

# Three-phase monitoring relays CM-PVS

## CM-PVS.31 and CM-PVS.41

The three-phase monitoring relays CM-PVS.x1 monitor the phase parameters phase sequence, phase failure as well as over- and undervoltage. All devices are 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).

### Characteristics

- Monitoring of three-phase mains for phase sequence (can be switched off), phase failure, over- and undervoltage
- Suitable for railway applications
- TRMS measuring principle
- Threshold values for over- and undervoltage are adjustable as absolute values
- Tripping delay  $T_v$  can be adjusted or switched off by means of a logarithmic scale (0 s; 0.1-30 s)
- ON-delayed or OFF-delayed tripping delay selectable
- Powered by the measuring circuit
- Precise adjustment by front-face operating controls
- Screw connection technology 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
- 2 c/o (SPDT) contacts
- 22.5 mm (0.89 in) width
- 3 LEDs for the indication of operational states

### Order data

#### Three-phase monitoring relays

Type	Rated control supply voltage = measuring voltage	Connection technology	Order code
CM-PVS.31P	3 x 160-300 V AC	Push-in terminals	1SVR740794R1300
CM-PVS.31S		Screw terminals	1SVR730794R1300
CM-PVS.41P	3 x 300-500 V AC	Push-in terminals	1SVR740794R3300
CM-PVS.41S		Screw terminals	1SVR730794R3300

### Accessories

Type	Description	Order code
ADP.01	Adapter for screw mounting	1SVR430029R0100
MAR.01	Marker label for devices without DIP switches	1SVR366017R0100
COV.11	Sealable transparent cover	1SVR730005R0100

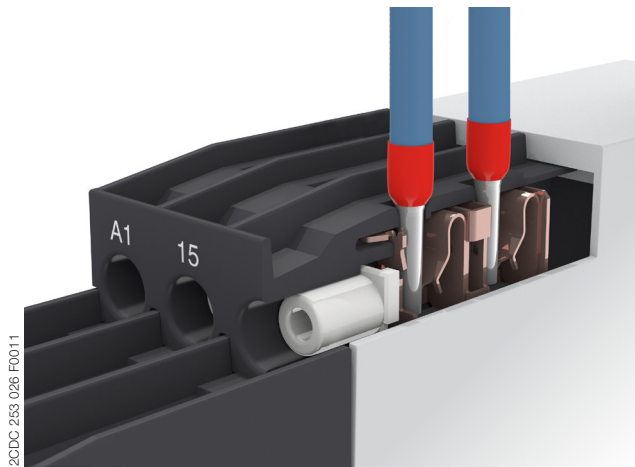


2CDC 251 001 V0012

## Connection technology

### Maintenance free Easy Connect Technology with push-in terminals

Type designation CM-xxS.yyP

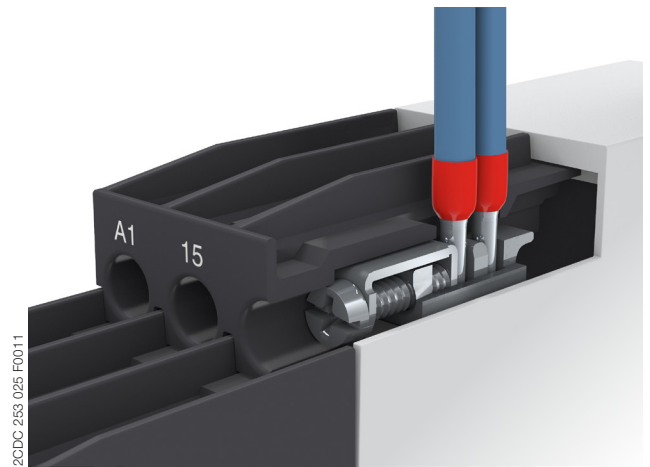


#### Push-in terminals

- Tool-free connection of rigid and flexible wires with wire end ferrule
- Easy connection of flexible wires without wire end ferrule by opening the terminals
- No retightening necessary
- One operation lever for opening both connection terminals
- For triggering the lever and disconnecting of wires you can use the same tool (Screwdriver according to DIN ISO 2380-1 Form A 0.8 x 4 mm (0.0315 x 0.157 in), DIN ISO 8764-1 PZ1 ø 4.5 mm (0.177 in))
- Constant spring force on terminal point independent of the applied wire type, wire size or ambient conditions (e. g. vibrations or temperature changes)
- Opening for testing the electrical contacting
- Gas-tight

### Approved screw connection technology with double-chamber cage connection terminals

Type designation CM-xxS.yyS

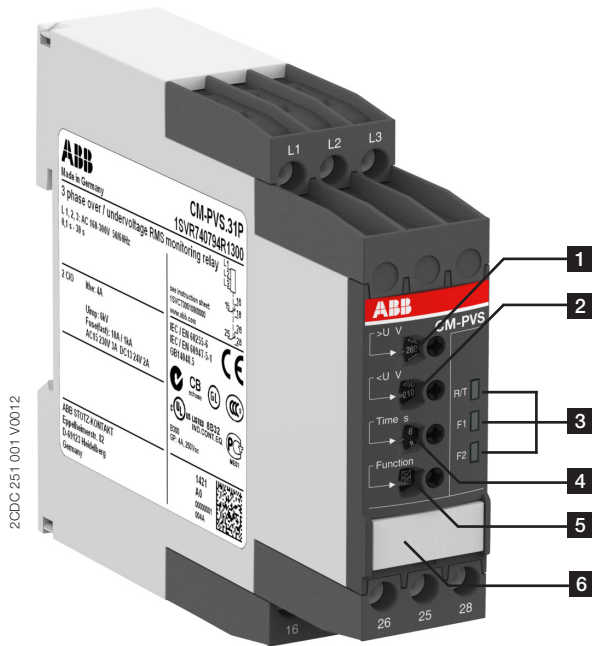


#### Double-chamber cage connection terminals

- Terminal spaces for different wire sizes
- One screw for opening and closing of both cages
- Pozidrive screws for pan- or crosshead screwdrivers according to DIN ISO 2380-1 Form A 0.8 x 4 mm (0.0315 x 0.157 in), DIN ISO 8764-1 PZ1 ø 4.5 mm (0.177 in)

Both the Easy Connect Technology with push-in terminals and screw connection technology with double-chamber cage connection terminals have the same connection geometry as well as terminal position.

## Operating controls









- 1** Adjustment of the threshold value  $>U$  for overvoltage
- 2** Adjustment of the threshold value  $<U$  for undervoltage
- 3** Indication of operational states
  - R/T: yellow LED – Relay status / timing
  - F1: red LED – Fault message
  - F2: red LED – Fault message
- 4** Adjustment of the tripping delay  $T_v$
- 5** Function selection (see rotary switch „Function“)
- 6** Marker label

## Application

The three-phase monitoring relays CM-PVS.x1 are designed for use in three-phase mains for monitoring the phase parameters phase sequence, phase failure as well as over- and undervoltage.

The CM-PVS.x1 provide an adjustable tripping delay and work according to the closed-circuit principle.

## Operating mode

The CM-PVS.x1 have 2 c/o (SPDT) contacts and are available for 3-wire AC systems. The units are adjusted with front-face operating controls. The selection of ON-delay with phase sequence monitoring , OFF-delay with phase sequence monitoring , ON-delay without phase sequence monitoring  , OFF-delay without phase sequence monitoring   is made with a rotary switch.

Potentiometers, with direct reading scale, allow the adjustment of the threshold values for overvoltage ( $>U$ ), undervoltage ( $<U$ ) and the tripping delay  $T_v$ . The tripping delay  $T_v$  is adjustable over a range of instantaneous to a 30 s delay. Timing is displayed by a flashing yellow LED labelled R/T.

### Adjustment potentiometer

## Threshold values

By means of three separate potentiometers with direct reading scales, the threshold values for over- and undervoltage as well as for phase unbalance can be adjusted within the measuring range.

	Measuring range for overvoltage	Measuring range for undervoltage
CM-PVS.31	3 x 220-300 V AC	3 x 160-230 V AC
CM-PVS.41	3 x 420-500 V AC	3 x 300-380 V AC





Tripping delay  $T_v$

The tripping delay  $T_v$  can be adjusted within a range of 0.1 to 30 s by means of a potentiometer with logarithmic scale. By turning to the left stop, the tripping delay can be switched off.

## Rotary switch











### Type of tripping delay and phase sequence monitoring

The type of tripping delay and phase sequence monitoring can be selected via the rotary switch „Function“.

	<b>ON-delay with phase sequence monitoring</b> The output relays de-energize as soon as a phase sequence error occurs. The output relays re-energize automatically as soon as the phase sequence is correct again.
	<b>OFF-delay with phase sequence monitoring</b> The output relays de-energize as soon as a phase sequence error occurs. The output relays re-energize automatically as soon as the phase sequence is correct again.
	<b>ON-delay without phase sequence monitoring</b> Phase sequence errors will not cause a tripping of the relay.
	<b>OFF-delay without phase sequence monitoring</b> Phase sequence errors will not cause a tripping of the relay.

## Indication of operational states

### LEDs, status information and fault messages

Operational state	R/T: LED yellow	F1: LED red	F2: LED red
Control supply voltage applied, output relay energized		-	-
Tripping delay $T_v$ active		-	-
Phase failure	-		
Phase sequence	-	 alternating	
Overvoltage	-		-
Undervoltage	-	-	
Adjustment error <sup>1)</sup>			

<sup>1)</sup> Overlapping of the threshold values: The threshold value for overvoltage is set to a smaller value than the threshold value for undervoltage.

Function descriptions / diagrams

Configuration of the devices is made by means of operating controls accessible on the front of the unit and signalling is made by means of front-face LEDs.

Phase sequence and phase failure monitoring

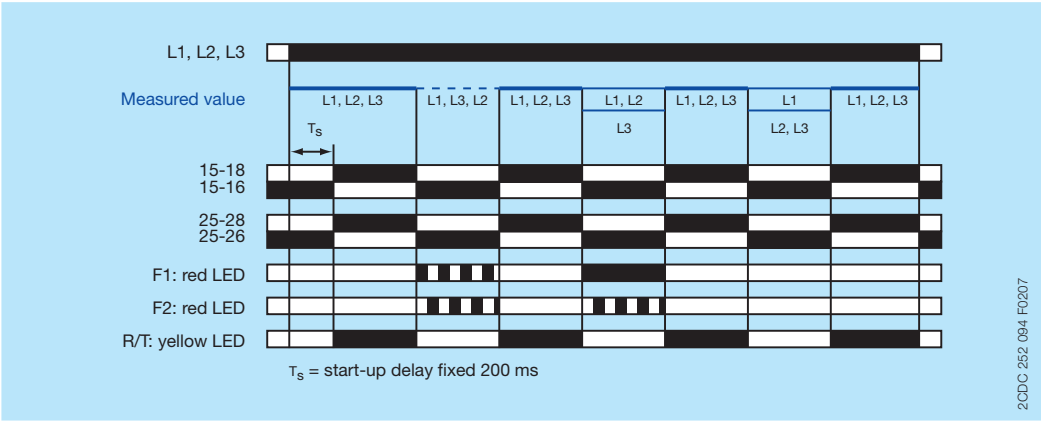
Applying control supply voltage begins the fixed start-up delay  $T_s$ . When  $T_s$  is complete and all phases are present with correct voltage, the output relays energize and the yellow LED R/T is on.

Phase sequence monitoring:

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

Phase failure monitoring:

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

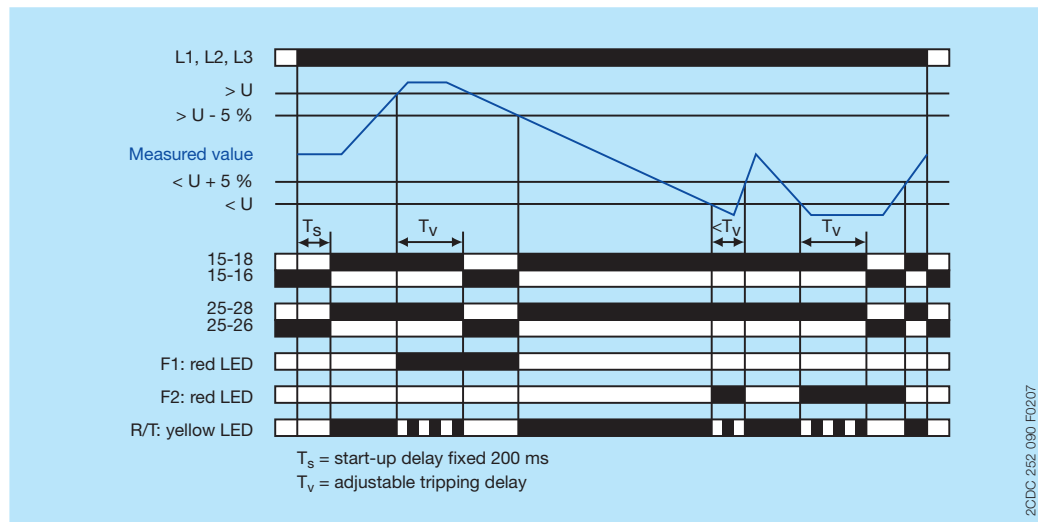


## Over- and undervoltage monitoring

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

Type of tripping delay = ON-delay ☒

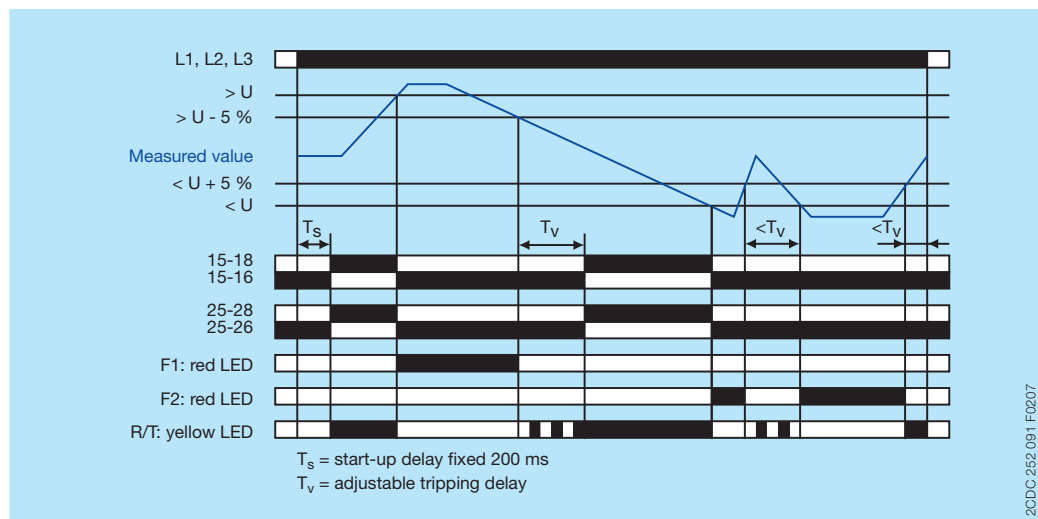
If the voltage to be monitored exceeds or falls below the set threshold value, the output relays de-energize after the set tripping delay  $T_v$  is complete. The LED R/T flashes during timing and turns off as soon as the output relays de-energize. The output relays re-energize automatically as soon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



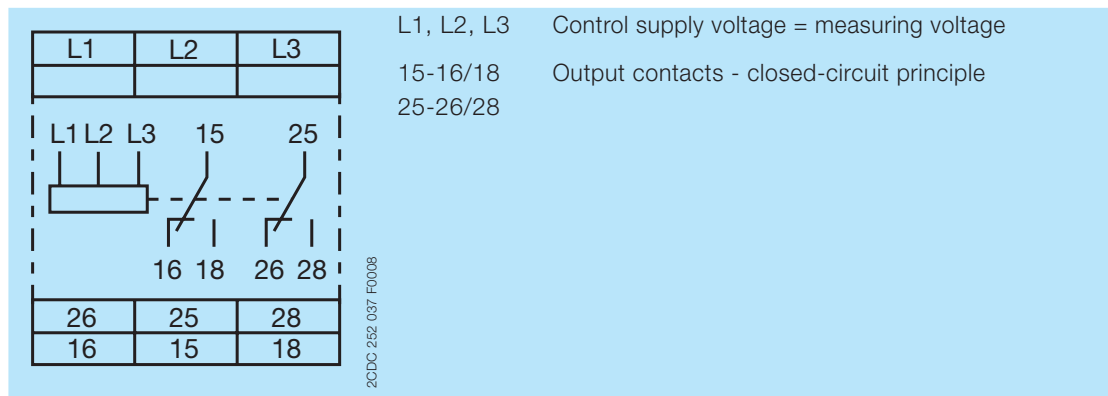
Type of tripping delay = OFF-delay ■

If the voltage to be monitored exceeds or falls below the set 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.



## Electrical connection



Connection diagram CM-PVS.x1

## Technical data

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

### Input circuit

Type	CM-PVS.31	CM-PVS.41
<b>Supply circuit = measuring circuit</b>	<b>L1, L2, L3,</b>	
Rated control supply voltage $U_s$ = measuring voltage	3 x 160-300 V AC	3 x 300-500 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 (230 V AC)	25 mA / 18 VA (400 V AC)
<b>Measuring circuit</b>	<b>L1, L2, L3</b>	
Monitoring functions	Phase failure	■
	Phase sequence	can be switched off
	Over-/undervoltage	■
Measuring range	Overvoltage	3 x 220-300 V AC
	Undervoltage	3 x 160-230 V AC
Thresholds	Overvoltage	adjustable within the measuring range
	Undervoltage	adjustable within the measuring range
Tolerance of the adjusted threshold value	6 % of full-scale value	
Hysteresis related to the threshold value	Over-/undervoltage	fixed 5 %
Rated frequency of the measuring signal	50/60 Hz	
Frequency range of the measuring signal	45-65 Hz	
Maximum measuring cycle time	100 ms	
Accuracy within the rated control supply voltage tolerance	$\Delta U \leq 0.5\text{ %}$	
Accuracy within the temperature range	$\Delta U \leq 0.06\text{ % / °C}$	
Measuring method	True RMS	
<b>Timing circuit</b>		
Start-up delay $T_s$	fixed 200 ms	
Tripping delay $T_v$	ON- or OFF-delay 0 s; 0.1-30 s adjustable	
Repeat accuracy (constant parameters)	< $\pm 0.2\text{ %}$	
Accuracy within the rated control supply voltage tolerance	$\Delta t \leq 0.5\text{ %}$	
Accuracy within the temperature range	$\Delta t \leq 0.06\text{ % / °C}$	

## User interface

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

Details see table 'LEDs, status information and fault messages' on page 5 and 'Function descriptions / diagrams' on page 6.

## Output circuits

Kind of output	15-16/18	relay, 1st c/o (SPDT) contact
	25-26/28	relay, 2nd c/o (SPDT) contact 1 x 2 (SPDT) contacts
Operating principle		closed-circuit principle <sup>1)</sup>
Contact material		AgNi alloy, Cd free
Rated operational voltage $U_o$		250 V
Minimum switching voltage / Minimum switching current		24 V / 10 mA
Maximum switching voltage / Maximum switching current		see load limit curves
Rated operational current $I_o$	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 at B 300	3600/360 VA
Mechanical lifetime		30 x 10 <sup>6</sup> switching cycles
Electrical lifetime	AC-12, 230 V, 4 A	0.1 x 10 <sup>6</sup> switching cycles
Maximum fuse rating to achieve short-circuit protection	n/c contact	6 A fast-acting
	n/o contact	10 A fast-acting

## General data

MTBF			on request	
Duty time			100 %	
Dimensions			see 'Dimensional drawings'	
Weight			Screw connection technology	Easy Connect Technology (push-in)
	net weight	CM-PVS.31	0.141 kg (0.311 lb)	0.132 kg (0.291 lb)
		CM-PVS.41	0.139 kg (0.306 lb)	0.131 kg (0.289 lb)
	gross weight	CM-PVS.31	0.166 kg (0.366 lb)	0.157 kg (0.346 lb)
		CM-PVS.41	0.164 kg (0.362 lb)	0.156 kg (0.343 lb)
Mounting			DIN rail (IEC/EN 60715), snap-on mounting without any tool	
Mounting position			any	
			CM-PVS.31	CM-PVS.41
Minimum distance to other units		horizontal	10 mm (0.39 in) in case of continuous voltage of ...	
			> 220 V	
			> 400 V	
Material of housing			UL 94 V-0	
Degree of protection		housing	IP50	
		terminals	IP20	

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



## Electrical connection

		Screw connection technology	Easy Connect Technology (push-in)
Connecting capacity	fine-strand with(out) wire end ferrule	1 x 0.5-2.5 mm <sup>2</sup> (1 x 18-14 AWG) 2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)	2 x 0.5-1.5 mm <sup>2</sup> (2 x 18-16 AWG)
		rigid 1 x 0.5-4 mm <sup>2</sup> (1 x 20-12 AWG) 2 x 0.5-2.5 mm <sup>2</sup> (2 x 20-14 AWG)	2 x 0.5-1.5 mm <sup>2</sup> (2 x 20-16 AWG)
Stripping length		8 mm (0.32 in)	
Tightening torque		0.6 - 0.8 Nm (7.08 lb.in)	-

## Environmental data

Ambient temperature ranges	operation	-25...+60 °C
	storage	-40...+85 °C
Damp heat, cyclic (IEC/EN 60068-2-30)		6 x 24 cycle, 55 °C, 95 % RH
Climatic class		3K3
Vibration, sinusoidal		Class 2
Shock		Class 2

## Isolation data

Type		
Rated insulation voltage U <sub>i</sub>	input circuit / output circuit	600 V
	output circuit 1 / output circuit 2	300 V
Rated impulse withstand voltage U <sub>imp</sub>	input circuit / output circuit	6 kV, 1.2/50 µs
	output circuit 1 / output circuit 2	4 kV, 1.2/50 µs
Basic insulation	input circuit / output circuit	600 V
Protective separation (IEC/EN 61140, EN 50178)	input circuit /	-
	output circuit	
Pollution degree		3
Overvoltage category		III

## Standards / Directives

Standards	IEC/EN 60947-5-1, IEC/EN 60255-27, EN 50178
Low Voltage Directive	2014/35/EU
EMC directive	2014/30/EU
RoHS directive	2011/65/EU

## Railway application standards

EN 50155, IEC 60571	temperature class	T3
"Railway applications – Electronic equipment used on rolling stock"	supply voltage category	S1, S2, C1*), C2*)
IEC/EN 61373		Category 1, Class B
"Railway applications – Rolling stock equipment – Shock and vibration tests"		
EN 45545-2 Railway applications – Fire protection on railway vehicles – part 2: Requirements for fire behavior of materials and components		HL3
	ISO 4589-2	LOI 32.3 %
	NF X-70-100-1	C.I.T. (T12) 0.45
	EN ISO 5659-2	Ds max (T10.03) 104
NF F 16-101: Rolling stock. Fire behaviour. Materials choosing		I2 / F2
NF F 16-102: Railway rolling stock. Fire behaviour. Materials choosing, application for electric equipment		
DIN 5510-2 Preventive fire protection in railway vehicles. Part 2: Fire behaviour and fire side effects of materials and parts		fulfilled

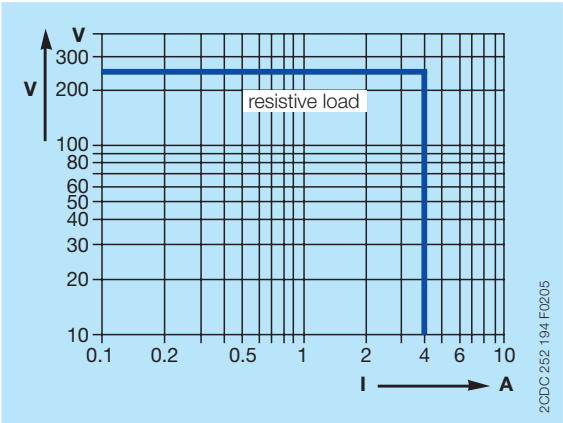
\*) only applicable for devices with DC supply

## Electromagnetic compatibility

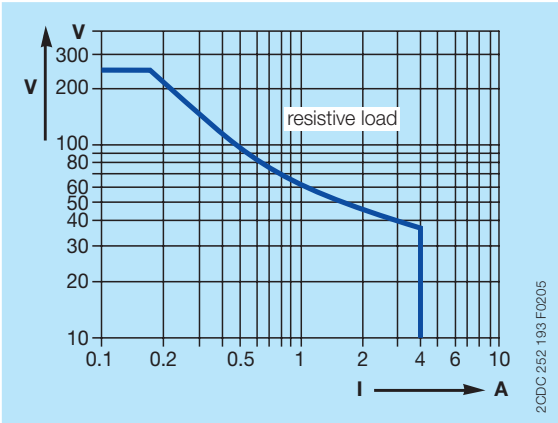
Type		
Interference immunity to		IEC/EN 61000-6-2
electrostatic discharge	IEC/EN 61000-4-2	Level 3 (6 kV / 8 kV)
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3 (2 kV / 2 kHz)
surge	IEC/EN 61000-4-5	Level 4 (2 kV L-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

Technical diagrams

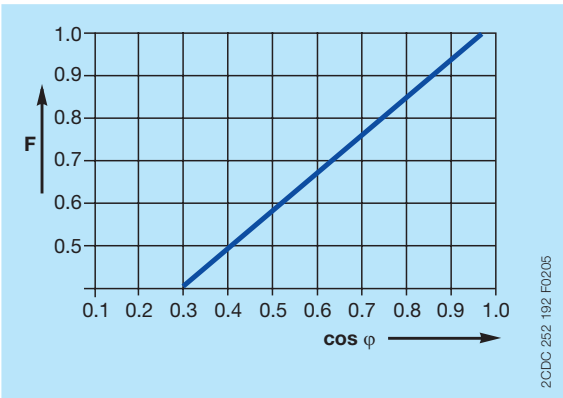
Load limit curves



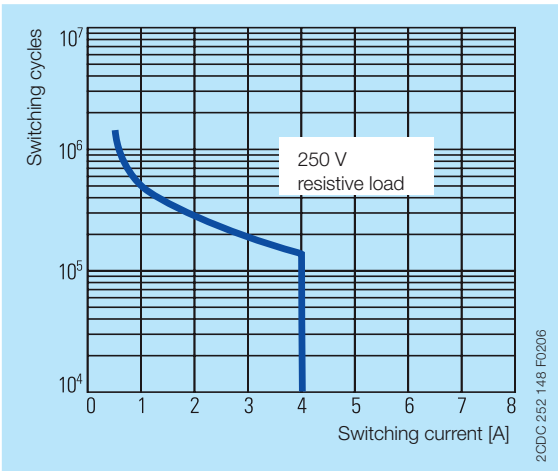
AC load (resistive)



DC load (resistive)



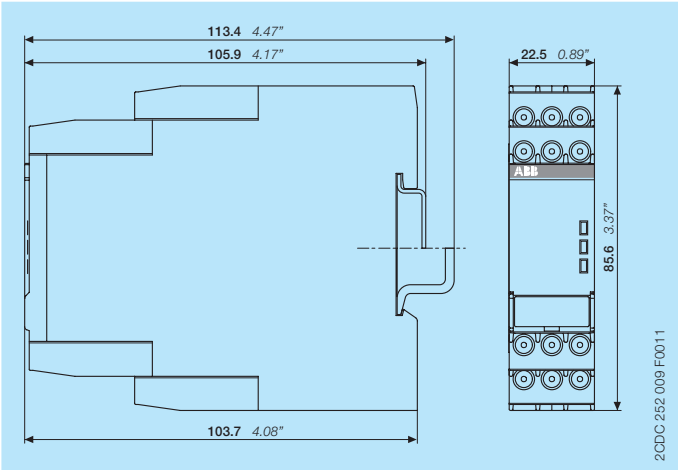
Derating factor  $F$  for inductive AC load



Contact lifetime

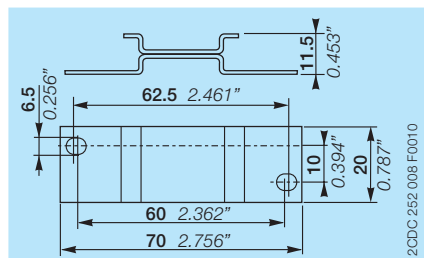
Dimensions

in mm and inches

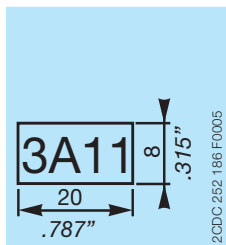


## Accessories

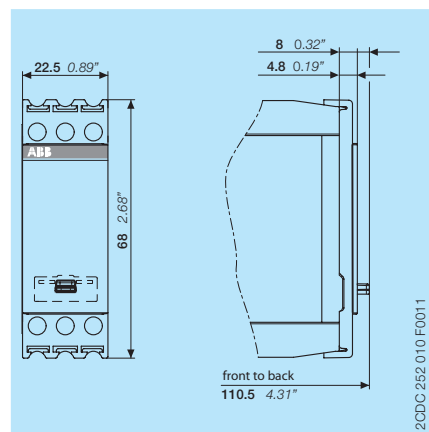
in **mm** and *inches*



ADP.01 - Adapter for screw mounting



MAR.01 - Marker label for devices without DIP switches



COV.11 - Sealable transparent cover

## Further documentation

Document title	Document type	Document number
Electronic relays and controls	Catalog	2CDC 110 004 C02xx
CM-PAS, CM-PFS, CM-PSS, CM-PVS	Instruction manual	1SVC 730 510 M0000

You can find the documentation on the internet at [www.abb.com/lowvoltage](http://www.abb.com/lowvoltage)

-> Automation, control and protection -> Electronic relays and controls -> Measuring and monitoring relays.

## CAD system files

You can find the CAD files for CAD systems at <http://abb-control-products.partcommunity.com>

-> Low Voltage Products & Systems -> Control Products -> Electronic Relays and Controls.

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