

Thermistor motor protection relays CM-MSE, CM-MSS, CM-MSN

Benefits and advantages, Selection table

2

Operating principle and fields of application for thermistor motor protection relays

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

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

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

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

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

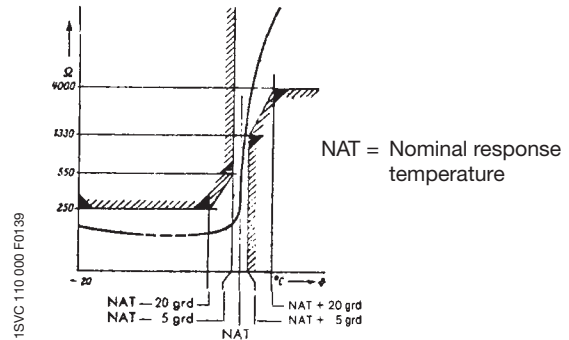
Devices with manual (pushbutton on front-side) or remote reset configuration have to be controlled via the control input by the required signal.

Further applications:

Temperature monitoring of equipment with PTC sensors integrated, such as

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

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



Selection table thermistor motor protection relays

Type	CM-MSE	CM-MSS (1)	CM-MSS (2)	CM-MSS (3)	CM-MSS (4)	CM-MSS (5)	CM-MSS (6)	CM-MSS (7)	CM-MSN
Function									
Measuring range									
Number of sensor circuits	1	1	1	1	1	1	2	3	6
Wire break monitoring	•	•	•	•	•	•	•	•	•
Short-circuit detection	-	-	-	• ¹⁾	•	•	•	•	•
Non-volatile fault storage	-	-	-	-	• ²⁾	• ²⁾	-	• ²⁾	• ²⁾
Operation/Reset									
Auto reset	•	•	•	•	• ²⁾	• ²⁾	• ²⁾	• ²⁾	• ²⁾
Manual reset	-	-	•	•	•	•	•	•	•
Remote reset	-	-	•	•	•	•	•	•	•
Test button	-	-	-	-	•	•	•	•	•
Output contacts									
Operational principle	closed-circuit principle								
Number / type	1 c/o	1 n/o	2 c/o	2 c/o	1 n/o + 1 n/c	2 c/o	1 c/o per sensor circuit	1 n/o + 1 n/c accumulative evaluation	1 n/o + 1 n/c accumulative evaluation
Width of enclosure	22.5 mm								45 mm
Supply voltages and order codes									
24 V AC	1SVR550805R9300		1SVR430811R9300						
24 V AC/DC		1SVR430800R9100	1SVR430810R9300	1SVR430710R9300					
110-130 V AC	1SVR550800R9300		1SVR430811R0300	1SVR430711R0300					
220-240 V AC	1SVR550801R9300	1SVR430801R1100	1SVR430811R1300	1SVR430711R1300					
380-440 V AC				1SVR430711R2300					
24-240 V AC/DC					1SVR430720R0400	1SVR430720R0300	1SVR430710R0200	1SVR430720R0500	1SVR450025R0100

1) configurable via terminals

2) Auto reset without non-volatile fault storage configurable by permanent jumpering of connecting terminals S1-T2 or S1/X1-S2/X2

Thermistor motor protection relays

CM-MSE, CM-MSS

Ordering details

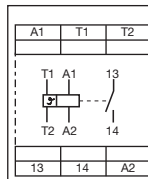
2CDC 251 012 F0b03



CM-MSE

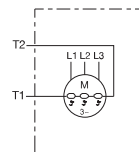
CM-MSE

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



1SVC 110 000 F0140

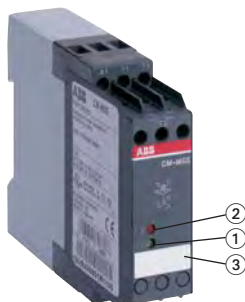
A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
13-14 Output contact - Closed-circuit principle



1SVC 110 000 F0141

Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSE	24 V AC	1SVR 550 805 R9300	1		0.11 / 0.24
	110-130 V AC	1SVR 550 800 R9300	1		0.11 / 0.24
	220-240 V AC	1SVR 550 801 R9300	1		0.11 / 0.24

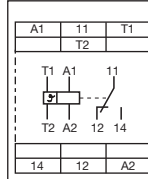
1SVR 430 801 F1100



CM-MSS (1)

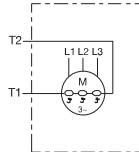
CM-MSS (1), 1 c/o contact

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



1SVC 110 000 F0142

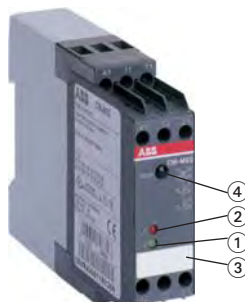
A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
11-12/14 Output contact - Closed-circuit principle



1SVC 110 000 F0141

Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSS (1)	24 V AC/DC ¹⁾	1SVR 430 800 R9100	1		0.15 / 0.33
	220-240 V AC	1SVR 430 801 R1100	1		0.15 / 0.33

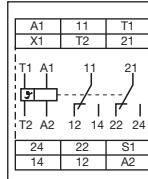
1SVR 430 811 F1300



CM-MSS (2)

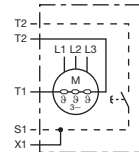
CM-MSS (2), 2 c/o contacts

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



1SVC 110 000 F519

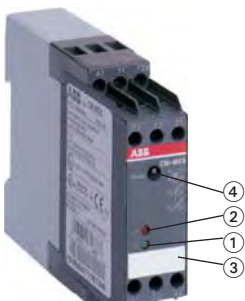
A1-A2 Rated control supply voltage
T1-T2 Sensor circuit
S1-T2 Remote reset jumper = no storage
X1-T2 Output contacts - Closed-circuit principle



2CDC 252 123 F0b07

Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSS (2)	24 V AC/DC ¹⁾	1SVR 430 810 R9300	1		0.15 / 0.33
	24 V AC	1SVR 430 811 R9300	1		0.15 / 0.33
	110-130 V AC	1SVR 430 811 R0300	1		0.15 / 0.33
	220-240 V AC	1SVR 430 811 R1300	1		0.15 / 0.33

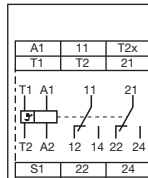
1SVR 430 711 F1300



CM-MSS (3)

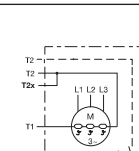
CM-MSS (3), 2 c/o contacts, short-circuit monitoring configurable

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



1SVC 110 000 F0143

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



1SVC 110 000 F0144

Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSS (3)	24 V AC/DC ¹⁾	1SVR 430 710 R9300	1		0.15 / 0.33
	110-130 V AC	1SVR 430 711 R0300	1		0.15 / 0.33
	220-240 V AC	1SVR 430 711 R1300	1		0.15 / 0.33
	380-440 V AC	1SVR 430 711 R2300	1		0.15 / 0.33

¹⁾ not electrically isolated

• Accessories: PTC sensors 2/72	• Technical data 2/73
• Technical diagrams 2/102	• Dimensional drawings 2/103
	• Accessories 2/104

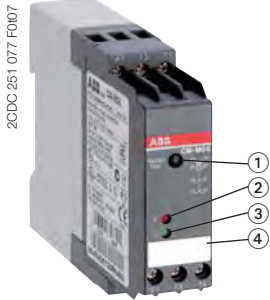
- F: red LED - fault tripping
- U: green LED - control supply voltage
- Marker label
- Reset button

Thermistor motor protection relays

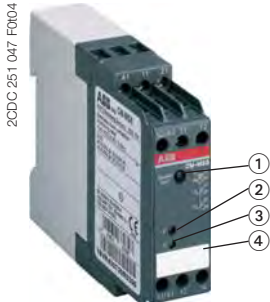
CM-MSS

Ordering details

2

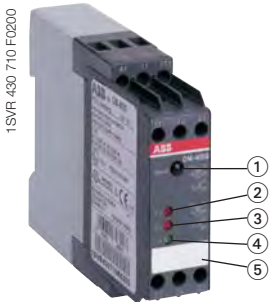


CM-MSS (4)



CM-MSS (5)

- ① Reset / test button
- ② F: red LED - fault tripping
- ③ U: green LED - control supply voltage
- ④ Marker label



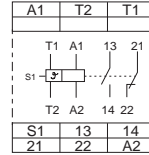
CM-MSS (6)

- ① Reset button
- ② to ③ F1-F2: red LED - fault tripping 1 to 2
- ④ U: green LED - control supply voltage
- ⑤ Marker label

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

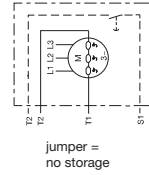
- Short-circuit monitoring of the sensor circuit
- Wide supply voltage range: 24-240 V AC/DC
- Non-volatile fault storage selectable
- Reset and test button
- Remote reset
- Auto reset configurable
- Output contacts: 1 n/c and 1 n/o or 2 c/o contacts
- 2 LEDs for status indication

CM-MSS (4)



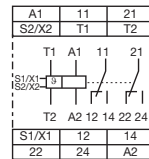
2CDC 252 016 F0004

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



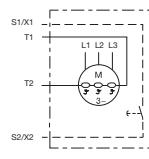
1SYC 110 000 F0145

CM-MSS (5)



2CDC 252 147 F0006

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

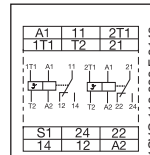


2CDC 252 044 F0004

Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSS (4) 1-channel 1n/c, 1n/o	24-240 V AC/DC	1SVR 430 720 R0400	1		0.15 / 0.33
CM-MSS (5) 1-channel 2 c/o	24-240 V AC/DC	1SVR 430 720 R0300	1		0.15 / 0.33

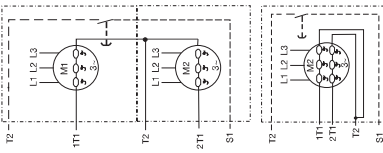
CM-MSS (6), 2-channel, single evaluation

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



1SYC 110 000 F 0148

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



1SYC 110 000 F 0146

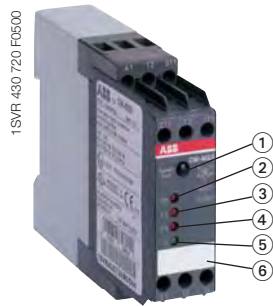
Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSS (6)	24-240 V AC/DC	1SVR 430 710 R0200	1		0.15 / 0.33

• Accessories: PTC sensors 2/72 • Technical data 2/73
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Thermistor motor protection relays

CM-MSS, CM-MSN

Ordering details

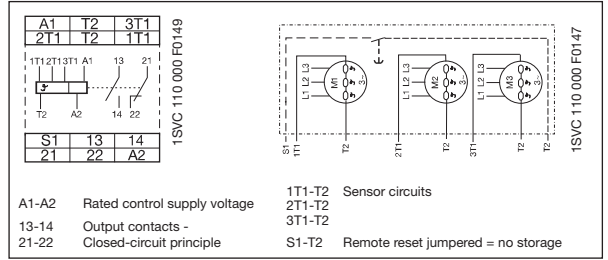


CM-MSS (7)

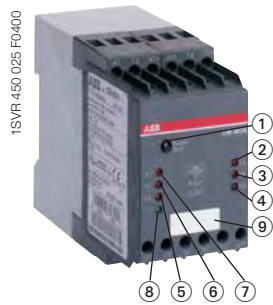
- ① Reset / test button
- ② to ④ F1-F3: red LED - fault tripping 1 to 3
- ⑤ U: green LED - control supply voltage
- ⑥ Marker label

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

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



Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSS (7)	24-240 V AC/DC	1SVR 430 720 R0500	1		0.15 / 0.33

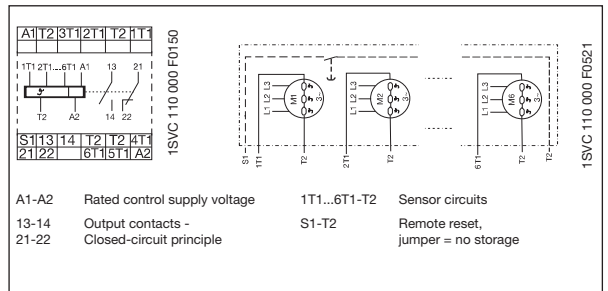


CM-MSN

- ① Reset / Test button
- ② to ⑦ F1-F6: red LED - fault tripping F1 to F6
- ⑧ U: green LED - control supply voltage
- ⑨ Marker label

CM-MSN, 6 sensor circuits, accumulative evaluation

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



Type	Rated control supply voltage	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
CM-MSN	24-240 V AC/DC	1SVR 450 025 R0100	1		0.23 / 0.51

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

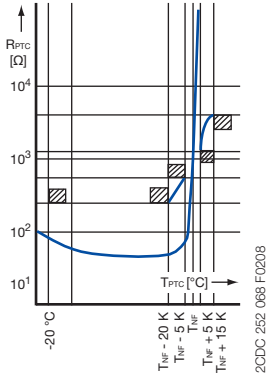
• Accessories: PTC sensors 2/72	• Technical data 2/73
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Thermistor motor protection PTC temperature sensors C011

Ordering details, technical data

2

Temperature sensor characteristic



ZCDC 252 068 F0208

1SVC 110 000 F0531



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

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

One temperature sensor must be embedded in each phase winding. For instance, in case of three-phase squirrel cage motors, three sensors are embedded in the stator windings. For pole-changing motors with one winding (Dahlander connection), 3 sensors are also sufficient. Pole-changing motors with two windings, however, require 6 sensors.

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

The sensors are suitable for embedding in motor windings with rated operating voltages of up to 600 V AC.

Conductor length: 500 mm per sensor.

A 14 V varistor can be connected in parallel to protect the sensors from overvoltage.

Due to their characteristics, the thermistor motor protection relays can also be used with PTC temperature sensors of other manufacturers which comply with DIN 44 081 and DIN 44 082.

Type	Rated response temperature T_{NF}	Color coding	Order code	Pack. unit set	Price 1 set	Weight 1 piece kg / lb
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Temperature sensor C011, standard version acc. to DIN 44081

1 set = 3 pieces

C011-70	70 °C	white-brown	GHC 011 0003 R0001	1		0.02/0.044
C011-80	80 °C	white-white	GHC 011 0003 R0002	1		0.02/0.044
C011-90	90 °C	green-green	GHC 011 0003 R0003	1		0.02/0.044
C011-100	100 °C	red-red	GHC 011 0003 R0004	1		0.02/0.044
C011-110	110 °C	brown-brown	GHC 011 0003 R0005	1		0.02/0.044
C011-120	120 °C	gray-gray	GHC 011 0003 R0006	1		0.02/0.044
C011-130	130 °C	blue-blue	GHC 011 0003 R0007	1		0.02/0.044
C011-140	140 °C	white-blue	GHC 011 0003 R0011	1		0.02/0.044
C011-150	150 °C	black-black	GHC 011 0003 R0008	1		0.02/0.044
C011-160	160 °C	blue-red	GHC 011 0003 R0009	1		0.02/0.044
C011-170	170 °C	white-green	GHC 011 0003 R0010	1		0.02/0.044

Type	Rated response temperature T_{NF}	Color coding	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg / lb
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Triple temperature sensor C011-3

C011-3-150	150 °C	black-black	GHC 011 0033 R0008	1		0.05/0.11
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Technical data

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

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

¹⁾ Not embedded in windings.

²⁾ For triple temperature sensor take values x 3.

Thermistor motor protection relays

CM-MSE, CM-MSS, CM-MSN

Technical data

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

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

Thermistor motor protection relays

CM-MSE, CM-MSS, CM-MSN

Technical data

2

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