

# Thermistor motor protection relays

## Product group picture

2



# Thermistor motor protection relays

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# Thermistor motor protection relays

## Benefits and advantages, Applications

### Operating principle and fields of application for thermistor motor protection relays

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

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

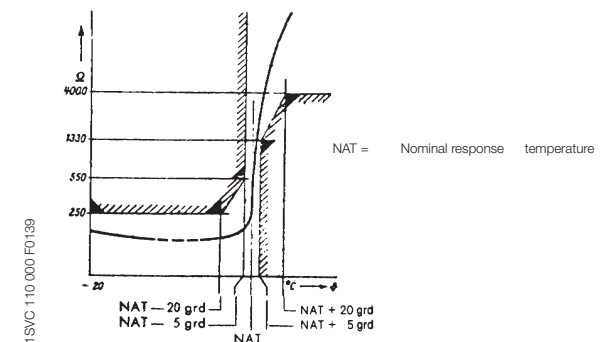
### Further applications:

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

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

### Resistance characteristic

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



### CM-MSE

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

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

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

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

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

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

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

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

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

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

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

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

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

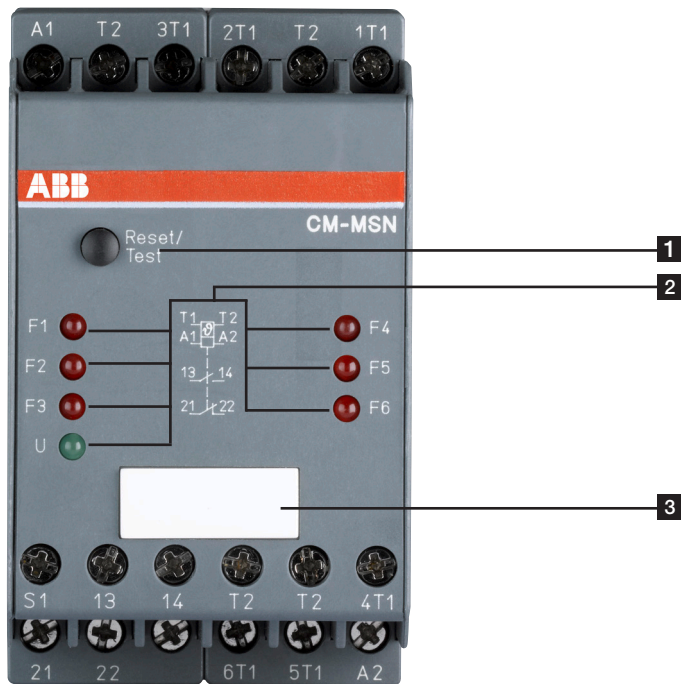
### CM-MSN, 6 sensor circuits, accumulative evaluation

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

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

# Thermistor motor protection relays

## Operating controls



- 1** Reset / Test button
- 2** Indication of operational states  
U: green LED – control supply voltage  
F: red 1-6 LED – fault message
- 3** Marker label

# Thermistor motor protection relays

## Selection table thermistor motor protection relays

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

<sup>1)</sup> For CM-MSS (3): configurable via terminals

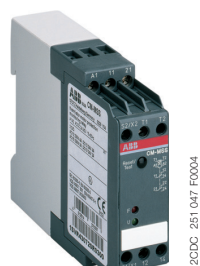
<sup>2)</sup> Auto reset without non-volatile fault storage configurable by permanent jumpering of connection terminals S1-T2 or S1/X1-S2/X2

# Thermistor motor protection relays

## Ordering details



CM-MSE



CM-MSS (5)



CM-MSN

### Description

The thermistor motor protection relays CM-MSE, CM-MSS and CM-MSN are used to control motors equipped with PTC temperature sensors. The PTC temperature sensors are incorporated in the motor windings to measure the motor heating. This enables direct control and evaluation of various operating conditions. Depending on the products also ATEX approvals for use in hazardous areas are available.

ABB also offers PTC temperature sensors C011 (according to DIN 44081) which are suitable for embedding in motor windings.

### Ordering details

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

<sup>1)</sup> Not electrically isolated

<sup>2)</sup> CM-MSS (4): 1-channel 1 n/c, 1 n/o

<sup>3)</sup> CM-MSS (5): 1-channel 2 c/o

<sup>4)</sup>

# Thermistor motor protection relays

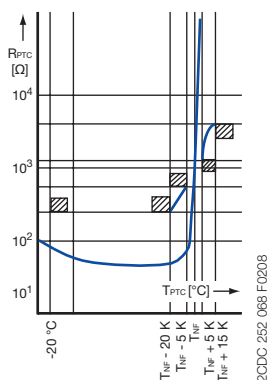
## Ordering details - PTC temperature sensors C011

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1SVC 110 000 F0531

### Temperature sensor characteristics



2CDC 252 068 F0208

### Description

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

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

One temperature sensor must be embedded in each phase winding. For instance, in case of three-phase squirrel cage motors, three sensors are embedded in the stator windings. For pole-changing motors with one winding (Dahlander connection), 3 sensors are also sufficient. Pole-changing motors with two windings, however, require The sensors are suitable for embedding in motor windings with rated operating voltages of up to 600 V AC. Conductor length: 500 mm per sensor. A 14 V varistor can be connected in parallel to protect the sensors from overvoltage. Due to their characteristics, the thermistor motor protection relays can also be used with PTC temperature sensors of other manufacturers which comply with DIN 44 081 and DIN 44 082 6 sensors.

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

### Ordering details

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

<sup>1)</sup> Temperature sensor C011, standard version acc. to DIN 44081

<sup>2)</sup> Triple temperature sensor C011-3

### Technical data

Characteristic data		Sensor type C011		
Cold-state resistance		50 -100 Ω at 25 °C		
Warm-state resistance ± 5 up to 6 K of rated response temperature $T_{NF}$		10 000 Ω		
Thermal time constant, sensor open <sup>1)</sup>		< 5 s		
Permitted ambient temperature		+180 °C		
Rated response temperature ± tolerance $T_{NF} \pm \Delta T_{NF}$	PTC resistance R from -20 °C to $T_{NF} - 20$ K	PTC resistance $R^{2)}$ at PTC temperatures of:		
		$T_{NF} - \Delta T_{NF}$ (UPTC ≤ 2.5 V)	$T_{NF} + \Delta T_{NF}$ (UPTC ≤ 2.5 V)	$T_{NF} + 15$ K (UPTC ≤ 7.5 V)
70 ± 5 °C	≤ 100 Ω	≤ 570 Ω	≥ 570 Ω	-
80 ± 5 °C				
90 ± 5 °C				
100 ± 5 °C				
110 ± 5 °C				
120 ± 5 °C		≤ 550 Ω	≥ 1330 Ω	≥ 4000 Ω
130 ± 5 °C				
140 ± 5 °C				
150 ± 5 °C				
160 ± 5 °C				
170 ± 7 °C		≤ 570 Ω	≥ 570 Ω	-

<sup>1)</sup> Not embedded in windings.

<sup>2)</sup> For triple temperature sensor take values x 3.

# Thermistor motor protection relays

## Technical data

Type		CM-MSE	CM-MSS	CM-MSN
<b>Input circuit</b>				
Rated control supply voltage $U_s$ power consumption	A1-A2	24 V AC approx. 1.5 VA		
	A1-A2	24 V AC/DC approx. 1.1 VA / 0.6 W		
	A1-A2	110-130 V AC approx. 1.5 VA		
	A1-A2	220-240 V AC approx. 1.5 VA		
	A1-A2	380-440 V AC approx. 1.7 VA		
	A1-A2	24-240 V AC/DC approx. 1.4-1.7 W / approx. 3.5-5.7 VA		
Rated control supply voltage $U_s$ tolerance		-15 % ... +10 %		
Rated frequency		AC: 50-60 Hz / 24-240 V AC/DC versions: 15-400 Hz		
Duty time		100 %		
<b>Measuring circuit</b>		<b>T1-T2</b>	<b>T1-T2/T2x, 1T1...6T1-T2</b>	<b>1T1...6T1-T2</b>
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
<b>Sensor circuit</b>				
Temperature threshold (relay de-energizes)		2.7-3.7 k $\Omega$	CM-MSS (1+2): 3050 $\pm$ 550 $\Omega$ CM-MSS (3-7): 3.6 k $\Omega$ $\pm$ 5 %	3.6 k $\Omega$ $\pm$ 5 %
Temperature hysteresis (relay energizes)		1.7-2.3 k $\Omega$	CM-MSS (1+2): 1900 $\pm$ 400 $\Omega$ CM-MSS (3-7): 1.6 k $\Omega$ $\pm$ 5 %	1.6 k $\Omega$ $\pm$ 5 %
Short-circuit threshold (relay de-energizes)		<18 $\Omega$		
Short-circuit hysteresis (relay energizes)		>45 $\Omega$		
Maximum total resistance of sensors connected in series (cold state)		$\leq$ 1.5 k $\Omega$		
Maximum sensor cable length for short-circuit detection		2 x 100 m at 0.75 mm <sup>2</sup> , 2 x 400 m at 2.5 mm <sup>2</sup>		
Response time		<100 ms		
<b>Control circuit for storage and hysteresis function</b>				
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	
<b>Indication of operational states</b>				
Control supply voltage	U: green LED	-	[ ] L: control supply voltage applied	
Fault indication	F: red LED	-	[ ] L: output relay de-energized	
<b>Output circuits</b>		<b>13-14</b>	<b>11-12/14, 21-22/24, 13-14, 21-22</b>	<b>13-14, 21-22</b>
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 $I_s$ (IEC/EN 60947-5-1)	AC12 (resistive) at 230 V	4 A		
	AC15 (inductive) at 230 V	3 A		
	DC12 (resistive) at 24 V	4 A		
	DC13 (resistive) at 24 V	2 A (1.5 A - n/c contact <sup>1)</sup> )		
AC rating (UL 508)	Utilization category (Control Circuit Rating Code)			
	max. rated operational voltage	300 V AC		
	max. continuous thermal current at B 300	5 A		
	max. making/breaking apparent power at B300	3600/360 VA		
Mechanical lifetime		30 (10 <sup>11</sup> ) x 10 <sup>6</sup> switching cycles		
Electrical lifetime (AC12, 230 V, 4 A)		0.1 x 10 <sup>6</sup> switching cycles		
Max. fuse rating to achieve short-circuit protection	n/c contact	10 A fast-acting	4 A (10 A <sup>1)</sup> ) fast-acting	10 A fast-acting
	n/o contact	10 A fast-acting	6 A (10 A <sup>1)</sup> ) fast-acting	10 A fast-acting
<b>General data</b>				
Dimensions (W x H x D)		22.5 x 78 x 78.5 mm (0.89 x 3.07 x 3.09 in)	22.5 x 78 x 100 mm (0.89 x 3.07 x 3.94 in)	45 x 78 x 100 mm (1.77 x 3.07 x 3.94 in)
Weight		approx. 0.11 kg (0.24 lb)	approx. 0.15 kg (0.33 lb)	approx. 0.23 kg (0.51 lb)
Mounting position		any		
Degree of protection	housing / terminals	IP50 / IP20		
Ambient temperature range	operation	-20...+60 °C		-25...+65 °C
	storage	-40...+85 °C		
Mounting		DIN rail (IEC/EN 60715)		

<sup>1)</sup> 1SVR 430 710 R 0200, 1SVR 430 8xx R xxxx

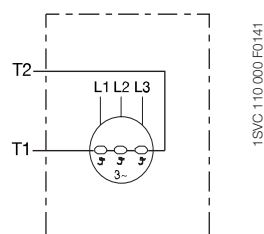
# Thermistor motor protection relays

## Technical data,

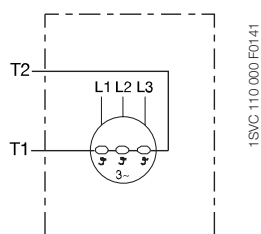
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Type		CM-MSE	CM-MSS	CM-MSN
Electrical connection				
Wire size	fine strand with wire end ferrule	2 x 1.5 mm <sup>2</sup> (2 x 16 AWG)	2 x 2.5 mm <sup>2</sup> (2 x 14 AWG)	
	fine strand without wire end ferrule	2 x 0.75-1.5 mm <sup>2</sup> (2 x 18-16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

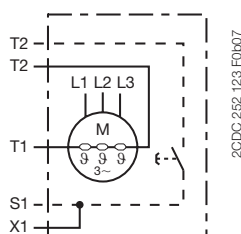
CM-MSE



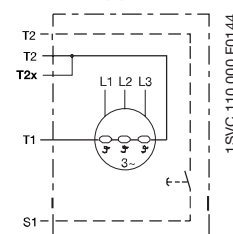
CM-MSS(1)



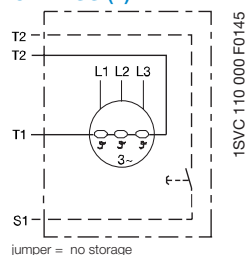
CM-MSS(2)



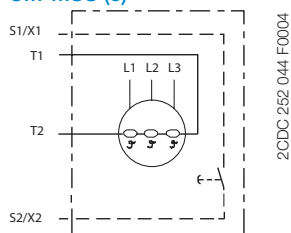
CM-MSS(3)



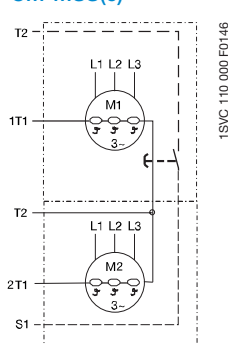
CM-MSS (4)



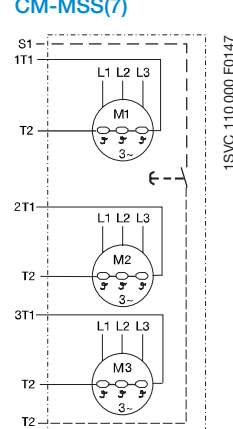
CM-MSS (5)



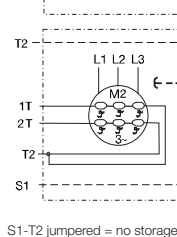
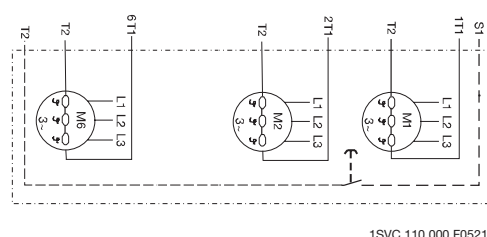
CM-MSS(6)



CM-MSS(7)



CM-MSN

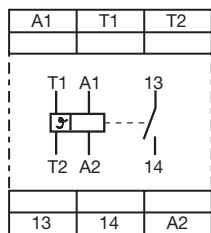


1T1-T2 Sensor circuits  
2T1-T2  
3T1-T2  
S1-T2 Remote reset jumpered = no storage

# Thermistor motor protection relays

## Connection diagrams

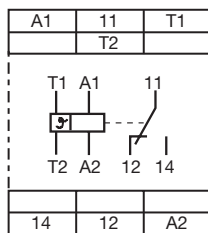
### CM-MSE



1SVC 110 000 F0140

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

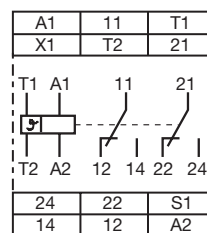
### CM-MSS(1)



1SVC 110 000 F0142

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

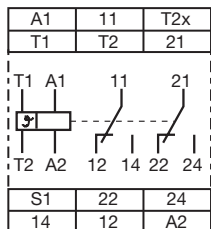
### CM-MSS(2)



1SVC 110 000 F519

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

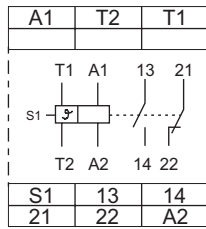
### CM-MSS(3)



1SVC 110 000 F0143

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

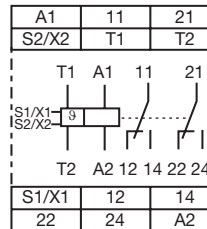
### CM-MSS (4)



2CDC 252 016 F0004

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

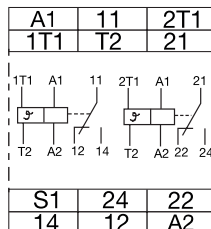
### CM-MSS (5)



2CDC 252 147 F0606

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

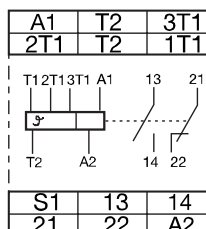
### CM-MSS(6)



1SVC 110 000 F0148

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

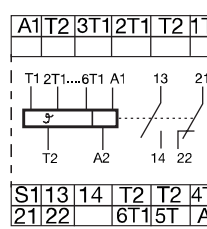
### CM-MSS(7)



1SVC 110 000 F0149

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

### CM-MSN



1SVC 110 000 F0150

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