Temperature monitoring relays
Product group picture

Temperature monitoring relays
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Temperature monitoring relays

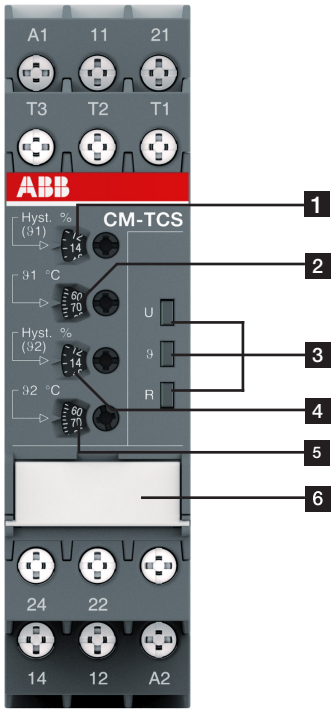
Temperature monitoring relays
Benefits and advantages, Operating controls

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

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

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

Operating controls



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

2 **Adjustment of the threshold value ϑ1**

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

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

5 **Adjustment of the threshold value ϑ2**

6 **DIP switch functions / marker label (on page 2/104)**
- Overtemperature monitoring
- Undertemperature monitoring
- Temperature window monitoring activated
- Temperature window monitoring de-activated
- Closed-circuit principle
- Open-circuit principle
- 2 x 1 c/o (SPDT) contact
- 1 x 2 c/o (SPDT) contacts

Temperature monitoring relays
Selection table - Temperatur monitoring relays

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-circiut principle	■	■	■	■	■	■	■	■	■	■	■	■
Output contacts												
c/o	2	2	2	2	2	2	2	2	2	2	2	2

Temperature monitoring relays
Ordering details

CM-TCS

Description

The temperature monitoring relays CM-TCS are able to measure temperatures of solids, liquids and gaseous media using different types of 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

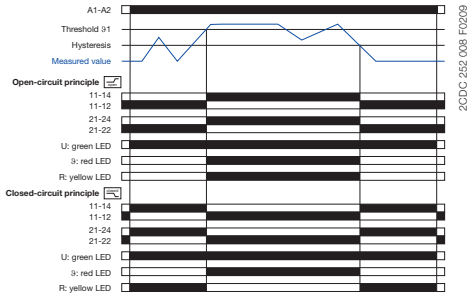
Rated control supply voltage	Measuring range	Temperature sensors	Type	Order code	Price 1 pc	Weight (1 pc) kg (lb)
24-240 V AC/DC	-50...+50 °C	PT100	CM-TCS.11S	1SVR730740R0100		0.151 (0.333)
			CM-TCS.11P	1SVR740740R0100		0.140 (0.309)
	0...+100 °C		CM-TCS.12S	1SVR730740R0200		0.151 (0.333)
			CM-TCS.12P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

Temperature monitoring relays
Function diagrams

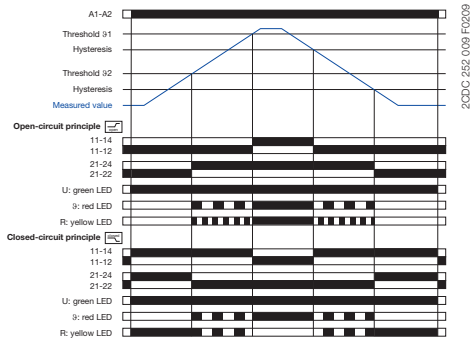
Overtemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

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.



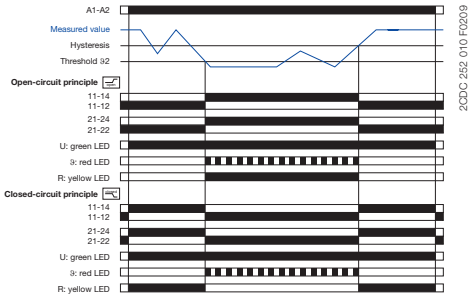
Overtemperature monitoring, 2 x 1 c/o contact 2x1 c/o

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.



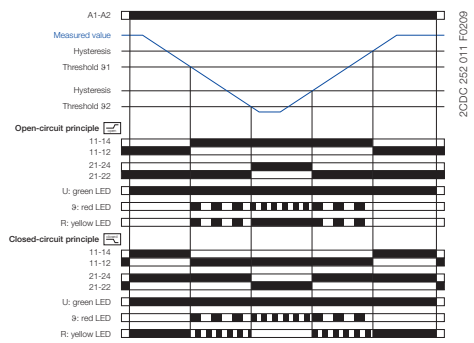
Undertemperature monitoring, 1 x 2 c/o contacts 1x2 c/o

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.



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

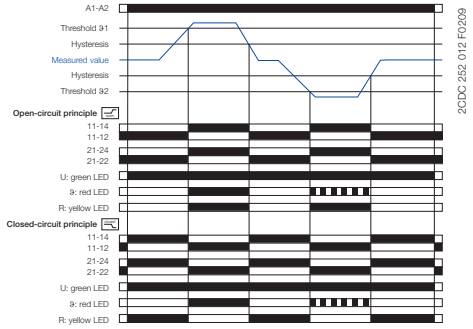
Open-circuit principle:
If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value drops below the adjusted threshold value $\vartheta 1$, output relay R1 (prewarning) energizes. If the measured value drops below the adjusted 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 monitoring relays
Function diagrams and DIP switches

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

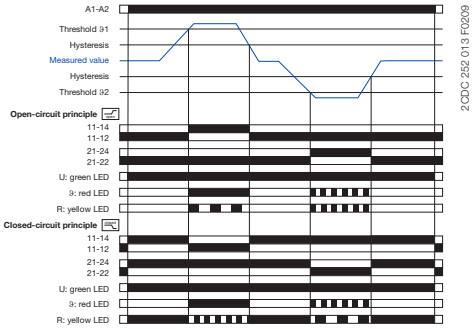
Open-circuit principle:
If the measured value is correct, the output relays remain de-energized when control supply voltage is applied. If the measured value exceeds the adjusted threshold value $\vartheta 1$ or drops below the adjusted threshold value $\vartheta 2$, the output relays energize. If the 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.



2CDC 252 012 F0209

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

Open-circuit principle:
If the measured value is correct, the output relays remain de-energized when control supply voltage is applied.
If the measured value exceeds the adjusted threshold value $\vartheta 1$ 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.



2CDC 252 013 F0209

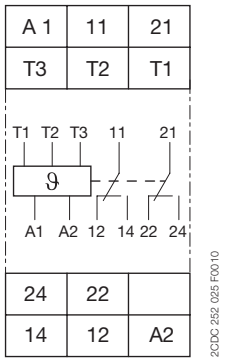
DIP switches CM-TCS

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

	ON	OFF (default)
DIP switch 1 Monitoring principle	Overtemperature monitoring If overtemperature monitoring is selected, the CM-TCS recognizes temperatures above the selected threshold and trips the output relay according to the selected operating principle.	Undertemperature monitoring If undertemperature monitoring is selected, the CM-TCS recognizes temperatures below the selected threshold and trips the output relay according to the selected operating principle.
DIP switch 2 Temperature window monitoring	Temperature window monitoring activated If temperature window monitoring is selected, the CM-TCS monitors over- and undertemperature. If temperature window monitoring is activated, DIP switch 1 is disabled.	Temperature window monitoring de-activated Temperature window monitoring is de-selected.
DIP switch 3 Operating principle of the output relays	Closed-circuit principle If closed-circuit principle is selected, the output relays are energized. They de-energize if a fault is occuring.	Open-circuit principle If open-circuit principle is selected, the output relays are deenergized. They energize if a fault is occuring.
DIP switch 4 2 x 1 c/o contact, 1 x 2 c/o contacts	2 x 1 c/o (SPDT) contact If operating principle 2 x 1 c/o contact is selected, the output relay R1 (11-12/14) reacts to threshold value $\vartheta 1$ 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.

Temperature monitoring relays
Connection diagram, Resistance thermometer sensors

Connection diagram

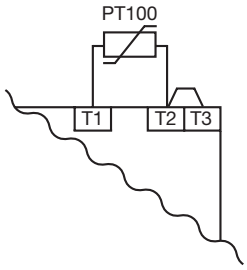


A1-A2 Control supply voltage
11-12/14 Output relay R1
21-22/24 Output relay R2
T1, T2, T3 Measuring input, connection PT100

Connection of resistance thermometer sensors

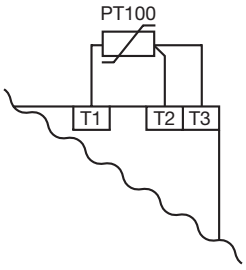
2-wire measurement

When using 2-wire temperature sensors the sensor resistance and the wire resistance are added together. The resulting systematic errors must be taken into account when adjusting the tripping device. A jumper must be connected between the terminals T2 and T3. The following table can be used for PT100 sensors to determine the temperature errors caused by the line length.
When using resistance sensors with two-wire connection a bridge must be inserted between terminals T2 and T3.



3-wire measurement

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



Error caused by the line

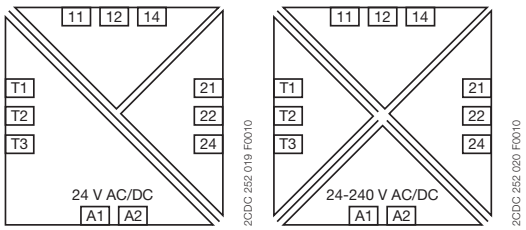
The error resulting from the line resistance amounts to approx. 2.5 Kelvin/Ohm. If the resistance of the line is not known and it is not possible to measure it, the error caused by the line can be estimated using the following table.

Temperature error

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

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

Electrical isolation



Electrical isolation

Protective separation acc. to IEC/EN 61140, EN 50178

Temperature monitoring relays
Technical data - CM-TCS

Type		CM-TCS.11/12/13	CM-TCS.21/22/23
Input circuit			
Rated control supply voltage U_s	A1-A2	24-240 V AC/DC	24 V AC/DC
Rated control supply voltage U_s tolerance		-15...+10 %	
Typical current / power / consumption	24 V DC	33 mA / 0.8 VA	18 mA / 0.45 VA
	115 V AC	12.5 mA / 1.5 VA	n/a
	230 V AC	13 mA / 2.9 VA	n/a
Rated frequency	AC	15-400 Hz	50/60 Hz
Frequency range	AC	13.5-440 Hz	45-65 Hz
Power failure buffering time	min.	20 ms	
Measuring circuit		**T1, T2, T3**	
Sensor type		PT100	
Connection of the sensor	2-wire	yes, jumper between T2-T3	
	3-wire	yes, use terminal T1, T2, T3	
Monitoring function		overtemperature, undertemperature or window monitoring	
Threshold values adjustable within the measuring range	CM-TCS.x1	-50...+50 °C	
	CM-TCS.x2	0...+100 °C	
	CM-TCS.x3	0...+200 °C	
Number of possible thresholds		2	
Tolerance of the adjusted threshold value		typ. ±5 % of the range end value	
Hysteresis related to the threshold value		2-20 % of threshold value, min. 1 °C	
Measuring principle		continuous current	
Typical current in the sensor circuit		0.8 mA	
Maximum current in sensor circuit		0.9 mA	
Interrupted wire detection		yes, indicated via LED status	
Short-circuit detection		yes, indicated via LED status	
Accuracy within the rated control supply voltage tolerance		< 0.2 °C / or < 0.01 %/K	
Accuracy within the temperature range		< 0.2 °C / or < 0.01 %/K	
Repeat accuracy (constant parameters)		< 0.2 % of full scale	
Maximum measuring cycle		320 ms	
Output circuit			
Kind of output		2 x 1 or 1 x 2 c/o (SPDT) contacts configurable	
Operating principle		open- or closed-circuit principle configurable [1]	
Contact material		AgNi alloy, Cd free	
Rated operational voltage		250 V AC / 300 V DC	
Minimum switching voltage / Minimum switching current		24 V / 10 mA	
Maximum switching voltage / Maximum switching current		see 'Load limit curves'	
Rated operating current I_e	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	
General data			
Dimensions		see 'Dimensional drawings'	
Mounting		DIN rail (IEC/EN 60715), snap-on mounting without any tool	
Mounting position		any	
Ambient temperature range	operation	-40...+60 °C	
	storage/transport	-40...+85 °C	
Degree of protection	enclosure / terminals	IP50 / IP20	

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

Temperature monitoring relays
Technical data - CM-TCS

Type			CM-TCS.11/12/13	CM-TCS.21/22/23
Electrical connection				
Connecting capacity			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 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) 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 (7.08 lb.in)	-
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	
Basic 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, EN 50178)		supply circuit / measuring circuit	250 V AC / 250 V DC	-
		supply circuit / output circuits	250 V AC / 300 V DC	250 V AC / 250 V DC
		measuring circuit / output circuits	250 V AC / 300 V DC	250 V AC / 250 V DC
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 (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	