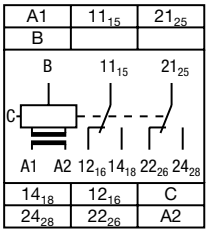
OFF = Default

Single-phase voltage monitoring relays
Technical diagrams

Connection diagram

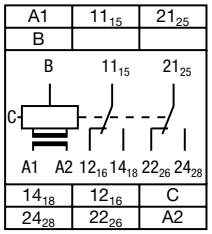
CM-ESS.1, CM-ESS.2





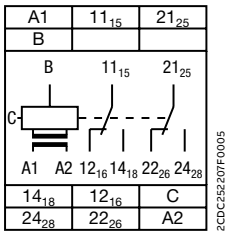
A1-A2	Control supply voltage
B-C	Measuring ranges AC/DC: 3-30 V; 6-60 V; 30-300 V; 60-600 V
11_{15}-12_{16}/14_{18} 21_{25}-22_{26}/24_{28}	Output contacts - open-circuit principle

CM-EFS.2



A1-A2	Control supply voltage
B-C	Measuring ranges AC/DC: 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

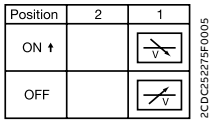
CM-ESS.M



A1-A2	Control supply voltage
B-C	Measuring ranges AC/DC: 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

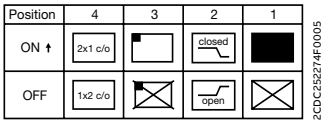
DIP switch functions

CM-ESS.1, CM-ESS.2



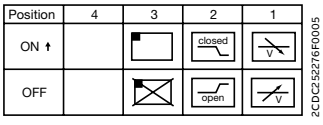
1	ON	Undervoltage monitoring
	OFF	Overvoltage monitoring
OFF = Default		

CM-EFS.2



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	ON	2x1 c/o contact
	OFF	1x2 c/o contacts
OFF = Default		

CM-ESS.M



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		

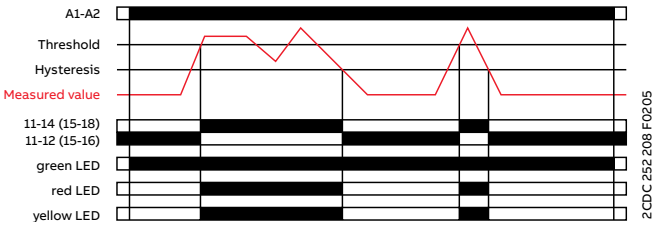
Single-phase monitoring relays
Function diagrams

CM-SRS.1x and CM-SRS.2x

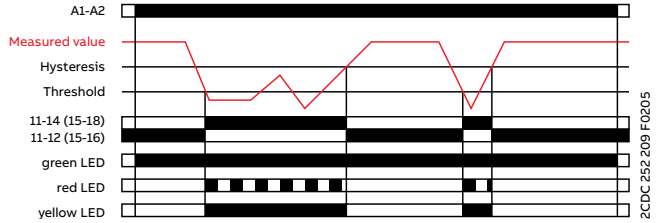
If the measured value exceeds resp. drops below the adjusted threshold value, the output relay(s) energize(s): on the CM-SRS.1x - immediately, on the CM-SRS.2x - after the set tripping delay T_V. If the measured value exceeds resp. drops below the threshold value plus resp. minus the adjusted hysteresis,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

CM-SRS.1x

Overcurrent monitoring

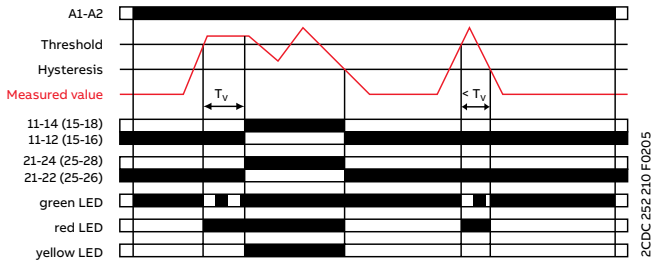


Undercurrent monitoring

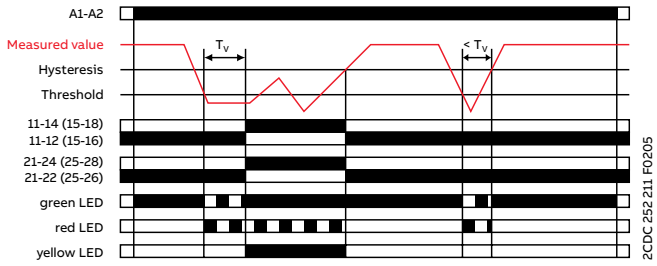


CM-SRS.2x

Overcurrent monitoring



Undercurrent monitoring



Further function diagrams see data sheet.

Single-phase monitoring relays

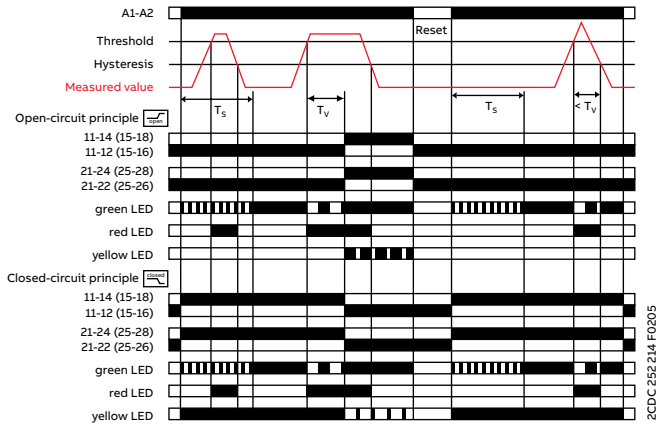
Function diagrams

CM-SRS.Mx

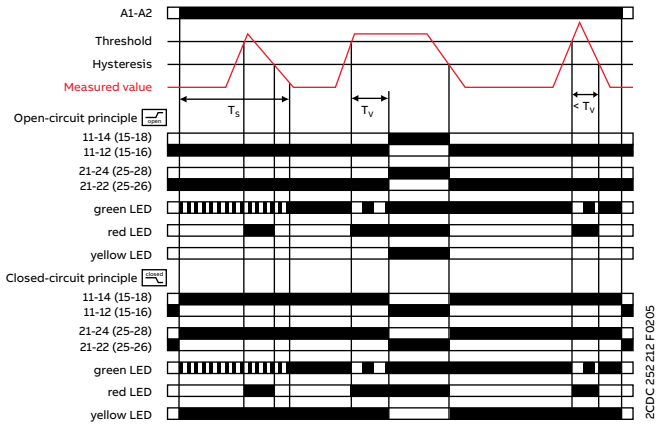
If the measured value exceeds resp. drops below the adjusted threshold value before the set start-up delay T_S is complete, the output relays do not change their actual state. If the measured value exceeds resp. drops below the adjusted threshold value when T_S is complete, the tripping delay T_V starts.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

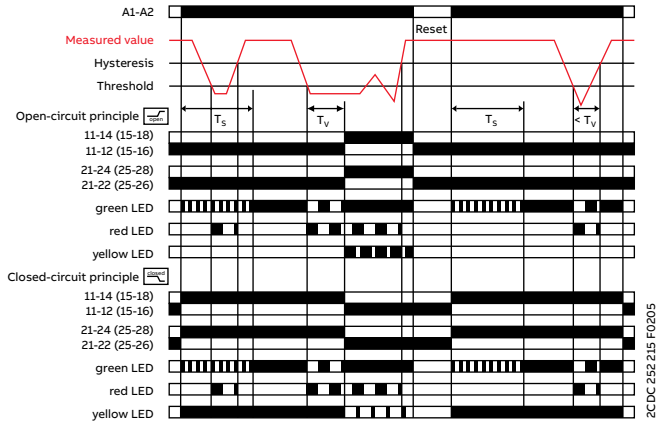
Overcurrent monitoring with latching



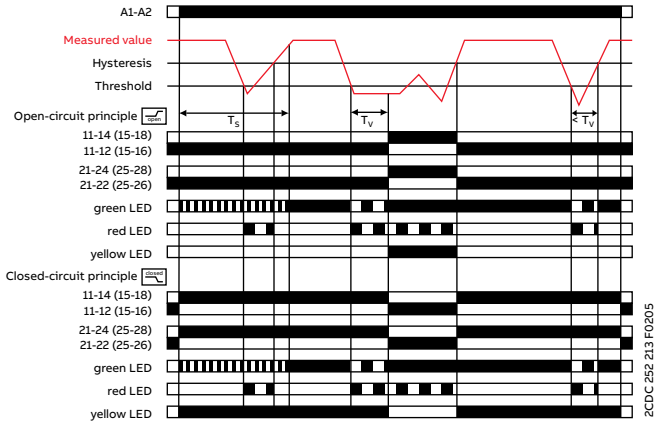
Overcurrent monitoring without latching



Undercurrent monitoring with latching



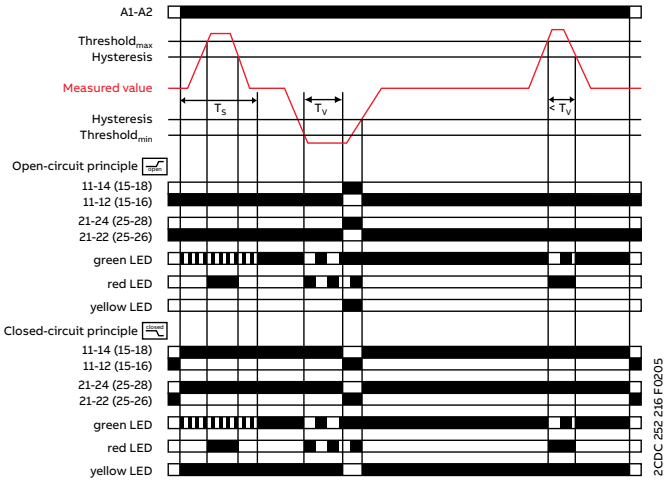
Undercurrent monitoring without latching



Further function diagrams see data sheet.

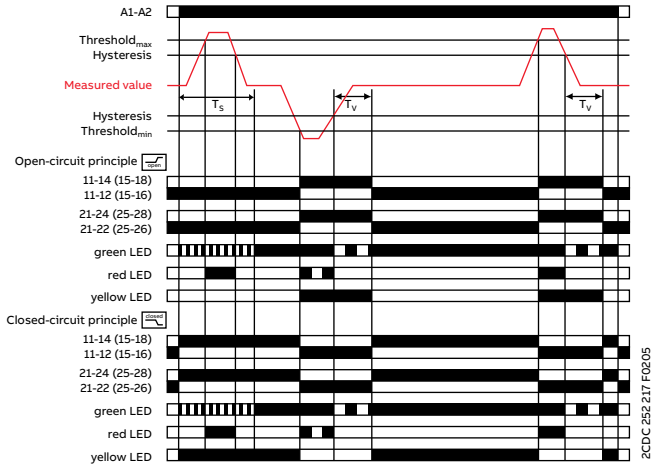
Single-phase monitoring relays
Function diagrams

CM-SFS.2x
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 open /de-energize closed.
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 open / energize closed. With activated latching function ▭ the output relays remain energized open and de-energize only when the supply voltage is interrupted / the output relays remain de-energized closed and energize only when the supply voltage is switched off and then again switched on = Reset.

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 open / de-energize closed, 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 open / energize closed, provided that the latching function is not activated ⊠. With activated latching function ▭ the output relays remain energized open and de-energize only when the supply voltage is interrupted / the output relays remain de-energized closed 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. 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}

Further function diagrams see data sheet.

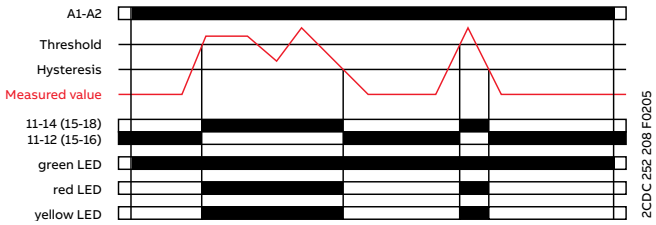
Single-phase monitoring relays
Function diagrams

CM-ESS.1x and CM-ESS.2x

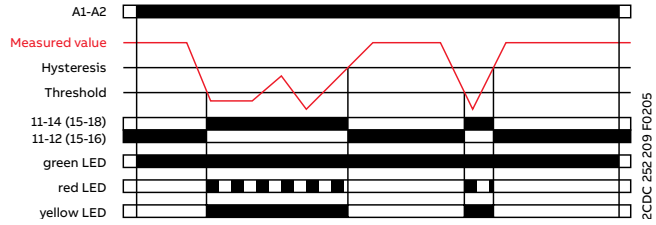
Depending on the configuration, the voltage monitoring relays CM-ESS.1 and CM-ESS.2 can be used for over- or under-voltage monitoring in single-phase AC and/or DC systems. The voltage to be monitored (measured value) is applied to terminals B-C. The devices work according to the open-circuit principle. 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.

CM-ESS.1x

Overvoltage monitoring

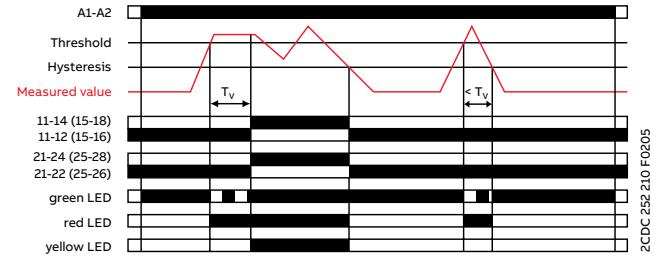


Undervoltage monitoring

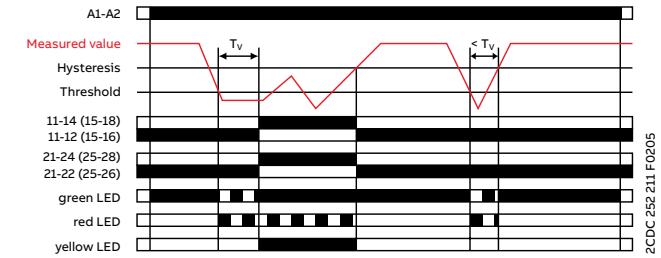


CM-ESS.2x

Overvoltage monitoring



Undervoltage monitoring



Further function diagrams see data sheet.

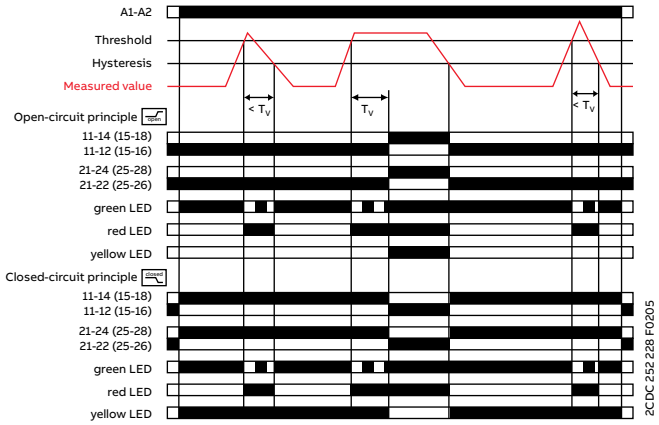
Single-phase monitoring relays

Function diagrams

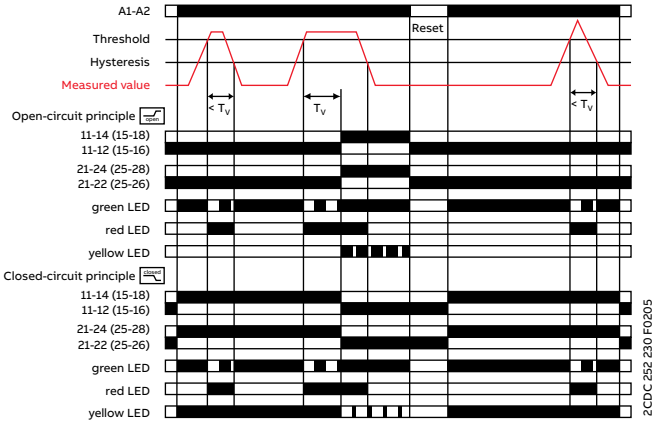
CM-ESS.Mx

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.

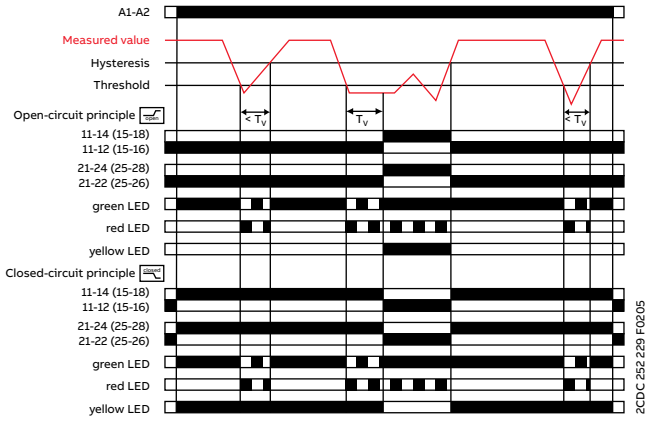
Overvoltage monitoring without latching



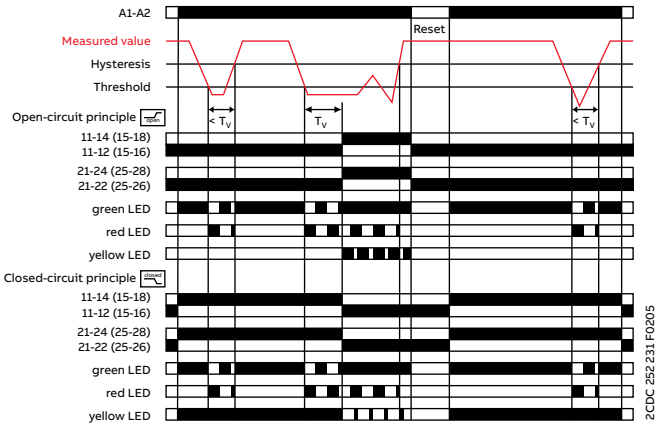
Overvoltage monitoring with latching



Undervoltage monitoring without latching



Undervoltage monitoring with latching

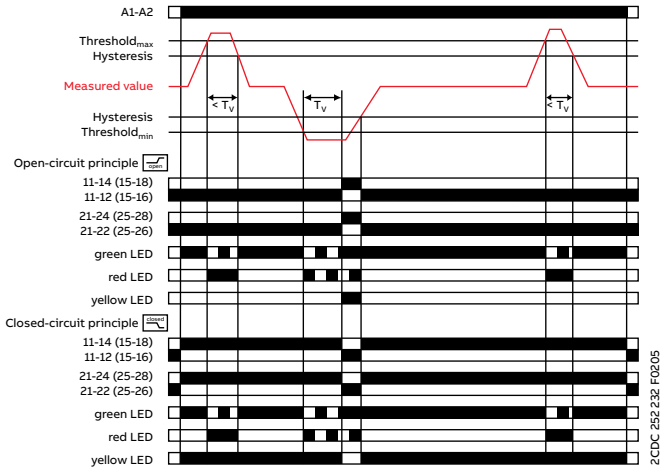


Further function diagrams see data sheet.

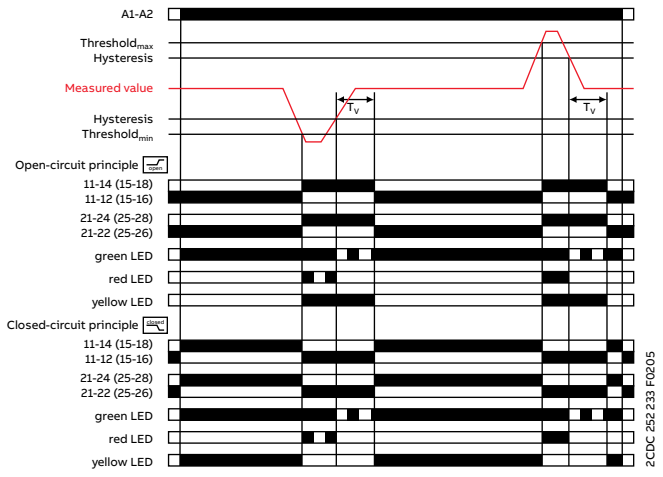
Single-phase monitoring relays
Function diagrams

CM-EFS.2x

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



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



ON-delayed ⊠ voltage window monitoring with parallel switching c/o contacts 1x2 c/o:
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 open / de-energize closed.
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 open / energize closed. With activated latching function ⊠ the output relays remain energized open and de-energize only when the supply voltage is interrupted / the output relays remain de-energized closed 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 1x2 c/o:
If the measured value exceeds resp. drops below the adjusted threshold value, the output relays energize open / de-energize closed, 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 open / energize closed, provided that the latching function is not activated ⊠. With activated latching function ⊠ the output relays remain energized open and de-energize only when the supply voltage is interrupted / the output relays remain de-energized closed 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. 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}

Further function diagrams see data sheet.


L1 L2 L3
ABB
CM-PFE
CM-PAS
CM-MPN
CM-PSS
Asym. %
Time s
R/T
F1
F2
Function
>U 440V
≤U 360V
26 25 28
16

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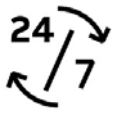
Three-phase monitoring relays
Benefits and advantages

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



Continuous operation

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

Reliable in harsh conditions

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

Easy installation

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

Three-phase monitoring relays
Benefits and advantages

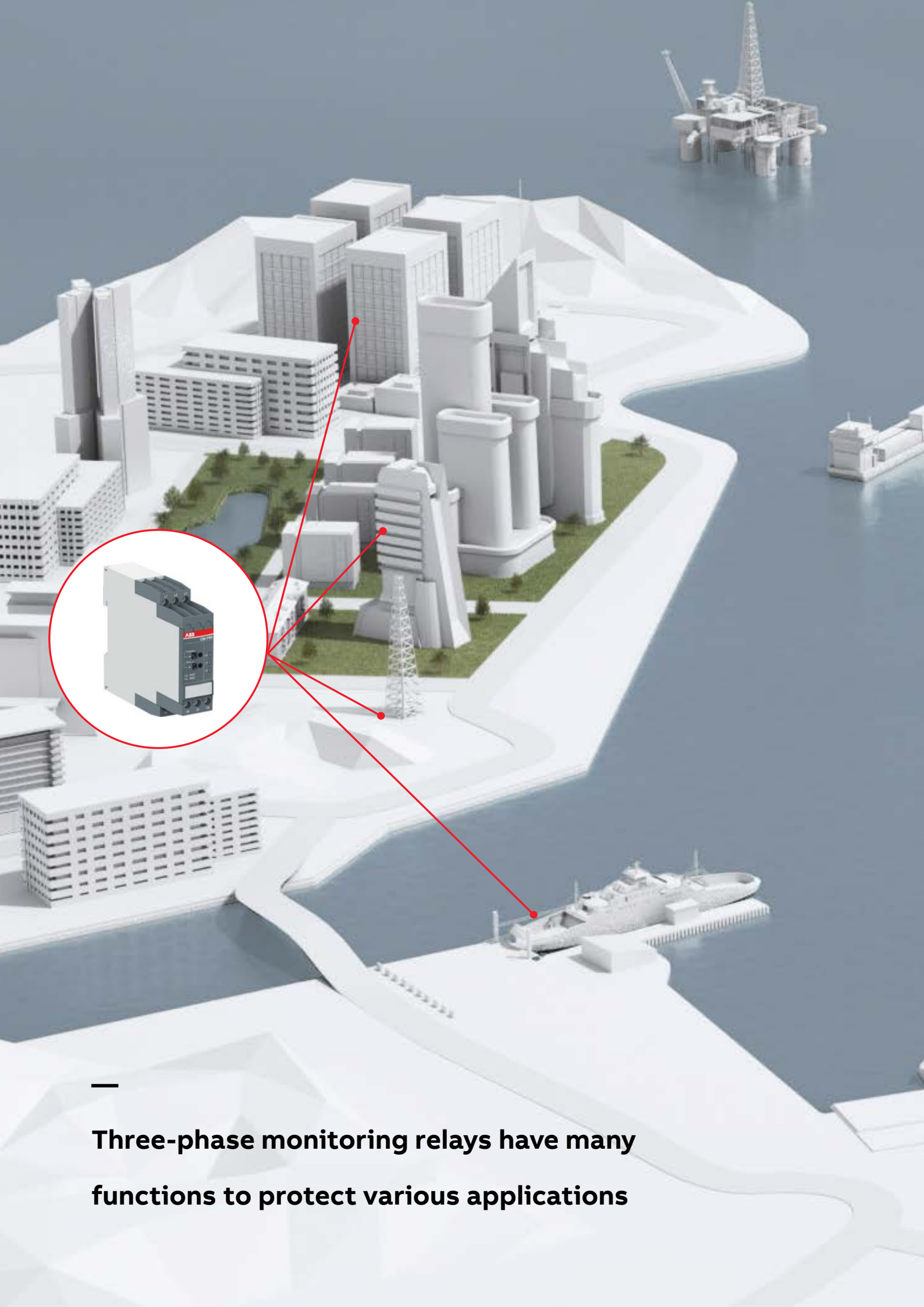
Characteristics

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

[1)] devices CM-MPS.23 and CM-MPS.43

Applications

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



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

Three-phase monitoring relays
Function

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

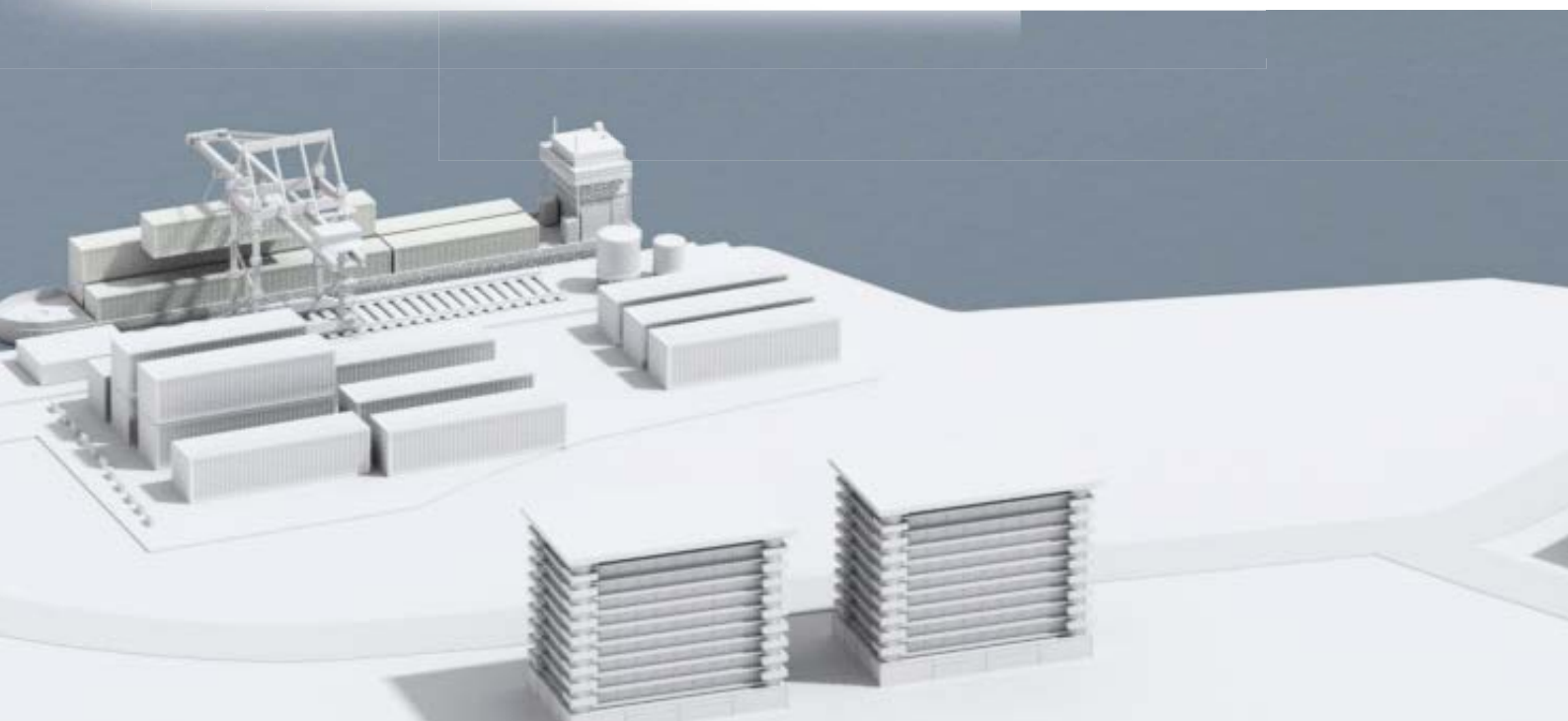
Phase sequence
Changing the phase sequence during operation or a wrong phase sequence prior to startup causes a change of the rotational direction of the connected device. Generators, pumps or fans rotate in the wrong direction and the installation is no longer working properly. In particular, for moveable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

Phase loss
In case of phase loss, undefined 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 installation and cause damage or destruction of valuable parts.

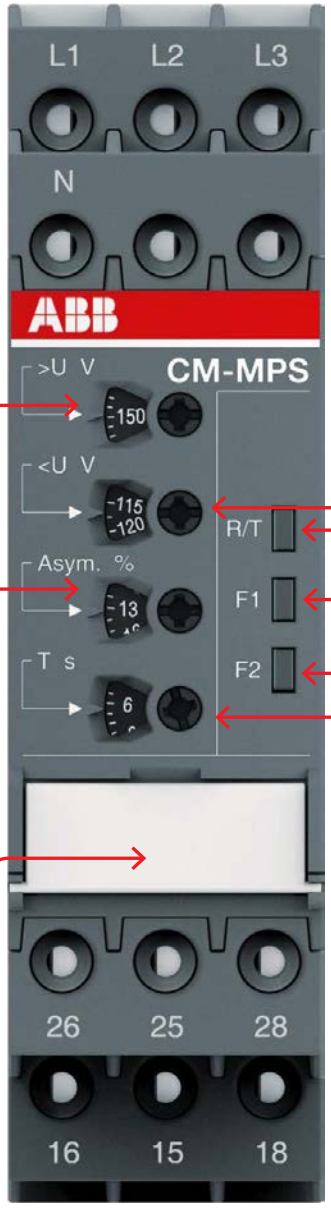
Selectable phase sequence monitoring
The phase sequence monitoring can be switched off by means of a rotary switch or a DIP switch. This enables monitoring of three-phase mains where phase sequence is not relevant for the application, for example in case of motors with forward and reverse rotation, heating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

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



Three-phase monitoring relays
Operating controls

S-range housing



Adjustment of the threshold value >U for overvoltage

Adjustment of the threshold value Asymetry for phase unbalance

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

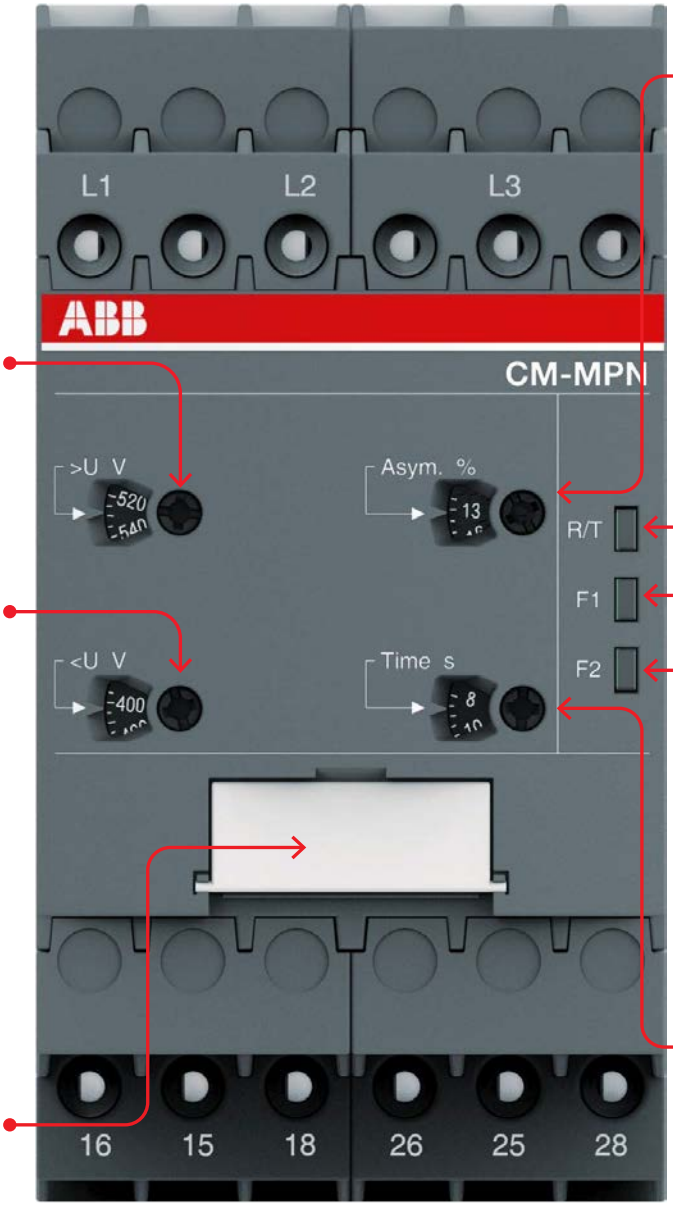
Adjustment of the threshold value <U for undervoltage

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

Adjustment of the tripping delay T

Three-phase monitoring relays
Operating controls

N-range housing



Adjustment of the threshold value Asymmetry for phase unbalance

Adjustment of the threshold value >U for overvoltage

Adjustment of the threshold value <U for undervoltage

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

Adjustment of the tripping delay T

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

Three-phase monitoring relays

Selection table - singlefunctional

	Order number	1SVR550881R9400	1SVR550882R9500	1SVR550870R9400	1SVR550871R9500	1SVR550824R9100	1SVR550826R9100	1SVR730824R9300	1SVR740824R9300	1SVR730784R2300	1SVR740784R2300	1SVR730784R3300	1SVR740784R3300	1SVR730794R1300	1SVR740794R1300	1SVR730794R3300	1SVR740794R3300	1SVR730794R2300	1SVR740794R2300	1SVR730774R1300	1SVR740774R1300	1SVR730774R3300	1SVR740774R3300
	Type	CM-PBE	CM-PBE	CM-PVE	CM-PVE	CM-PFE	CM-PFE.2	CM-PFS.S	CM-PFS.P	CM-PSS.31S	CM-PSS.31P	CM-PSS.41S	CM-PSS.41P	CM-PVS.31S	CM-PVS.31P	CM-PVS.41S	CM-PVS.41P	CM-PVS.81S	CM-PVS.81P	CM-PAS.31S	CM-PAS.31P	CM-PAS.41S	CM-PAS.41P
Rated control supply voltage U_s																							
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			■	■																			
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	sel	■	■	■	■	■
Overvoltage			■	■					■	■	■	■	■	■	■	■	■	■					
Undervoltage			■	■					■	■	■	■	■	■	■	■	■	■					
Unbalance																			■	■	■	■	■
Neutral[1)]	■		■																				
Thresholds																							
adjustable (adj) or fixed (fix)	fix	fix	fix	fix	fix	fix	fix	fix	fix	fix	fix	fix	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
Timing functions for tripping delay																							
ON-delay	fix	fix	fix	fix	fix	fix	fix	fix											adj	adj	adj	adj	adj
ON- or OFF-delay									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.

adj: adjustable
sel: selectable
fix: fixed

Three-phase monitoring relays

Ordering details - singlefunctional

CM-PBE

CM-PSS.41P

CM-PAS.31P

Description

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

Ordering details

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

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

S: screw connection
P: push-in connection

Three-phase monitoring relays

Selection table - multifunctional

	Order number	1SVR730885R1300	1SVR740885R1300	1SVR730885R3300	1SVR740885R3300	1SVR730884R1300	1SVR740884R1300	1SVR730884R3300	1SVR740884R3300	1SVR730885R4300	1SVR740885R4300	1SVR730884R4300	1SVR740884R4300	1SVR750487R8300	1SVR760487R8300	1SVR750488R8300	1SVR760488R8300	1SVR750489R8300	1SVR760489R8300
	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
Rated control supply voltage U_s																			
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																			
Mains with harmonic content										■	■	■	■						
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		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Interrupted neutral monitoring [1]		■	■	■	■					■	■								
Thresholds																			
Adjustable (adj)		adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
Timing functions for tripping delay																			
On- or 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 relay detects by means of a phase unbalance the interruption of the neutral conductor. The external conductor voltage towards the neutral conductor is measured too.

adj: adjustable
sel: selectable

Three-phase monitoring relays

Ordering details - multifunctional

CM-MPS.23P

CM-MPN.52P

Description

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

Ordering details

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

S: screw connection
P: push-in connection

Three-phase monitoring relays

Technical data

Type		**CM-PBE**[1]	**CM-PBE**	**CM-PVE**[1]	**CM-PVE**	**CM-PFE**	**CM-PFE.2**	**CM-PFS**
Input circuit - supply circuit		**L1-L2-L3-N**	**L1-L2-L3**	**L1-L2-L3-N**	**L1-L2-L3**			
Rated control supply voltage U_S = measuring voltage		3x380-440 V AC, 220-240 V AC	3x380-440 V AC	3x320-460 V AC, 185-265 V AC	3x320-460 V AC	3x208-440 V AC	3x200-500 V AC	
Power consumption							13 mA / 9 VA	approx. 15 VA
Rated control supply voltage U_S tolerance		-15...+15 %		-15...+10 %				
Rated frequency		50/60 Hz		50/60 Hz (-10...+10 %)		50/60 Hz		
Duty time		100 %						
Input circuit - measuring circuit		**L1-L2-L3-N**	**L1-L2-L3**	**L1-L2-L3-N**	**L1-L2-L3**			
Monitoring functions	phase failure	■	■	■	■	■	■	■
	phase sequence	-	-	-	-	■	■	■
	over- / undervoltage	-	-	■	■	-	-	-
	neutral	■	-	■	-	-	-	-
Measuring ranges		3x380-440 V AC, 220-240 V AC	3x380-440 V AC	3x320-460 V AC, 185-265 V AC	3x320-460 V AC	3x208-440 V AC	3x200-500 V AC	
Thresholds	U_{min}	0.6 x U_N		fixed 185 V / 320 V	fixed 320 V	0.6 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 temperature range		-		$\Delta U \leq 0.06$ % / °C				
Timing circuit								
Start-up delay t_s		fixed 500 ms (±20 %)				fixed 500 ms		
Tripping t_v		fixed 150 ms (±20 %)		at over-/ undervoltage fixed 500 ms (±20 %)		fixed 500 ms		-
Indication of operational states								
Relay status	R: yellow LED	⎍ output relay energized						
Fault message	F: red LED	Only CM-PFS: ⎍ phase failure / ⎍ phase sequence error						

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-PFE.2	CM-PFS
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)]						
Minimum switching voltage / Minimum switching current		24 V / 10 mA						
Maximum switching voltage / maximum switching voltage		see data sheets						
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) 230 V	4 A						
	AC-15 (inductive) 230 V	3 A						
	DC-12 (resistive) 24 V	4 A						
	DC-13 (inductive) 24 V	2 A						
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300 pilot duty, general purpose 250 V, 4 A, cos phi 0.75						
	max. rated operational voltage	300 V AC						
	max. continuous thermal current at B 300	5 A						
	max. making/breaking apparent power at B 300	3600/360 VA						
Mechanical lifetime		30 x 10^6 switching cycles						
Electrical lifetime (AC-12, 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						
Conventional thermal current I_{th}						4 A		

Three-phase monitoring relays

Technical data

Type		CM-PBE[1)]	CM-PBE	CM-PVE[1)]	CM-PVE	CM-PFE	CM-PFE.2	CM-PFS
General data								
Duty cycle		100 %						
Dimensions		see dimensional drawings						
Mounting		DIN rail (IEC/EN 60715)						
Mounting position		any						
Minimum distance to other unites	horizontal	not necesarry				≥ 10 mm if ambient temperature > 50 °C and rated operational currents > 2 A		≥ 10 mm in case of continuous measuring voltage > 440 V
Degree of protection	housing / terminals	IP50 / IP20						
Electrical connection								
Connecting capacity	fine-strand with wire end ferrule	2 x 0.75-1.5 mm² (2 x 18-16 AWG)						Same as CM-PSS.31
	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 in)						Same as CM-PSS.31
Tightening torque		0.6-0.8 Nm						
Environmental data								
Ambient temperature range	operation / storage	-20..+60 °C / -40...+85 °C						
Climatic class		-				3K3		
Damp heat	IEC/EN 60068-2-30	40 °C, 93 % RH, 4 days				-		
Damp heat, cyclic	IEC/EN 60068-2-30					6 x 24 h cycle, 55 °C, 95 % RH		
Vibration withstand	IEC/EN 60068-2-6	10-57 Hz: 0.075 mm; 57-150 Hz: 1 g				-		
Vibration, sinusoidal		-				class 2		
Shock		-				class 2		
Isolation data								
Rated insulation voltage U_i	between input, measuring and output circuits	400 V				-		
	input circuit / output circuit	-				600 V		
	output circuit 1 / output circuit 2	-						300 V
Rated impulse withstand voltage U_{imp}	between input, measuring and output circuits	4 kV / 1.2 -50 µs				-		
	input circuit / output circuit	-				6 kV		
	output circuit 1 / output circuit 2	-						4 kV
Basic insulation	supply circuit / output circuit	-						600 V AC
Pollution degree		3						
Overvoltage category		III						
Standards / Directives								
Standards		IEC/EN 60947-5-1				IEC/EN 60255-27, IEC/EN 60947-5-1		
Low Voltage Directive		2014/35/EU						
EMC Directive		2014/30/EU						
RoHS Directive		2011/65/EU						

Three-phase monitoring relays

Technical data

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

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

Three-phase monitoring relays

Technical data

Type		**CM-PSS.31**	**CM-PSS.41**	**CM-PVS.31**	**CM-PVS.41**	**CM-PVS.81**	**CM-PAS.31**	**CM-PAS.41**
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 measuring range	
Tolerance of the adjusted threshold value		6 % of full-scale value						
Hysteresis related to the threshold value	Over- / undervoltage	fixed 5 %					-	
	Phase unbalance	-	-	-	-	-	fixed 20 %	
Maximum measuring cycle time		100 ms						
Accuracy within the temperature range		$\Delta U \leq 0.06$ % / °C						
Measuring method		true RMS						
Timing circuit								
Start-up delay t_s		fixed, 200 ms			fixed, ≤ 200 ms	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)		-	-	-	-	< ± 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 LEDs				
		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						
Minimum switching power		24 V / 10 mA						
Maximum switching voltage		see "Load limit curves"						

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

Three-phase monitoring relays

Technical data

Type		CM-PSS.31	CM-PSS.41	CM-PVS.31	CM-PVS.41	CM-PVS.81	CM-PAS.31	CM-PAS.41
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) 230 V	4 A						
	AC-15 (inductive) 230 V	3 A						
	DC-12 (resistive) 24 V	4 A						
	DC-13 (inductive) 24 V	2 A						
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300						
	max. rated operational voltage	300 V AC						
	max. continuous thermal current at B 300	5 A						
	max. making/breaking apparent power at B 300	3600/360 VA						
Mechanical lifetime		30 x 10^6 switching cycles						
Electrical lifetime (AC-12, 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 cycle		100%						
Dimensions		see dimensional drawings						
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool						
Mounting position		any						
Minimum distance to other units	horizontal	10 mm (0.39 in) in case of continuous measuring voltages						
		> 400 V	> 400 V	> 220 V	> 400 V	-	> 220 V	> 400 V
Material of housing		UL 94 V-0						
Degree of protection	housing / terminals	IP50 / IP20						
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 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)				2 x 0.5-1.5 mm² (2 x 18-16 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 (7.08 lb.in)				-		
Environmental data								
Ambient temperature ranges	operation / storage	-25...+60 °C / -40...+85 °C						
Damp heat, cyclic (IEC 60068-2-30)		6 x 24 h cycle, 55 °C, 95 % RH						
Climatic class		3K3						
Vibration (sinusoidal)		class 2						
Shock		class 2						
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}	input circuit	6 kV; 1.2/50 µs						
	output circuit	4 kV; 1.2/50 µs						
Basic insulation	input circuit / output circuit	600 V						
Protective separation	input circuit / output circuit	-						
Pollution degree		3						
Overvoltage category		III						

Three-phase monitoring relays

Technical data

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

Three-phase monitoring relays

Technical data

Type			**CM-MPS.11**	**CM-MPS.21**	**CM-MPS.31**	**CM-MPS.41**
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			
Tolerance of the adjusted threshold value			6 % of full-scale value			
Hysteresis related to the threshold value		Over- / undervoltage	fixed 5 %			
		Phase unbalance	fixed 20 %			
Accuracy within the temperature range			$\Delta U \leq 0.06$ % / °C			
Measuring method			True RMS			
Timing circuit						
Start-up delay t_s			fixed, 200 ms	fixed, ≤ 200 ms	fixed, 200 ms	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			
Minimum switching power			24 V / 10 mA			
Maximum switching voltage			see load limit curves			
Rated operational voltage U_e and rated operational current I_e		AC-12 (resistive) 230 V	4 A			
		AC-15 (inductive) 230 V	3 A			
		DC-12 (resistive) 24 V	4 A			
		DC-13 (inductive) 24 V	2 A			
AC rating (UL 508)		Utilization category (Control Circuit Rating Code)	B 300			
		max. rated operational voltage	300 V AC			
		max. continuous thermal current at B 300	5 A			
		max. making/breaking apparent power at B 300	3600/360 VA			
Mechanical lifetime			30 x 10^6 switching cycles			
Electrical lifetime (AC-12, 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			see dimension drawings			
Mounting			DIN rail (IEC/EN 60715), snap-on mounting without any tool			
Mounting position			any			
Minimum distance to other units		horizontal	10 mm (0.39 in) in case of continuous measuring voltages > 120 V	> 240 V	> 220 V	> 400 V
Material of housing			UL 94 V-0			
Degree of protection		housing / terminals	IP50 / IP20			
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 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)		2 x 0.5-1.5 mm² (2 x 18-16 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 (7.08 lb.in)		-	
Environmental data						
Ambient temperature ranges		operation / storage	-25...+60 °C / -40...+85 °C			
Damp heat, cyclic			6 x 24 h cycle, 55 °C, 65 % RH			
Climatic class			3K3			
Vibration			class 2			
Shock			class 2			
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}		input circuit	6 kV; 1.2/50 µs			
		output circuit	4 kV; 1.2/50 µs			
Test voltage between all isolated circuits (routine test)			2.5 kV, 50 Hz, 1 s			
Basic insulation		input circuit / output circuit	600 V			
Protective separation (IEC/EN 61140)		input circuit / output circuit	yes		-	
Pollution degree			3			
Overvoltage category			III			
Standards / Directives						
Standards			IEC/EN 60255-2, IEC/EN 60947-5-1			
Low Voltage Directive			2014/35/EU			
EMC directive			2014/30/EU			
RoHS directive			2011/65/EU			
Electromagnetic compatibility						
Interference immunity to			IEC/EN 61000-6-2			
	electrostatic discharge	IEC/EN 61000-4-2	level 3 (6 kV / 8 kV)			
	radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	level 3 (10 V/m)			
	electrical fast transient / burst	IEC/EN 61000-4-4	level 3 (2 kV / 2 kHz)			
	surge	IEC/EN 61000-4-5	level 4 (2 kV L-N)		Level 4 (2 kV L-L)	
	conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	level 3 (10 V)			
	harmonics and interharmonics	IEC/EN 61000-4-13	class 3			
Interference emission			EN 61000-6-3, EN 61000-6-4			
	high-frequency radiated	IEC/CISPR 22, EN 55022	class B			
	high-frequency conducted	IEC/CISPR 22, EN 55022	class B			

Three-phase monitoring relays

Technical data

Type		**CM-MPS.23**	**CM-MPS.43**	**CM-MPN.52**	**CM-MPN.62**	**CM-MPN.72**
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				
Tolerance of the adjusted thrshold value		6 % of full-scale value				
Hysteresis related to the threshold value	Over- / undervoltage	fixed 5 %				
	Phase unbalance	fixed 20 %				
Maximum measuring cycle time		100 ms				
Accuracy within the temperature range		$\Delta U \leq 0.06$ % / °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				
Minimum switching power		24 V / 10 mA				
Maximum switching voltage		see load limit curves				
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) 230 V	4 A				
	AC-15 (inductive) 230 V	3 A				
	DC-12 (resistive) 24 V	4 A				
	DC-13 (inductive) 24 V	2 A				
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300				
	max. rated operational voltage	300 V AC				
	max. continuous thermal current at B 300	5 A				
	max. making/breaking apparent power at B 300	3600/360 VA				
Mechanical lifetime		30 x 10^6 switching cycles				
Electrical lifetime (AC-12, 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			see dimensional drawings				
Mounting			DIN rail (IEC/EN 60715), snap-on mounting without any tool				
Mounting position			any				
Minimum distance to other units		horizontal	10 mm (0.39 in)		not necessary		
Material of housing			UL 94 V-0				
Degree of protection		housing / terminals	IP50 / IP20				
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 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 20-16 AWG)		2 x 0.5-1.5 mm² (2 x 18-16 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 (7.08 lb.in)			-	
Environmental data							
Ambient temperature ranges		operation / storage	-25...+60 °C / -40...+85 °C				
Damp heat, cyclic (IEC 60068-2-30)			6 x 24 h cycles, 55 °C, 95 % RH				
Climatic category			3K3				
Vibration (sinusoidal) (IEC/EN 60255-21-1)			class 2				
Shock (IEC/EN 60255-21-2)			class 2				
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}		input circuit	6 kV; 1.2/50 µs		8 kV; 1.2/50 µs		
		output circuit	4 kV; 1.2/50 µs				
Basic insulation	input circuit / output circuit		600 V		1000 V		
Protective separation (IEC/EN 61140, EN 50148)		input circuit / output circuit	-				
Pollution degree			3				
Overvoltage category			III				
Standards / Directives							
Standards			IEC/EN 60255-27, IEC/EN 60947-5-1				
Low Voltage Directive			2014/35/EU				
EMC Directive			2014/30/EU				
RoHS Directive			2011/65/EU				
Electromagnetic compatibility							
Interference immunity to			IEC/EN 61000-6-2				
electrostatic discharge		IEC/EN 61000-4-2	level 3 (6 kV / 8 kV)				
radiated, radio-frequency, electromagnetic field		IEC/EN 61000-4-3	level 3 (10 V/m)				
electrical fast transient / burst		IEC/EN 61000-4-4	level 3 (2 kV / 2 kHz)				
surge		IEC/EN 61000-4-5	level 4 (2 kV L-N)	Level 4 (2 kV L-L)			
conducted disturbances, induced by radio-frequency fields		IEC/EN 61000-4-6	level 3 (10 V)				
harmonics and interharmonics		IEC/EN 61000-4-13	class 3				
Interference emission			IEC/EN 61000-6-3				
high-frequency radiated		IEC/CISPR 22, EN 55022	class B				
high-frequency conducted		IEC/CISPR 22, EN 55022	class B				

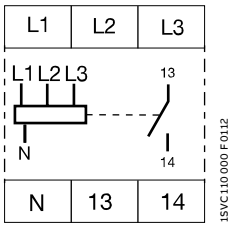
Three-phase monitoring relays

Technical diagrams

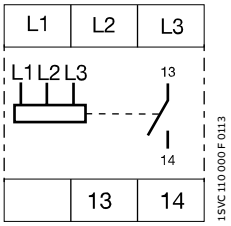
Connection diagrams

CM-PBE, CM-PVE

with neutral

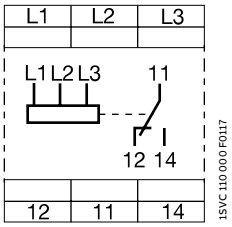


without neutral



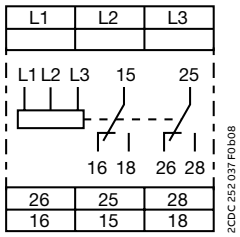
L1, L2, L3, (N)	Control supply voltage = Measuring voltage
13-14	Output contact - closed-circuit principle

CM-PFE



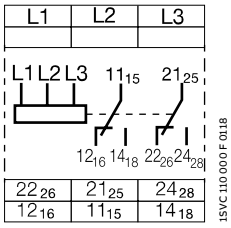
L1, L2, L3	Control supply voltage = Measuring voltage
11-12/14	Output contact - closed-circuit principle

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



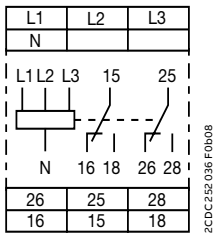
L1, L2, L3	Control supply voltage = Measuring voltage
15-16/18 25-26/28	Output contact - closed-circuit principle

CM-PFS



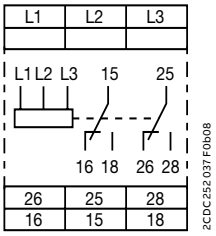
L1, L2, L3	Control supply voltage = Measuring voltage
11_{15}-12_{16} /14_{18} 21_{25}-22_{26}/24_{28}	Output contact - closed-circuit principle

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



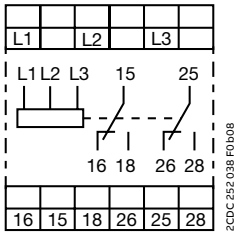
L1, L2, L3, (N)	Control supply voltage = Measuring voltage
15-16/18 25-26/28	Output contact - closed-circuit principle

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



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

CM-MPN.x2



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

Three-phase monitoring relays

Technical diagrams

Rotary switch "Function"

CM-PVS

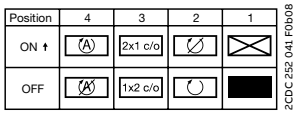
	ON-delay with phase sequence monitoring
	OFF-delay with phase sequence monitoring
	ON-delay without phase sequence monitoring
	OFF-delay without phase sequence monitoring

CM-PSS

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

DIP switch functions

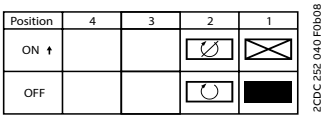
CM-MPS.x3 and CM-MPN.x2



1	**Timing function**	
	ON	ON-delayed
	OFF	OFF-delayed
2	**Phase sequence monitoring**	
	ON	deactivated
	OFF	activated
3	**Operating principle of output**	
	ON	2x1 c/o contact
	OFF	1x2 c/o contact
4	**Phase sequence correction**	
	ON	activated
	OFF	deactivated

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

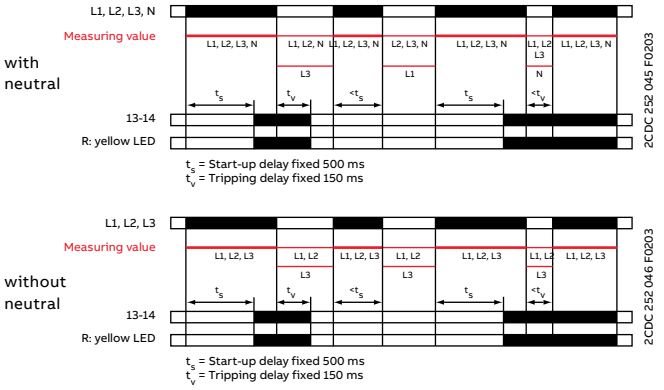
CM-MPS.x1



1	**Timing function**	
	ON	ON-delayed
	OFF	OFF-delayed
2	**Phase sequence monitoring**	
	ON	deactivated
	OFF	activated
3	**No function**	
4	**No function**	

Three-phase monitoring relays
Function diagrams

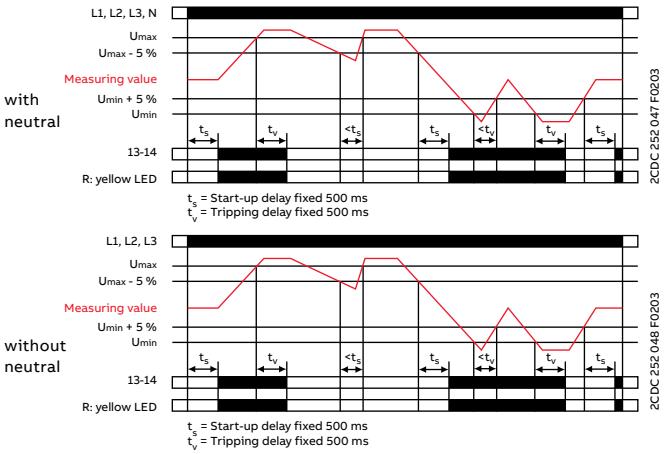
CM-PBE



t_s = Start-up delay fixed 500 ms
t_v = Tripping delay fixed 150 ms

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

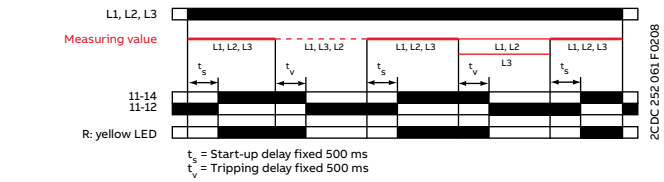
CM-PVE



t_s = Start-up delay fixed 500 ms
t_v = Tripping delay fixed 500 ms

Phase failure, under- / overvoltage detection
If all phases (and the neutral) are present with correct voltage, the output relay energizes after the start-up delay t_s is complete. If the voltage exceeds or falls below the fixed threshold value or if a phase failure occurs, the tripping delay t_v starts. When timing is complete, the output relay de-energizes. As soon as the voltage returns to the tolerance range, timing of t_s starts. When timing is complete, the output relay re-energizes automatically. The yellow LED glows when the output relay is energized.

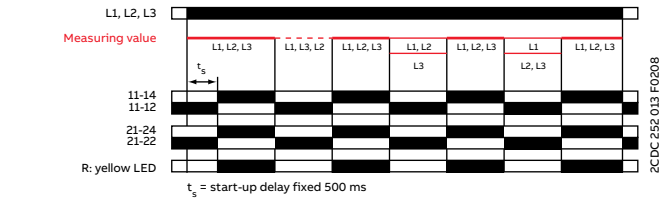
CM-PFE, CM-PFE.2



t_s = Start-up delay fixed 500 ms
t_v = Tripping delay fixed 500 ms

Phase failure detection, phase sequence monitoring
If all phases are present with the correct phase sequence, the output relay energizes after the start-up delay t_s is complete. If a phase failure or a phase sequence error occurs, the tripping delay t_v starts. When timing is complete, the output relay de-energizes. The yellow LED glows when the output relay is energized.
In case of motors which continue running with only two phases, the CM-PFE detects phase failure if the reverse fed voltage is less than 60 % of the originally applied voltage.

CM-PFS



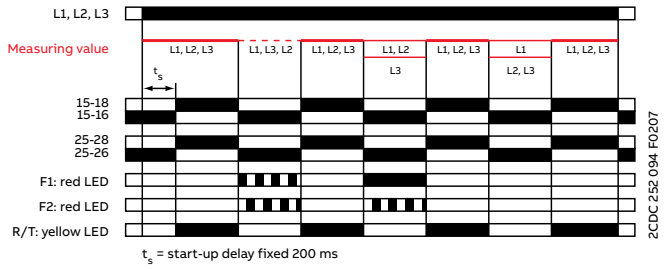
t_s = start-up delay fixed 500 ms

Phase failure detection, phase sequence monitoring
If all phases are present with the correct phase sequence, the output relay energizes after the start-up delay t_s is complete. If a phase failure or a phase sequence error occurs, the output relay de-energizes instantaneous. The yellow LED glows when the output relay is energized.
In case of motors which continue running with only two phases, the CM-PFS detects phase failure if the reverse fed voltage is less than 60 % of the originally applied voltage.

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

Three-phase monitoring relays
Function diagrams

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



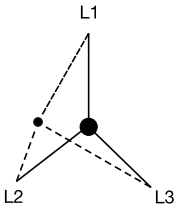
t_s = start-up delay fixed 200 ms

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

Phase sequence monitoring
If phase sequence monitoring is activated, the output relays de-energize as soon as a phase sequence error occurs. The fault is displayed by alternated flashing of the LEDs F1 and F2. The output relays re-energize automatically as soon as the phase sequence is correct again.

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

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

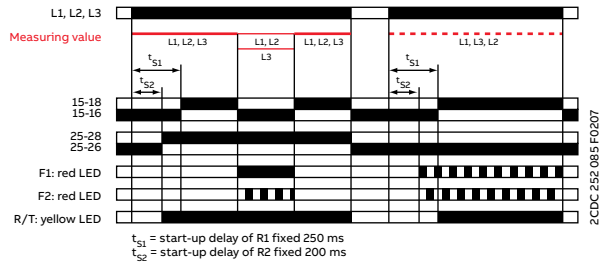


Displacement of the star point

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

Three-phase monitoring relays
Function diagrams

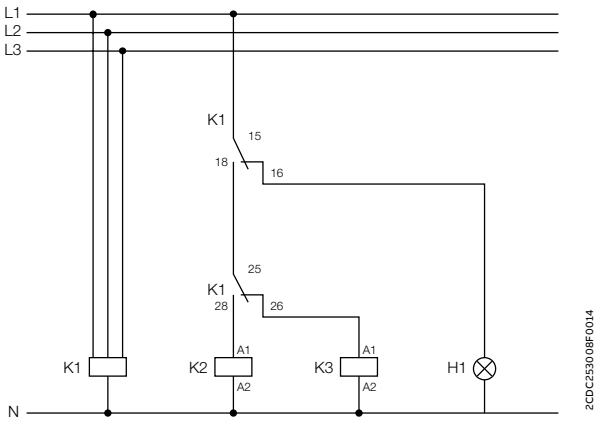
CM-MPS.x3, CM-MPN.x2



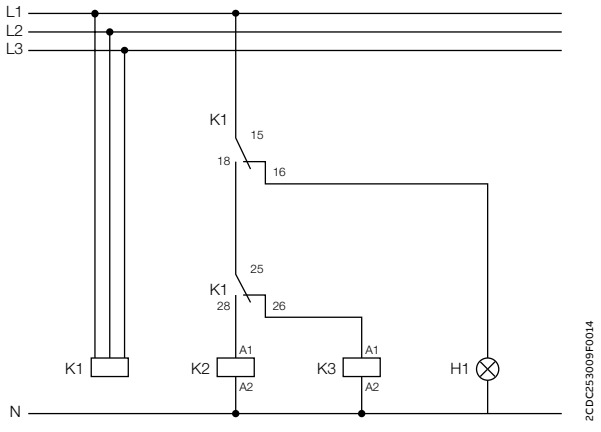
Automatic phase sequence correction
This function can be selected only if phase sequence monitoring is activated and operating mode 2x1 c/o (SPDT) contact is selected.

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

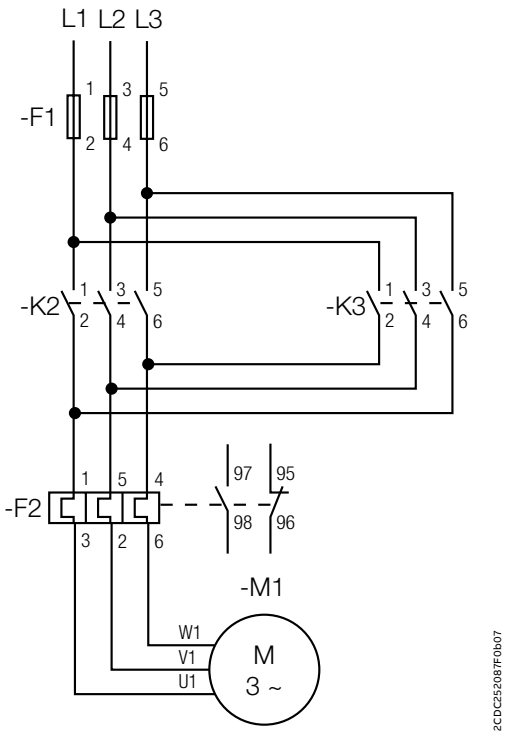
If the voltage to be monitored exceeds or falls below the set threshold values for phase unbalance, over- or undervoltage or if a phase failure occurs, output relay R1 de-energizes and the LEDs F1 and F2 indicate the fault.
Output relay R2 is responsive only to a false phase sequence. In conjunction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



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



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

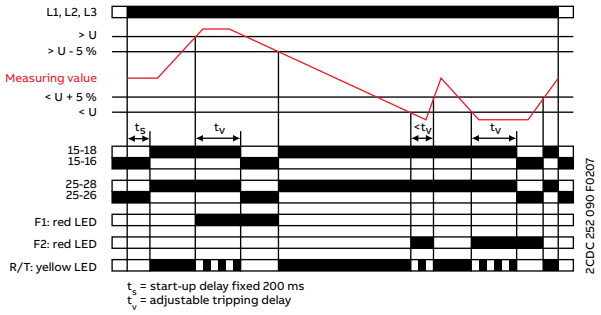


Power circuit diagram

Three-phase monitoring relays
Function diagrams

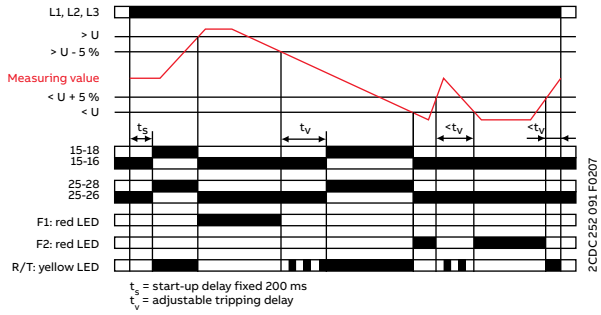
CM-PSS.xx (1), CM-PVS.xx (2), CM-MPS.xx (2), CM-MPN.xx (2)

ON-delay ⊠, 1x2 c/o contacts 1x2 c/o



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

Over- and undervoltage monitoring 1x2 c/o

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

Type of tripping delay = ON-delay

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

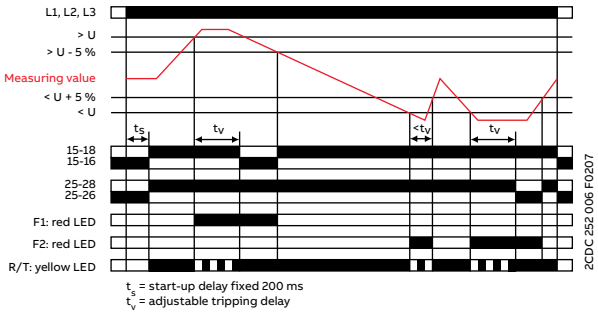
Type of tripping delay = OFF-delay

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

Three-phase monitoring relays
Function diagrams

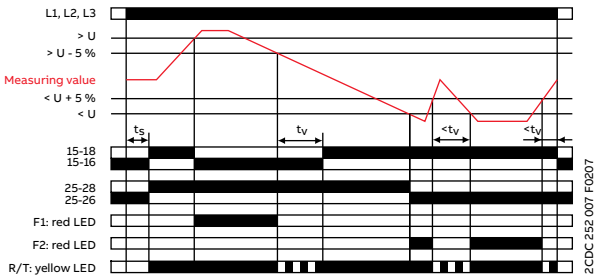
CM-MPS.x3, CM-MPN.x2

ON-delay ⊠, 2x1 c/o contact 2x1 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

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 the correct phase sequence, the output relays energize. The yellow LED R/T glows as long as at least one output relay is energized.

Type of tripping delay = ON-delay

If the voltage to be monitored exceeds or falls below the set threshold value, output relay R1 (overvoltage) or output relay R2 (undervoltage) de-energizes after the set tripping delay t_v is complete. The LED R/T flashes during timing.
The corresponding output relay re-energizes automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %.

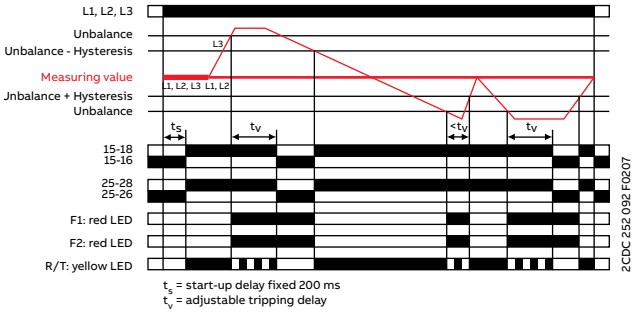
Type of tripping delay = OFF-delay

If the voltage to be monitored exceeds or falls below the set threshold value, output relay R1 (overvoltage) or output relay R2 (undervoltage) de-energizes instantaneously.
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 5 %, the corresponding output relay re-energizes automatically after the set tripping delay t_v is complete. The LED R/T flashes during timing.

Three-phase monitoring relays
Function diagrams

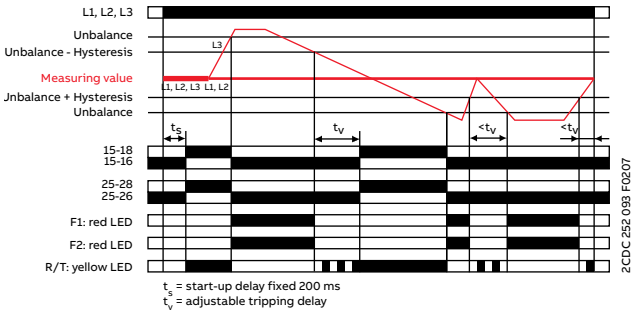
CM-PAS.xx, CM-MPS.xx, CM-MPN.xx

ON-delay ⊠



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

OFF-delay ■



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

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

Type of tripping delay = ON-delay
If the voltage to be monitored exceeds or falls below the set phase unbalance threshold value, the output relays de-energize after the set tripping delay t_v is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize.
The output relays re-energize automatically as soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 20 % and the LED R/T glows.

Type of tripping delay = OFF-delay
If the voltage to be monitored exceeds or falls below the set phase unbalance threshold value, the output relays de-energize instantaneously and the LED R/T turns off.
As soon as the voltage returns to the tolerance range, taking into account a fixed hysteresis of 20 %, the output relays re-energize automatically after the set tripping delay t_v is complete. The LED R/T flashes during timing and turns steady when timing is complete.

Three-phase monitoring relays
Function diagrams

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

LED functions

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

Possible wrong adjustments of the front-facing operating controls

Overlapping of the threshold values:

- An overlapping of the threshold values is given if the threshold value for overvoltage is set to a smaller value than the threshold value for undervoltage.
- DIP switch 3 = OFF
- DIP switch 4 = ON: Automatic phase sequence correction is activated and selected operating mode is 1x2 c/o contacts
- DIP switch 2 and 4 = ON: Phase sequence detection is deactivated and the automatic phase sequence correction is activated

Type of tripping delay

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

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


A1
A2
Y1
Y2
Y3
Y0
L1
L2
L3
N
CM-UFD
ABB
ESC
OK
U/T
F
Rx/Tx
14
11
12
24
21
22
34
31
32
18
15
16
28
25
26
38
35
36
A
B
C

Grid feeding monitoring relays
Table of contents

68	**Benefits and advantages**
72	**Operating controls**
73	**Selection table**
74	**Ordering details**
75	**Technical data**
76	**Technical diagrams**

Grid feeding monitoring relays
Benefits and advantages

ABB's grid feeding monitoring relays detect unusual events in the public power grid and keeps it stable by automatically disconnecting and reconnecting the renewable power plant. The CM-UFD displays all relevant measuring data and events and can communicate them via a build-in communication interface. The cloud-based service Energy Manager available with CM-UFD.M*M enables customers to monitor the conditions in real-time, send the values into the cloud and access the diagnostics remotely.

Optimum interface

Reduce downtime by up to 70%
Operate the device via LCD or remotely with the Modbus RTU. Users are informed immediately in case of an event in the public grid. Redundant microcontrollers ensure reliable measuring values and tripping.

Global availability

Cut installation time by up to 60%
There’s no need to learn every possible adjustment and its effects on your system – ABB’s trained staff supports your business and answers your technical questions promptly.

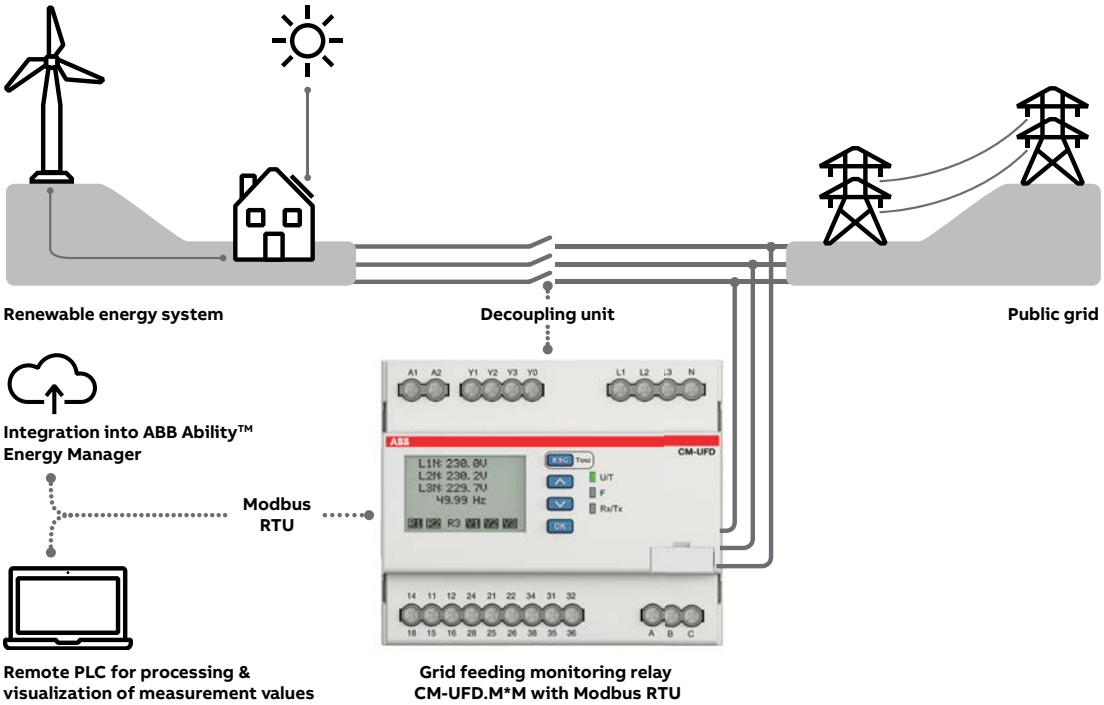
Easy installation

Commission & configure up to 60% faster
Simple instructions, pre-set for local grid feeding standards, and ABB’s intuitive menu structure make installation quicker. Commissioning and troubleshooting errors are prevented.

Grid feeding monitoring relays
Benefits and advantages

ABB's CM-UFD multi-functional grid feeding monitoring relays provide interface protection and are to be installed between a renewable energy system and the public grid. These innovative relays guarantee grid stability and seek to prevent black-outs. If the voltage or frequency magnitudes of the public grid are outside the permited range, then the devices change status and act to disconnect the renewable energy system from the public grid by sending a signal to a decoupling unit (e.g. contactor, switch disconnector or circuit breaker). Furthermore, the CM-UFD.M*M are equipped with a Modbus RTU communication interface, enabling the possibility for remote monitoring and the a connection to the state-of-the-art cloud solution, ABB Ability™ Energy Manager.

The CM-UFD range provides different monitoring functions in accordance with several local grid feeding standards to detect over-/undervoltage and over-/underfrequency.



Advantages

- Highly accurate measurement and setting
- Modbus RTU communication interface and ABB Ability™ Energy Manager connectivity
- Functional safety - single fault tolerances
- Clear multiline, backlit LCD
- Intuitive and user-friendly menu
- Event storage
- Pre-settings meet several local standards
- Type-tested to a number of local grid feeding standards by 3rd party certification authority

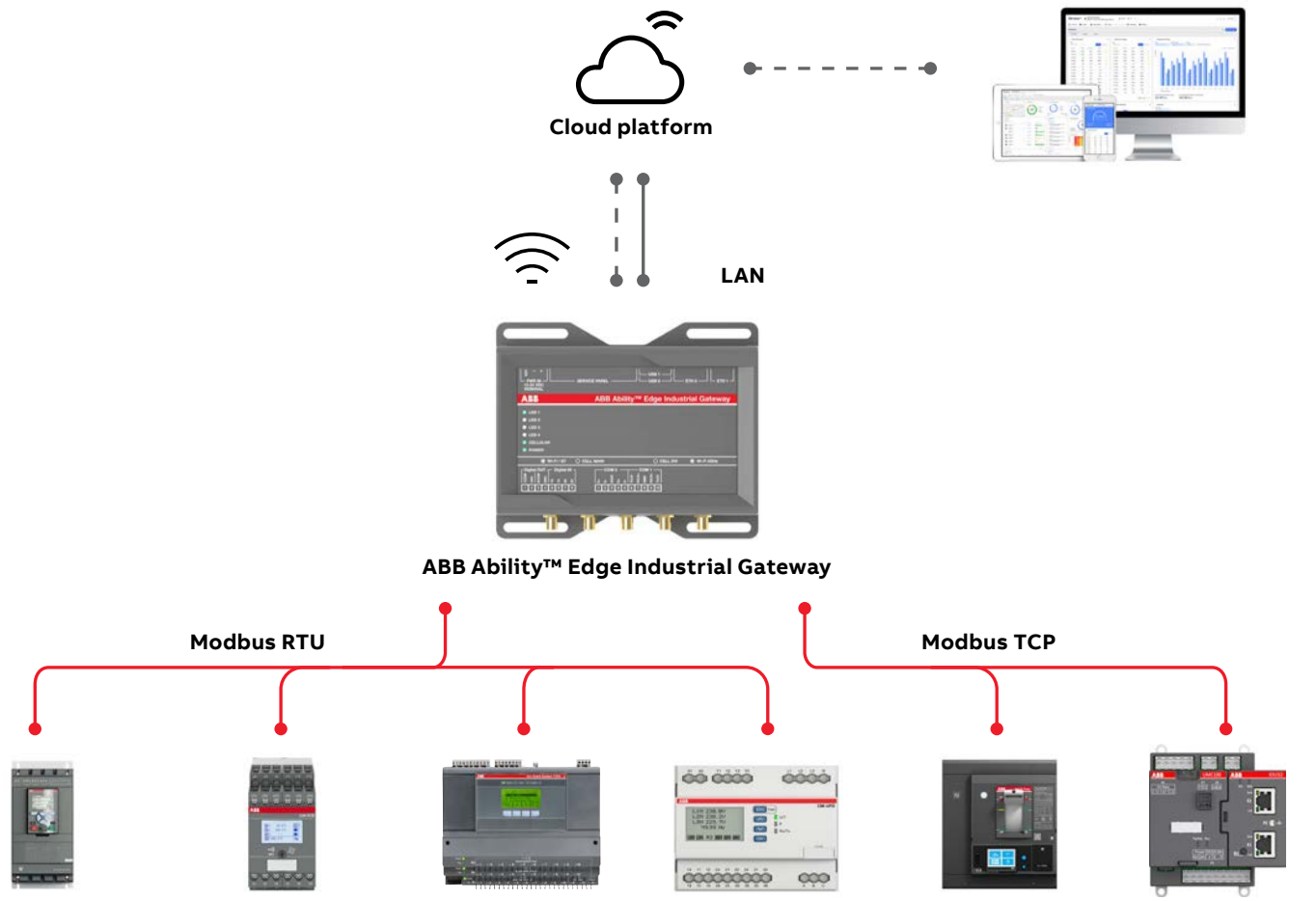
Functionality

The device measures the ten-minute average value, voltage increases and decreases, as well as any changes in grid frequency. The rate of change of frequency (ROCOF) and vector shift monitoring to detect a loss of mains event can be easily configured.

Grid feeding monitoring relays
Benefits and advantages

The cloud-based service Ability™ Energy Manager enables customers to monitor the condition of CM-UFD.M*M in real-time and access the diagnostics remotely. This functionality is very important when operating in the field of critical power. Parametrize with ABB Ekip Connect and access data no matter where you are.

—
Example architecture



Softstarter
PSTX

Smart temperature monitoring relay
CM-TCN.012

Arc Flash active protection
TVOC-2

Grid feeding monitoring relay
CM-UFD

Molded case circuit breaker
Tmax XT

Universal motor controller
UMC100.3

The grid feeding monitoring relays can be connected to the cloud directly by using Ekip Com Hub module. Another option is to connect via Modbus RTU when there is some other device equipped with the Ekip Com Hub like the Emax 2 air-circuit breaker.

In addition to the Ekip Connect 3 software, the following hardware is required:
- Ekip UP
- Ekip Com Hub
- Ekip Com Modbus RTU
- Ekip Supply
- Ekip T&P cable
- CM-UFD.M*M

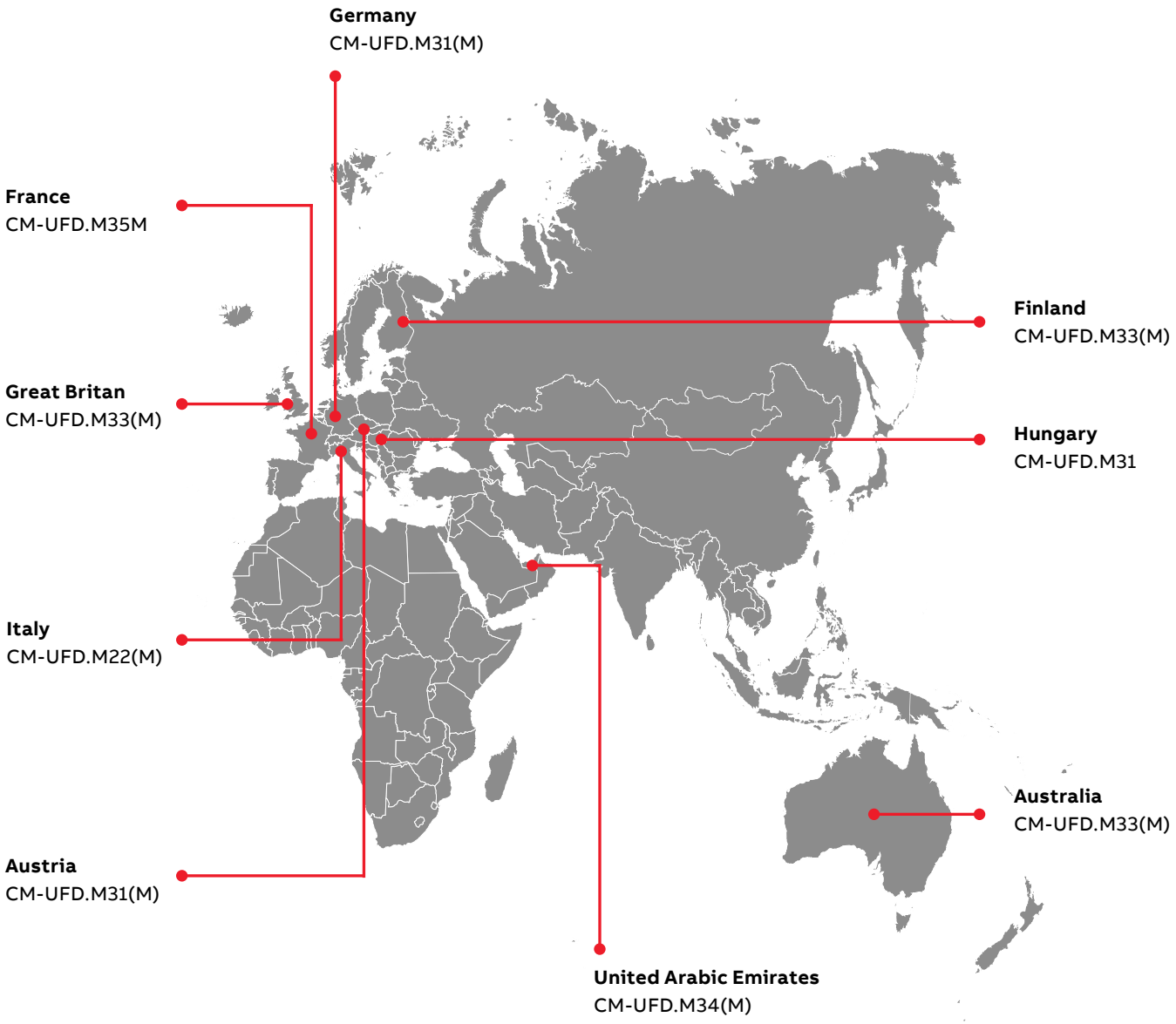
For further information regarding integration into ABB Ability™ Energy Manager, please use the application note "1SAC200328M0001 User Manual for integrating CM-UFD into ABB Ability™ Energy Manager".

Grid feeding monitoring relays
Benefits and advantages

A reliable solution that takes country-specific requirements into account: the range is already pre-set to local requirements, making installation quick and simple. The devices can also be set manually with the display and used all over the world.

Pre-set devices
In accordance with a number of local standards, the CM-UFD relays can be used in all low voltage plants and in medium voltage plants.

Type-tested
To ensure reliability and compliance, the range is type-tested to local standards by 3rd party certification authority.

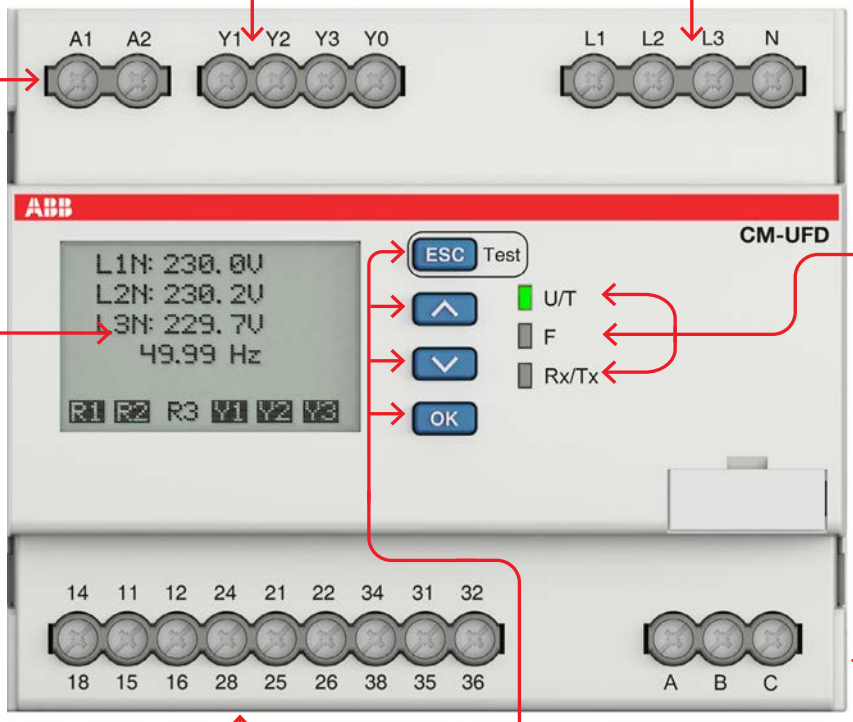


Grid feeding monitoring relays
Operating controls

Wide range power supply
24-240 V AC/DC

3 control inputs

Measuring circuits
L-L: 0-540 V AC
L-N: 0-312 V AC



Indication of operational states
U/T: green LED
⌐¬ Control supply voltage applied
⌐⌐ Timing
F: red LED:
Fault message
Rx/Tx: yellow LED:
Modbus frame reception and transmission

Display

3 output relays

Keypad
ESC: escape / return to previous menu
^: up / value increase
v: down / value decrease
OK: enter / confirm selection

Modbus RTU interface

Grid feeding monitoring relays
Selection table

	Order number	1SVR560730R3400	1SVR560731R3700	1SVR560730R3401	1SVR560731R3701	1SVR560730R3402	1SVR560731R3702	1SVR560730R3403	1SVR560731R3703	1SVR560731R3704
	Type	CM-UFD.M22	CM-UFD.M22M	CM-UFD.M31	CM-UFD.M31M	CM-UFD.M33	CM-UFD.M33M	CM-UFD.M34	CM-UFD.M34M	CM-UFD.M35M
Rated control supply voltage Us										
24-240 V AC/DC		■	■	■	■	■	■	■	■	■
Standard										
CEI 0-21		■	■							
VDE AR-N 4105, VDE AR-N 4110, VDE AR-N 4120				■	■					
ENA G99						■	■			
DRRG standard of DEWA								■	■	■
VDE 0126-1-1 (2013-08)										■
EN50549-1						■	■			
TOR Erzeuger Typ A, B, C, D				■	■					
Clause 6.4.1 of the Hungarian Operation Code				■						
Rated frequency										
DC or 50/60 Hz		■	■	■	■	■	■	■	■	
Modbus RTU			■		■		■		■	■
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		■	■	■	■	■	■	■	■	■
Vector shift				■	■	■	■	■	■	■
Thresholds		adj	adj	adj	adj	adj	adj	adj	adj	adj

Grid feeding monitoring relays
Ordering details

CM-UFD.M*M

Description

The grid feeding monitoring relays CM-UFD.M*M are designed to monitor the voltage and the frequency of the public low voltage or medium voltage grid. Whenever the measured values are not within the range of the adjusted threshold values, the CM-UFD.M*M causes tripping of the section switch (consisting of 1 or 2 switching devices according to the applicable standard). This tripping disconnects the power generation, such as photovoltaic systems, wind turbines, block-type thermal power stations from the grid.

Ordering details

Description	Type	Order code	Weight (1 pc) kg (lb)
See selection table	CM-UFD.M22	1SVR560730R3400	0.304 (0.670)
	CM-UFD.M22M	1SVR560731R3700	0.312 (0.688)
	CM-UFD.M31	1SVR560730R3401	0.304 (0.670)
	CM-UFD.M31M	1SVR560731R3701	0.312 (0.688)
	CM-UFD.M33	1SVR560730R3402	0.304 (0.670)
	CM-UFD.M33M	1SVR560731R3702	0.312 (0.688)
	CM-UFD.M34	1SVR560730R3403	0.304 (0.670)
	CM-UFD.M34M	1SVR560731R3703	0.312 (0.688)
	CM-UFD.M35M	1SVR560731R3704	0.312 (0.688)

Grid feeding monitoring relays
Technical data


DATA SHEET

Grid feeding monitoring according to VDE 0126-1-1 (2013-08)

CM-UFD.M35M with Modbus RTU

Now with ABB Ability™

The CM-UFD.M35M with Modbus RTU is a multifunctional grid feeding monitoring relay. It provides different monitoring functions in accordance with VDE 0126-1-1 (2013-08) to detect over- and undervoltage (10-minutes average value, voltage increase and decrease protection) as well as any changes in grid frequency (frequency increase and decrease protection).

The device is connected between the distributed generation and the public grid in order to disconnect the distributed generation in case of problems (e.g. unstable grid), faults or maintenance on the grid. Additionally, monitoring of ROCOF (rate of change of frequency) and vector shift can be configured.

Characteristics

- Monitoring of voltage and frequency in single- and three-phase mains (2-wire, 3-wire or 4-wire AC systems)
- Type-tested in accordance with VDE 0126-1-1 (2013-08)
- Pre-settings in accordance with VDE 0126-1-1 (2013-08) for external relay
- Modbus RTU communication interface
- MultiLine, backlit LCD display
- True RMS measuring principle
- Over- and undervoltage, 10-minutes average value as well as over- and underfrequency monitoring
- Two-level threshold settings for over-/undervoltage and over-/underfrequency
- ROCOF (rate of change of frequency) monitoring and vector shift configurable
- Interrupted neutral detection
- All threshold values and tripping delays adjustable
- Error memory for up to 99 entries (incl. cause of error, measured value, relative timestamp)
- Test function
- Password setting protection
- 3 control inputs, e.g. for feedback signal, remote trip
- 3 c/o (SPDT) contacts
- Can be connected to ABB Ability™
- Various certifications and approvals (see overview, document no. 2CDC112249D0201)

Ordering details

Type	Rated control supply voltage	Measuring range	Order code

Data sheets

A technical data sheet is available for each variant within the CM-UFD.M*M range.

- Operating control and mode
- Operating principles
- Modbus RTU functionality where available
- Electrical connection
- Configuration and settings
- Menu structure
- Display and failure messages
- Connection and wiring
- Technical data
- Technical diagrams
- CAS system files

Ordering data and data sheet numbers

Description	Type	Order code	Data sheet number
	CM-UFD.M22	1SVR560730R3400	2CDC112258D0201
	CM-UFD.M22M	1SVR560731R3700	2CDC112258D0201
	CM-UFD.M31	1SVR560730R3401	2CDC112208D0201
	CM-UFD.M31M	1SVR560731R3701	2CDC112270D0201
	CM-UFD.M33	1SVR560730R3402	2CDC112210D0201
	CM-UFD.M33M	1SVR560731R3702	2CDC112271D0201
	CM-UFD.M34	1SVR560730R3403	2CDC112272D0201
	CM-UFD.M34M	1SVR560731R3703	2CDC112272D0201
	CM-UFD.M35M	1SVR560731R3704	1SAC200291H0001

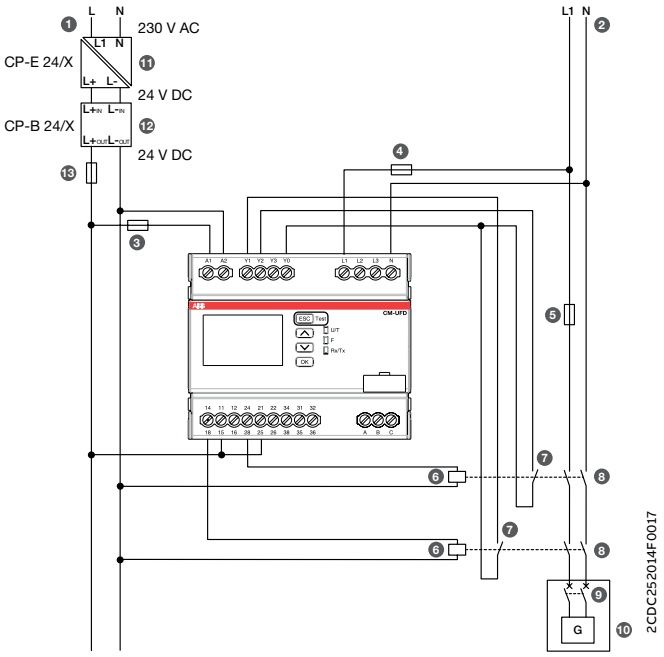
For further information regarding integration into ABB Ability™ Energy Manager, please use the application note "1SAC200328M0001 User Manual for integrating CM-UFD into ABB Ability™ Energy Manager".

For further information regarding grid feeding systems and application, please use the application note "9AKK108469A5442 Grid Feeding System for Distributed Energy Sources".

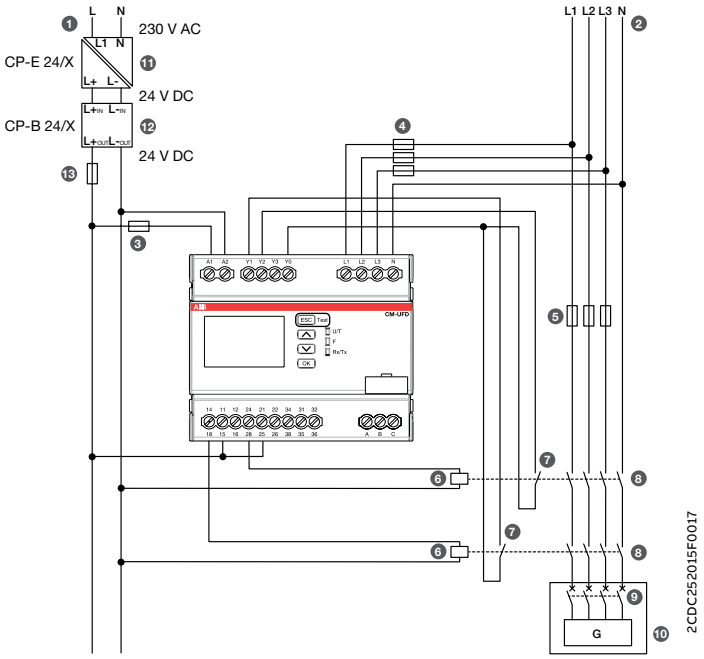
Grid feeding monitoring relays

Technical diagrams

Example of a single-phase application



Example of a three-phase application

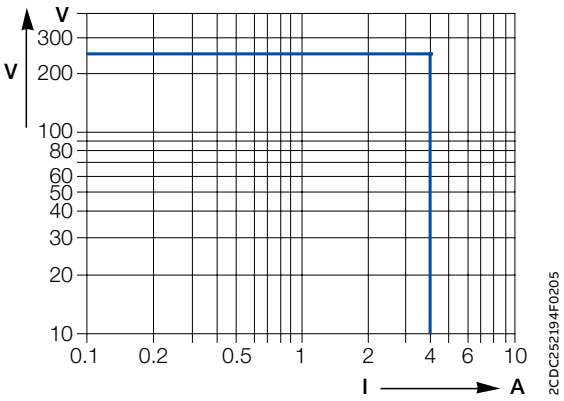


Legend

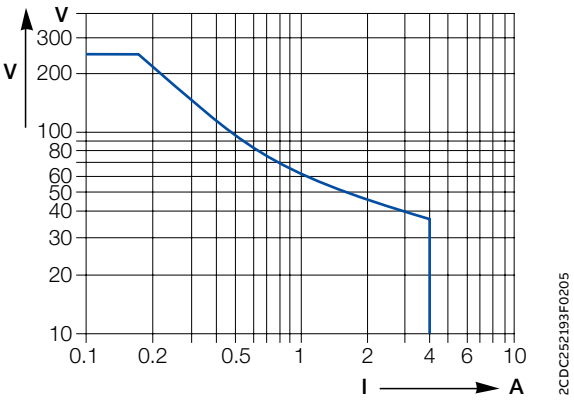
1. Control supply voltage for CM-UFD.M*M
2. Public grid
3. Protection fuse for the CM-UFD.M*M
4. Protection fuse for the measuring circuit of the CM-UFD.M*M (optional)
5. Short-circuit protection
6. Undervoltage release
7. Control input for feedback function
8. Switching device of the section switch
9. Switching device of the generator and/or inverter
10. Generator and/or inverter
11. Primary switch mode power supply unit CP-E (230 V AC / 24 V DC) for the buffer module CP-B
12. Ultra-capacitor based buffer module CP-B (24 V DC in/out)
13. Wire protection fuse for the output of the buffer module CP-B

Grid feeding monitoring relays
Technical diagrams

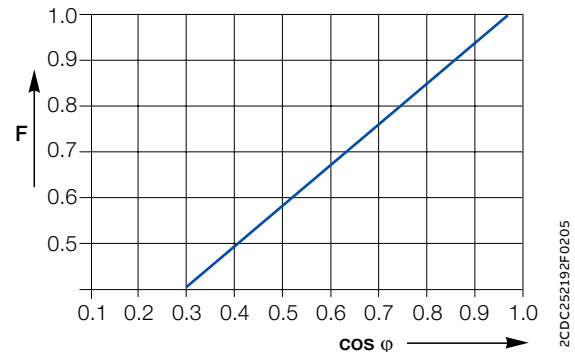
Load limits curves



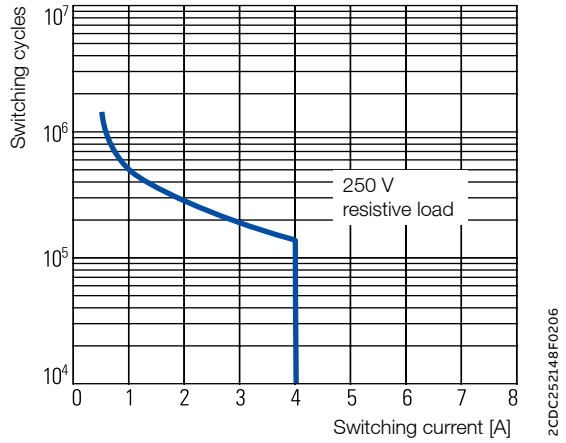
AC load (resistive)



DC load (resistive)

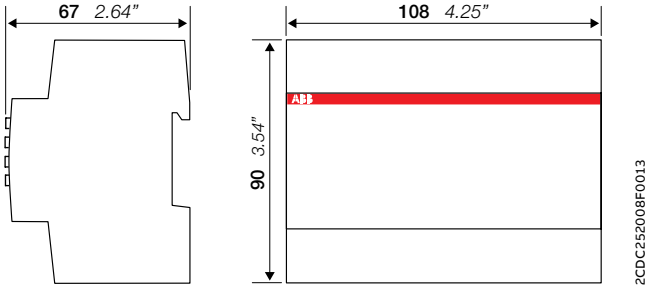


Derating factor F at inductive AC load



Contact lifetime

Dimensional drawings
in **mm** and inches




A1
11
KE
S1
S2
S3
ABB
CM-IWS
Test / Reset
R.1-value kΩ
R.2-value kΩ
R=R.1+R.2
U
F
R
L+
L-
A1
11
S1
S2
S3
ABB
CM-IWS
Test / Reset
R.1-value kΩ
R.2-value kΩ
R=R.1+R.2
L
A1
11
21
S1
S2
S3
ABB
CM-IWN
Test / Reset
R1.1-value kΩ
R2.1-value kΩ
Rx=Rx.1+Rx.2
R1.2-value kΩ
R2.2-value kΩ
12
14
L+
VS
V1+
V1-
VL+
VL-
ABB
CM-IVN
mains connection
CM-IVN
CM-IWN
L+
V1+
L-
V1-

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

The insulation monitoring relays of the CM-IWx range guarantee a continuous insulation monitoring of an IT system. The devices recognize insulation faults as they develop and warn immediately if the value has fallen below the minimum set threshold. This ensures a reliable operation of the system and prevents operational interruption caused by a second, more severe, insulation fault which may lead to a short circuit tripping the main circuit breaker.

Continuous operation

Keep the system online and reduce downtime with early pre-warnings which enable time for maintenance planning. Monitor voltage free networks for early fault detection. Due to variants with rail and ship approval, the devices have a wide range of applications.

Safety and protection

Safe and reliable detection of insulation faults according to the latest standards is what ABB's insulation monitoring relays deliver. The portfolio extends from standard to more challenging applications and can prevent fire due to fast and reliable earth fault detection. Built-in self-diagnosis and interrupted wire detection further ensure safety.

Easy installation

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

Insulation monitoring relays
Benefits and advantages

Overview
The CM-IWx product family offers a convincing solution for monitoring ungrounded AC, AC/DC and DC networks according to EN/IEC 61557-8. An IT network is supplied either by an isolating transformer or a voltage source, such as a battery or generator. In these systems, no active conductor is directly connected to earth potential.

The high reliability of an IT system is guaranteed thanks to continuous insulation monitoring. The insulation monitoring device recognizes insulation faults (at least one conductor has a galvanic connection to earth potential) as they develop and immediately reports if the insulation resistance has fallen below a given threshold. Therefore, maintenance activities can be scheduled and executed while the plant keeps running.

Main benefits
- Increase plant availability and avoid costly unplanned stops of a plant / machine by quickly detecting faults first
- Prevents fires due to detection of a creeping deterioration of the insulation resistance
- The adjustment of the setting values is simple and done in a user-friendly way with rotary switches on the front of the device
- Device status is displayed with LEDs that are easy to read and understand
- Devices for standard and more challenging applications are available
- Variants with rail and ship approvals are available

Insulation monitoring relays
Benefits and advantages

CM-IWS.1 – for unearthed AC, DC or mixed AC/DC systems

The CM-IWS.1 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 with a voltage up to 250 V AC and 300 V DC. It can be configured to the requirements of the applications and therefore has multi-functional uses. The device is available with two different terminal versions. You can choose between the proven screw connection technology (double-chamber cage connection terminals) and the completely tool-free Easy Connect Technology (push-in terminals).

- For monitoring the insulation resistance of unearthed IT systems up to U_n = 250 V AC and 300 V DC
- Test function
- According to IEC/EN 61557-8
- Rated control supply voltage 24-240 V AC/DC
- Prognostic measuring principle with superimposed square wave signal
- One measuring range 1-100 kΩ
- 1 c/o (SPDT) contact, closed-circuit principle
- Precise adjustment by front-face operating controls in 1 kΩ steps
- Interrupted wire detection
- Fault storage / latching configurable by control input
- Screw connection or Easy Connect Technology available
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting on DIN rail as well as demounting
- 22.5 mm width
- 3 LEDs for status indication

CM-IWS.2 – for unearthed pure AC systems

The CM-IWS.2 serves to monitor insulation resistance in accordance with IEC 61557-8 in unearthed IT AC systems with a voltage up to 400 V AC. The CM-IWS.2 can be configured to the requirements of the applications and therefore has multi-functional uses. The device is available with two different terminal versions. You can choose between the proven screw connection technology (double-chamber cage connection terminals) and the completely tool-free Easy Connect Technology (push-in terminals).

- For monitoring the insulation resistance of unearthed IT systems up to U_n = 400 V AC
- Test function
- According to IEC/EN 61557-8
- Rated control supply voltage 24–240 V AC/DC
- Measuring principle with superimposed DC voltage
- One measuring range 1-100 kΩ
- Fault storage / latching configurable by control input
- Precise adjustment by front-face operating controls in 1 kΩ steps
- Screw connection or Easy Connect Technology available
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting on DIN rail as well as demounting
- 1 c/o (SPDT) contact, closed-circuit principle
- 22.5 mm width
- 3 LEDs for status indication

Insulation monitoring relays
Benefits and advantages

CM-IWN.1 – for unearthed AC, DC or mixed AC/DC systems

The CM-IWN.1 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 with a voltage up to 400 V AC and 600 V DC. The measuring range can be extended up to 690 V AC and 1000 V DC by using the coupling unit CM-IVN. It can be configured to the requirements of the applications and therefore has multi-functional uses. The CM-IWN.1 is available with two different terminal versions. You can choose between the proven screw connection technology (double chamber cage connection terminals) and the completely tool-free Easy Connect Technology (push-in terminals).

- For monitoring the insulation resistance of unearthed IT systems up to U_n= 400 V AC and 600 V DC, expansion to 690 V AC and 1000 V DC with CM-IVN
- Test function
- According to IEC/EN 61557-8
- Rated control supply voltage 24-240 V AC/DC
- Prognostic measuring principle with superimposed square wave signal
- Two measuring ranges 1-100 kΩ and 2-200 kΩ
- Precise adjustment of the measuring value in 1 or 2 kW steps
- One (1 x 2 c/o) or two (2 x 1 c/o) threshold values Ran1/ R1 (warning) and Ran2/R2 (pre-warning) configurable
- 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
- Screw connection or Easy Connect Technology available
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting on DIN rail as well as demounting
- 45 mm width
- 3 LEDs for status indication

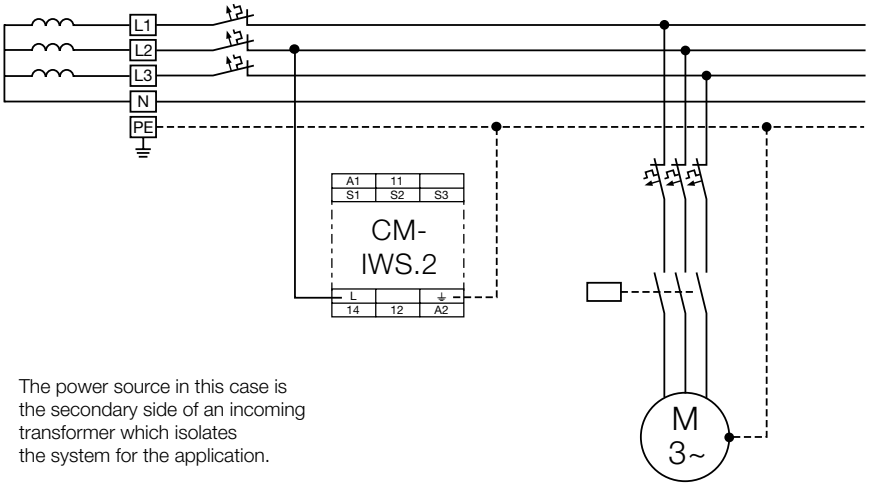
CM-IWM.10 and CM-IWM.11 – for unearthed AC, DC or mixed AC/DC systems with up to 1500 V measurement voltage

The insulation monitors CM-IWM.10 and CM-IWM.11 provide the best and up-to-date insulation monitoring of modern IT systems in an optimum and state of-the-art way fulfilling the relevant standards. The devices can be used in the most flexible way for AC, DC and AC/DC systems even with large leakage capacity to earth (PE). The adjustment of the setting values is simple and done in a user-friendly way on two rotary switches on the front of the device. Via LEDs the measured value, device parameters and device status are indicated easy to read.

- Insulation monitoring according to IEC/EN 61557-8
- Detection of symmetric and asymmetric insulation faults
- 1 c/o contact each for pre-warning and warning
- Measuring circuits can be disconnected via control terminals, e.g. for mains couplings
- Pre-warning threshold setting range: 20 kΩ ... 2 MΩ
- Warning threshold setting range: 1 kΩ ... 250 kΩ
- Open- or closed-circuit principle configurable
- Setting the maximum earth leakage capacitance to shorten the response time
- Simple, clearly arranged adjustment of the device with screwdriver
- LED chain to indicate the current insulation resistance
- Display of active measuring circuits
- Automatic and manual device self-test
- Alarm storage selectable
- External test and reset push button can be connected
- 90 mm width

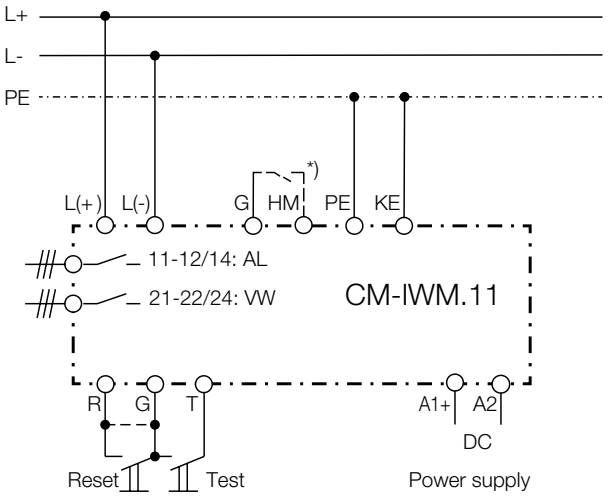
Insulation monitoring relays
Applications

The CM-IWS.x and CM-IWN.x series provide excellent insulation monitoring for general purpose supply networks, such as:
- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Battery networks
- Hybrid and battery-powered vehicles
- Railway applications



Earth fault / insulation resistance monitoring of a 4-wire IT AC system with CM-IWS.2

CM-IWM.x can be additionally used in special applications, such as:
- Industrial networks with frequency inverters or direct current drives
- Photovoltaic systems with high system leakage capacitance
- Networks with system voltages up to 1500 V DC or 1100 V AC without requiring a coupling unit
- Installation on the AC or DC side of an inverter
- Networks which require measuring circuit deactivation in case two or more un-earthed networks are coupled



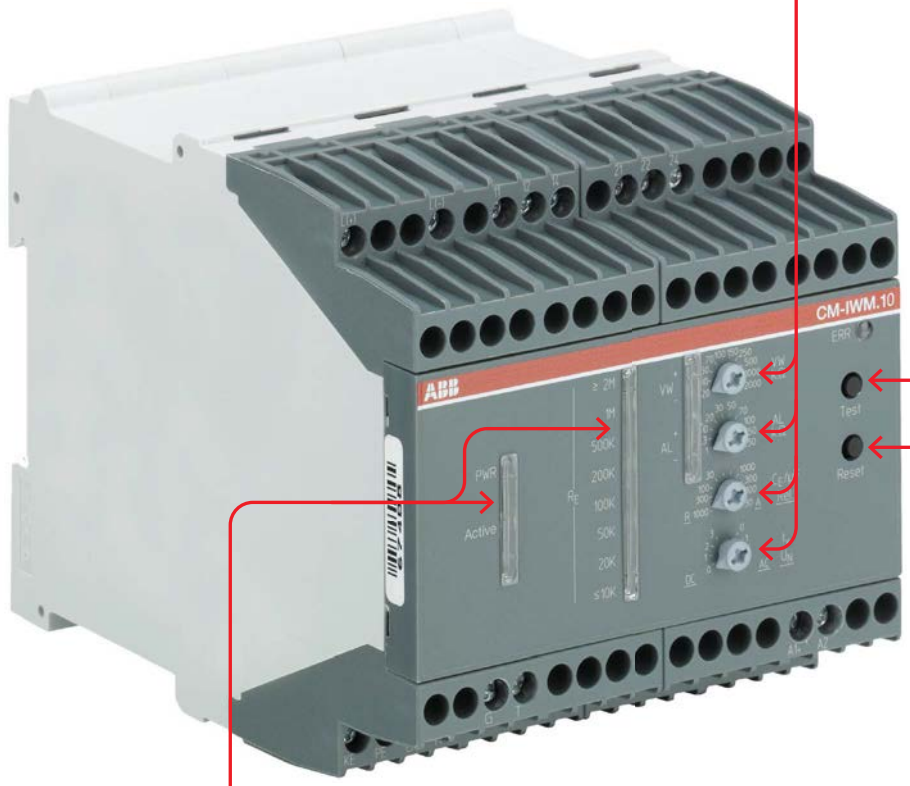
*) G-HM connected: Measuring circuit is off

Example of a DC application with CM-IWM.11

Note:
Only one insulation monitor must be connected and active in a network at the same time.

Insulation monitoring relays
Operating controls

CM-IWM



Front-facing rotary switches
to adjust threshold values

Test and reset button

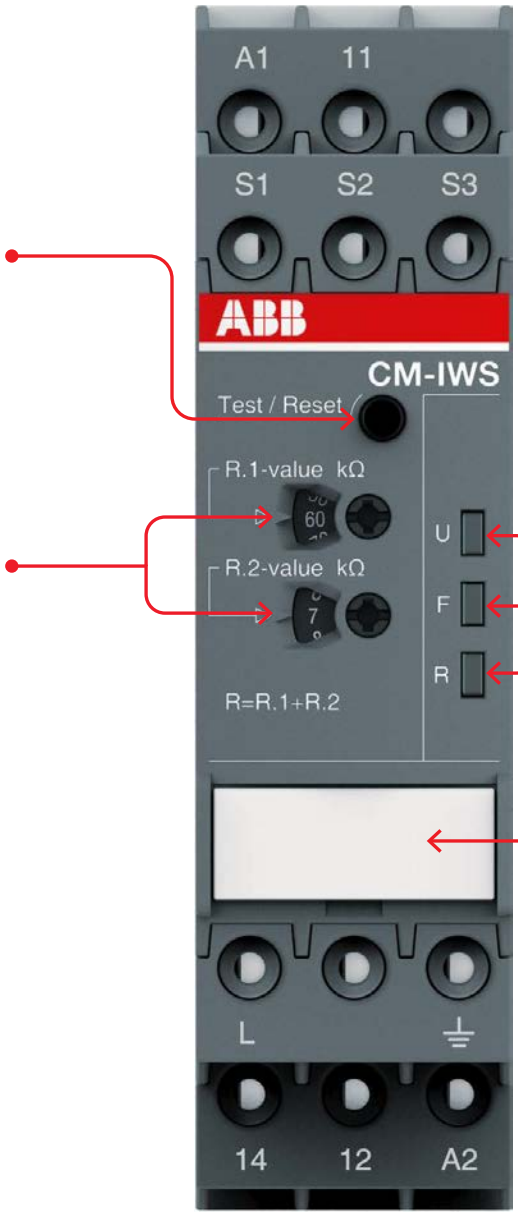
Indication of operational state and measured ground fault resistance

Insulation monitoring relays
Operating controls

CM-IWS

Test and reset button

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

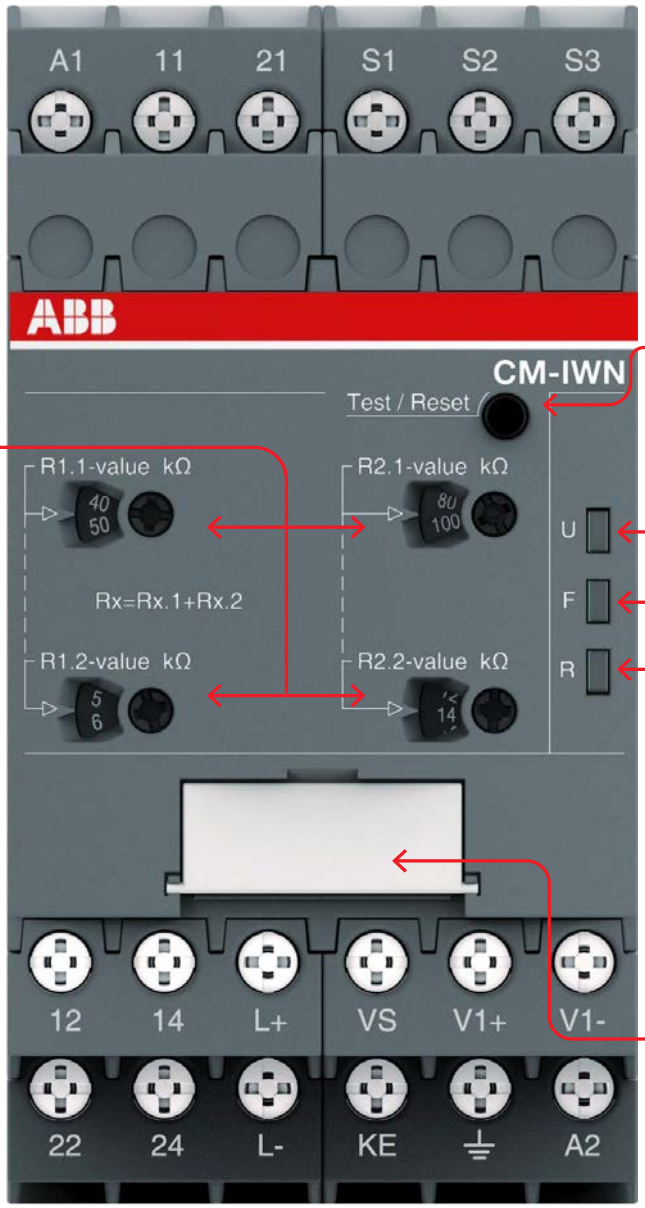


Indication of operational states
U: green LED - control supply voltage
F: red LED - fault message
R: yellow LED - relay status

Marker label for devices without DIP switches

Insulation monitoring relays
Operating controls

CM-IWN



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

Test and reset button

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

DIP switches
(see DIP switch functions)

Insulation monitoring relays

Selection table

	Order number	1SVR730670R0200	1SVR740670R0200	1SVR730660R0100	1SVR740660R0100	1SVR750660R0200	1SVR760660R0200	1SVR470670R1000	1SVR470670R1100
	Type	CM-IWS.2S	CM-IWS.2P	CM-IWS.1S	CM-IWS.1P	CM-IWN.1S	CM-IWN.1P	CM-IWM.10	CM-IWM.11
Rated control supply voltage U_s									
24 - 240 V AC/DC		■	■	■	■	■	■		
24 V DC								■	■
Measuring voltages									
250 V AC (L-PE)				■	■				
400 V AC (L-PE)		■	■			■	■		
690 V AC (L-PE)						■ (1)	■ (1)	■ (2)	
1000 V AC (L-PE)									■ (3)
300 V DC (L-PE)				■	■				
600 V DC (L-PE)						■	■		
690 V DC (L-PE)								■ (2)	
1000 V DC (L-PE)						■ (1)	■ (1)		■ (3)
Measuring range									
1 - 100 kΩ		■	■	■	■	■	■		
2 - 200 kΩ						■	■		
2 - 250 kΩ								■	■
System leakage capacitance, max.									
10 µF		■	■	■	■				
20 µF						■	■		
1000 µF								■	
3000 µF									■
Output									
1 c/o		■	■	■	■				
1 x 2 c/o or 2 x 1 c/o						■	■		
2 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
Control input (measuring input deactivation)									■
Connection type									
Push-in terminals			■		■		■		
Double-chamber cage connection terminals		■		■		■			
Screw terminals								■	■

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

2) Allowed voltage range of the supervised network: 0-760 V AC / 0-1000 V

3) Allowed voltage range of the supervised network: 0-1100 V AC / 0-1500 V DC

Insulation monitoring relays
Ordering details


2CDC 251 009 V0012

CM-IWS.1


2CDC 251 017 V0012

CM-IWS.2


2CDC 251 020 V0012

CM-IWN.1


LK5894

CM-IWM.10


LK5895

CM-IWM.11


2CDC 252 027 V0012

CM-IVN

Description

The CM-IWx 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 IT DC systems. The devices are able to monitor control circuits (single-phase) and main circuits (3-phase).

The CM-IWM.x provides the best and up-to-date insulation monitoring of modern IT supply systems in an optimum and state of-the-art way according to IEC 61558-8 including annex C. The device can be used in the most flexible way for AC, DC and AC/DC systems, even with a large leakage capacity to earth (PE) and under adverse conditions.

Ordering details

Type	Rated control supply voltage	Nominal voltage U_n of the distribution system to be monitored	System leakage capaci-tance, max.	Adjustment range of the specified response value R_{an} (threshold)	Type	Order code	Weight (1 pc) kg (lb)
CM-IWS.x	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)
		0-400 V AC			CM-IWS.2S	1SVR730670R0200	0.141 (0.311)
					CM-IWS.2P	1SVR740670R0200	0.130 (0.287)
CM-IWN.x		0-400 V AC / 0-600 V DC	20 µF	1-100 kΩ 2-200 kΩ	CM-IWN.1S	1SVR750660R0200	0.241 (0.531)
					CM-IWN.1P	1SVR760660R0200	0.217 (0.478)
CM-IWM.x	24 V DC	0-690 V AC/DC [1]	1000 µF	1-250 kΩ 20 kΩ-2 MΩ	CM-IWM.10	1SVR470670R1000	0.500 (1.1)
		0-1000 V AC/DC [2]	3000 µF		CM-IWM.11	1SVR470670R1100	

1) Allowed voltage range of the supervised network: 0-760 V AC / 0-1000 V DC
2) Allowed voltage range of the supervised network: 0-1100 V AC / 0-1500 V DC

Coupling unit

Rated control supply voltage = measuring voltage	Nominal voltage U_n of the distribution system to be monitored	Type	Order code	Weight (1 pc) 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 connection

Insulation monitoring relays

Technical data - CM-IWx

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

			CM-IWS.2	CM-IWS.1	CM-IWN.1
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		
Start-up time t_s, fixed			min. 10 s	max. 15 s	min. 15 s
Input circuit - Measuring circuit			**L, ⏚**	**L+, L-, ⏚, KE**	**L+, L-, ⏚, KE**
Monitoring function			insulation resistance monitoring of IT systems		
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	0-400 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		20 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 Ω		–
		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 (yellow marked scale)	≥ 15 %, max. ±0.5 kΩ		≥ 15 %, max. ± 1 kΩ, with CM-IVN ± 1.5 kΩ
		at 10-100 kΩ R_F	±6 %		–
		at 1-15 kΩ R_F	–		± 1 kΩ, with CM-IVN ± 1.5 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 Ω / 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	

Insulation monitoring relays

Technical data - CM-IWx

		CM-IWS.2	CM-IWS.1	CM-IWN.1
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	
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 configurable[1)]
Contact material		AgNi alloy, Cd free		
Min. switching voltage / Min. switching current		24 V / 10 mA		
Max. switching voltage / Max. switching current		see data sheet		
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) at 230 V	4 A		
	AC-15 (inductive) at 230 V	3 A		
	DC-12 (resistive) at 24 V	4 A		
	DC-13 (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 (AC-12, 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}		4 A		
General data				
Duty cycle		100 %		
Dimensions		see dimensional drawings		
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool		
Mounting position		any		
Minimum distance to other units	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 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)	2 x 0.5-1.5 mm² (2 x 18-16 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 occurring
Open-circuit principle: Output relay(s) energize(s) if a fault is occurring

Insulation monitoring relays

Technical data - CM-IWx

		CM-IWS.2	CM-IWS.1	CM-IWN.1
Environmental data				
Ambient temperature ranges	operation / storage / transport	-25...+60 °C/-40...+85 °C/-40...+85 °C		
Climatic class	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		25 Hz: 2.5 g		
Isolation data				
Rated impulse withstand voltage U_{imp}	supply / measuring circuit	6 kV		
	supply / output circuit	6 kV		
	measuring / output circuit	6 kV		
	output 1 / output circuit 2			4 kV
Rated insulation voltage U_i	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 insulation	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		
Pollution degree		3		
Overvoltage category		III		
Standards / Directives				
Standards		IEC/EN 60947-5-1, IEC/EN 61557-1, IEC/EN 61557-8		
Low Voltage Directive		2014/35/EU		
EMC Directive		2014/30/EU		
RoHS Directive		2011/65/EU		
Electromagnetic compatibility				
Interference immunity to		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		
high-frequency radiated	IEC/CISPR 22, EN 55022	class B		
high-frequency conducted	IEC/CISPR 22, EN 55022	class B		

Insulation monitoring relays

Technical data - CM-IVN

		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 cycle		100 %
Dimensions		see dimensional drawings
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool
Mounting position		any
Minimum distance to other units	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}	input circuit / PE	8 kV
Rated insulation voltage U_i	input circuit / PE	1000 V
Pollution degree		3
Overvoltage category		III
Standards / Directives		
Standards		IEC/EN 60947-5-1, IEC/EN 61557-1, IEC/EN 61557-8
Low Voltage Directive		2014/35/EU
EMC Directive		2014/30/EU
RoHS Directive		2011/65/EU

Insulation monitoring relays

Technical data - CM-IVN

		CM-IVN
Electromagnetic compatibility		
Interference immunity to		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
high-frequency radiated	IEC/CISPR 22, EN 50022	class B
high-frequency conducted	IEC/CISPR 22, EN 50022	class B

Insulation monitoring relays

Technical data - CM-IWM

		CM-IWM.10	CM-IWM.11
Input circuit			
Rated control supply voltage U_S		24 V DC	
Voltage range		20-30 V DC	
Typical power consumption		max. 5 W	
Measuring circuit		L(+) / L(-) to PE / KE	
Nominal voltage U_N		0-690 V AC/DC	0-1000 V AC/DC
Allowed voltage range of the supervised network		0-760 V AC / 0-1000 V DC	0-1100 V AC / 0-1500 V DC
Frequency range		DC or 16-1000 Hz	DC or 16-1000 Hz
Max. system leakage capacitance C_e		1000 µF	3000 µF
Internal resistance (AC/DC)		> 280 kΩ	
Measuring voltage		approx. ± 95 V	
Max. measured current (R_E = 0)		< 0.35 mA	
Response values R_E each adjustable via rotary switches			
	pre-warning ("VW")	warning ("AL")	
	20 kΩ	1 kΩ	
	30 kΩ	3 kΩ	
	50 kΩ	10 kΩ	
	70 kΩ	20 kΩ	
	100 kΩ	30 kΩ	
	150 kΩ	50 kΩ	
	250 kΩ	70 kΩ	
	500 kΩ	100 kΩ	
	1000 kΩ	150 kΩ	
	2000 kΩ	250 kΩ	
Response inaccuracy	IEC/EN 61557-8	± 15 % + 1.5 kΩ	
Response value hysteresis	at range 10 kΩ ... 700 kΩ	approx. 25 %	
	out of range:	approx. 40 % + 0.5 kΩ	
ON delay	at C_E = 1 µF R_E of ∞ to 0.5 * response value	< 10 s	
Control input		between T, R and G	between HM, T, R and G
Current flow		approx. 3 mA	
No-load voltage to ground		approx. 12 V	
Permissible wire length		< 50 m	
Min. activation time		0.5 s	
Output			
Contacts		2 x 1 c/o contacts for VW and AL	
Thermal current I_{th}		4 A	
Switching capacity to AC-15	n/o contact	3 A / AC 230 V acc. to IEC/EN 60947-5-1	
	n/c contact	1 A / AC 230 V acc. to IEC/EN 60947-5-1	
Electrical life	at 8 A, AC 250 V	1 x 10^4 switching cycles	
Short circuit strength max. fuse rating		4 A gL acc. to IEC/EN 60947-5-1	
Mechanical life		10 x 10^6 switching cycles	

Insulation monitoring relays

Technical data - CM-IWM

		CM-IWM.10	CM-IWM.11
General Data			
Operating mode		continuous operation	
Temperature range	operation	- 25 ... + 60 °C	- 25 ... + 60 °C (device mounted away from heat generation components) -25 ... +45 °C (device mounted without distance to other devices)
	storage	- 40 ... + 70 °C	
Relative air humidity		93 % at 40 °C	
Atmospheric pressure		860-1600 mbar (86-106 kPa)	
Altitude	IEC/EN 60664-1	< 4000 m	
Clearance and creepage distances			
Rated impulse voltage / pollution degree		IEC/EN 60664-1	
Measuring ciruit L(+) / L(-) to	auxiliary voltage DC and relay contacts VW, AL	8 kV / 2	
	auxiliary voltage DC to relay contacts VW, AL	8 kV / 2	
	relay contacts VW to relay contact AL	4 kV / 2	
Insulation test voltage, routine test		AC 5 kV; 1 s AC 2.5 kV; 1 s	
Technical data			
EMC			
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	8 kV (air)	
HF irradiation	IEC/EN 61000-4-3	80 MHz-2.7 GHz: 10 V/m	
Fast transients	IEC/EN 61000-4-4	4 kV	
Surge voltages	IEC/EN 61000-4-5	between A1 - A2: 1 kV L(+) - L(-): 2 kV A1, A2 - PE: 4 kV L(+), L(-) - PE: 4 kV control line: 0.5 kV control line and earth: 1 kV	
HF-wire guided	IEC/EN 61000-4-6	10 V	
Interference suppression	EN 55011	limit value class A when connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken	
Degree of protection			
Housing	IEC/EN 60529	IP 40	
Terminals	IEC/EN 60529	IP 20	
Housing		thermpolastic with V0 behaviour according to UL subject 94	
Vibration resistance	IEC/EN 60068-2-6	10-55 Hz: 0.35 mm 2-13.2 Hz: ± 1 mm 13.2-100 Hz: ± 7 g	
Shock resistance	IEC/EN 60068-2-27	10 g / 11 ms, 3 pulses	
Climate resistance	IEC/EN 60068-1	25 / 060 / 04	
Terminal designation		EN 50005	
Connecting capacity		1 x 4 mm^2 solid	
		1 x 2.5 mm^2 stranded ferruled (isolated)	
		2 x 1.5 mm^2 stranded ferruled (isolated) DIN 46228-1/-2/-3-4	
		2 x 2.5 mm^2 stranded ferruled (isolated) DIN 46228-1/-2/-3	
Stripping length		8 mm	
Tightening torque		0.8 Nm	
Wire fixing		plus-minus terminal scews M3.5 terminal with wire protection	
Mounting	IEC/EN 60715	DIN rail	
Dimensions	width x height x depth	90 x 90 x 121 mm	

Insulation monitoring relays

Technical diagrams

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)	

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

CM-IWM.x

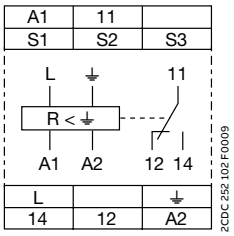
LED status	LED	Status
PWR: green LED		Control supply voltage applied
ERR: red LED		Internal device error
		Connection error L+/L-
		Connection error PE/KE
Active: green LED		Measuring phase with positive polarity
		Measuring phase with negative polarity
LED chain: yellow LED		8 LEDs indicate the current insulating resistance (≤ 10 kΩ ... ≥ 2 MΩ)
VW +: yellow LED		R_E lower than prewarning value to + potential
VW -: yellow LED		R_E lower than prewarning value to - potential
VW + and VW -: yellow LED		AC fault / symmetric fault
AL +: red LED		R_E lower than warning value to + potential
AL -: red LED		R_E lower than warning value to - potential
AL + and AL -: red LED		AC fault / symmetric fault

Insulation monitoring relays

Technical diagrams

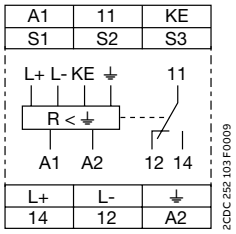
Connection diagrams

CM-IWS.2



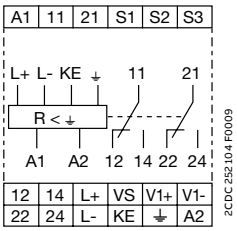
A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L	Measuring circuit/input, system connection
⏚	Measuring circuit/input, earth connections
11-12/14	Output relay, closed-circuit principle

CM-IWS.1



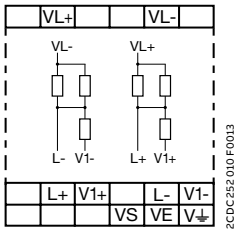
A1-A2	Control supply voltage
S1-S3	Remote test
S2-S3	Remote reset
L+, L–	Measuring circuit/input, system connection
⏚, KE	Measuring circuit/input, earth connections
1-12/14	Output relay, closed-circuit principle

CM-IWN.1



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	Connections for the coupling unit (if used)
11-12/14	Output relay 1, open- or closed-circuit principle
21-22/24	Output relay 2, open- or closed-circuit principle

CM-IVN



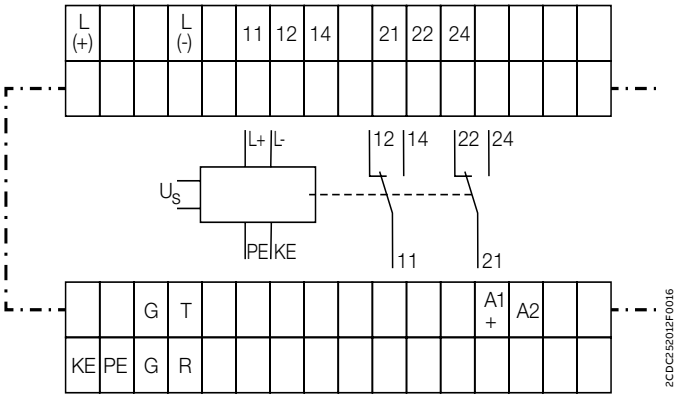
VE	Connection to CM-IWN.x - ⏚
VS	Connection to CM-IWN.x - VS
L+	Connection to CM-IWN.x - L+
V1+	Connection to CM-IWN.x - V1+
L-	Connection to CM-IWN.x - L-
V1-	Connection to CM-IWN.x - V1-
VL+ VL-	Measuring circuit / Measuring input, Connection to the system
V⏚	Measuring circuit / Measuring input, Connection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

Insulation monitoring relays

Technical diagrams

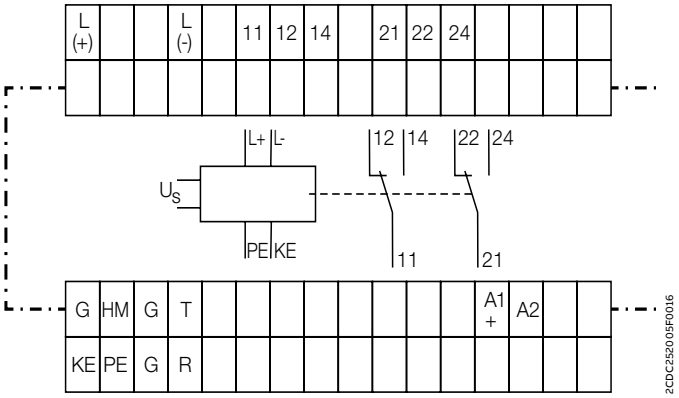
Connection diagrams

CM-IWM.10



Terminal designation	Signal designation
A1+, A2	Control supply voltage
L(+), L(-)	Connection for measuring ciruit
KE, PE	Connection for protective conductor
G, R	Control input (manual/auto reset) • G/R not jumpered: manual reset • G/R jumpered: auto reset
G, T	Control input (External test input) connection for an external device test pushbutton
11-12/14	Output relay 1 (warning)
21-22/24	Output relay 2 (prewarning)

CM-IWM.11



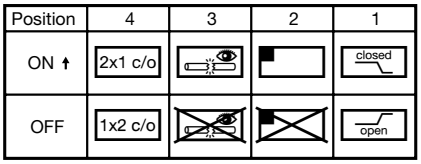
Terminal designation	Signal designation
A1+, A2	Control supply voltage
L(+), L(-)	Connection for measuring ciruit
KE, PE	Connection for protective conductor
G, R	Control input (manual/auto reset) • G/R not jumpered: manual reset • G/R jumpered: auto reset
G, T	Control input (External test input) connection for an external device test pushbutton
G, HM	Control input (measuring circuit deactivation) • G/HM not jumpered: measuring circuit activated • G/HM jumpered: measuring circuit deactivated
11-12/14	Output relay 1 (warning)
21-22/24	Output relay 2 (prewarning)

Insulation monitoring relays

Technical diagrams

DIP switches

CM-IWN.1



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 occurring. 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 occurring. 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 interrupted 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.

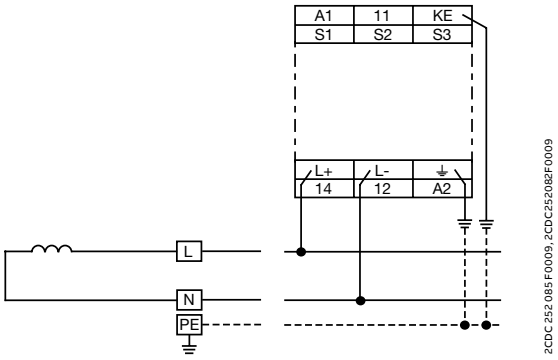
Insulation monitoring relays

Technical diagrams

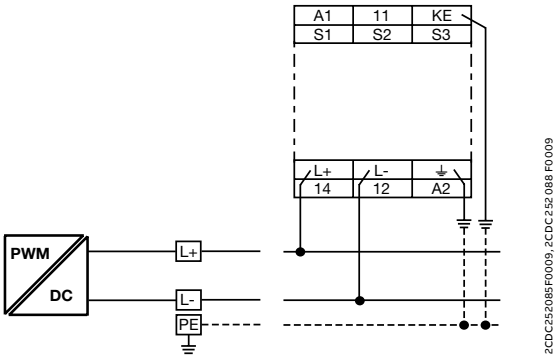
Wiring diagrams

CM-IWS.1

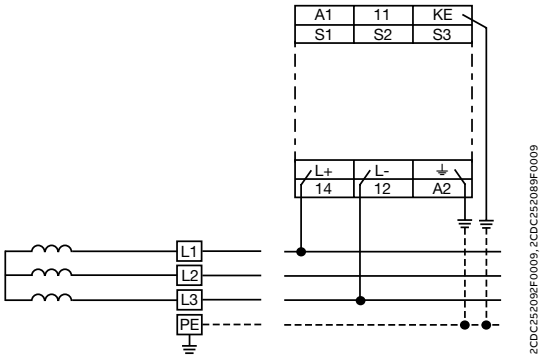
Always connect L+ and L- to different conductors. L+ and L- can be connected to any of the conductors.
$U_n \leq 250$ V AC; 300 V DC



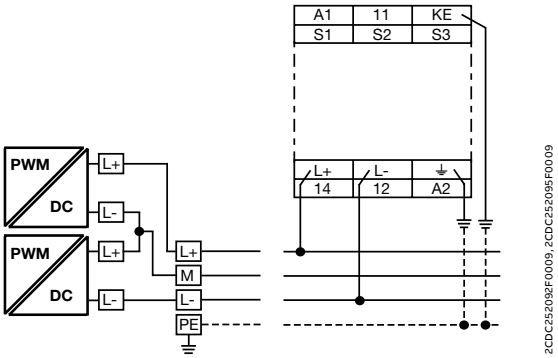
2-wire AC system



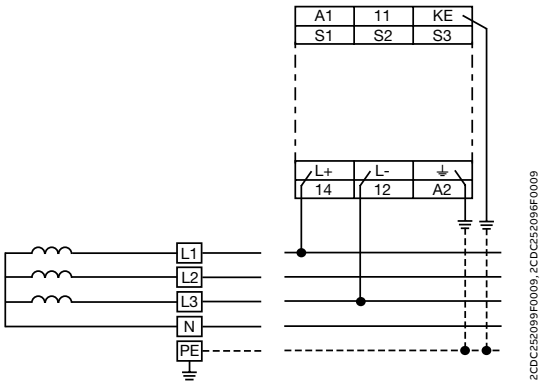
2-wire DC system



3-wire AC system



3-wire DC system

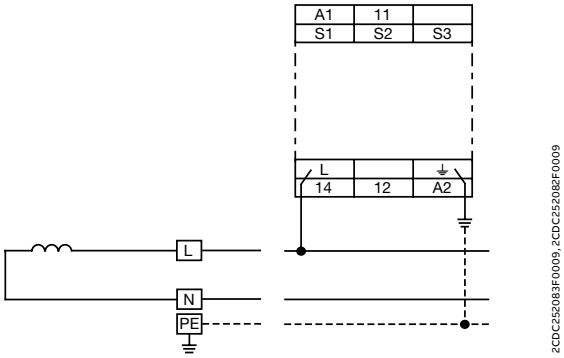


4-wire AC system

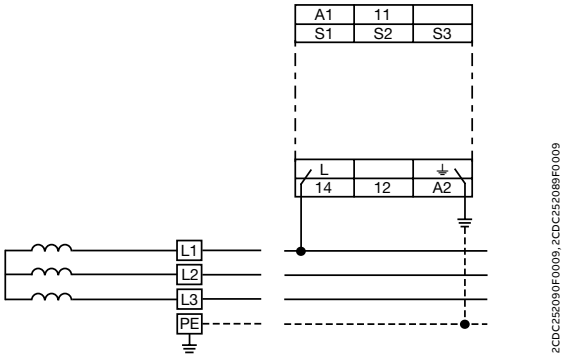
Insulation monitoring relays
Technical diagrams

Wiring diagrams
CM-IWS.2

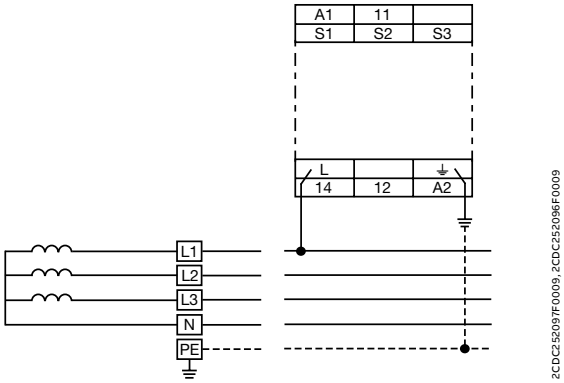
L can be connected to any of the conductors.
$U_n \leq 400$ V AC



2-wire AC system



3-wire AC system



4-wire AC system

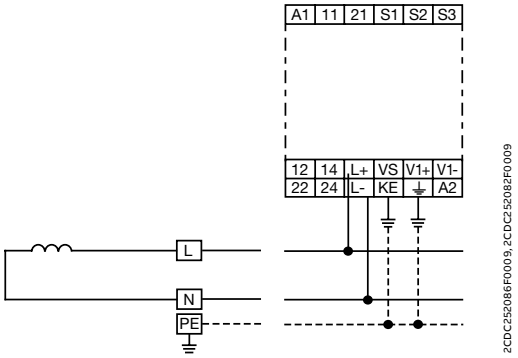
Insulation monitoring relays

Technical diagrams

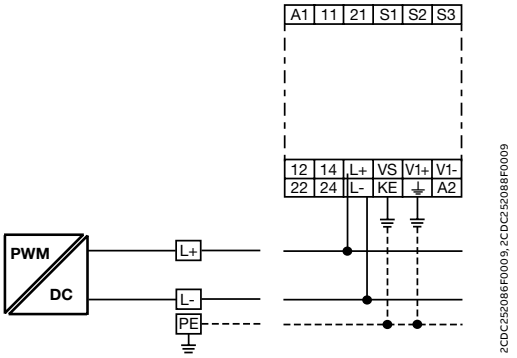
Wiring diagrams

CM-IWN.1

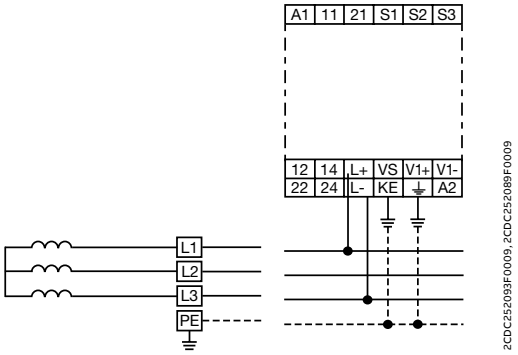
Always connect L+ and L- to different conductors. L+ and L- can be connected to any of the conductors.
$U_n \leq 400$ V AC; 600 V DC (For monitoring of systems with higher voltages, use coupling unit CM-IVN.)



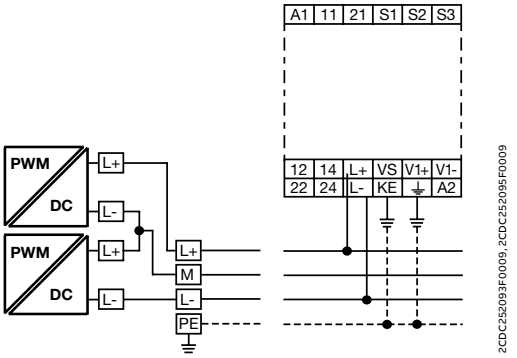
2-wire AC system



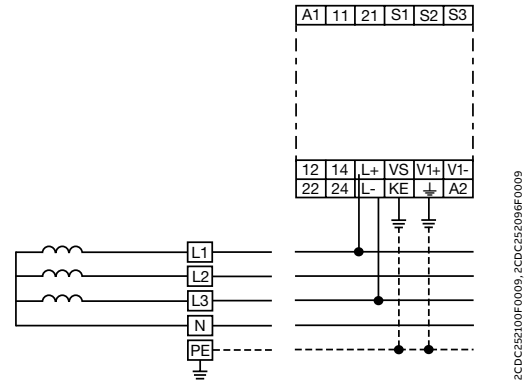
2-wire DC system



3-wire AC system



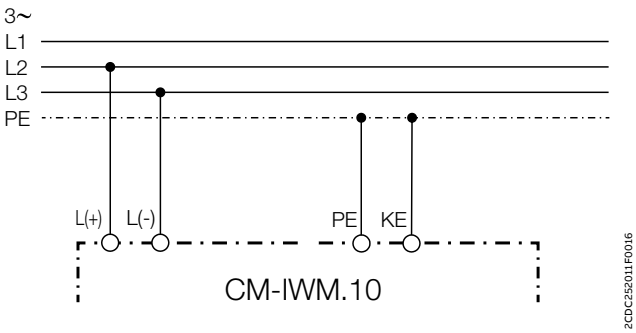
3-wire DC system



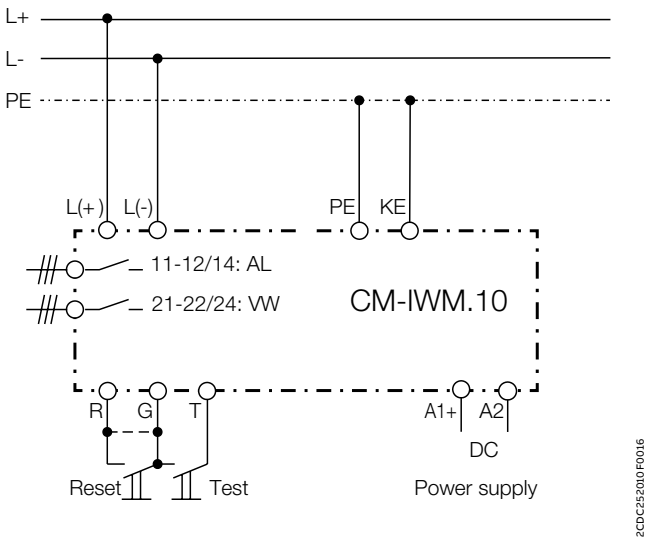
4-wire AC system

Insulation monitoring relays
Technical diagrams

Wiring diagrams
CM-IWM.10

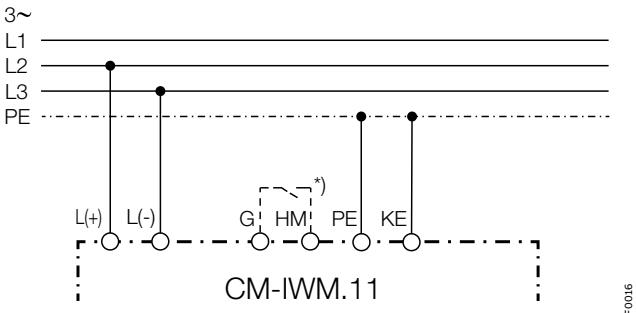


Example of a AC application



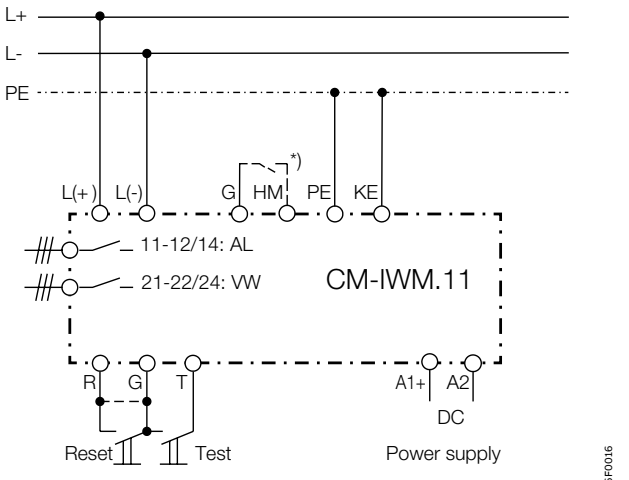
Example of a DC application

CM-IWM.11



*) G-HM connected: Measuring circuit is off

Example of a AC application



*) G-HM connected: Measuring circuit is off

Example of a DC application

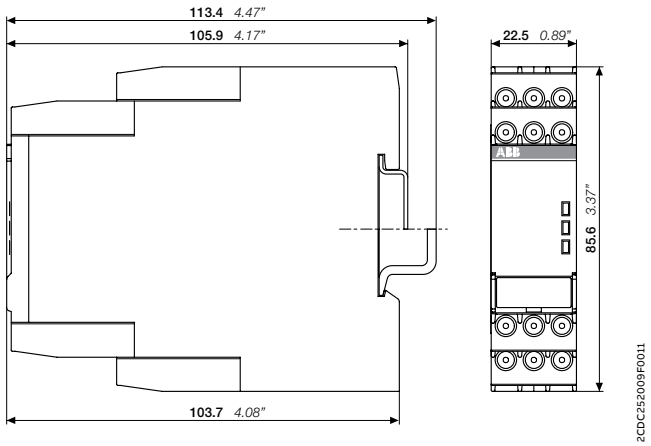
Insulation monitoring relays

Technical diagrams

Dimensional drawings

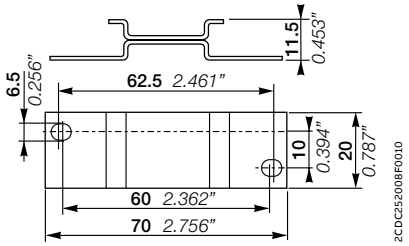
in **mm** and inches

CM-IWS.x

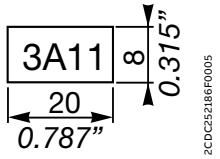


CM-IWS.x

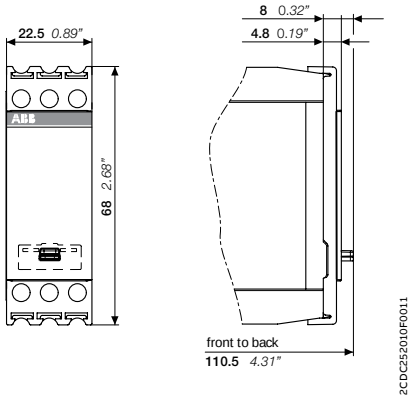
Accessories



ADP.01 - Adapter for screw mounting



MAR.01 - Marker label for devices without DIP switches



COV.11 - Sealable transparent cover

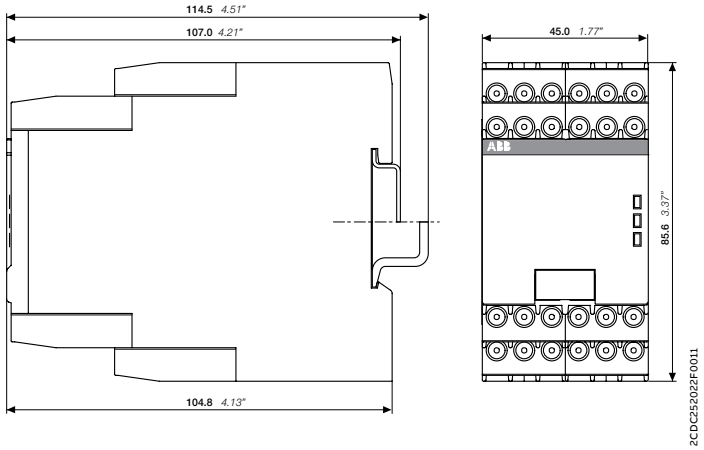
Insulation monitoring relays

Technical diagrams

Dimensional drawings

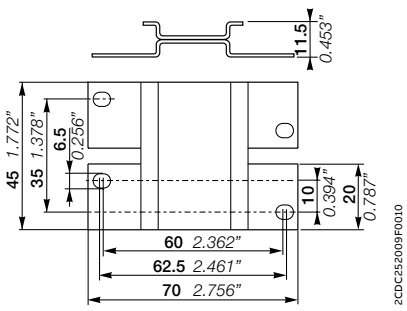
in **mm** and inches

CM-IWN.x

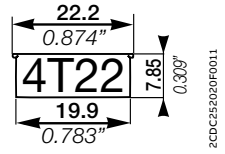


CM-IWN.x

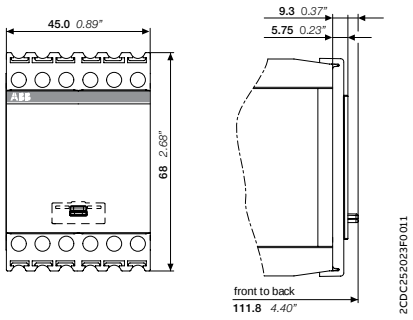
Accessories



ADP.02 - Adapter for screw mounting



MAR.12 - Marker label for devices with DIP switches



COV.12 - Sealable transparent cover


A1
11
21
T2
T1
ABB
CM-MSS
Reset
Test / Reset
U
F
R
24
22
S1
1T1
1T2/2T2
2T1

Thermistor motor protection relays
Table of contents

112	**Benefits and advantages**
113	**Applications**
114	**Features**
116	**Offer overview**
118	**Operating controls**
119	**Selection table**
120	**Ordering details**
122	**Technical data**
129	**Technical diagrams**

Thermistor motor protection relays
Benefits and advantages

The thermistor motor protection relays of the CM-MSx range protect motors with PTC sensors against high temperature. These sensors are incorporated in the motor windings, thus measuring the motor heat directly.

Continuous operation

By using thermistor motor protection relays from ABB, the down and commissioning time can be reduced. The relay is continuously monitoring the sensor circuit to detect short-circuit or interrupted i.e. wire faults, thus contributing to maintenance and time saving in case of faults. In addition, the clear error messages of the front LEDs makes it possible to distinguish between the various fault causes.

Reliable in harsh conditions

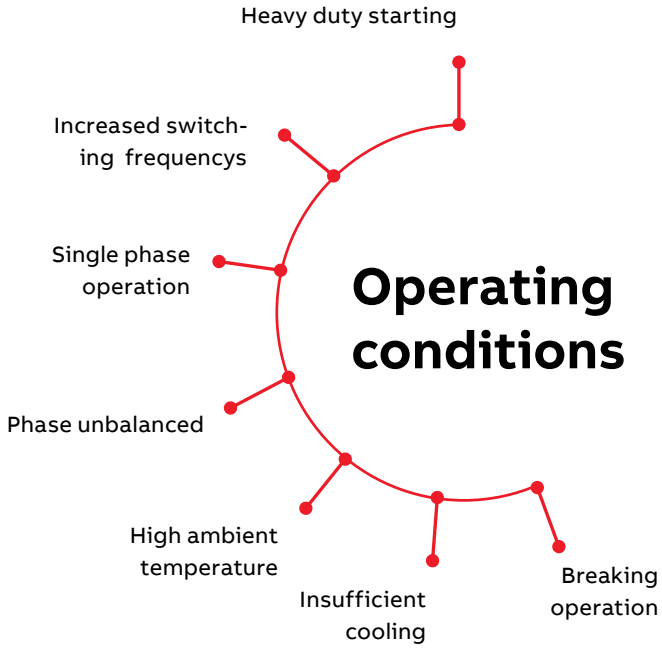
Direct motor protection through temperature monitoring of the motor winding offers 100 % motor protection, even under the most difficult ambient conditions. The ABB thermistor motor protection relays give you access to worldwide markets and are approved by local and international standards for many applications such as industry, renewable energies, the marine sector and dangerous and explosive environments. To prove that, the CM-MSS thermistor motor protection relays are certified according to ATEX Ex II (2) G and D for environments with explosive gas or dust loads.

Easy installation

Due to the compliance with the latest standards, there is no need to make any adjustments on the device. All relays come with two different connection possibilities - screw or push-in - to make any adjustments on the installation a breeze. Thanks to direct measurement of the motor temperature, dimensioning of the thermistor motor protection relay, considering the size of the motor, is not necessary.

Thermistor motor protection relays
Applications

Direct temperature monitoring
Generally, motor damage caused by overload or overheating situations can be prevented in different ways. Compared to the indirect temperature measuring which monitors the motor current, the temperature inside the motor can be measured by direct temperature measuring. This enables direct control and evaluation of different operating conditions:
Therefore, the consequences from overheating, such as abrasion as well as electrical failures, can be prevented. The direct measuring principle is carried out by a combination of the thermistor motor protection relay and three PTC sensors which are installed directly in the motor by the manufacturer. Those 3 PTC sensors are placed directly at the thermal hotspots, the motor windings.



Motor protection using current- and temperature-dependent protective devices
IEC 60204 stipulates that motors must be protected from overheating at a rating of 0.5 kW and higher. The protection can be provided or executed by overload protection, overtemperature protection or current limiting. For motors with frequent starting and braking, and in environments where cooling may be impaired (e.g. by dust), it is recommended to use the overtemperature protection option in the form of a protective device coordinated with this mode of operation.

On rotor-critical motors, overtemperature detection in the stator windings can lead to delayed and hence inadequate protection. In this case, the standards stipulate additional protection, e.g. by means of an overload relay. This combination of thermistor motor protection and an overload relay is recommended for full motor protection in case of frequent starting and braking of motors, irregular intermittent duty or excessive switching frequency.

Operating mode
The thermistor motor protection relays are used to monitor the temperature of motors or generators equipped with PTC sensors type A according to the latest product standard IEC/EN 60947-8. The sensors are built-in into the motor windings, measuring the motor heating. In case of an increase of the temperature in the motor, the resistance of the PTC sensors increases as well. If the motor heats-up excessively (>2.83 kΩ), the output relay(s) de-energize(s) and the corresponding LED displays the overtemperature. A short circuit and an interrupted wire within the sensor circuit can also be detected. A reset is only possible after cooling down of the motor (<1.1 kΩ) or after a wire interruption, or a short circuit within the sensor circuit has been removed. A reset after tripping can be done manually with the Test / Reset button, externally with a push button between S1 and 1T2/2T2, or automatically by jumpering S1-1T2/2T2.

Thermistor motor protection relays
Features

Test function
The test function is only possible when there is no fault. By pressing the front-face combined Test / Reset button, a system test routine is executed. If the function „Remote Test / Reset“ (DIP switch 4) is activated, the system test routine is also possible via control input S1-T2 (S1-1T2/2T2*).
After starting the test routine, the output relays de-energize. They remain de-energized until the Test / Reset button is pressed again or control input S1-T2 (S1-1T2/2T2*) is closed (remote reset).

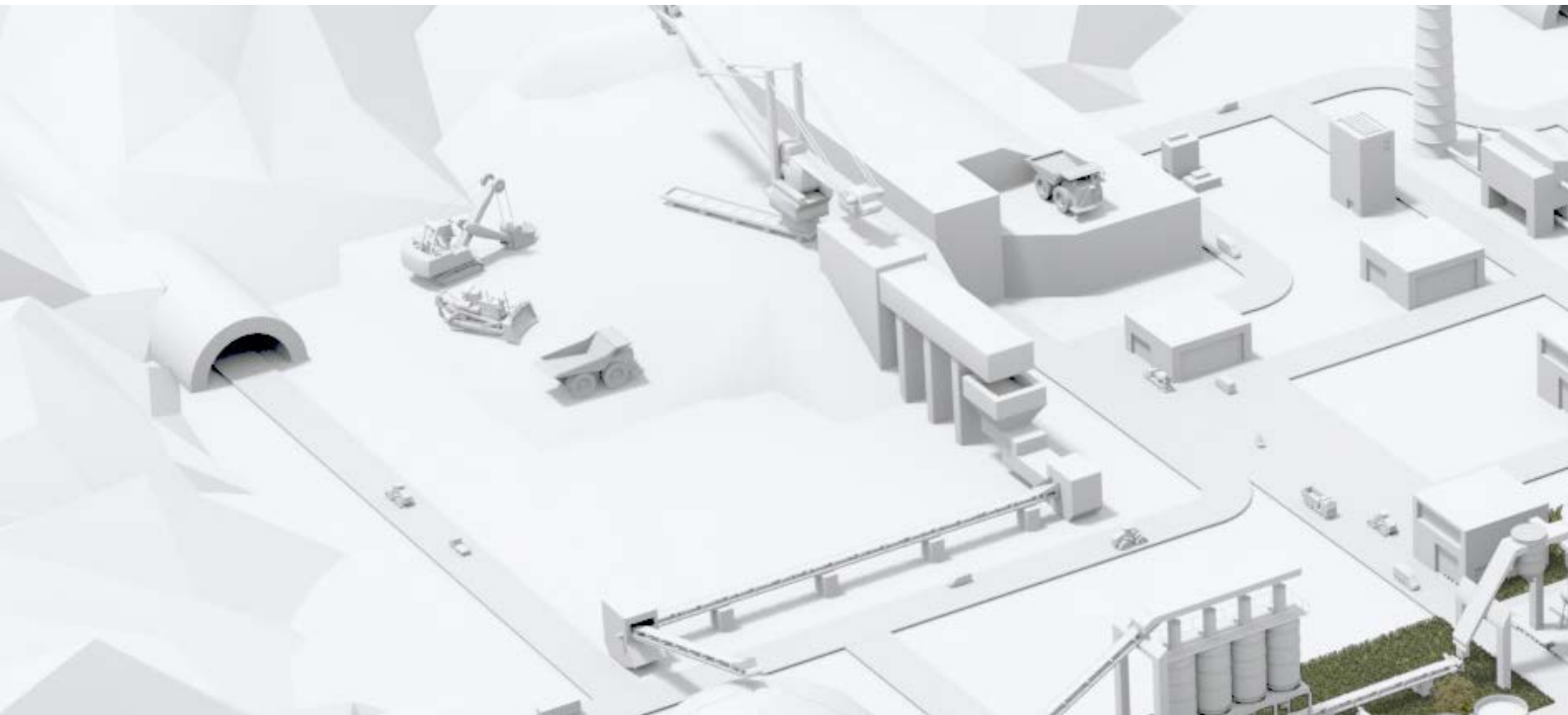
Short-circuit detection
If a short circuit is detected between the two lines of a sensor circuit, the output relay(s) de-energize(s) and the LEDs will display the specific error code.

Dynamic interrupted wire detection
During the operation, the device is permanently monitoring the measuring circuit. If the resistance in the measuring circuit rises, the device distinguishes if there is an overtemperature or an interrupted wire.

Fault storage, reset function
The fault storage is designed as non-volatile (remanent). This means that after switch-off and return of the control supply voltage the device returns to the state it was prior to the switch-off. If there was no fault prior to the interruption of the control supply voltage, the device restarts automatically after re-applying control supply voltage.
If there was a fault prior to the interruption, reset can be reset manually by the Test / Reset button or externally by remote reset between S1-T2 (S1-1T2/2T2*).
With deactivated fault storage, reset can be made manually by the Test / Reset button, automatically by jumpering S1-T2 (S1-1T2/2T2*) or externally by remote reset between S1-T2 (S1-1T2/2T2*). Depending on the configuration of DIP switch 1, there are several possibilities to reset the device as shown in the picture.

DIP switch 1		
S1 1T2/2T2	1.) Front 2.) Remote 3.) A1-A2	1.) Front 2.) Remote
S1 1T2/2T2	1.) Front 2.) A1-A2	1.) Front
S1 1T2/2T2	1.) Auto-Reset	

*CM-MSS.51



Thermistor motor protection relays
Features

Single and accumulative evaluation

Single evaluation 2x1 c/o

If a fault occurs in the measuring circuit 1, output relay 1 (11-12/14) de-energizes. If a fault occurs in the measuring circuit 2, output relay 2 (21-22/24) de-energizes.

Accumulative evaluation 1x2 c/o

In case of a fault in one of the two measuring circuits, both output relays de-energize synchronously.

Bimetallic switches

In some applications, bimetallic switches - such as Klixon - are used as sensors instead of PTC temperature sensors. Bimetallic switches are temperature and current dependent, normally closed contacts, and are available for different temperature ranges. Since bimetallic switches have almost no resistance below their opening temperature, short-circuit detection is not possible when bimetallic switches are used.

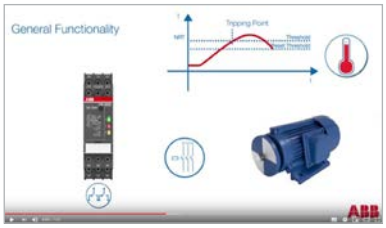
ATEX certification

Suitably selected and adjusted devices are necessary for the safe operation of explosion-protected motors. Only the sensor line is conducted into the explosive atmosphere. The motor protection relay itself must be installed outside the potentially explosive atmospheres.

Marking:

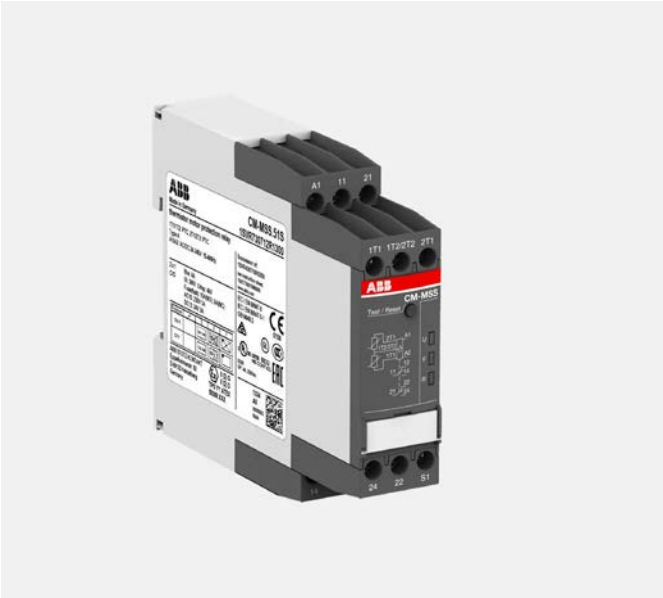
II (2) G
II (2) D

CM-MSS functionality video



Thermistor motor protection relays
Offer overview

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

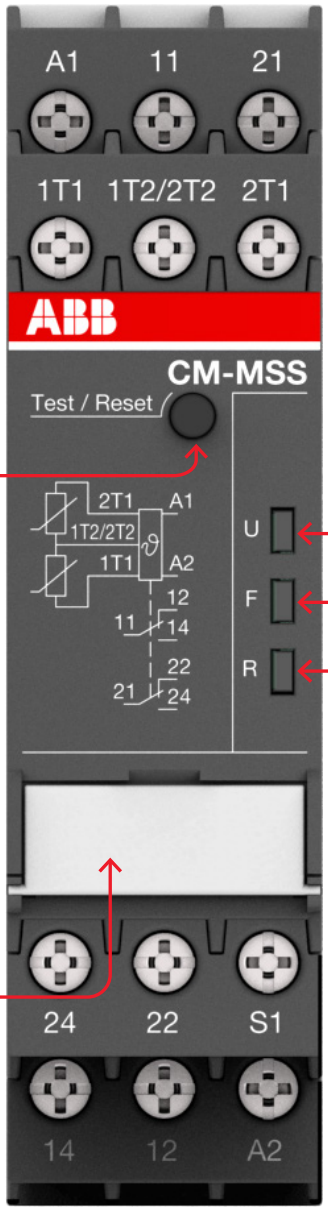


CM-MSS [1)]
- Different types of contacts available
  - 1 x 2 c/o (SPDT) contacts
  - 2 x 1 c/o (SPDT) contact
  - 1 n/o and 1 n/c contact
- 1 or 2 measuring circuits
- Different types of reset functions
  - Automatic
  - Manual
  - Remote
- Rated control supply voltages
  - 24 V AC/DC
  - 24-240 V AC/DC
  - 110-130 V AC, 220-240 V AC
- Various approvals and marks

[1)] Depending on device the characteristics vary, for detailed overview see "Selection table" on page 189.


ABB
ABB

Thermistor motor protection relays
Operating controls



Test / Reset button
Test - only possible if/when the relay doesn't show any fault.
Reset - only possible if measured value < switch-on resistance

Marker label / DIP switches (depending on device) e.g.

2x1 c/o Single evaluation 2 x 1 c/o (SPDT) contact
1x2 c/o Accumulative evaluation 1 x 2 c/o (SPDT) contacts
Short-circuit detection de-activated
Short-circuit detection activated
Non-volatile fault storage activated
Non-volatile fault storage de-activated
Remote Reset
Remote Test/Reset

Indication of operational states with LEDs
U: green LED - Status indication of control supply voltage
Control supply voltage applied
F: red LED - Fault message
R: yellow LED - Status indication of the output relay

For detailed status and failure analysis, please see "LEDs, status information and fault messages".

Thermistor motor protection relays
Selection table

	Order code	1SVR550805R9300	1SVR550800R9300	1SVR550801R9300	1SVR740720R1400	1SVR730720R1400	1SVR740700R0100	1SVR730700R0100	1SVR740700R2100	1SVR730700R2100	1SVR740722R1400	1SVR730722R1400	1SVR740700R0200	1SVR730700R0200	1SVR740700R2200	1SVR730700R2200	1SVR740712R1400	1SVR730712R1400	1SVR740712R0200	1SVR730712R0200	1SVR740712R2200	1SVR730712R2200	1SVR740712R1200	1SVR730712R1200	1SVR740712R1300	1SVR730712R1300
	Type	CM-MSE	CM-MSE	CM-MSE	CM-MSS.11P	CM-MSS.11S	CM-MSS.12P	CM-MSS.12S	CM-MSS.13P	CM-MSS.13S	CM-MSS.21P	CM-MSS.21S	CM-MSS.22P	CM-MSS.22S	CM-MSS.23P	CM-MSS.23S	CM-MSS.31P	CM-MSS.31S	CM-MSS.32P	CM-MSS.32S	CM-MSS.33P	CM-MSS.33S	CM-MSS.41P	CM-MSS.41S	CM-MSS.51P	CM-MSS.51S
Characteristics																										
ATEX approval					■	■					■	■					■	■	■	■	■	■	■	■	■	■
Number of sensor circuits		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
Single or accumulative evaluation																									■	■
Number of LEDs					3	3	2	2	2	2	3	3	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Contacts																										
1 c/o (SPDT) contact							■	■	■	■																
2 c/o (SPDT) contacts													■	■	■	■			■	■	■	■	■	■		
1 n/o		■	■	■																						
1 n/c and 1 n/o					■	■					■	■					■	■								
2 x 1 c/o or 1 x 2 c/o contacts, configurable																									■	■
Reset																										
Manual													■	■	■	■	■	■	■	■	■	■	■	■	■	■
Remote													■	■	■	■	■	■	■	■	■	■	■	■	■	■
Auto		■	■	■	■	■	■	■	■	■	■	■	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (1)	■ (2)	■ (2)
Test button																	■	■	■	■	■	■	■	■	■	■
Functions																										
Short-circuit detection											■	■					■	■	■	■	■	■				
Short-circuit detection, configurable																							■	■	■	■
Dynamic interrupted wire detection					■	■					■	■					■	■	■	■	■	■	■	■	■	■
Non-volatile fault storage					■	■					■	■					■	■								
Non-volatile fault storage, configurable																							■	■	■	■
Rated control supply voltage U_s																										
24 V AC		■																								
110-130 V AC			■																							
220-240 V AC				■																						
24-240 V AC/DC					■	■					■	■					■	■					■	■	■	■
24 V AC/DC							■	■					■	■					■	■						
110-130 V AC, 220-240 V AC									■	■					■	■					■	■				
Connection type																										
Push-in terminals					■		■		■		■		■		■		■		■		■		■		■	
Double-chamber cage connection terminals						■		■		■		■		■		■		■		■		■		■		■
Screw		■	■	■																						

1) For automatic reset, connect terminals S1 to T2.
2) For automatic reset, connect Terminals S1 to 1T2/2T2.

Thermistor motor protection relays
Ordering details


2CDC 251 004 V0014

CM-MSS.12S


2CDC 251 013 V0014

CM-MSS.41S


2CDC 251 014 V0014

CM-MSS.51S

Description

The thermistor motor protection relay CM-MSS monitors the winding temperature and thus protects the motor from overheating, overload and insufficient cooling in accordance to the product standard IEC/EN 60947-8.

Ordering details

CM-MSx

Characteristics	Type	Order code	Weight (1 pc) kg (lb)
See selection table	CM-MSE	1SVR550805R9300	0.11 (0.24)
	CM-MSE	1SVR550800R9300	0.11 (0.24)
	CM-MSE	1SVR550801R9300	0.11 (0.24)
	CM-MSS.11P	1SVR740720R1400	0.119 (0.263)
	CM-MSS.11S	1SVR730720R1400	0.127 (0.280)
	CM-MSS.12P	1SVR740700R0100	0.105 (0.231)
	CM-MSS.12S	1SVR730700R0100	0.113 (0.249)
	CM-MSS.13P	1SVR740700R2100	0.147 (0.324)
	CM-MSS.13S	1SVR730700R2100	0.155 (0.342)
	CM-MSS.21P	1SVR740722R1400	0.118 (0.260)
	CM-MSS.21S	1SVR730722R1400	0.126 (0.278)
	CM-MSS.22P	1SVR740700R0200	0.121 (0.267)
	CM-MSS.22S	1SVR730700R0200	0.132 (0.291)
	CM-MSS.23P	1SVR740700R2200	0.163 (0.359)
	CM-MSS.23S	1SVR730700R2200	0.174 (0.384)
	CM-MSS.31P	1SVR740712R1400	0.120 (0.265)
	CM-MSS.31S	1SVR730712R1400	0.128 (0.282)
	CM-MSS.32P	1SVR740712R0200	0.120 (0.265)
	CM-MSS.32S	1SVR730712R0200	0.130 (0.287)
	CM-MSS.33P	1SVR740712R2200	0.162 (0.357)
	CM-MSS.33S	1SVR730712R2200	0.172 (0.379)
	CM-MSS.41P	1SVR740712R1200	0.130 (0.287)
	CM-MSS.41S	1SVR730712R1200	0.141 (0.311)
	CM-MSS.51P	1SVR740712R1300	0.135 (0.298)
	CM-MSS.51S	1SVR730712R1300	0.145 (0.320)

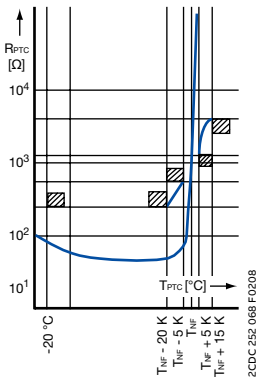
S: screw connection
P: push-in connection

Thermistor motor protection relays

Ordering details - PTC temperature sensors C011

1SVC 110 000 F0531

Temperature sensor example



Temperature sensor characteristics

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), three sensors are also required. Pole-changing motors with two windings, however, require six 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.

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 IEC/EN 60947-8.

Ordering details

CM-MSS accessories

Rated response temperature T_{NF}	Color coding	Type	Order code	Weight (1 pc) 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 IEC/EN 60947-8
2) Triple temperature sensor C011-3

Thermistor motor protection relays

Technical data - PTC temperature sensors C011

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} ± ΔT_{NF}	PTC resistance R from -20 °C to T_{NF} - 20 K	PTC resistance R[2)] at PTC temperatures of:		
		T_{NF} - iT_{NF} (UPTC ≤ 2.5 V)	T_{NF} + iT_{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 - CM-MSS

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

Type			CM-MSS.x1	CM-MSS.x2	CM-MSS.x3
Supply circuit - Input circuit					
Rated control supply voltage U_s		A1-A2	24-240 V AC/DC	24 V AC/DC	220-240 V AC
		A2-A3	-	-	110-130 V AC
Rated control supply voltage U_s tolerance			-15...+10 %		
Rated frequency			15-400 Hz	50-60 Hz	
Electrical insulation between supply circuit and measuring circuit			yes	no	yes
Power failure buffering time			20 ms		
Supply circuit - Measuring circuit / Sensor circuit					
Number of circuits			1 (CM-MSS.51: 2)		
Sensor type			PTC type A (IEC/EN 60947-8)		
Max. total resistance of sensors connected in series, cold state			< 750 Ω		
Overtemperature monitoring	switch-off resistance (relay de-energizes)		2.83 kΩ ± 1% (CM-MSS.12 /.13 /.22 /.23: 2.7 kΩ ± 5%)		
	switch-on resistance (relay energizes)		1.1 kΩ ± 1% (CM-MSS.12 /.13 /.22 /.23: 1.2 kΩ ± 5%)		
Maximum voltage in sensor circuit		1.33 kΩ	2.5 V		
		4 kΩ	3.7 V		
		∞ kΩ	5.5 V		
Maximum current in sensor circuit			3.7 mA		
Maximum sensor cable length			2 x 100 m at 0.75 mm², 2 x 400 m at 2.5 mm²		
Accuracy within the rated control supply voltage tolerance			0.50 % (CM-MSS.12 /.13 /.22 /.23: 5 %)		
Accuracy within the temperature range			0.01 %/K (CM-MSS.12 /.13 /.22 /.23: 0.5 %/K)		
Repeat accuracy (constant parameters)			on request		
Reaction time of the safety function			< 100 ms		
Hardware fault tolerance (HFT)			0		
Control circuit					
Control function			see "Selection table" on page 189		
Maximum no-load voltage			5.5 V		
Max. current			0.6 mA (CM-MSS.12 /.13 /.22 /.23: 1.2 mA)		
Maximum cable length			2 x 100 m at 0.75 mm², 2 x 400 m at 2.5 mm²		
Indication of operational states					
Control supply voltage		U	LED green		
Relay status		R	LED yellow		
Fault message		F	LED red		
Output circuit					
Kind of output			see "Selection table" on page 189		
Operating principle			closed-circuit principle		
Contact material			AgNi alloy, Cd free		
Rated operational voltage U_e (IEC/EN 60947-1)			250 V AC		
Minimum switching voltage / Minimum switching current			24 V / 10 mA		
Maximum switching voltage / Maximum switching current			see data sheet		
Rated operating current I_e (IEC/EN 60947-5-1)		AC-12 (resistive) at 230 V	4 A		
		AC-15 (inductive) at 230 V	3 A		
		DC-12 (resistive) at 24 V	4 A		
		DC-13 (inductive) at 24 V	2 A		
AC Rating (UL 508)		utilization category (Control Circuit Rating Code)	B 300		
		maximum rated operational voltage	300 V AC		
		maximum continuous thermal current at B 300	5 A		
		maximum making/breaking apparent power at B 300	3600/360 VA		
		general purpose rating	250 V AC - 4 A		
Mechanical lifetime			30 x 10^6 switching cycles		
Electrical lifetime		at AC12, 230 V AC, 4 A	0.1 x 10^6 switching cycles		
Maximum fuse rating to achieve short-circuit protection		n/c contact	10 A fast-acting (CM-MSS.12, CM-MSS.13, CM-MSS.51: 6 A)		
		n/o contact	10 A fast-acting		

Thermistor motor protection relays

Technical data - CM-MSS

Type		CM-MSS.x1	CM-MSS.x2	CM-MSS.x3
General data				
MTBF		on request		
Duty time		100 %		
Dimensions		see "Dimensional drawings"		
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool		
Mounting position		any		
Minimum distance to other units	vertical / horizontal	10 mm (0.394 in) if switching current > 2 A		
Material of housing		UL 94 V-0		
Degree of protection	housing	IP50		
	terminals	IP20		
Electrical connection		**Screw connection technology**		**Easy Connect Technology (push-in)**
Connection capacity	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm² (1 x 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)		2 x 0.5-1.5 mm² (2 x 18-16 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 (7.08 lb.in)		-
Environmental data				
Ambient temperature ranges	operation	-25...+60 °C (-13...+140 °F)		
	storage	-40...+85 °C (-40...+185 °F)		
Damp heat, cyclic (IEC/EN 60068-2-30)		6 x 24 h cycle, 55 °C, 95 % RH		
Climatic class (IEC/EN 60721-3-3)		3K5 (no condensation, no ice formation)		
Vibration, sinusoidal		5-13.2 Hz: ±1 mm; 13.2-100 Hz: 0.7 g		
Shock		Class 2		
Isolation data				
Rated insulation voltage U_i	Supply circuit / Measuring circuit[1)]	300 V AC (CM-MSS.x2: n/a)		
	Supply circuit / Output circuits	300 V AC		
	Measuring circuit (1) / Output circuits	300 V AC		
	Output circuit 1 / Output circuit 2	300 V AC		
Rated impulse withstand voltage U_{imp}	Supply circuit / Measuring circuit[1)]	4 kV (CM-MSS.x2: n/a)		
	Supply circuit / Output circuits	4 kV		
	Measuring circuit (1) / Output circuits	4 kV		
	Output circuit 1 / Output circuit 2	4 kV		
Basic insulation	Supply circuit / Measuring circuit[1)]	600 V AC (CM-MSS.x2: n/a)		
	Supply circuit / Output circuits	600 V AC		
	Measuring circuit (1) / Output circuits	600 V AC		
	Output circuit 1 / Output circuit 2	300 V AC		
Protective separation (IEC/EN 61140)	Supply circuit / Measuring circuit[1)]	yes, up to 300 V		
	Supply circuit / Output circuits	yes (CM-MSS.x2: n/a)		
	Measuring circuit (1) / Output circuits	yes		
	Output circuit 1 / Output circuit 2	no		
Pollution degree (IEC/EN 60664-1)		3		
Overvoltage category (IEC/EN 60664-1)		III		

[1)] Potential of measuring circuit = Potential of control circuit

Standards	
Product standard	EN 60947-5-1, EN 60947-8
Low Voltage Directive	2014/35/EU
EMC directive	2014/30/EU
ATEX directive	2014/34/EU (only ATEX variants, see "Selection table" on page 189)
RoHS directive	2011/65/EU

Thermistor motor protection relays

Technical data - CM-MSS

Type		CM-MSS.x1	CM-MSS.x2	CM-MSS.x3
Electromagnetic compatibility				
Interference immunity to		IEC/EN 61000-6-2, IEC/EN 60947-8		
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV contact discharge, 8 kV air discharge		
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-N		
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3, 0.15-80 MHz, 10 V, 80 % AM (1kHz)		
voltage dips, short interruptions and voltage variations	IEC/EN 61000-4-11	Class 3		
harmonics and interharmonics	IEC/EN 61000-4-13	Class 3		
Additional interference immunity according to product standard IEC/EN 60255-1 (reference on IEC/EN 60255-26)				
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	10 V/m (80 MHz - 3 GHz)		
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	10 V at stated frequencies		
damped oscillatory waves	IEC/EN 61000-4-18	Signal lines, symmetric coupling: 1 kV peak voltage Power supply, asymmetric coupling: 2.5 kV peak voltage		
Interference emissions		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		
high-frequency radiated	Germanischer Lloyd	increased requirements in the emergency call frequency band		

Thermistor motor protection relays

Technical data - CM-MSE

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

Type			CM-MSE
Supply circuit - Input circuit			
Rated control supply voltage U_s power consumption		1SVR550805R9300	24 V AC approx. 1.5 A
		1SVR550800R9300	110-130 V AC approx. 1.5 A
		1SVR550801R9300	220-240 V AC approx. 1.5 A
Rated control supply voltage U_s tolerance			-15...+10 %
Rated frequency			50-60 Hz
Measuring circuit			
Monitoring function		T1-T2	temperature monitoring by means of PTC sensors
Number of sensor circuits			1
Sensor circuit			
Sensor type			PTC type A (IEC/EN 60947-8)
Max. total resistance of sensors connected in series, cold state			≤1.0 kΩ
Overtemperature monitoring		switch-off resistance (relay de-energizes)	2.0-3.0 kΩ
		switch-on resistance (relay energizes)	1.2-1.65 kΩ
Maximum voltage in sensor circuit		4 kΩ	5 V
		∞ kΩ	15 V
Maximum current in sensor circuit			2 mA
Maximum sensor cable length			2 x 100 m at 0.75 mm², 2 x 400 m at 2.5 mm²
Reaction time			<100 ms
Output circuit			
Kind of output		13-14	1 n/o contact
Operational principle			closed-circuit principle (output relay de-energizes if the measured value exceeds/drops below the adjusted threshold)
Maximum switching voltage			250 V
Rated operating voltage U_e and rated operating current I_e		AC-12 (resistive) at 230 V	4 A
		AC-15 (inductive) at 230 V	3 A
		DC-12 (resistive) at 24 V	4 A
		DC-13 (inductive) at 24 V	2 A
AC Rating (UL 508)	utilization category (Control Circuit Rating Code)		B 300
	maximum rated operational voltage		300 V AC
	maximum continuous thermal current at B 300		5 A
	maximum making/breaking apparent power at B 300		3600/360 VA
	general purpose rating		250 V AC - 4 A
Mechanical lifetime			30 x 10^6 switching cycles
Electrical lifetime		at AC12, 230 V AC, 4 A	0.1 x 10^6 switching cycles
Maximum fuse rating to achieve short-circuit protection		n/c contact	10 A fast-acting
		n/o contact	10 A fast-acting
General data			
Dimensions			see "dimensional drawings"
Duty cycle			100 %
Mounting			DIN rail (IEC/EN 60715)
Mounting position			any
Degree of protection		housing / terminals	IP50 / IP20
Electrical connection			
Connecting capacity	fine strand with wire end ferrule		2 x 1.5 mm² (2 x 16 AWG)
	fine strand without wire end ferrule		2 x 0.75-1.5 mm² (2 x 18-16 AWG)
	rigid		2 x 1-1.5 mm² (2 x 18-16 AWG)
Stripping length			2 x 0.75-1.5 mm² (2 x 18-16 AWG)
Tightening torque			0.6-0.8 Nm (5.31-7.08 lb.in)
Environmental data			
Ambient temperature ranges		Operation	-20..+60 °C
		Storage	-40...+85 °C
Damp heat		IEC/EN 60068-2-30	40 °C, 93 % RH, 4 days
Vibration withstand		IEC/EN 60062-2-6	10-57 Hz: 0.075 mm; 57-150 Hz: 1 g

Thermistor motor protection relays

Technical data - CM-MSE

Type		CM-MSE
Isolation data		
Rated insulation voltage U_i	supply, measuring / output circuit	250 V
Rated impulse withstand voltage U_{imp}	between all isolated circuits	4 kV / 1.2 - 50 µs
Pollution degree		3
Overvoltage category		III
Standards / Directives		
Standards		IEC/EN 60947-5-1, IEC/EN 60947-8
Low Voltage Directive		2014/35/EU
EMC Directive		2014/30/EU
RoHS Directive		2011/65/EU
Electromagnetic compatibility		
Interference immunity to		IEC/EN 61000-6-2, IEC/EN 60947-8
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV contact discharge, 8 kV air discharge
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-N
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3, 0.15-80 MHz, 10 V, 80 % AM (1kHz)
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

Thermistor motor protection relays
Technical data

LEDs, status information and fault messages

CM-MSS

Operational state	U: green LED	F: red LED	R: yellow LED
Absence of control supply voltage	OFF	OFF	OFF
Internal fault[2)]	OFF	⎍⎍⎽	⎍⎍⎽
Internal fault[2)]	⎍⎍⎍⎽	⎍⎍⎍⎽	⎍⎍⎍⎽
Control supply voltage not within the tolerance range	⎍⎍⎍⎽	⎍‾‾‾⎽	OFF
Short circuit	⎍‾‾‾⎽	⎍⎍⎍⎽	OFF
Interrupted wire	⎍‾‾‾⎽	⎍⎍⎍⎍⎽	OFF
Measuring circuit 2: Overtemperature	⎍‾‾‾⎽	⎍⎍⎽	OFF
Measuring circuit 1: Overtemperature	⎍‾‾‾⎽	⎍‾‾‾⎽	OFF
Fault rectified but not confirmed	⎍‾‾‾⎽	- [1)]	⎍⎍⎍⎽
Test function	⎍⎍⎍⎽	OFF	OFF
Change of configuration not confirmed	⎍‾‾‾⎽	OFF	⎍⎍⎍⎽
No fault	⎍‾‾‾⎽	OFF	⎍‾‾‾⎽

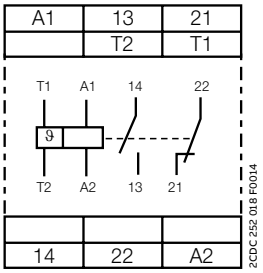
1) Depending on the fault with the highest priority
2) Restart the device. If after restart the same fault is indicated, replace the device.

Thermistor motor protection relays

Technical diagrams

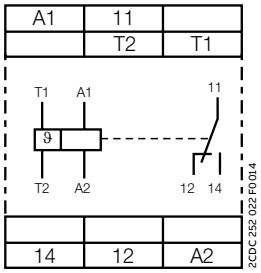
Connection diagrams

CM-MSS.11x, CM-MSS.21x



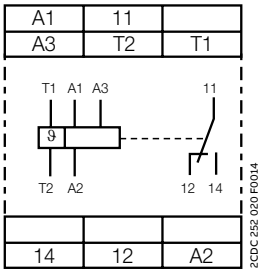
A1 – A2	Control supply voltage
13 – 14	n/o contact
21 – 22	n/c contact
T1 – T2	Measuring circuit

CM-MSS.12x



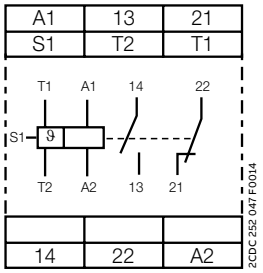
A1 – A2	Control supply voltage
11 – 12/14	c/o contact
T1 – T2	Measuring circuit

CM-MSS.13x



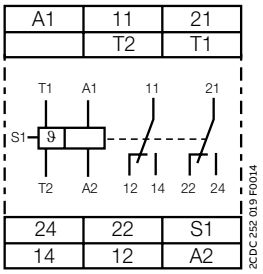
A1 – A2	Control supply voltage 220-240 V AC
A2 – A3	Control supply voltage 110-130 V AC
11 – 12/14	c/o contact
T1 – T2	Measuring circuit

CM-MSS.31x



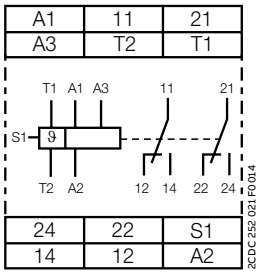
A1 – A2	Control supply voltage
13 – 14	n/o contact
21 – 22	n/c contact
S1 – T2	Automatic reset (jumpered)
T1 – T2	Measuring circuit

CM-MSS.22x, CM-MSS.32x, CM-MSS.41x



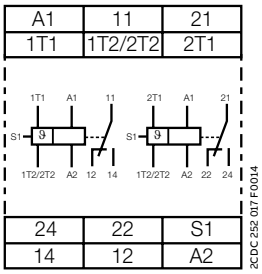
A1 – A2	Control supply voltage 24 V AC/DC
11 – 12/14	1st c/o (SPDT) contact
21 – 22/24	2nd c/o (SPDT) contact
S1 – T2	Automatic reset (jumpered)
T1 – T2	Measuring circuit

CM-MSS.23x, CM-MSS.33x



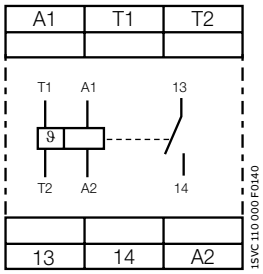
A1 – A2	Control supply voltage 220-240 V AC
A2 – A3	Control supply voltage 110-130 V AC
11 – 12/14	1st c/o (SPDT) contact
21 – 22/24	2nd c/o (SPDT) contact
S1 – T2	Automatic reset (jumpered)
T1 – T2	Measuring circuit

CM-MSS.51x



A1 – A2	Control supply voltage 220-240 V AC
11 – 12/14	1st c/o (SPDT) contact
21 – 22/24	2nd c/o (SPDT) contact
S1 – 1T2/2T2	Automatic reset (jumpered)
1T1 – 1T2/2T2	Measuring circuit 1
2T1 – 1T2/2T2	Measuring circuit 2

CM-MSE



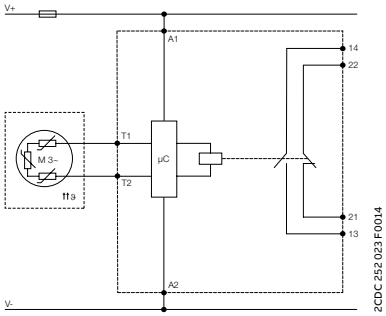
A1 – A2	Control supply voltage 24 V AC
T1-T2	Sensor circuit
13-14	Output contact - Closed circuit principle

Thermistor motor protection relays

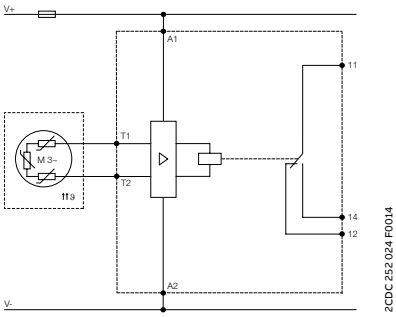
Technical diagrams

Circuit diagrams

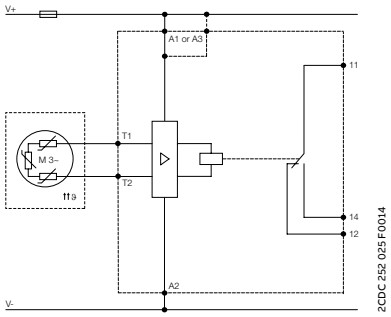
CM-MSS.11x, CM-MSS.21x



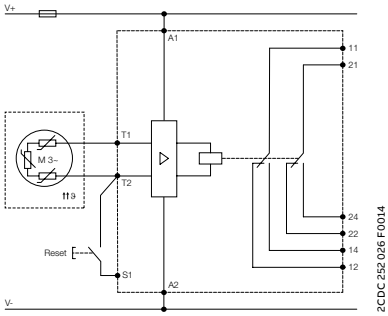
CM-MSS.12x



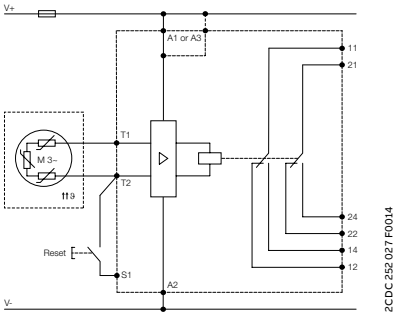
CM-MSS.13x



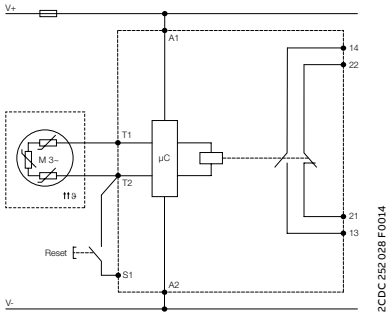
CM-MSS.22x



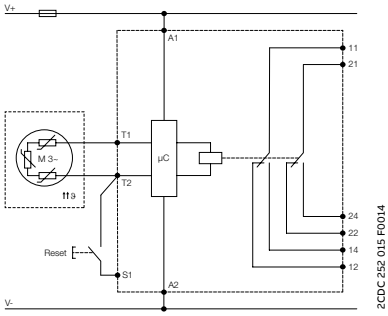
CM-MSS.23x



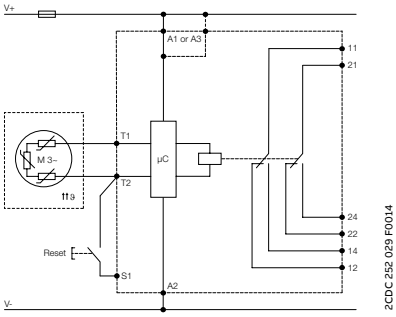
CM-MSS.31x



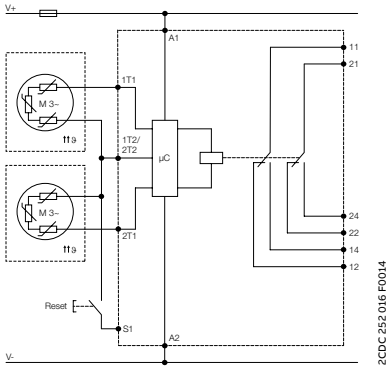
CM-MSS.32x, CM-MSS.41x



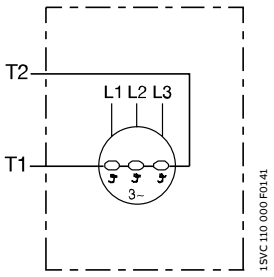
CM-MSS.33x



CM-MSS.51x



CM-MSE




A1
11
21
T3
T2
T1
ABB
CM-TCS
Hyst. %
(ϑ1)
ϑ1 °C
Hyst. %
(ϑ2)
ϑ2 °C
U
R
14
24
22

Analog temperature monitoring relays
Table of content

134	**Benefits and advantages**
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Analog temperature monitoring relays
Benefits and advantages

The temperature monitoring relays of the CM-TCS range are able to measure temperatures of solids, liquids and gaseous media using PT100 sensors. Over-temperature and undertemperature monitoring, as well as open- or closed-circuit principle is configurable for all devices. As soon as the temperature falls below or exceeds the set threshold value, the output relays change their positions and the front-face LED‘s display the current status.

Continuous operation

By using temperature monitoring relays, both the downtime and the commissioning time can be reduced. The relay is continuously monitoring the sensor circuit to detect short-circuit or interrupted wire faults. The high accuracy of the measuring input leads to a fast detection of exceeding threshold values. In case of fault, maintenance effort is reduced and time saved.

Reliable in harsh conditions

All relays work reliably in environments with low temperatures down to -40 °C. Additionally, the housing fulfills the UL 94 V-0 flammability standard requirements. Together with the vibration resistant push-in terminals, the relay is not only reliable no matter the environment temperature but is also durable to shock and vibration. Save time as retightening is no longer needed and enhance the reliability and safety not only for the equipment.

Easy installation

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

Analog temperature monitoring relays
Applications

The temperature monitoring relays CM-TCS monitor overtemperature, undertemperature, or temperatures between two threshold values (window monitoring) with a 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.

The current status is displayed by front-faced LEDs. Regardless of the selected configuration, the device is monitoring its measuring circuit for interrupted wires or short-circuits.

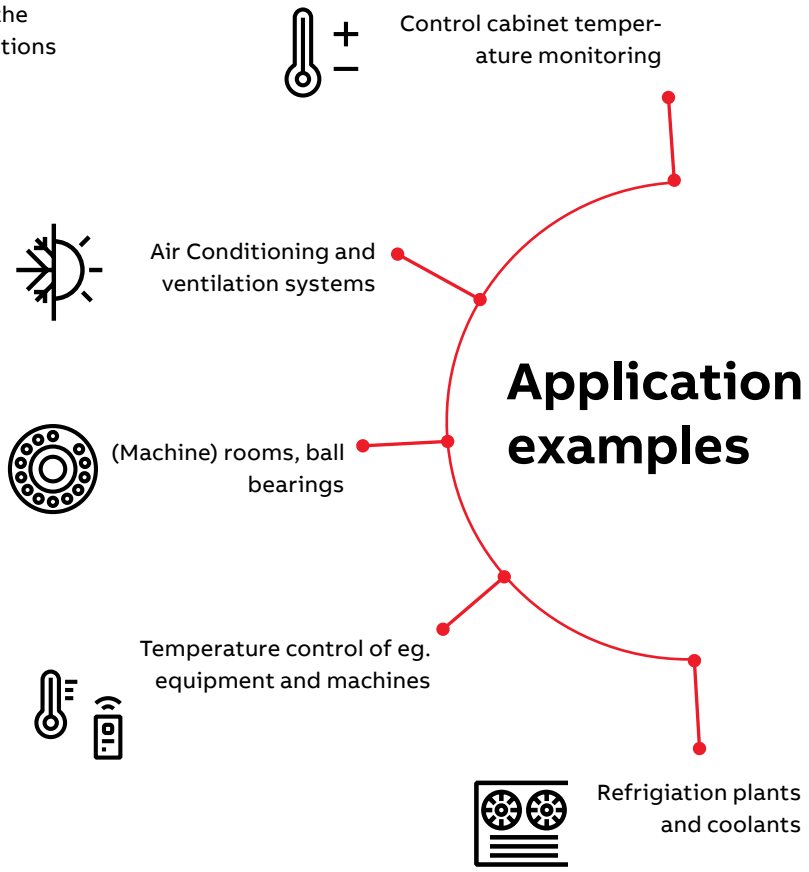


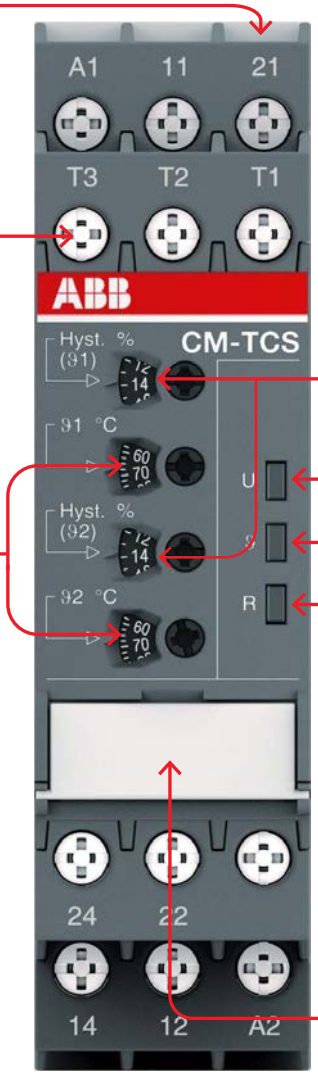

ABB
Thermo
SCIENTIFIC
LYNX 6000

Analog temperature monitoring relays
Operating controls

Push-in and screw terminals

Measuring input:
PT100

Adjustment of the threshold value
- 50 ... + 50 °C
0 ... + 100 °C
0 ... + 200 °C



Adjustment of the hysteresis for threshold value 2 - 20 %

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

DIP switch functions / marker label
- 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

Analog temperature monitoring relays

Selection table

	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
	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
Rated control supply voltage U_s													
24 V AC/DC		■	■			■	■			■	■		
24-240 V AC/DC				■	■			■	■			■	■
Sensor circuits (2 or 3 wire)													
Number of temperature sensors		1	1	1	1	1	1	1	1	1	1	1	1
Number of thresholds		2	2	2	2	2	2	2	2	2	2	2	2
Measuring temperature range													
-50...+50 °C		■	■	■	■								
0...+100 °C						■	■	■	■				
0...+200 °C										■	■	■	■
Monitoring function													
Overtemperature		■	■	■	■	■	■	■	■	■	■	■	■
Undertemperature		■	■	■	■	■	■	■	■	■	■	■	■
Window temperature		■	■	■	■	■	■	■	■	■	■	■	■
Operating principle													
Open or closed-circuit principle		■	■	■	■	■	■	■	■	■	■	■	■
Output contacts													
c/o		2	2	2	2	2	2	2	2	2	2	2	2

Analog temperature monitoring relays
Ordering details

CM-TCS

Description CM-TCS

The temperature monitoring relays CM-TCS are able to measure temperatures of solids, liquids and gaseous media using PT100 sensors. Overtemperature and undertemperature monitoring, as well as open- or closed-circuit principle, is configurable for all devices. As soon as the temperature falls below or exceeds the set threshold value, the output relays change their positions according to the configured functionality and the front-face LEDs display the current status.

Ordering details

Temperature monitoring relays CM-TCS

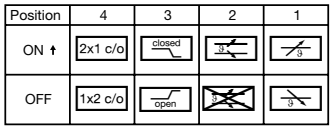
Rated control supply voltage	Measuring range	Temperature sensors	Type	Order code	Weight (1 pc) kg (lb)
24-240 V AC/DC	-50...+50 °C	PT100	CM-TCS.11S	1SVR730740R0100	0.151 (0.333)
			CM-TCS.11P	1SVR740740R0100	0.140 (0.309)
	0...+100 °C		CM-TCS.12S	1SVR730740R0200	0.151 (0.333)
			CM-TCS.12P	1SVR740740R0200	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)

S: screw connection
P: push-in connection

Analog temperature monitoring relays

Configuration and setup

DIP switches

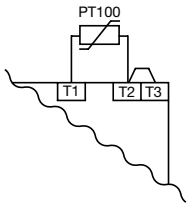


	ON	OFF (default)
DIP switch 1 Monitoring principle	Overtemperature monitoring If overtemperature monitoring is selected, the CM-TCS recognizes temperatures above the selected threshold and trips the output relay according to the selected operating principle.	Undertemperature monitoring If undertemperature 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 occurring.	Open-circuit principle If open-circuit principle is selected, the output relays are deenergized. They energize if a fault is occurring.
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 $\vartheta 1$ and the output relay R2 (21-22/24) reacts to threshold value $\vartheta 2$.	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 $\vartheta 2$ have no effect on the operation. Undertemperature monitoring: Settings of the threshold values $\vartheta 2$ have no effect on the operation.

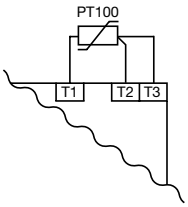
Analog temperature monitoring relays
Configuration and setup

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.



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

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.

Analog temperature monitoring relays

Technical data

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	
Minimum switching voltage / Minimum switching current		24 V / 10 mA	
Maximum switching voltage / Maximum switching current		see 'Load limit curves'	
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) 230 V	4 A	
	AC-15 (inductive 230 V	3 A	
	DC-12 (resistive) 24 V	4 A	
	DC-13 (inductive) 24 V	2 A	
AC Rating (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 (AC-12, 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}		4 A	

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

Analog temperature monitoring relays

Technical data

Type			CM-TCS.11/12/13	CM-TCS.21/22/23
General data				
Dimensions			see "dimensional drawings"	
Mounting			DIN rail (IEC/EN 60715), snap-on mounting without any tool	
Mounting position			any	
Degree of protection		enclosure / terminals	IP50 / IP20	
Ambient temperature range		operation	-40...+60 °C	
		storage /transport	-40...+85 °C	
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 / Directives				
Standards			IEC/EN 60255-27, IEC/EN 60947-5-1	
Low Voltage Directive			2014/35/EU	
EMC Directive			2014/30/EU	
RoHS Directive			2011/65/EU	
Environmental data				
Ambient temperature ranges		operation/storage/ transport	-40...+60 °C/-40...+85 °C/-40...+85 °C	
Climatic class		IEC/EN 60721-3-3	3K5 (no condensation, no ice formation)	
Damp heat, cyclic		IEC/EN 600068-2-30	6 x 24 h cycle, 55 °C, 95 % RH	
Vibration, sinusoidal			Class 2	
Shock			Class 2	
Isolation data				
Rated impulse withstand voltage U_{imp}		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	
Rated insulation voltage U_i		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	

Analog temperature monitoring relays

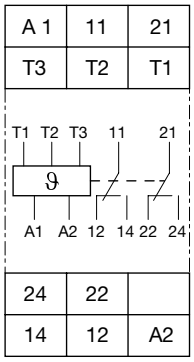
Technical data

Type		**CM-TCS.11/12/13**	**CM-TCS.21/22/23**
Basis insulation	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)	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
Pollution degree		3	
Overvoltatge category		III	
Electromagnetic compatibility			
Interference immunity to		IEC/EN 61000-6-2	
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV / 8 kV	
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3, 10 V/m (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		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	

Analog temperature monitoring relays

Technical diagrams

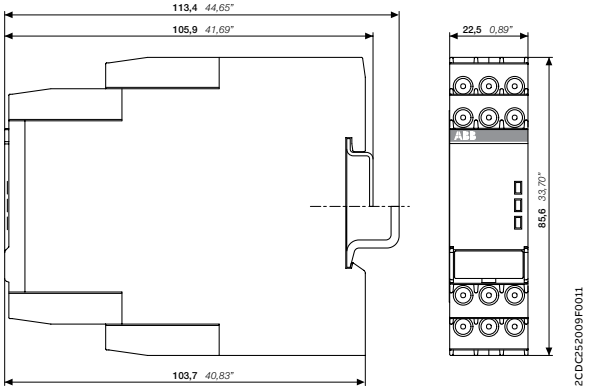
Connection diagram



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

Dimensional drawing

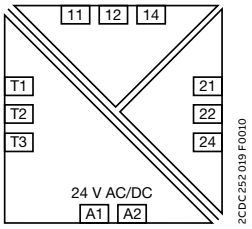
in **mm** and inches



CM-TCS.xxx

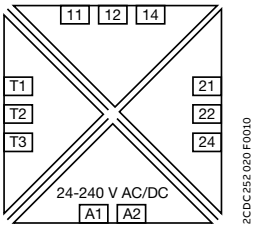
Electrical isolation

CM-TCS.2x



Electrical isolation

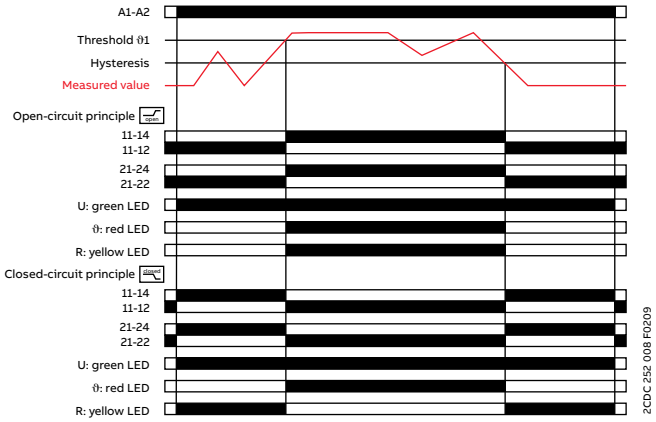
CM-TCS.1x



Protective separation acc. to IEC/EN 61140

Temperature monitoring relays with potentiometer

Function diagrams

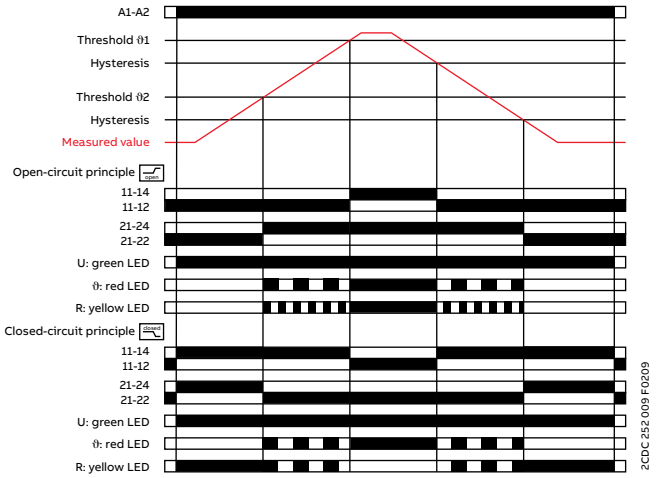


Overtemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

With this configuration, settings via $\vartheta 2$ have no influence on the operating function ($\vartheta 2$ 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 $\vartheta 1$, the output relays energize. If the measured value drops again below the adjusted threshold value $\vartheta 1$ minus the adjusted hysteresis, the output relays de-energize.

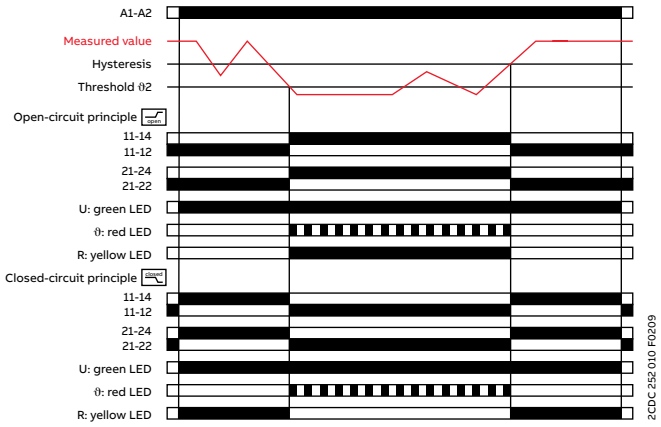
Closed-circuit principle:
The behavior is inverse to the one with open-circuit principle.



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 $\vartheta 2$, output relay R2 (prewarning) energizes. If the measured value exceeds the adjusted threshold value $\vartheta 1$, output relay R1 (final switch-off) energizes.
If the measured value drops again below the adjusted threshold value $\vartheta 1$ minus the adjusted hysteresis, output relay R1 (final switch-off) de-energizes. If the measured value drops below the adjusted threshold value $\vartheta 2$ minus the adjusted hysteresis, output relay R2 (prewarning) de-energizes.

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



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

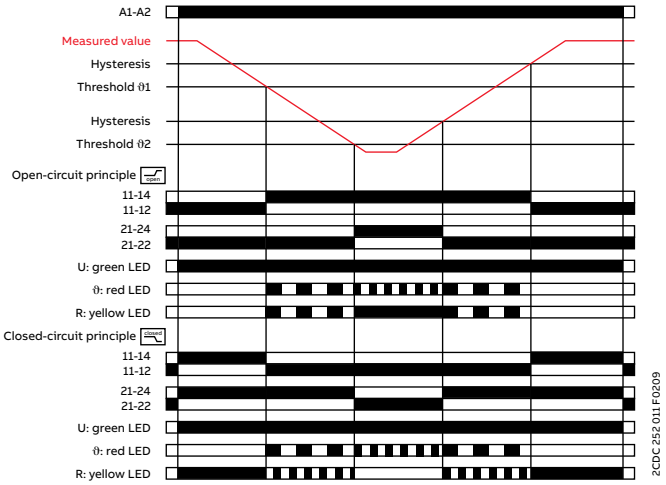
With this configuration, settings via $\vartheta 1$ have no influence on the operating function ($\vartheta 1$ disabled).

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 $\vartheta 2$, the output relays energize. If the measured value exceeds again the adjusted threshold value $\vartheta 2$ plus the adjusted hysteresis, the output relays de-energize.

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

Temperature monitoring relays with potentiometer

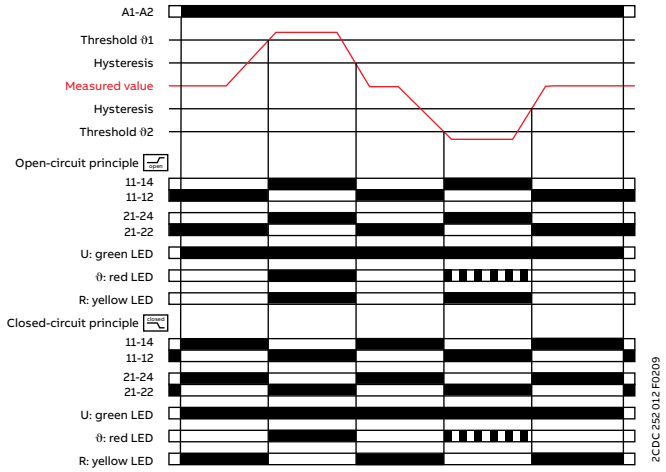
Function diagrams



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 $\vartheta 1$, output relay R1 (prewarning) energizes. If the measured value drops below the adjusted threshold value $\vartheta 2$, output relay R2 (final switch-off) energizes.
If the measured value exceeds again the adjusted threshold value $\vartheta 2$ plus the adjusted hysteresis, output relay R2 (final switch-off) de-energizes. If the measured value exceeds the adjusted threshold value $\vartheta 1$ plus the adjusted hysteresis, output relay R1 (prewarning) de-energizes.

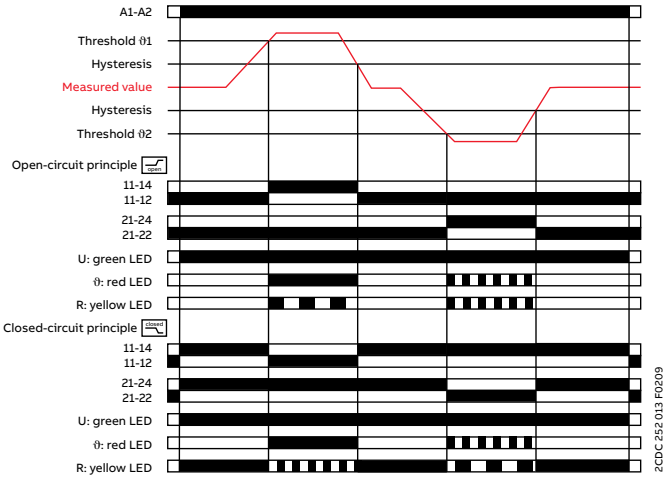
Closed-circuit principle:
The behavior is inverse to the one with open-circuit principle.



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 $\vartheta 1$ or drops below the adjusted threshold value $\vartheta 2$, the output relays energize. If the measured value drops again below the adjusted threshold value $\vartheta 1$ minus the adjusted hysteresis or exceeds again the adjusted threshold value $\vartheta 2$ plus the adjusted hysteresis, the output relays de-energize.

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



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 $\vartheta 1$ or drops below the adjusted threshold value $\vartheta 2$, output relay R1 (> $\vartheta 1$) or R2 (< $\vartheta 2$) respectively energizes.
If the measured value drops again below the adjusted threshold value $\vartheta 1$ minus the adjusted hysteresis or exceeds again the adjusted threshold value $\vartheta 2$ plus the adjusted hysteresis, output relay R1 (>$\vartheta 1$) or R2 (<$\vartheta 2$) respectively de-energizes.

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


A1
A2
T1
T2
T3
ABB
CM-TCS
25.5°C
>20.0°C
NFC
11
12
14
21
A1
A2
S1
1T1
1T2
1T3
2T1
2T2
2T3
3T1
3T2
3T3
ABB
CM-TCN
1: 28.5°C
2: 108.4°C
3: ---
2 > 90.0°C
NFC
11
12
14
21
22
24

Smart temperature monitoring relays
Table of contents

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One look, one touch – one device
Features and benefits

Set up these innovative temperature monitoring relays exactly as you need, either via a back-lit LCD or smartphone app. Parametrization and configuration are just one touch away with the ABB EPiC app – even in a non-powered state – reducing installation time by 80%. And with just one relay covering a wide range of application, stocks can be reduced significantly, making ABB's Smart monitoring relays a true game changer.

Easy to install

One look - back-lit LCD for easy reading and parametrization
Everything you need at a glance: the LCD at the front of the relay shows the currently measured values and maintenance data. And with just one push, the symbol-based menu structure can be accessed via the push-rotate button. Simply set the thresholds and parameters with the help of an intuitive and future-ready interface.

Optimum interface

One touch - NFC parametrization via smartphone app
One touch is all that is needed for fast, easy and intuitive configuration with the ABB EPiC smartphone app. Simply touch the relay with your mobile phone: parameter settings can be edited and stored in the app and then copied to different devices, even if they are not in the powered state. Available in a range of different languages, installation and configuration have never been so easy.

Continuous operation

One device - for thermal protection and condition monitoring
By providing early detection of unacceptable temperature rises and alerting the operator to the need for maintenance, temperature monitoring ensures that applications remain operational and asset lifetime is improved. Thermal protection and condition monitoring can also be accomplished remotely via a Modbus RTU and ABB Ability™ Energy Manager*. Remote management improves safety as personnel no longer need access to the switchboard to read measurements.

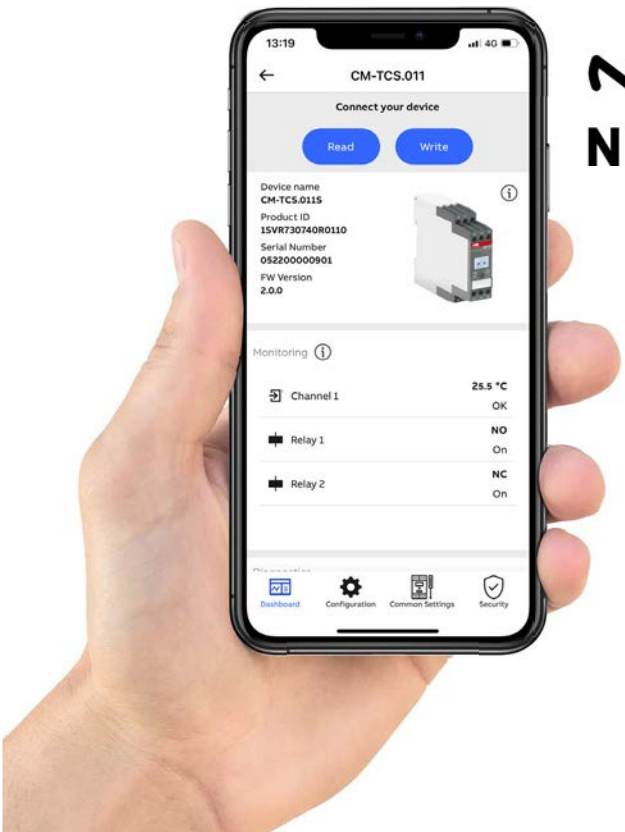
*Available with CM-TCN.012.

Smart temperature monitoring relays
Setup via display or smartphone app

The temperature monitoring relays can measure temperatures of solids, liquids and gaseous media in up to three sensor circuits using various types of sensors.

One...

look **to have the information needed**
the display shows the measured values and relay status at a glance. The symbol-based menu structure and presettings make parametrization simple.



NFC

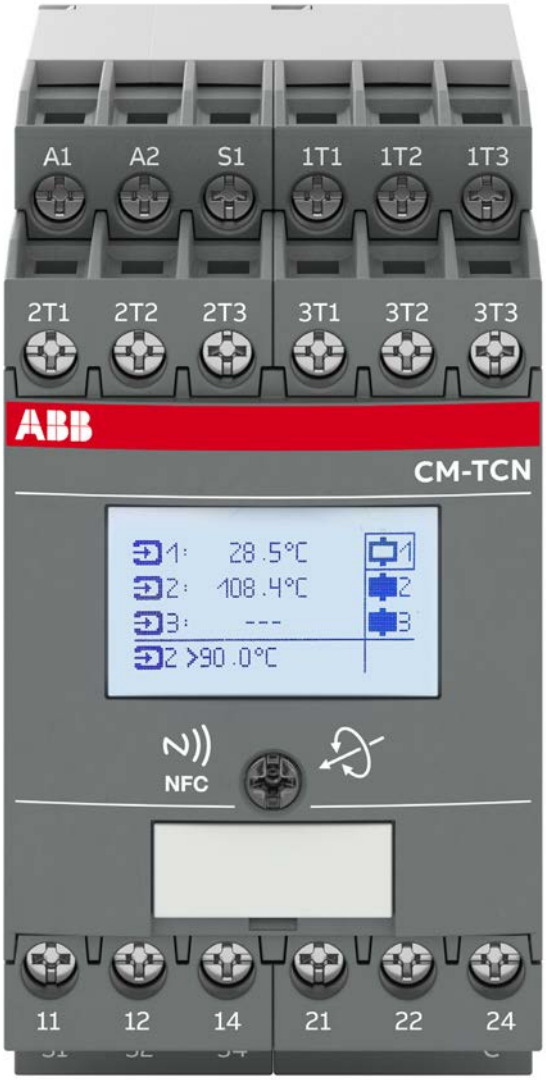
touch **for up to 80% faster setup**
for easy parametrization and copying of settings between multiple devices via NFC with the ABB EPiC smartphone app – even if the relay is not powered.

device **for thermal protection and condition monitoring**
Just one relay to cover many different applications, monitor their condition, improve safety and ensure uptime.

One look - back-lit LCD

Easy reading and setup with one push

Just one look is all it takes to see the status and measured values of the relay, easily navigate through the symbol-based menu and even configure the device with the new, back-lit LCD at the front of the relay.



Start screen
Know the status at one glance.

Symbol-based menu structure
Due to the symbol-based menu structure, there is no need for any translation, which helps avoid misunderstandings and dramatically increases efficiency in after sales support.

Pre- and user-defined settings
For frequently used applications, the device offers predefined settings to save installation time. Parameters can be individually set and saved in one of four user settings.

Simulation mode
Simulation of temperature values to test the relay configuration or simulation of the relays trip for commissioning or testing.

Push-rotate adjustment
Adjust the relay with a simple screw driver by pushing and rotating the potentiometer to navigate through the menu.

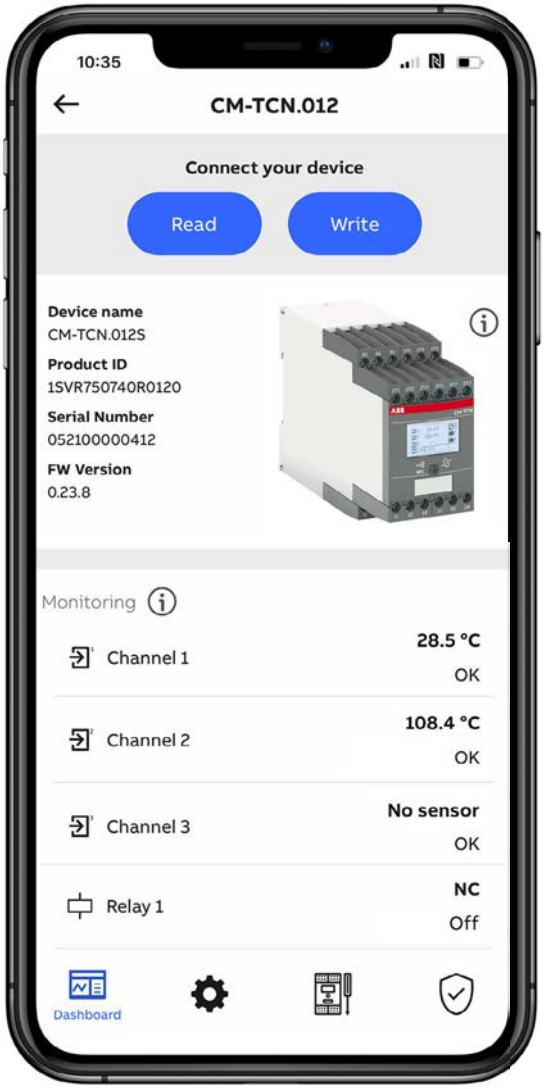
Back-lit LCD
The back-lit LCD at the front of the relay shows the currently measured values and maintenance data and makes setup easy.

Diagnostic data
Event history, operating hours counter, statistics and others are easily accessible from the menu

Password & parameter lock
Improved security is achieved through the password protection and parameter lock.

One touch - setup via smartphone app
Powerless configuration with NFC

Configuration and parametrization of temperature monitoring relays has never been simpler. One touch is all that is needed for fast, easy and intuitive configuration with the ABB EPiC mobile phone app.



Near Field Communication (NFC)
NFC is an international transmission standard based on radio-frequency identification technology for the contact-less exchange of data. This technology is already integrated into most electronic devices like tablets and smartphones and part of everyday life, e.g. for contactless payment.

ABB EPiC smartphone app
Electrification Products intuitive Configurator (EPiC) is a mobile application that makes it possible to configure and check the status of ABB low voltage products. The app is available for free - just download it and connect to your smart monitoring relays, circuit breakers and other devices.

Easy visualization
Monitor the status of the relay and read the measured values in the app.

Store and send parameters
Store a set of parameters in the app and distribute them globally and copy them to other devices.

Powerless adjustment
Parametrize and configure the relays even while not connected to a power supply, e.g. on office desks.

One touch setup
Handle the relays with just one touch- just hold the smartphone against the front of the relay.

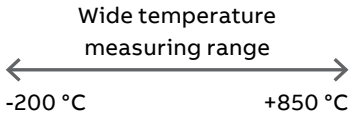
Copy and paste functionality
Simply copy the settings from one device to another–with just one touch to the relay.

Event history
Examine the history of the device and recent events.

One device - thermal protection
Flexible adjustment and condition monitoring

Knowing the status of your devices at all times: thanks to the smart monitoring relays, you are always up to date and flexible in controlling your devices. Remote monitoring via Modbus RTU and ABB Ability™ Energy Manager also enables the early detection of potential errors and possible maintenance requirements.

Flexible adjustment
The smart monitoring relays are configurable over a wide setting range and can be adjusted flexibly no matter the thresholds, time values or other settings. For example, first relay can be assign as pre-alarm and second as alarm. Nine signals in CM-TCN and six signals in CM-TCS are available for assignment to allow various combination of tripping thresholds



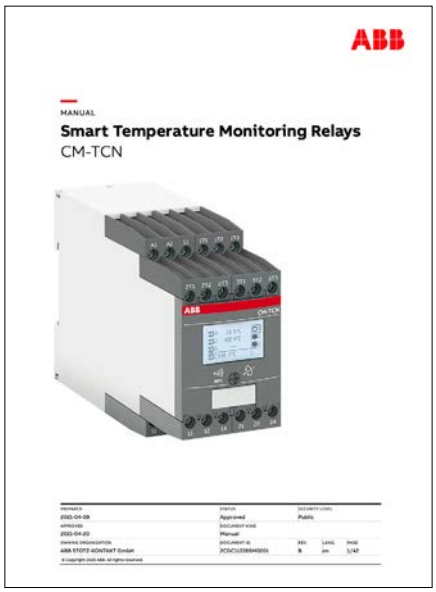
Early detection of potential fault and need for maintenance
Thanks to support of the most commonly used sensors (PTC, PT100, PT1000, NTC), the smart temperature relay can be used for temperature monitoring of busbars and cables allowing detecting the issues related to tightening, which results in the need for maintenance. In addition, the relay can be used for temperature monitoring of electrical motor's bearings and windings allowing to sense unacceptable temperature rise that shorten the lifetime of equipment.

Improve safety
The smart monitoring relays improves safety thanks to remote temperature monitoring using Modbus RTU or ABB Ability™ Energy. The personal no longer need to access to the switchboard to read the measurements*.

*Available with CM-TCN.012.

Built-in connectivity
Communication via embedded Modbus RTU

The smart temperature monitoring relay CM-TCN.012 supports the data transfer using the Modbus RTU communication protocol. The communication interface RS-485 is embedded in the relay and does not require installation of any accessories.



CM-TCN manual
Modbus communication map and information about the device configuration can be found in the CM-TCN user manual

The communication interface makes it possible to:

Read the temperature measurements, relays state and temperature sensors status.

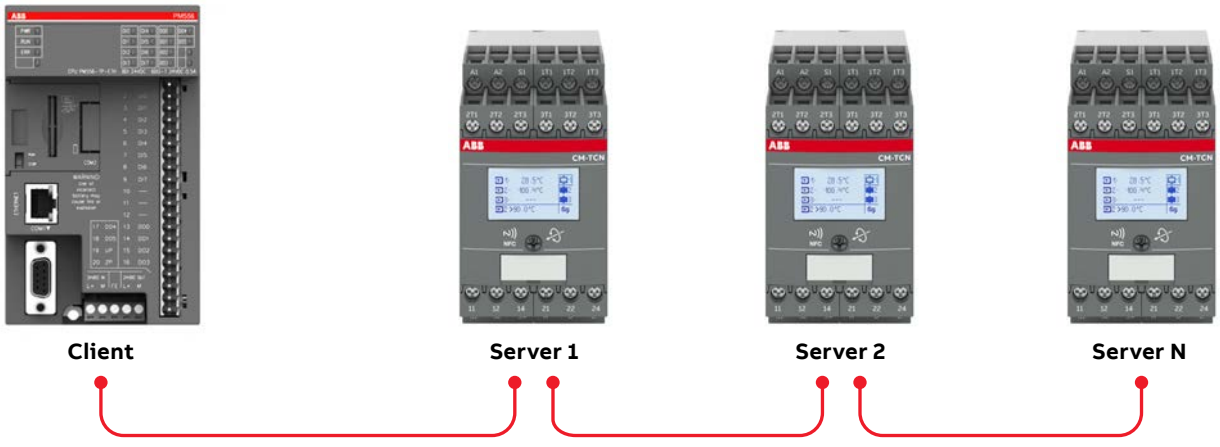
Reset the history and settings (trip counter, event history, etc)

Access the diagnostic data such as event history, operating hours counter, maintenance counter, statistics.

Read system information (serial number, firmware version)

Configure the smart monitoring relay remotely.

Control output relays and trigger them in case of the communication bus error



Cloud integration with ABB Ability™
Data monitoring and temperature trends

Providing full remote visibility of asset and electrical-system behavior, ABB Ability™ Energy Manager provides insights that help you minimize costs, risks and maximize performance as well as safety across your operations.

The CM-TCN.012 smart monitoring relay is enabled in ABB Ability™ Energy Manager. Thus, allowing access to the data monitoring and temperature trends from the cloud solution.

The data received from CM-TCN.012 is organized in user friendly widget for the remote condition monitoring of assets such as a machine, motor, transformer or switchboard. The temperature trends can be compared between different measuring sensors giving you valuable insights about temperature behavior of your assets at the place of the sensors´ installation.

Additionally, the customer can set up SMS or E-mail alerts to notify key personnel in case of the temperature relay tripping or sensors error. The periodic report with temperature values can also be scheduled.

CM-TCN.012 can be connected to the cloud-computing platform via Modbus RS-485 communication interface. The interface is embedded in the device and does not require any accessories.

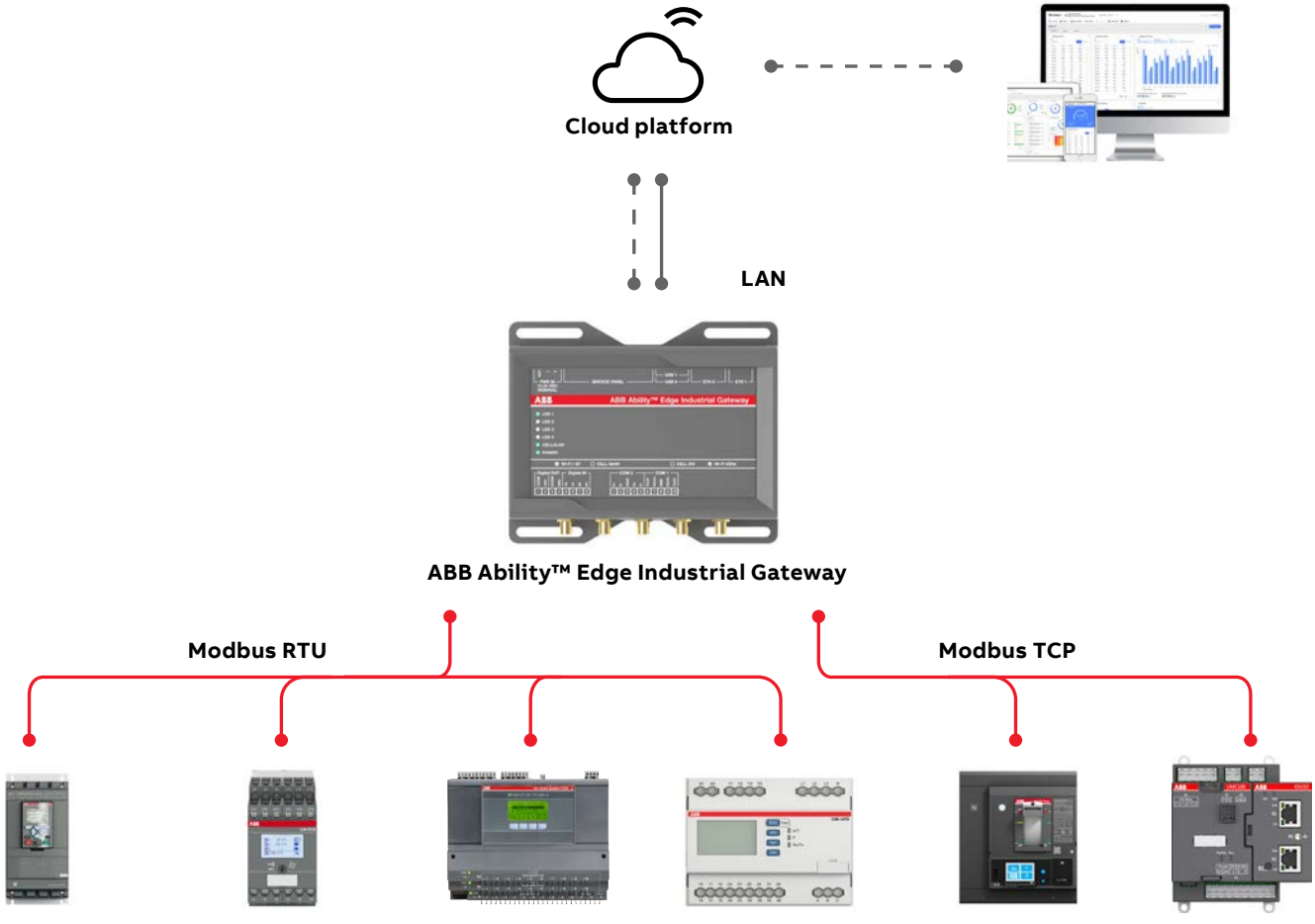
The smart relay can share the data with the platform using two options:
- Option A: Emax 2, Ekip Up, Tmax XT and TruONE equipped with the Ekip Com Hub
- Option B: External solution with ABB Ability™ Edge Industrial Gateway

ABB Ability™ Energy Manager

Example communication architecture
CM-TCN.012 ABB Ability™ Energy Manager enabled relay

ABB Ability™ Energy Manager is a state-of-the-art cloud solution that integrates energy and asset management in a single intuitive dashboard.

Option B: Architecture with ABB Ability™ Edge Industrial Gateway



Softstarter
PSTX

Smart temperature monitoring relay
CM-TCN.012

Arc Flash active protection
TVOC-2

Grid feeding monitoring relay
CM-UFD

Molded case circuit breaker
Tmax XT

Universal motor controller
UMC100.3

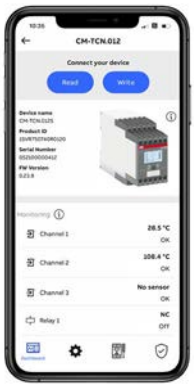
Integrate a range of devices like circuit breakers, motor controllers and the new CM-TCN.012 monitoring relay into the ABB Ability™ Energy Manager. It is a state-of-the-art cloud solution that integrates energy and asset management in a single intuitive dashboard. Providing full remote visibility of asset and electrical-system behavior, ABB Ability™ Energy Manager provides insights that help you minimize cost and risk and maximize performance and safety across your operations.

Applications

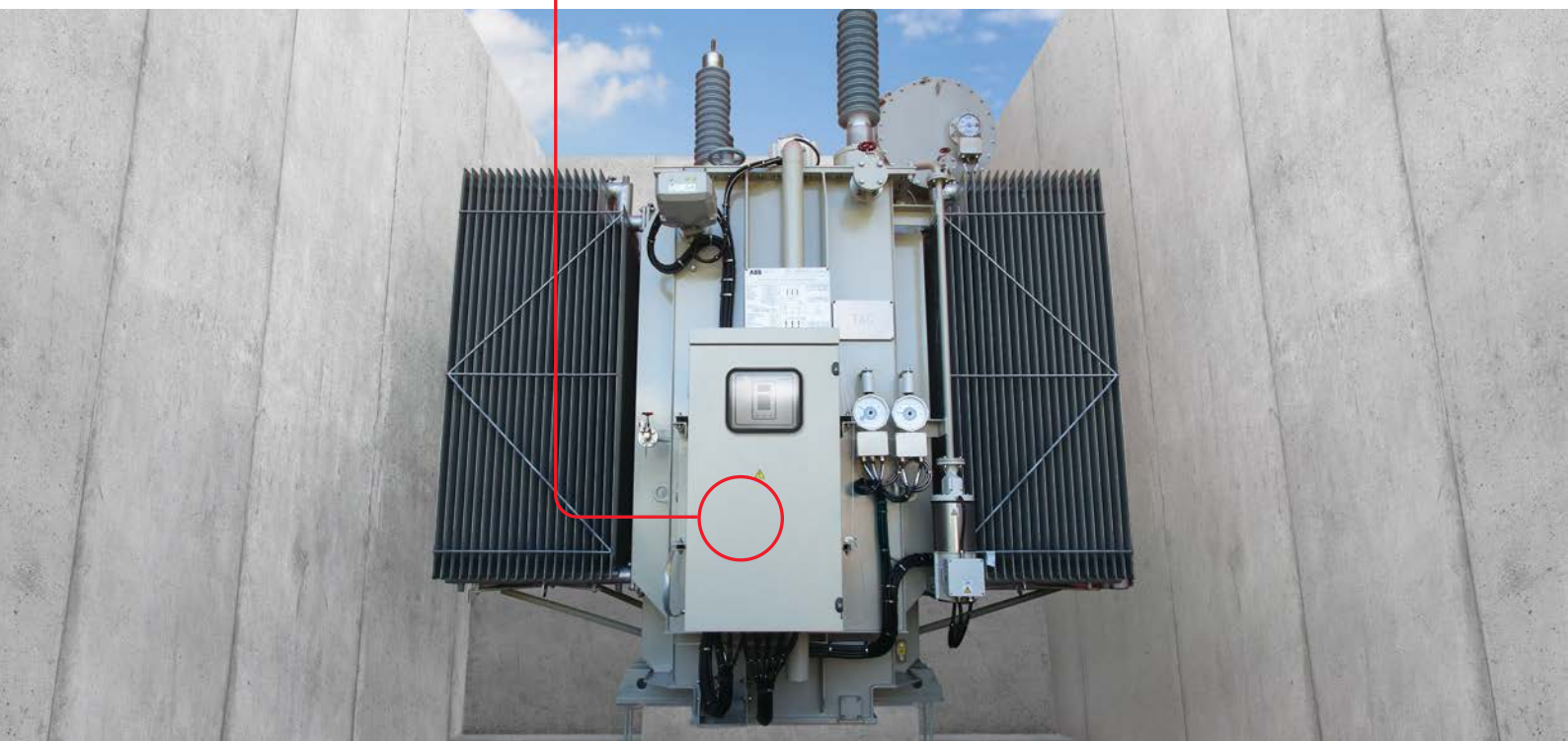
Temperature monitoring relays are used in a wide array of applications. In conjunction with temperature sensors, such as PT100 or PTC sensors, they monitor motor temperature, control cabinet temperature and protect transformers from overheating.

—
Temperature sensor, e.g. PT100

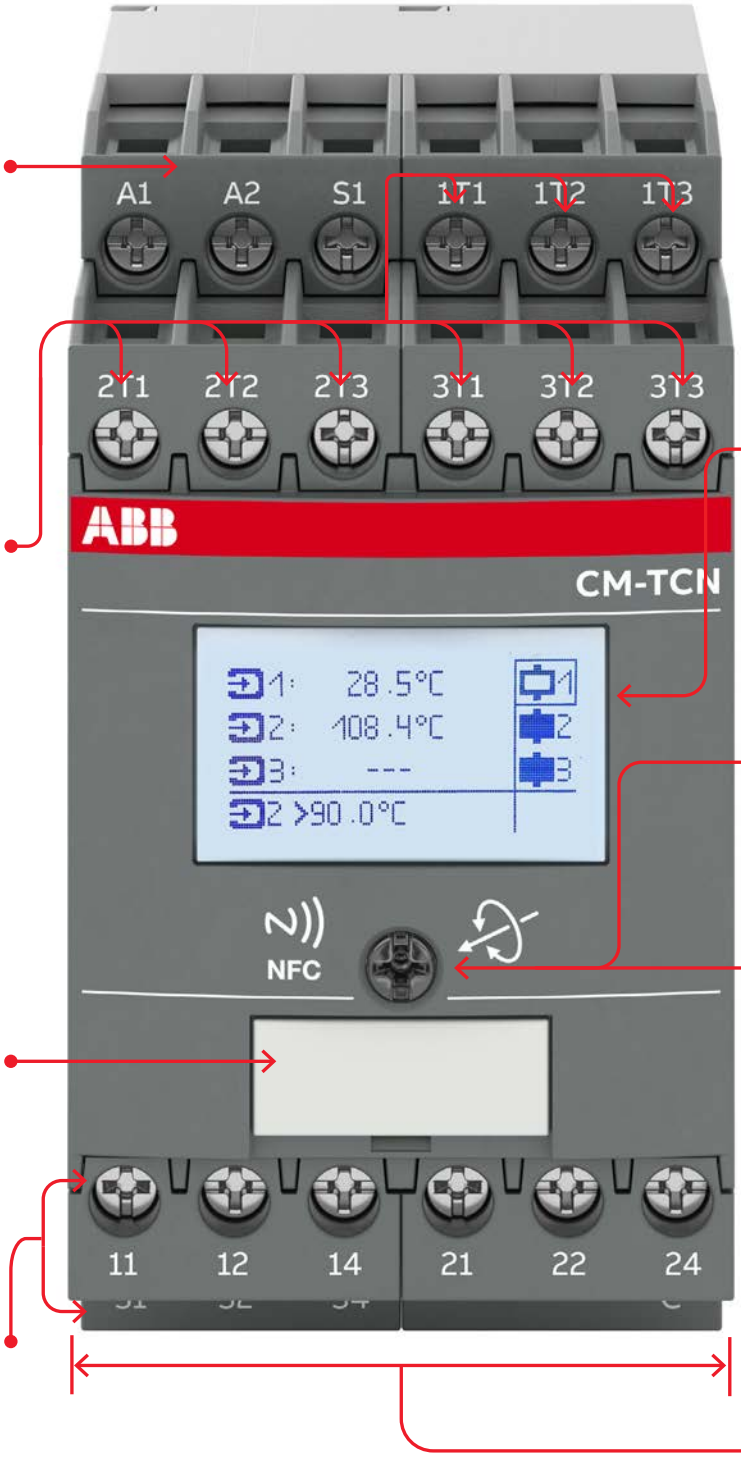
—
Smart temperature monitoring relay



—
ABB EPiC smart-phone app



Operating controls CM-TCN



Push-in and screw terminals

3 measuring inputs
PT100, PT1000, PTC, NTC, bi-metal switch

Marker label

Connection terminals
Wide terminal spacing allows connection of wires: 2 x 1.5 mm² (2 x 16 AWG) with wire end ferrules or 2 x 2.5 mm² (2 x 14 AWG) without ferrules.

Back-lit LCD
Symbol-based menu structure

Push-rotate button
Intuitive operation with just one button

LED status indication

Output circuits
3 c/o (SPDT) contacts configurable

Width 45 mm

Smart monitoring relays
Selection table

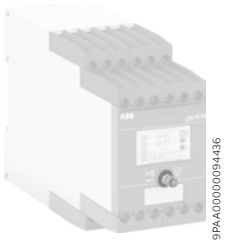
	Order number	1SVR730740R0110	1SVR740740R0110	1SVR750740R0110	1SVR760740R0110	1SVR750740R0120	1SVR760740R0120
	Type	CM-TCS.011S	CM-TCS.011P	CM-TCN.011S	CM-TCN.011P	CM-TCN.012S	CM-TCN.012P
Rated control supply voltage U_s							
24-240 V AC/DC		■	■	■	■	■	■
Sensor circuits (2 or 3 wire)							
Number of temperature sensors		1	1	3	3	3	3
Number of thresholds		6	6	9	9	9	9
Sensor types							
PT100		■	■	■	■	■	■
PT1000		■	■	■	■	■	■
NTC (type: B57227K)		■	■	■	■	■	■
PTC		■	■	■	■	■	■
Bi-metal switch		■	■	■	■	■	■
Measuring temperature range							
-200...+850 °C		■	■	■	■	■	■
Interface							
Display		■	■	■	■	■	■
NFC		■	■	■	■	■	■
Modbus RTU						■	■
Monitoring function							
Overtemperature		■	■	■	■	■	■
Undertemperature		■	■	■	■	■	■
Window temperature		■	■	■	■	■	■
Temperature difference				■	■	■	■
Operating principle							
Open or closed-circuit principle		■	■	■	■	■	■
Output contacts							
c/o		2	2	3	3	3	3

Smart monitoring relays

Ordering details

CM-TCS

CM-TCN



OPR.01

Description

The temperature monitoring relays CM-TCS and CM-TCN are able to measure temperatures of solids, liquids and gaseous media using different types of sensors, such as PT100, PT1000, PTC, NTC or bi-metal switch. CM-TCN allows to connect up to three sensor circuits, different types of sensors, e.g. PT100 and PTC sensors, can be monitored simultaneously. CM-TCS allows to connect one sensor circuit. The temperature is obtained by the sensors 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. Depending on the parametrization, output relays signalize the changes in the measuring circuits.

Smart temperature monitoring relays

Rated control supply voltage	Terminal type	Number of measuring circuits	Modbus RTU	Temperature sensor	Width mm	Type	Order code	Weight (1 pc) kg (lb)
24-240 V AC/DC	Screw	1	no	PT100, PTC, PT1000, NTC	22.5	CM-TCS.011S	1SVR730740R0110	0.172 (0.379)
	Push-in					CM-TCS.011P	1SVR740740R0110	0.172 (0.379)
	Screw	3			45	CM-TCN.011S	1SVR750740R0110	0.293 (0.646)
	Push-in					CM-TCN.011P	1SVR760740R0110	0.293 (0.646)
	Screw		yes			CM-TCN.012S	1SVR750740R0120	0.299 (0.659)
	Push-in					CM-TCN.012P	1SVR760740R0120	0.299 (0.659)

Accessories

Description	for type	Width mm	Type	Order code	Pkg qty	Weight (1 pc) g (oz)
Operating element for push-rotate button	CM-TCS.011 CM-TCN.01x		OPR.01	1SVR730007R0100	10	15 (0.53)
Adapter for screw mounting	CM-N.S/P	45	ADP.02	1SVR440029R0100	1	36.7 (1.30)
	CM-S.S/P	22.5	ADP.01	1SVR430029R0100	1	18.4 (0.65)
Marker label	CM-S.S/P CM-N.S/P		MAR.01	1SVR366017R0100	10	0.19 (0.007)
Sealable transparent cover	CM-N.S/P	45	COV.12	1SVR750005R0100	1	7.0 (0.247)
	CM-S.S/P	22.5	COV.11	1SVR730005R0100	1	4.0 (0.129)

Smart monitoring relays
Technical data

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

Type		**CM-TCS.011**	**CM-TCN.011**	**CM-TCN.012**
Input circuit		**A1-A2**		
Rated control supply voltage U_s		24-240 V AC/DC*		
Rated control supply voltage U_s tolerance		-15 ... +10 %		
Rated frequency	AC	50 - 60 Hz		
Frequency range	AC	45 - 66 Hz		
Typical current consumption	24 V DC	typ. 25 mA / max. 36 mA	typ. 30 mA / max. 40 mA	
	115 V AC	typ. 25 mA / max. 20 mA	typ. 16 mA / max. 20 mA	
	230 V AC	typ. 25 mA / max. 15 mA	typ. 13 mA / max. 15 mA	
Power failure buffering time		min. 20 ms		
Measuring circuits		**T1, T2, T3**	**xT1, xT2, xT3**	
Number of meausiring circuits		1	3	
Sensor type		PT100, PT1000**, PTC, NTC (type: B57227K), bi-metal switch		
Connection of the sensor	2-wire	yes, jumper xT2 - xT3		
	3-wire	yes, use terminal xT1, xT2, xT3		
Interrupted wire detection		yes		
Short-circuit detection		yes		
Measuring ranges	PT100	-200 °C ... +850 °C / -328 °F ... +1562 °F		
	PT1000	-200 °C ... +850 °C / -328 °F ... +1562 °F**		
	NTC	+80 °C ... +155 °C / +176 °F ... +311 °F		
	PTC	max. total resistance of connected resistors in cold state <750 Ohm		
Monitoring functions		undertemperature, overtemperature, window monitoring		
Measuring input range		-200 ... +850 °C / -328 ... +1562 °F		
Hysteresis related to the threshold values		1 ... 99.9 °C / 1.8 ... 179.8 °F		
Measuring principle		continuous current		
Typical current in the sensor circuit	PT100	0.5 mA		
	PT1000	0.5 mA		
Maximum current in sensor circuit		0.5 mA		
Measuring accuracy		± 0.5 K (-50 ... +200 °C / -58 ... +392 °F) ± 1 K (< -50 °C / -58 °F and > 200 °C / 392 °F)		
Accuracy within the rated control supply voltage tolerance		< 0.05 % full scale/1 V		
Accuracy within the temperature range		< 0.05 % full scale/1 K		
Repeat accuracy (constant parameters)		± 0.07 % full scale		
Maximum measuring cycle		< 2 s		
Maximum cable length		500 m / 1 mm^2 (shielded cable)		
Control circuits				
Type of triggering		-	volt-free triggering	
Control function	S1	-	remote reset	
Maximum input current		-	< 1.5 mA	
Maximum no-load voltage at the control inputs		-	< 15 V	
Minimum control pulse length		-	150 ms	
Maximum cable length at the control inputs		-	100 m - 100 pF/m	

* CM-TCN.011: supply voltage 24-240 V AC/DC for revision G or later and supply voltage 24 V AC/DC for revision F or earlier.
** When CM-TCN is used with PT1000 sensors, a bridge must be installed between terminals xT2 and xT3 of unused measuring circuits. The bridge must also be installed between open terminals xT2 and xT3 when CM-TCN is used with one or two PT1000 in combination with PTC or NTC or bimetal switch.

Smart monitoring relays
Technical data

Type		CM-TCS.011	CM-TCN.011	CM-TCN.012
Timing functions				
Power-on delay		2-999.9 s		
ON-delay*		0-6553.5 s		
OFF-delay*		0-6553.5 s		
Cyclic switching function	On time	1 min - 1 day		
	cycle time	10 min - 1 year		
Indication of operational states				
Control supply voltage applied		LED green		
Cyclic switching function running		LED orange		
Internal fault		LED red on		
Short circuit		LED red: ⎍⎍⎍		
Wire break		LED red: ⎍⎍⎍		
Overtemperature / Measurement value exceeds high limit		LED red: ⎍⎍		
Undertemperature / Measurement value exceeds low limit		LED red: ⎍⎍⎍		
Parameter error		Orange and red LEDs alternate		
NFC pairing		LED orange: ⎍⎍		
For details see the message on the display				
Display				
Technology		LCD		
Backlight	on	press button		
	off	switch-off delay adjustable, 10 s -1 h (default 10 s)		
Resolution		64 x 48 pixel	128 x 64 pixel	
Display size		12.14 x 12.78 mm	25.58 x 12.78 mm	
Operating controls				
Push-rotate button		Operable with screw driver: PZ1 DIN ISO 8764-1		
Near field communication (NFC)				
Standards		ISO/IEC 14443 Part 2+3 NFC Forum Type 2 tag compliant		
Communication interface				
Communication protocol		-		Modbus RTU
Physical interface		-		two-wire RS-485
Integrated termination resistors		-		no
Possible bus addresses		-		1 ... 247
Baud rates		-		1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 B/s
Typical response time		-		< 30 ms
Bus master supervision time / Timeout		-		adjustable 1 ... 255 s in steps of 1 s
Frame		-		8 data, Even, 1 stop 8 data, Odd, 1 stop 8 data, None, 2 stop 8 data, None, 1 stop

* If the selected ON-delay or OFF-delay is less than 2 s, the maximum measuring cycle should be taken into account.

Smart monitoring relays

Technical data

Type			**CM-TCS.011**	**CM-TCN.011**	**CM-TCN.012**
Output circuits					
Kind of outputs		11-12/14	relay R1, c/o (SPDT) contact		
		21-22/24	relay R2, c/o (SPDT) contact		
		31-32/34	-	relay R3, c/o (SPDT) contact	
Operating principle		open- or closed circuit principle*	configurable		
Contact material			AgNi alloy, Cd-free		
Maximum switching voltage / maximum switching current			see "Load limit curves"		
Rated operational voltage U_e and rated operational current I_e		AC-12 (resistive) at 230 V	4 A		
		AC-15 (inductive) at 230 V	3 A		
		DC-12 (resistive) at 24 V	4 A		
		DC-13 (inductive) at 24 V	2 A		
Mechanical lifetime			30 x 10^6 switching cycles		
Electrical lifetime		at AC-12, 230 V AC, 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}			4 A		
General data					
MTBF			on request		
Duty cycle			100 %		
Dimensions			see "Dimensional drawing"		
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		horizontal	not necessary		
Material of housing			UL 94 V-0		
Degree of protection		terminals	IP20		
Electrical connection			**CM-TCS.011S, CM-TCN.011S, CM-TCN.012S**		**CM-TCS.011P, CM-TCN.011P, CM-TCN.012P**
Connecting capacity	fine-strand with/ without wire end ferrule	A1, A2, R1, R2, R3, S1, C	1x 0.5-2.5 mm² (1x18-14 AWG) 2 x 0.5-1.5 mm² (2x18-16 AWG)		2x0.5-1.5 mm² (2x18-16 AWG)
		xT1, xT2, xT3, A, B, C	1x 0.2-2.5 mm² (1x24-14 AWG) 2 x 0.2-1.5 mm² (2x24-16 AWG)		2x0.2-1.5 mm² (2x24-16 AWG)
	rigid	A1, A2, R1, R2, R3, S1, C	1x 0.5-4 mm² (1x20-12 AWG) 2 x 0.5-2.5 mm² (2x20-14 AWG)		2x0.5-1.5 mm² (2x20-16 AWG)
		xT1, xT2, xT3, A, B, C	1x 0.2-4 mm² (1x24-12 AWG) 2 x 0.2-2.5 mm² (2x24-14 AWG)		2x0.2-1.5 mm² (2x24-16 AWG)
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 (7.08 lb.in)		-

* Closed-circuit principle: Output relay de-energizes if a fault is occurring
Open-circuit principle: Output relay energizes if a fault is occurring

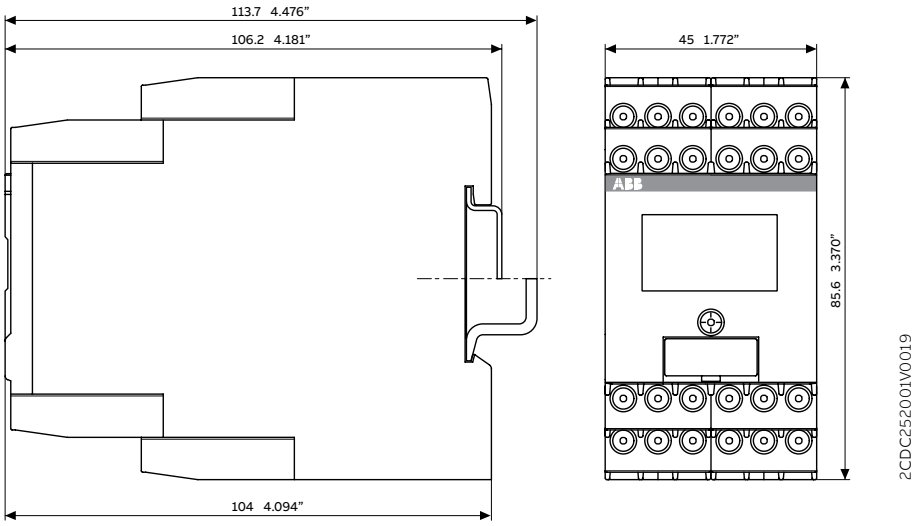
Smart monitoring relays

Technical data

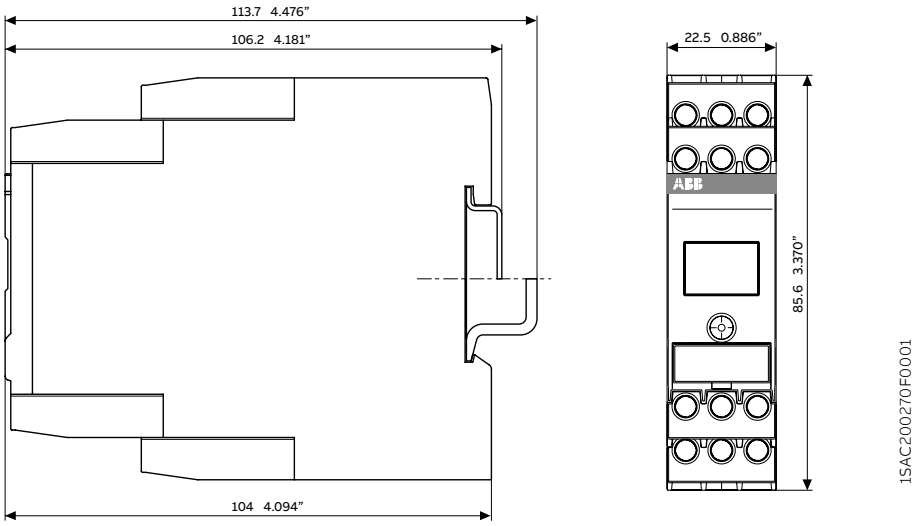
Type		CM-TCS.011	CM-TCN.011	CM-TCN.012
Environmental data				
Ambient temperature ranges	operation	-25 °C...+60 °C (-13...+140 °F)		
	storage	-40 °C...+85 °C (-40...+185 °F)		
Damp heat, cyclic	IEC/EN 60068-2-30	6 x 24 h cycle, 55 °C, 95 % RH		
Climatic class	IEC/EN 60721-3-3	3K5 (no condensation, no ice formation)		
Vibration, sinusoidal		class 1		
Shock		class 1		
Isolation data				
Rated impulse withstand voltage (U_{imp}) EN/IEC60664-1	supply circuit / measuring circuit and modbus / output circuits (relay)	6 kV		
	output circuit 1 / output circuit 2 / output circuit 3	4 kV		
Rated insulation voltage U_i Basic insulation	supply circuit / measuring circuit and modbus / output circuits (relay)	600 V		
	output circuit 1 / output circuit 2 / output circuit 3	300 V		
Protective separation IEC/EN 61140	supply circuit / measuring circuit and modbus / output circuits (relay)	300 V		
	output circuit 1 / output circuit 2 / output circuit 3	150 V		
Pollution degree		3		
Overvoltage category		III		
Standards/Directives				
Standards		IEC/EN 60947-5-1		
Low Voltage Directive		2014/35/EU		
EMC Directive		2014/30/EU		
RoHS Directive		2011/65/EU incl. 2015/863/EU		
WEEE Directive		2012/19/EU		
RED Directive		2014/53/EU		
Electromagnetic compatibility				
Interference immunity to		IEC/EN 60947-5-1		
electrostatic discharge	IEC/EN 61000-4-2	level 2, 4 kV contact discharge, 8 kV air discharge		
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	supply circuit: level 3; L-L 1 kV, L-PE 2 kV relay circuit: level 3; L-PE 2 kV measuring circuit, remote S1: level 2; L-PE 1 kV		
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		
Interference emission		IEC/EN 60947-5-1		
high-frequency radiated		fulfilled (environment A and B)		
high-frequency conducted		fulfilled (environment A and B)		

Smart monitoring relays
Technical diagrams

Dimensional drawings
in **mm** and inches



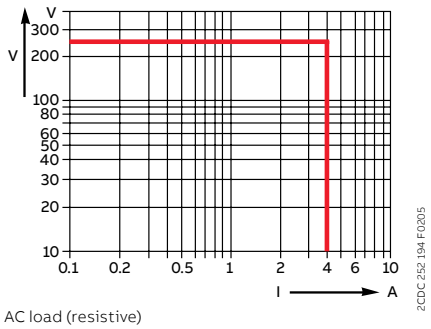
CM-TCN.011 and CM-TCN.0 12



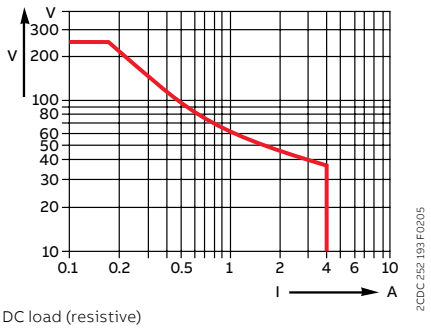
CM-TCS.011

Smart monitoring relays
Technical diagrams

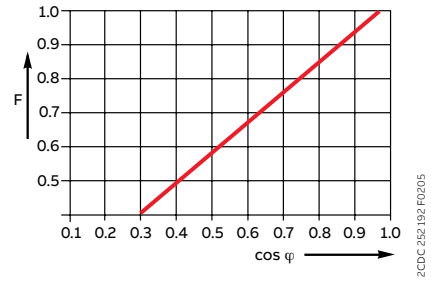
Load limit curves



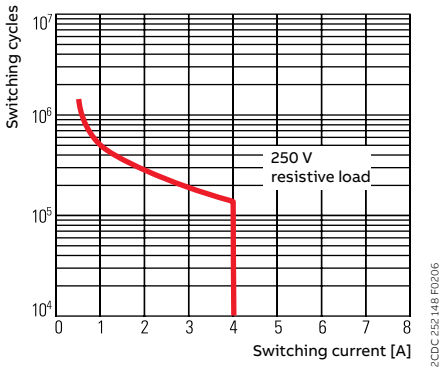
AC load (resistive)



DC load (resistive)



Derating factor F for inductive AC load



Contact lifetime


A1
11
15
C
MAX
MIN
ABB
CM-ENS
Time
Function
Sens. range Ω
Sens. Ω
U/T
R
MIN/MAX
24 28
21 25
22 26
Sens. kΩ
U
14

Liquid level monitoring relays
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187 **Technical diagrams**

Liquid level monitoring relays
Benefits and advantages

ABB's liquid level monitoring relays are the ideal solution to regulate and control liquid levels and ratios of mixtures of conductive fluids. The assortment includes single- or multifunctional devices which can be used for overflow protection, dry-running protection of pumps, filling and draining applications as well as max. and min. level alarming.

Global availability

The liquid level monitoring relays are designed to provide a wide supply voltage range, making global differences irrelevant. Additionally, the CM-ENS range meets a broad range of standards and requirements. Together with ABB's global support and sales network, using CM-ENS gives customers the confidence of worldwide sourcing – no matter where they build, install or operate their equipment.

Reliable in harsh conditions

High immunity against electromagnetic disturbances is ensured due to advanced measuring technology. Additionally, the housing fulfills the UL 94 V-0 flammability standard requirements. Together with the vibration resistant push-in terminals, the relay is not only reliable no matter the environment temperature but is also durable to shock and vibration. Save time as re-tightening is no longer needed and enhance the reliability and safety not only for the equipment.

Improve installation efficiency

Like all devices from the measuring and monitoring portfolio, the CM-ENS relays are easily configurable via front facing potentiometers. Easy threshold configuration without calculation is accomplished by direct reading scales. The device can be set up before installation in the application and easy adjustments during the process are possible.

Liquid level monitoring relays
Benefits and advantages

Operating principle

Liquid level control relays CM-ENS are designed to monitor levels of conductive liquids and media and is used, for example, for liquid level control in pump systems. The measuring principle is based on the resistance change sensed by single-pole electrodes. To avoid electrolytic phenomena, an AC current runs across the probes.
A selector switch on the front panel allows selection of the required function and the sensitivity range.

Suitability

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

Characteristics

CM-ENS.1x
- Control of one or two liquid levels (min/max)
- Fill or drain function
- Adjustable response sensitivity 5-100 kΩ

CM-ENS.2x
- Control of one or two liquid levels (min/max)
- Fill (UP) or Drain (DOWN), adjustable via front-face potentiometer
- Adjustable response sensitivity 0.1-1000 kΩ

CM-ENS.31
- Control of one or two liquid levels (min/max)
- Fill (UP) or Drain (DOWN), adjustable via front-face potentiometer
- Adjustable response sensitivity 0.1-1000 kΩ
- Selectable ON- or OFF-delay
- 2 c/o (SPDT) contacts

All CM-ENS devices
- Devices with wide rated control supply voltage 24-240 V AC/DC
- Cascadable
- High EMC immunity
- 3 LEDs for the indication of operational states
- Screw connection technology or Easy Connect Technology
- Housing material for highest fire protection classification UL 94 V-0
- Tool-free mounting and demounting on DIN rail
- 22.5 mm (0.89 in) width

Liquid level monitoring relays
Applications

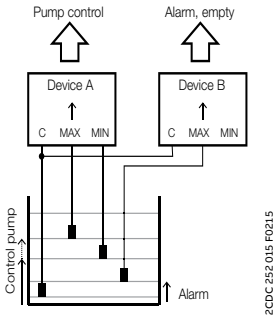
Liquid level monitoring relays work in conjunction with, for example, suspension electrodes, and can be used either for direct liquid level control or also for cascading devices, as well as operation modes with several electrodes, or control of two liquid levels are possible.

Suspension electrode

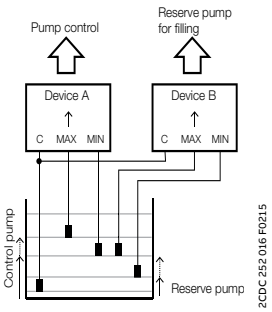
Liquid level monitoring relays
Applications

Cascading of several devices

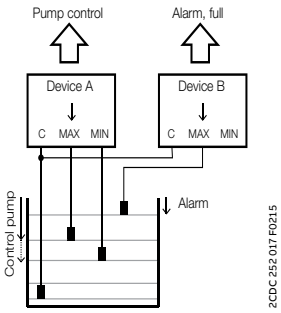
With the CM-ENS it is possible to use two devices in one tank. This enables the possibility to realize a pre-warning with additional electrodes. In this way, two additional alarm outputs for exceeding or dropping below the normal level can be implemented in addition to the filling levels MAX and MIN. In addition, a reserve pump can be connected to the additional device.



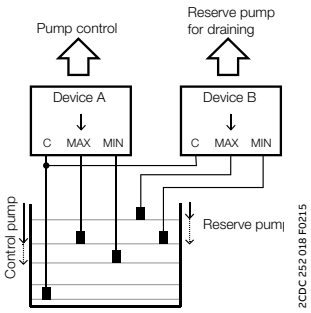
Filling with alarm empty



Filling with reserve pump



Draining with alarm full



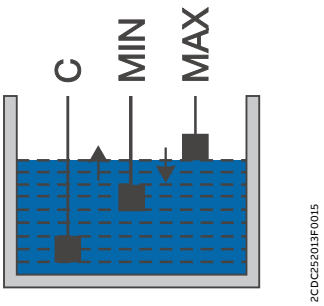
Draining with reserve pump

Operating mode with three electrodes

The CM-ENS measures the electrical resistance of the liquid between two immersion electrodes and a reference electrode.

For CM-ENS.1x only: If the relay is connected to the rated control supply voltage, the output relay changes its switching state as soon as the liquid level reaches the MAX-electrode, while the minimum sensor is submerged. The relay returns to the original state as soon as the minimum sensor is no longer in contact with the monitored medium.

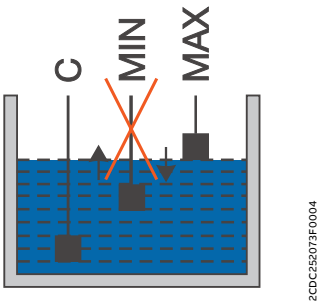
For CM-ENS.2x and CM-ENS.31 only: The function fill (^) or drain (v) can be selected via a front-face potentiometer. If the fill function is selected, the output relay is energized until the MAX-electrode becomes wet. Then it is de-energized and not re-energized until the MIN-electrode becomes dry. If the drain function is selected, the output relay energizes as soon as the MAX-electrode becomes wet. It remains energized until the liquid level has dropped below the MIN-electrode.



Operation mode with three electrodes

Operation mode with two electrodes

If only one level should be controlled, only the MAX-electrode shall be connected at the CM-ENS.

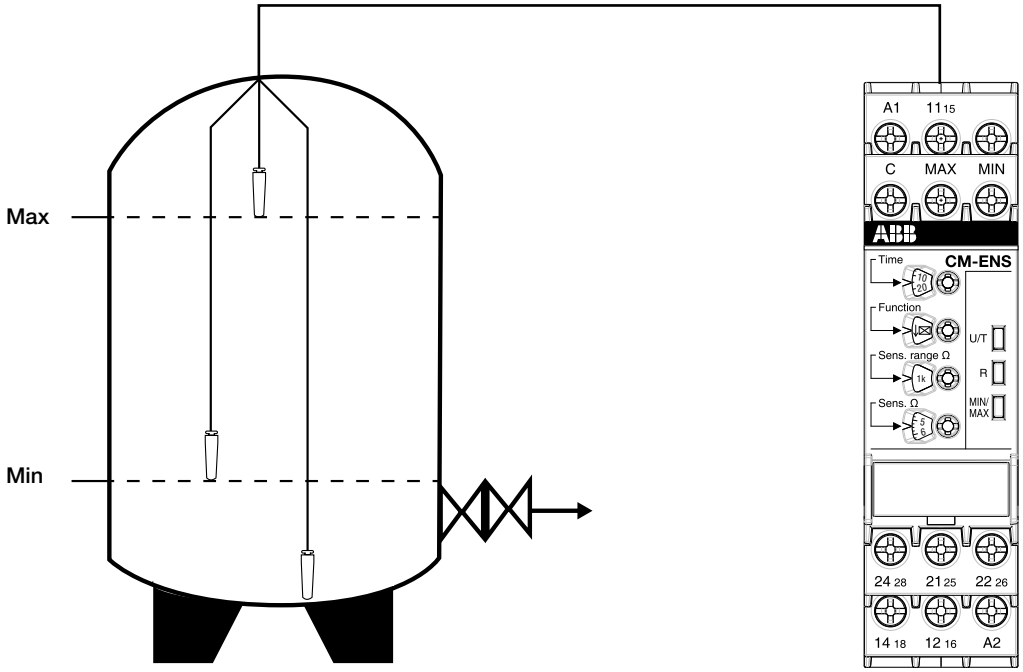


Operation mode with two electrodes

Liquid level monitoring relays
Applications

Control of two liquid levels via liquid level monitoring relay CM-ENS

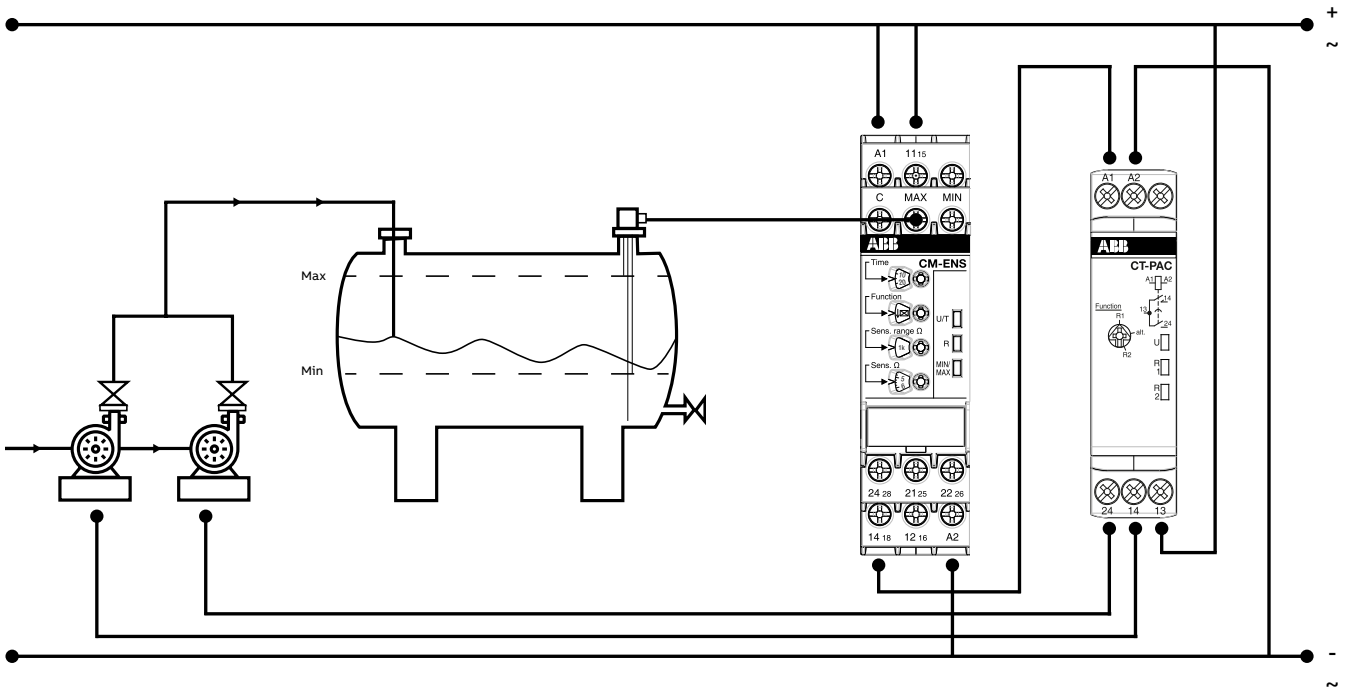
In combination with suspension electrodes CM-HC or CM-HCT (suitable for drinking water).

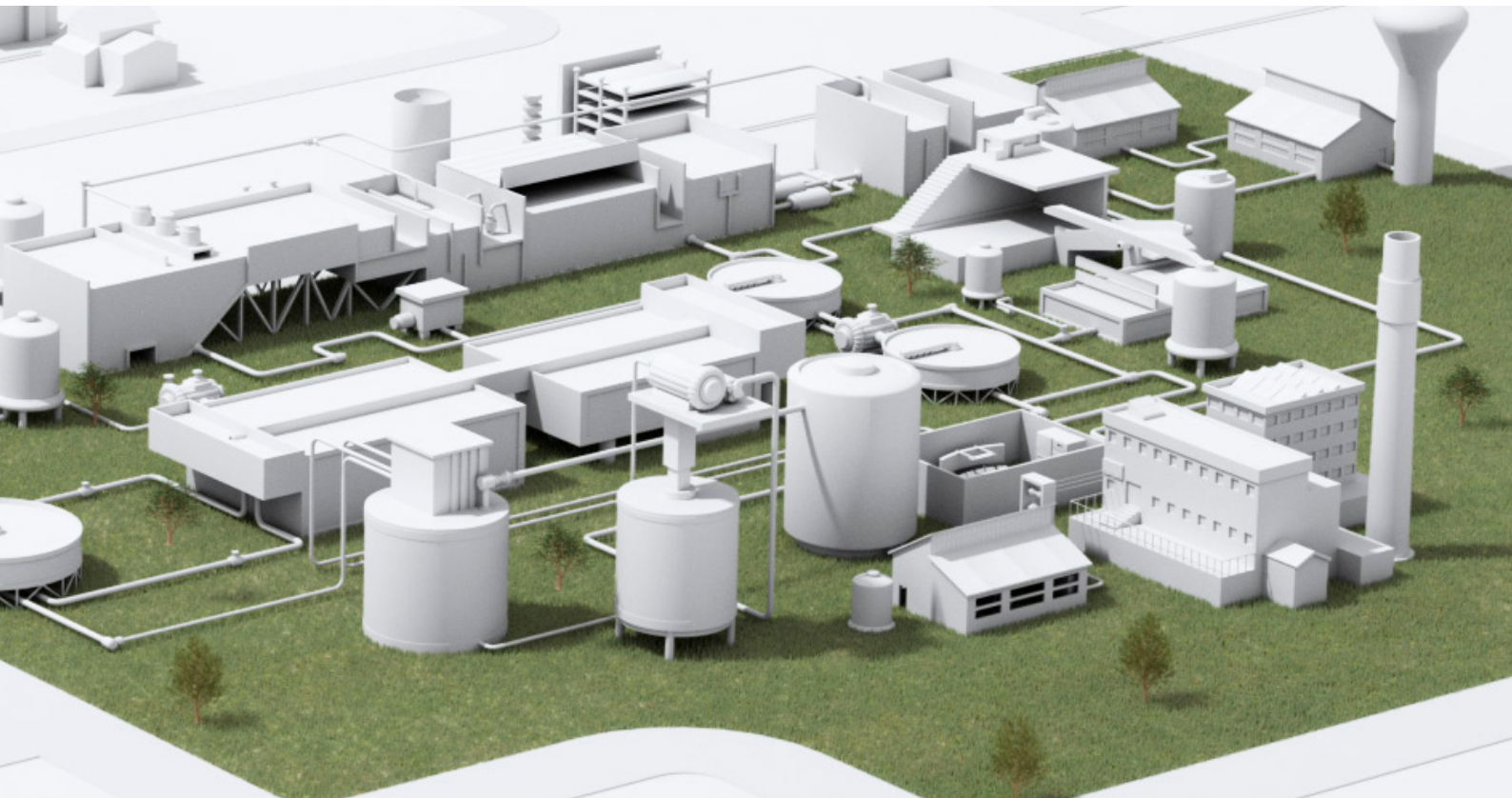


Liquid level monitoring relays
Applications

Liquid overflow monitoring in the twin pump system using liquid level monitoring relay CM-ENS and alternating time relay CT-PAC.22.

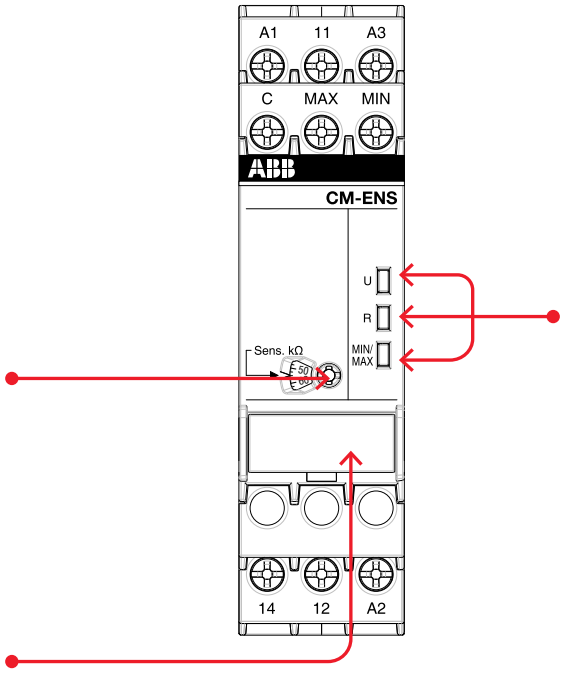
In combination with the compact support CM-KH-3 and 3 bar electrodes CM-SE.





Liquid level monitoring relays
Operating controls

CM-ENS.1x

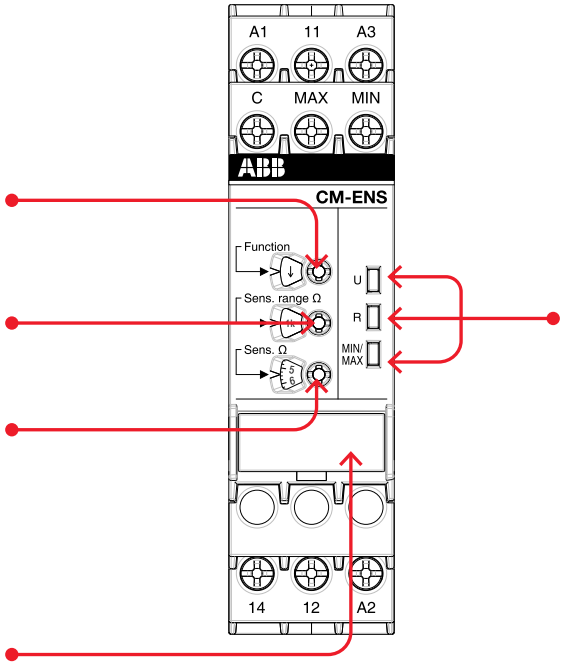


Adjustment of the response sensitivity

Marker label

Indication of operational states with LEDs
U: green LED - Status indication of control supply voltage
⎍⎺⎺⎺⎺⎺⎍ control supply voltage applied
R: yellow LED - Status indication of the output relays
⎍⎺⎺⎺⎺⎺⎍ energized
MIN/MAX: yellow LED - Status indication of the electrodes
⎍⎺⎺⎺⎺⎺⎍ MIN and MAX wet
⎍⎺⎍⎺⎍⎺⎺⎺⎍ MIN wet

CM-ENS.2x



Adjustment of the function
↑ Fill
↓ Drain

Adjustment of the response sensitivity range

Adjustment of the response sensitivity

Marker label

Indication of operational states with LEDs
U: green LED - Status indication of control supply voltage
⎍⎺⎺⎺⎺⎺⎍ control supply voltage applied
R: yellow LED - Status indication of the output relays
⎍⎺⎺⎺⎺⎺⎍ energized
MIN/MAX: yellow LED - Status indication of the electrodes
⎍⎺⎺⎺⎺⎺⎍ MIN and MAX wet
⎍⎺⎍⎺⎍⎺⎺⎺⎍ MIN wet

Liquid level monitoring relays
Operating controls

CM-ENS.31

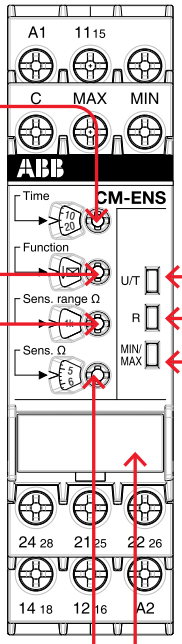
Adjustment of the time delay

Adjustment of the function
- ON-delayed Fill
- ON-delayed Drain
- OFF-delayed Fill
- OFF-delayed Drain

Adjustment of the response sensitivity range

Adjustment of the response sensitivity

Marker label



Indication of operational states with LEDS

U: green LED - Status indication of control supply voltage
- control supply voltage applied
- time delay is running

R: yellow LED - Status indication of the output relays
- energized

MIN/MAX: yellow LED - Status indication of the electrodes
- MIN and MAX wet
- MIN wet

Liquid level monitoring relays
Selection table

	Order code	1SVR 550 855 R9500	1SVR 550 850 R9500	1SVR 550 851 R9500	1SVR 550 855 R9400	1SVR 550 850 R9400	1SVR 550 851 R9400	1SVR 730 850 R0100	1SVR 740 850 R0100	1SVR 730 850 R2100	1SVR 740 850 R2100	1SVR 730 850 R0200	1SVR 740 850 R0200	1SVR 730 850 R2200	1SVR 740 850 R2200	1SVR 730 850 R0300	1SVR 740 850 R0300
	Type	CM-ENE MIN	CM-ENE MIN	CM-ENE MIN	CM-ENE MAX	CM-ENE MAX	CM-ENE MAX	CM-ENS.11S	CM-ENS.11P	CM-ENS.13S	CM-ENS.13P	CM-ENS.21S	CM-ENS.21P	CM-ENS.23S	CM-ENS.23P	CM-ENS.31S	CM-ENS.31P
Rated control supply voltage Us																	
24-240 V AC/DC								■	■			■	■			■	■
24 V AC		■			■												
110-130 V AC			■			■				■	■			■	■		
220-240 V AC				■			■			■	■			■	■		
Sensor circuit																	
Number of electrodes (including ground reference)		2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Response sensitivity range																	
0-100 kOhm		■	■	■	■	■	■										
5-100 kOhm								adj	adj	adj	adj						
0.1-1000 kOhm												adj	adj	adj	adj	adj	adj
Monitoring function																	
Dry running protection		■	■	■				■	■	■	■	■	■	■	■	■	■
Overflow protection					■	■	■	■	■	■	■	■	■	■	■	■	■
Liquid level control					■	■	■	■	■	■	■	■	■	■	■	■	■
Operating principle																	
Open-circuit principle		■	■	■				■	■	■	■						
Closed-circuit principle					■	■	■										
Open- or closed-circuit principle												sel	sel	sel	sel	sel	sel
Adjustable ON-/OFF-delay																	
0.1-10 s																■	■
Output contacts																	
n/o		1	1	1	1	1	1										
c/o (SPDT)								1	1	1	1	1	1	1	1	2	2
Connection type																	
Push-in terminals									■		■		■		■		■
Double-chamber cage connection terminals								■		■		■		■		■	
Screw		■	■	■	■	■	■										

adj: adjustable
sel: selectable

Liquid level monitoring relays

Ordering details

CM-ENE MIN

CM-ENS.3x

Description

The liquid level monitoring relays CM-ENS and CM-ENE monitors and controls the liquid level and ratios of mixtures of conductive fluids. It is used for filling and draining applications, to protect pumps against dry-running, to protect tanks against overflow, and for signalization of the status of the monitored liquid level.

Ordering details

Characteristics	Type	Order code	Weight (1 pc) kg (lb)
See selection table	CM-ENE MIN	1SVR550855R9500	0.15 (0.33)
		1SVR550850R9500	0.15 (0.33)
		1SVR550851R9500	0.15 (0.33)
	CM-ENE MAX	1SVR550855R9400	0.15 (0.33)
		1SVR550850R9400	0.15 (0.33)
		1SVR550851R9400	0.15 (0.33)
	CM-ENS.11S	1SVR730850R0100	0.124 (0.273)
	CM-ENS.11P	1SVR730850R2100	0.117 (0.258)
	CM-ENS.13S	1SVR740850R0100	0.153 (0.337)
	CM-ENS.13P	1SVR740850R2100	0.145 (0.320)
	CM-ENS.21S	1SVR730850R0200	0.125 (0.276)
	CM-ENS.21P	1SVR740850R0200	0.117 (0.258)
	CM-ENS.23S	1SVR730850R2200	0.154 (0.340)
	CM-ENS.23P	1SVR740850R2200	0.147 (0.324)
	CM-ENS.31S	1SVR730850R0300	0.143 (0.315)
	CM-ENS.31P	1SVR740850R0300	0.134 (0.295)

CT-PAC.22

Description

The alternating relay CT-PAC is designed to evenly use the electromechanical resources of twin pumps, compressors and generators. The alternating relay has two normally open contacts, which are closed alternately each time the control supply voltage is applied to terminals A1-A2.

A front-face rotary switch allows to select among three functions:

- R1 – each power cyclic contacts 13-14 close
- R2 – each power cycle contacts 13-24 close
- alt. – output contacts close alternately each power cycle

Ordering details

Rated control supply voltage	Type	Order code	Weight (1 pc) kg (lb)
24-240 V AC/ 24-48 V DC	CT-PAC.22	1SVR508180R0100	0.059 (0.130)

The technical data can be found in the time relay chapter.

Liquid level monitoring relays

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	
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			
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[1)]	closed-circuit principle[1)]
Rated operational voltage U_e	(IEC/EN 60947-1)	250 V	
Minimum switching voltage / minimum switching current		- / -	
Maximum switching voltage		250 V	
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) 230 V	4 A	
	AC-15 (inductive) 230 V	3 A	
	DC-12 (resistive) 24 V	4 A	
	DC-13 (inductive) 24 V	2 A	
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300	
	max. rated operational voltage	300 V AC	
	max. continuous thermal current at B 300	5 A	
	max. making/breaking apparent power at B 300	3600/360 VA	
Mechanical lifetime		30 x 10^6 switching cycles	
Electrical lifetime (AC-12, 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			
Duty cycle		100 %	
Dimensions		see dimensional drawings	
Mounting		DIN rail (IEC/EN 60715)	
Mounting position		any	
Degree of protection	enclosure / terminals	IP50 / IP20	
Ambient temperature range	operation / storage	-20...+60 °C / -40...+85 °C	
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	

Liquid level monitoring relays

Technical data

Type			CM-ENE MIN	CM-ENE MAX
Standards / Directives				
Standard			IEC/EN 60947-5-1, EN 50178	
Low Voltage Directive			2014/35/EU	
EMC Directive			2014/35/EU	
RoHS Directive			2011/65/EU	
Electromagnetic compatibility				
Interference immunity to			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)	
Interference emission				
	high-frequency radiated	IEC/CISPR 22, EN 55022	class B	
	high-frequency conducted	IEC/CISPR 22, EN 55022	class B	
Environmental data				
Ambient temperature ranges		operation/storage	-20..+60 °C / -40...+85 °C	
Damp heat		IEC/EN 60068-2-30	40 °C, 93 % RH, 4 days	
Vibration withstand		IEC/EN 60068-2-6	10-57 Hz: 0.075 mm; 57-150 Hz: 1 g	
Isolation data				
Rat. insulation volt. betw. supply, measuring & output circuit			250 V	
Rated impulse withstand voltage U_{imp} between all isolated circuits			4 kV / 1.2-50 µs	
Pollution category			3	
Overvoltage category			III	

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 monitoring relays

Technical data

Type		**CM-ENS.1x**		**CM-ENS.2x**		**CM-ENS.31**	
Supply circuit							
Rated control supply voltage U_s	CM-ENS.11, CM-ENS.21, CM-ENS.31: A1-A2	24-240 V AC/DC					
	CM-ENS.13, CM-ENS.23: A1-A2	220-240 V AC					
	CM-ENS.13, CM-ENS.23: A3-A2	110-130 V AC					
Rated control supply voltage U_s tolerance		-15...+10 %					
Rated frequency		50-60 Hz					
Frequency range		47-63 Hz					
Typical current / power consumption	24 V AC	25 mA / 0.6 W		25 mA / 0.6 W		25 mA / 0.6 W	
	110-130 V AC	20 mA / 2.6 VA		20 mA / 2.6 VA		8 mA / 1.1 VA	
	220-240 V AC	8.5 mA / 2.1 VA		8.5 mA / 2.1 VA		10 mA / 2.4 VA	
	24-240 V AC/DC	11 mA / 2.6 VA		11 mA / 2.6 VA		11 mA / 2.6 VA	
Power failure buffering time	min.	20 ms					
Start-up time t_s	Range 5-100 kΩ	max. 1.3 s		-		-	
	Range 0.1-1 kΩ	-		max. 900 ms			
	Range 1-10 kΩ	-		max. 900 ms			
	Range 10-100 kΩ	-		max. 1.3 s			
	Range 100-1000 kΩ	-		max. 6.3 s			
Measuring circuit		**MAX-MIN-C**					
Sensor type		electrode					
Monitoring function		fill or drain		fill or drain, selectable			
Measuring principle		conductivity measurement					
Number of electrodes		3					
Response sensitivity		adjustable: 5-100 kΩ		adjustable: 0.1-1000 kΩ			
Maximum electrode voltage		6 V AC					
Maximum electrode current		1 mA		2 mA			
		max cable capacity	**max cable length**	**max cable capacity**	**max cable length**	**max cable capacity**	**max cable length**
Electrode supply line	Range 5-100 kΩ	10 nF	100 m	-	-	-	-
	Range 0.1-1 kΩ	-	-	200 nF	1000 m	200 nF	1000 m
	Range 1-10 kΩ	-	-	200 nF	1000 m	200 nF	1000 m
	Range 10-100 kΩ	-	-	20 nF	100 m	20 nF	100 m
	Range 100-1000 kΩ	-	-	4 nF	20 m	4 nF	20 m
Max. measuring cycle	Range 5-100 kΩ	1000 ms		-		-	
	Range 0.1-1 kΩ	-		700 ms			
	Range 1-10 kΩ	-		700 ms			
	Range 10-100 kΩ	-		1.1 s			
	Range 100-1000 kΩ	-		5 s			
Timing circuit							
Time delay		-				0.1-30 s, adjustable, ON- or OFF-delay	
Indication of operational states							
Control supply voltage		U: green LED					
Output relay energized		R: Yellow LED					
Electrode / alarm status		MAX/MIN: Yellow LED					

Liquid level monitoring relays

Technical data

Type		**CM-ENS.1x**	**CM-ENS.2x**	**CM-ENS.31**
Output circuits				
Kind of output	11_{15}-12_{16}/14_{18}	relay, 1 c/o (SPDT) contact		relay, 1st c/o (SPDT) contact
	21_{15}-22_{16}/24_{18}	-		relay, 2nd c/o (SPDT) contact
Operational principle		open-circuit principle	open- or closed-circuit principle (selectable)	
Contact material		AgNi alloy, Cd free		
Minimum switching voltage / minimum switching current		12 V / 10 mA		
Maximum switching voltage / Maximum switching current		see data sheets		
Rated operational voltage U_e and rated operational current I_e (IEC/EN 60947-5-1)	AC-12 (resistive) 230 V	4 A		
	AC-15 (inductive) 230 V	3 A		
	DC-12 (resistive) 24 V	4 A		
	DC-13 (inductive) 24 V	2 A		
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)	B 300, pilot duty general purpose 250 V, 4 A, cos φ 0.75		
	max. rated operational voltage	300 V AC		
	max. continuous thermal current at B 300	5 A		
	max. making/breaking apparent power at B 300	3600/360 VA		
Mechanical lifetime		10 x 10^6 switching cycles		
Electrical lifetime (AC-12, 230 V, 4 A)		0.1 x 10^6 switching cycles		
Max. fuse rating to achieve short-circuit protection	n/c / n/o contact	6 A / 10 A fast-acting		10 A / 10 A fast-acting
Conventional thermal current I_{th}		4 A		

Liquid level monitoring relays

Technical data

Type		**CM-ENS.1x**	**CM-ENS.2x**	**CM-ENS.31**
General data				
MTBF		on request		
Duty cycle		100 %		
Dimensions		see dimensional drawings		
Weight		see ordering details		
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool		
Mounting position		any		
Minimum distance to other units		CM-ENS.x1: not necessary CM-ENS.x3: 10 mm if contact current > 2 A		
Degree of protection	housing / terminals	IP50 / IP20		
Material of housing		UL 94 V-0		
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 18-14 AWG) 2 x 0.5-1.5 mm² (2 x 18-16 AWG)		2 x 0.5-1.5 mm² (2 x 18-16 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 (7.08 lb.in)		-
Standards / Directives				
Standard		IEC/EN 60255-27, IEC/EN 60947-5-1		
Low Voltage Directive		2014/35/EU		
RoHS Directive		2014/30/EU		
EMC Directive		2011/65/EU		
Environmental data				
Ambient temperature ranges	operation	-25...+60 °C		
	storage	-40...+85 °C		
Damp heat, cyclic (IEC/EN 60068-2-30)		6 x 24 h cycle, 55 °C, 95 % RH		
Climatic category (IEC/EN 60721-3-3)		3K5 (no condensation, no ice formation)		
Vibration, sinusoidal (IEC/EN 60255-21-1)		class 2		
Shock (IEC/EN 60255-21-2)		class 2		
Isolation data				
Rated impulse withstand voltage U_{imp}	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	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		
Basisc insulation	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		

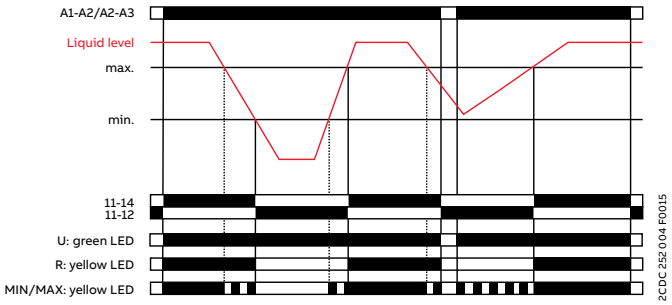
Liquid level monitoring relays

Technical data

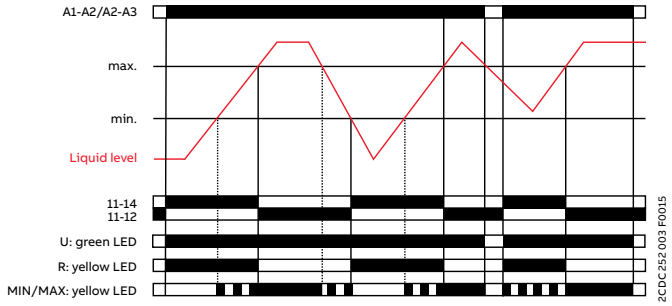
Type		**CM-ENS.1x**	**CM-ENS.2x**	**CM-ENS.31**
Protective separation (IEC/EN 61140, EN 50178)	supply circuit / measuring circuit	250 V AC / 300 V DC		
	supply circuit / output circuits	250 V AC / 300 V DC		
	measuring circuit / output circuits	250 V AC / 300 V DC		
Pollution degree		3		
Overvoltage category		III		
Electromagnetic compatibility				
Interference immunity to		EN 61000-6-1, EN60255-26		
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, 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		
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		

Liquid level monitoring relays
Function diagrams

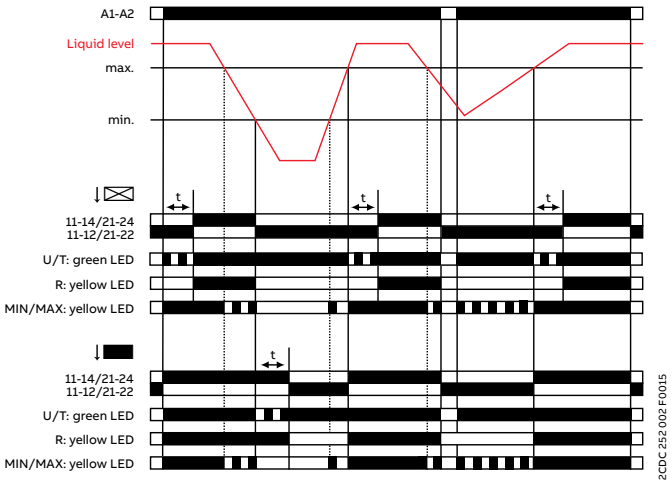
CM-ENS



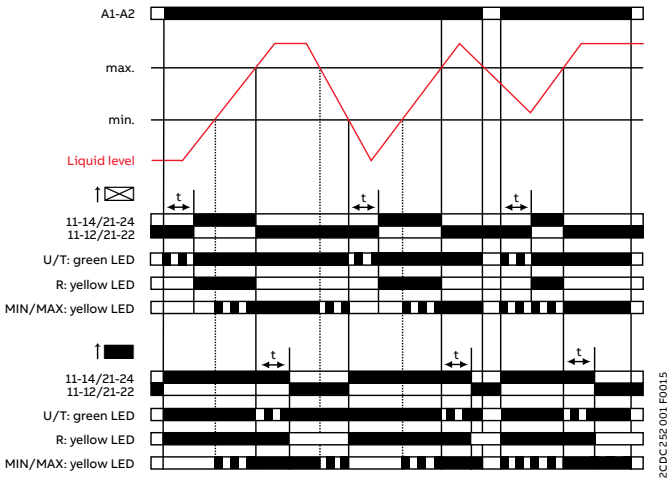
Drain: CM-ENS.1x, CM-ENS.2x



Fill: CM-ENS.2x

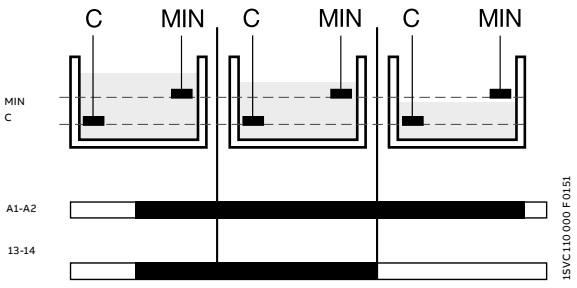


Drain: CM-ENS.31

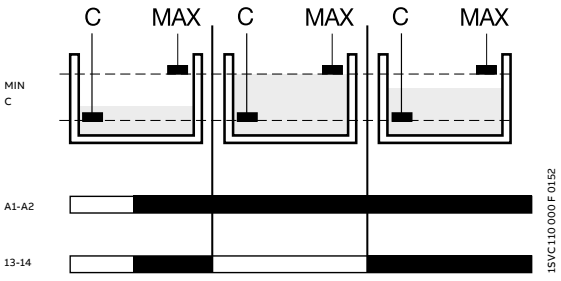


Fill: CM-ENS.31

CM-ENE MIN



CM-ENE MAX



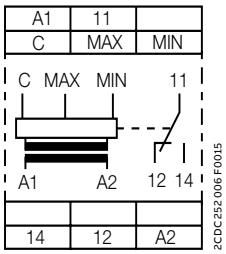
The liquid level relays CM-ENE MIN and CM-ENE MAX are used to monitor levels of conductive liquids, for example, in pump control systems for dry-running or overflow monitoring.
The measuring principle is based on the occurring resistance change when moistening single-pole electrodes. The single-pole 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.

Liquid level monitoring relays

Technical diagrams

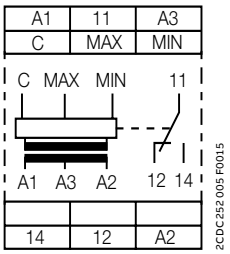
Connection diagrams

CM-ENS.11x, CM-ENS.21x



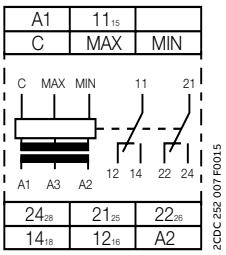
A1–A2	Control supply voltage
11–12/14	1 c/o (SPDT) contact
C	Reference electrode
MAX	Maximum level electrode
MIN	Minimum level electrode

CM-ENS.13x, CM-ENS.23x



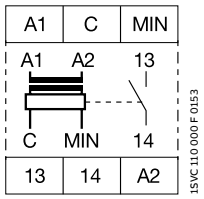
A1–A2	Control supply voltage 220-240 V AC
A3-A2	Control supply voltage 110-130 V AC
11–12/14	1 c/o (SPDT) contact
C	Reference electrode
MAX	Maximum level electrode
MIN	Minimum level electrode

CM-ENS.31x



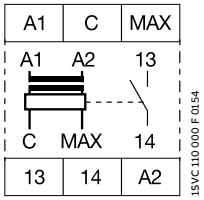
A1–A2	Control supply voltage
11_{15}–12_{16}/14_{18}	1 c/o (SPDT) contact
21_{25}-22_{26}/24_{28}	2nd c/o (SPDT) contact
C	Reference electrode
MAX	Maximum level electrode
MIN	Minimum level electrode

CM-ENE MIN



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

CM-ENE MAX



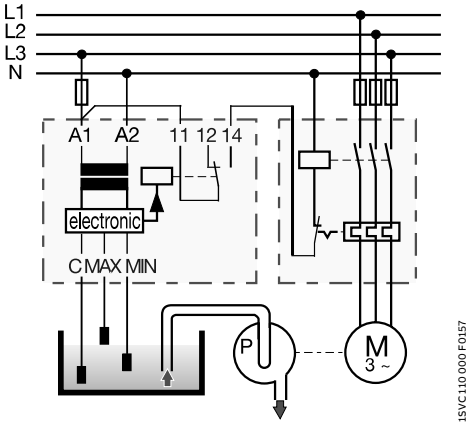
A1-A2	Rated control supply voltage
C	Reference electrode
MIN	Maximum level
13-14	Output contact -open-circuit principle

Liquid level monitoring relays

Technical diagrams

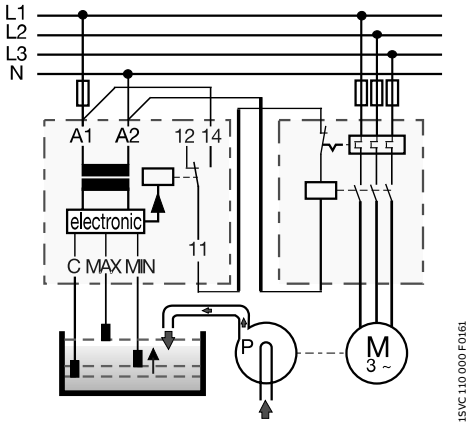
Connection diagrams

CM-ENS.1x



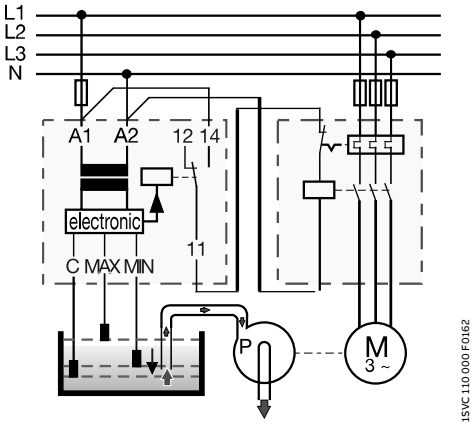
Liquid level control - drain

CM-ENS.2x, CM-ENS.31x



Liquid level control - fill - selected function "↑" (UP)

CM-ENS.2x, CM-ENS.31x



Liquid level control - drain - selected function "↓" (Down)

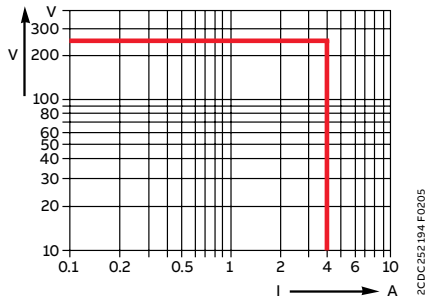
Liquid level monitoring relays

Technical diagrams

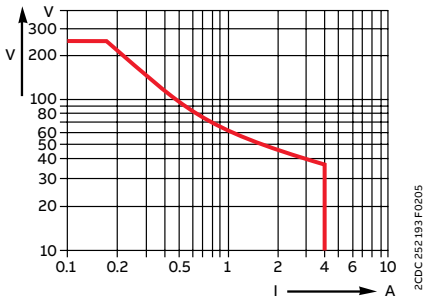
Load limit curves

CM-S (22.5 mm), CM-E (22.5 mm)

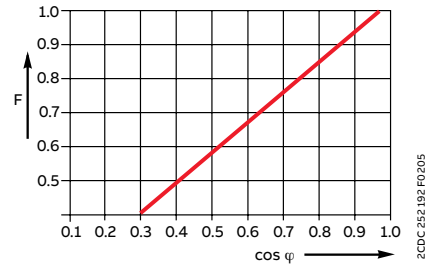
AC load (resistive)



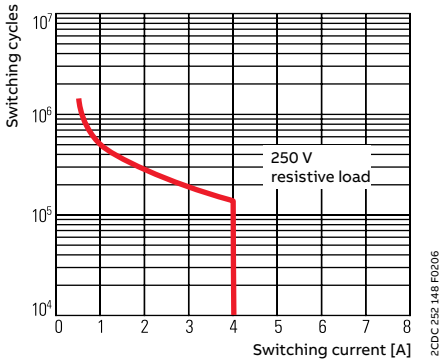
DC load (resistive)



Derating factor F for inductive AC load

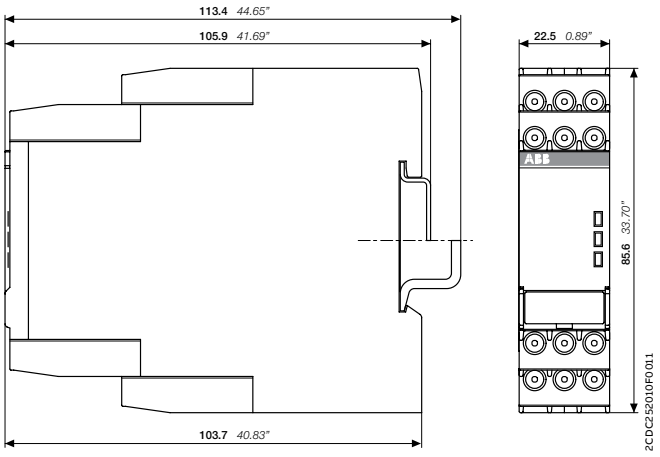


Contact lifetime



Dimensional drawing

Dimensions in mm and inches



CM-xxS
1SVR730xxxxxx, 1SVR740xxxxxx

Accessories
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Accessories
Ordering details

Bar electrode

Suspension electrode

Ordering details

Accessories

Description	For type	Width in mm	for devices	Type	Order code	Pkg qty	Weight (1 pc) g (oz)
Adapter for screw mounting	CM-S.S/P	22.5		ADP.01	1SVR430029R0100	1	18.4 (0.65)
	CM-N.S/P	45		ADP.02	1SVR440029R0100	1	36.7 (1.30)
Marker label	CM-S.S/P CM-N.S/P		without DIP switches	MAR.01	1SVR366017R0100	10	0.19 (0.007)
	CM-S.S/P CM-N.S/P		with DIP switches	MAR.12	1SVR730006R0000	10	0.152 (0.335)
Sealable transparent cover	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)

Bar electrodes

Description	Material no.	Type	Order code	Weight (1 pc) kg (lb)
Compact support for 3 bar electrodes	-	CM-KH-3	1SVR450056R6000	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)
Length: 300 mm	1.4301	CM-SE-300	1SVR450056R0000	0.08 (0.176)
Length: 600 mm	1.4301	CM-SE-600	1SVR450056R0100	0.08 (0.176)
Length: 1000 mm	1.4301	CM-SE-1000	1SVR450056R0200	0.08 (0.176)

Suspension electrodes

Description	Connec-tion	Material no.	Type	Order code	Weight (1 pc) kg (lb)
CM-HE suspension electrode high-alloy steel, material no. 1.4104 (according to EN 10088-1)	Screw	1.4104	CM-HE	1SVR402902R0000	0.074 (0.163)
CM-HC suspension electrode high-alloy steel, material no. 1.4104 (according to EN 10088-1)	Crimp	1.4104	CM-HC	1SVR402902R1000	0.09 (0.198)
CM-HCT suspension electrode suitable for drink water high-alloy steel, material no. 1.4301 (according to EN 10088-1)	Crimp	1.4301	CM-HCT	1SVR402902R2000	0.09 (0.198)

For further details, please see the instruction sheet.

Accessories

Ordering details

CM-CT

CM-CT
with mounted accessories

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	Weight (1 pc) 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)

Accessories

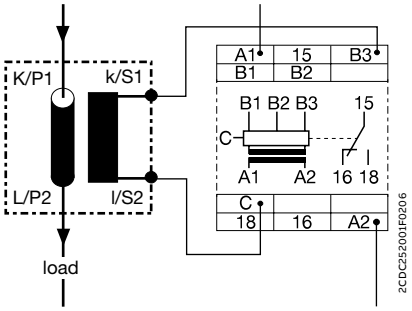
Description	Type	Order code	Weight (1 pc) g (oz)
Snap-on fastener for DIN rail mounting of CM-CT	CM-CT A	1SVR450118R1000	0.009 (0.02)

Accessories

Technical diagrams

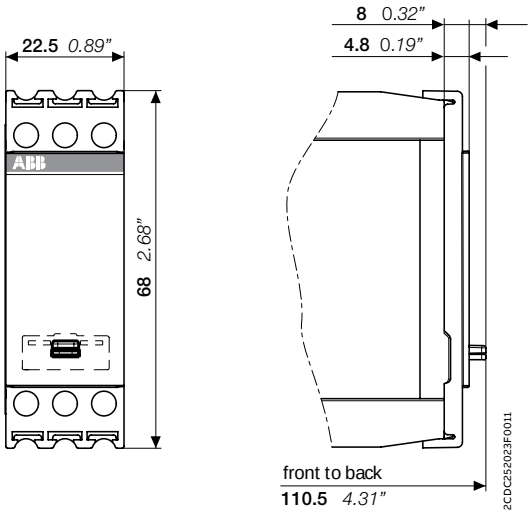
Operating principle / circuit diagram

CM-CT

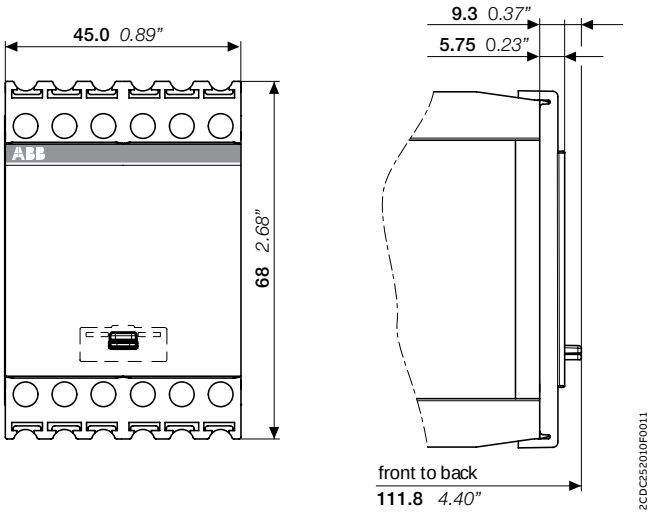


Dimensional drawings

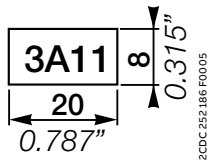
in **mm** and inches



Sealable cover
COV.11



Sealable cover
COV:12



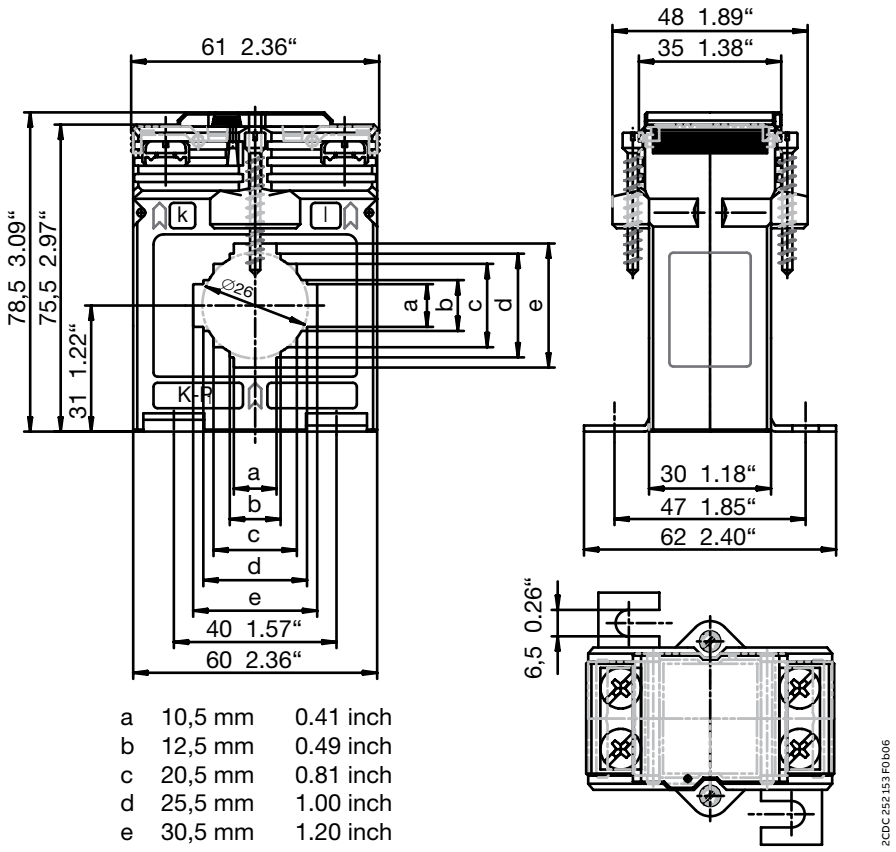
MAR.01

Accessories

Technical diagrams

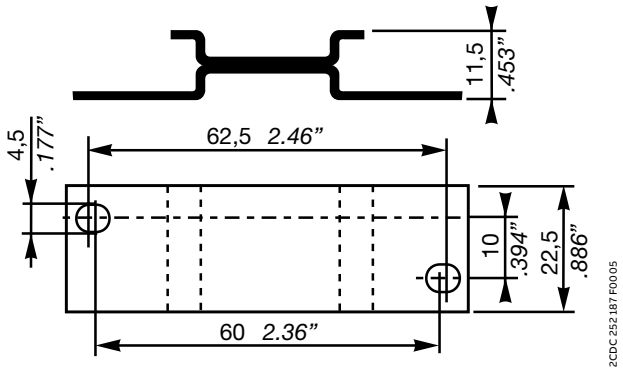
Dimensional drawings

in **mm** and inches

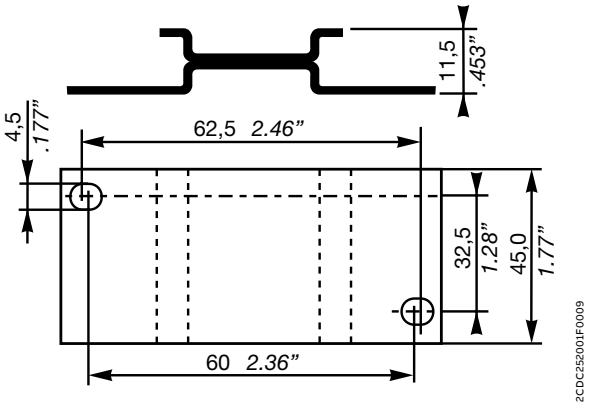


a	10,5 mm	0.41 inch
b	12,5 mm	0.49 inch
c	20,5 mm	0.81 inch
d	25,5 mm	1.00 inch
e	30,5 mm	1.20 inch

CM-CT



ADP.01



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1SVR760669R9400	CM-IVN.P	91
1SVR760740R0110	CM-TCN.011P	161
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