

JUMO GmbH & Co. KG
Delivery address: Mackenrodtstraße 14
36039 Fulda, Germany
Postal address: 36035 Fulda, Germany
Phone: +49 661 6003-0
Fax: +49 661 6003-607
Email: mail@jumo.net
Internet: www.jumo.net

JUMO UK LTD
JUMO House
Temple Bank, Riverway
Harlow, Essex, CM20 2DY, UK
Phone: +44 1279 63 55 33
Fax: +44 1279 62 50 29
Email: sales@jumo.co.uk
Internet: www.jumo.co.uk

JUMO Process Control, Inc.
6724 Joy Road
East Syracuse, NY 13057, USA
Phone: +1 315 437 5866
Fax: +1 315 437 5860
Email: info.us@jumo.net
Internet: www.jumousa.com



JUMO Panel-Mounted Thermostats EM

with 1, 2, 3, or 4 single-pole snap-action switches

Description

Thermostats control and monitor thermal processes. The devices of the EM series are available as temperature controllers (TR), temperature monitors (TW), and temperature limiters (TB). The TB places the monitored system into a safe operating condition in the event of malfunctions.

Panel-mounted thermostats operate according to the fluid expansion principle – a microswitch is used as an electrical switching element.

The current safety thermostats STB and STW are listed in data sheet 602026.

Areas of application

- Plastics industry
- Heating industry
- Mechanical engineering
- Baking ovens
- Air-conditioning technology

Special features

- Temperature ranges up to 500 °C with DIN and UL certification, technically up to 650 °C
- Batch size according to customer requirements

Switching functions

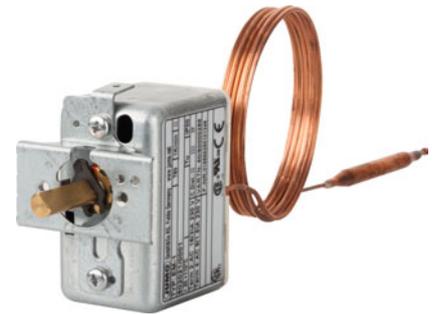
Temperature controller TR and temperature monitor TW

If the temperature on the temperature probe exceeds the setpoint value, the electrical circuit is opened or closed by a microswitch. If the temperature falls below the selected setpoint value (by the switching differential), the microswitch is reset to its initial position.

Temperature limiter TB

If the temperature at the temperature sensor exceeds the set limit value, the electrical circuit is opened or closed by a microswitch.

After the temperature has fallen below the limit value by approx. 10 % of the scale range (approx. 15 % with setpoint setting >350 °C), the microswitch can be unlocked manually.



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Approval marks and certificates

	Designation	DIN
	Testing agency	DIN CERTCO/TÜV Süd
	Certificates/certification numbers	TR777
	Inspection basis	DIN EN 14597
	Valid for	Type 602021/0001 (EM-1 up to 500 °C)
	Designation	DIN
	Testing agency	DIN CERTCO/TÜV Süd
	Certificates/certification numbers	TW778
	Inspection basis	DIN EN 14597
	Valid for	Type 602021/0002 (EM-2), Type 602021/0003 (EM-3 up to 500 °C)
	Designation	DIN
	Testing agency	DIN CERTCO/TÜV Süd
	Certificates/certification numbers	TB780
	Inspection basis	DIN EN 14597
	Valid for	Type 602021/0004 (EM-4), Type 602021/0005 (EM-5 up to 500 °C)
	Designation	DIN
	Testing agency	DIN CERTCO/TÜV Süd
	Certificates/certification numbers	STW(STB)775 S
	Inspection basis	DIN EN 14597
	Valid for	Type 602021/0020 (EM-20), Type 602021/0030 (EM-30 up to 500 °C)
	Designation	DIN
	Testing agency	DIN CERTCO/TÜV Süd
	Certificates/certification numbers	STB782
	Inspection basis	DIN EN 14597
	Valid for	Type 602021/0040 (EM-40), Type 602021/0050 (EM-50 up to 500 °C)
	Designation	B10d
	Testing agency	TÜV Süd
	Certificates/certification numbers	C-T 1370-01/11 ^a
	Inspection basis	DIN EN 14597, DIN EN ISO 13849-1, draft DIN EN 13611 A2
	Valid for	Type 602021/0020 (EM-20), Type 602021/0030 (EM-30), Type 602021/0040 (EM-40), Type 602021/0050 (EM-50)
	Designation	UL
	Testing agency	UL
	Certificates/certification numbers	E66358
	Inspection basis	UL 873, CSA-22.2 No. 24
	Valid for	Type 602021/0001 (EM-1), Type 602021/0002 (EM-2), Type 602021/0003 (EM-3), Type 602021/0004 (EM-4), Type 602021/0005 (EM-5), Type 602021/0020 (EM-20), Type 602021/0030 (EM-30), Type 602021/0040 (EM-40), Type 602021/0044 (EM-44), Type 602021/0050 (EM-50), Type 602021/0133 (EM-133 up to 500 °C)
	Designation	UL
	Testing agency	UL
	Certificates/certification numbers	MH45736
	Inspection basis	UL 353, CSA-22.2 No. 24
Valid for	Type 602021/... (EM-....up to 500 °C)	

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	Designation	PED
	Testing agency	TÜV Süd
	Certificates/certification numbers	Z-IS-TAF-MUC-18-06-2652099-07102504
	Inspection basis	2014/68/EU, DIN EN 14597
	Valid for	Type 602021/0020 (EM-20), Type 602021/0030 (EM-30), Type 602021/0040 (EM-40), Type 602021/0050 (EM-50 up to 500 °C)
	Designation	Railway application
	Testing agency	JUMO
	Certificates/certification numbers	–
	Inspection basis	EN 50155
	Valid for	Type 602021/... (EM-...) with extra code 950

^a For detailed information please refer to safety manual JUMO EM602021.

Russian documentation available upon request.

Types and DIN registry numbers

DIN-tested up to max. 500 °C.

The DIN registration number becomes invalid if protective sleeves are used that do not match the specified combination of material, sensor diameter, and protective tube diameter.

Version	Types	Switching function	DIN registry numbers
1 pole snap-action switches	EM-1	TR	TR777
	EM-2	TW	TW778
	EM-3 ^a	TW	TW778
	EM-4 ^a	TB	TB780
	EM-5	TB	TB780
2 single-pole snap-action switches	EM-13	TR/TW	TR777
	EM-23 ^a	TW/TW	TW778
	EM-33	TW/TW	TW778
	EM-14	TR/TB	TR777
	EM-24	TW/TB	TW778
	EM-44 ^a	TB/TB	TB780
3 single-pole snap-action switches	EMF-54	TB/TB	TB780
	EMF-133	TR/TW/TW	TR777
	EMF-134	TR/TW/TB	TR777
	EMF-233	TW/TW/TW	TW778
	EMF-234	TW/TW/TB	TW778
	EMF-333 ^a	TW/TW/TW	TW778
	EMF-444 ^a	TB/TB/TB	TB780
4 single-pole snap-action switches	EMF-544	TB/TB/TB	TB780
	EMF-1333	TR/TW/TW/TW	TR777
	EMF-2333	TW/TW/TW/TW	TW778
	EMF-3333 ^a	TW/TW/TW/TW	TW778

^a Setpoint value or limit value permanently factory-set according to customer specifications.

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Technical data

Control ranges and probe table

For TR, TW, TB – liquid-filled

Control range/ limit value range °C	Switching differential %	Max. probe tem- perature °C	Max. switching head tempera- ture °C	Max. capillary length in mm	Max. sequence con- tact gap K	Probe length "L", probe Ø "d" in mm	
						Ø 6 (Standard)	Ø 8
-20 to +40	1	50	50	5000	5	245	145
	2.5	50			8	245	145
	5	95			25	138	91
	7	100			50	103	73
0 to 50	1	60	60		5	283	165
	2.5	60			10	283	165
	5	105			25	159	101
	7	110			50	117	80
20 to 90	1	115	80		7	210	127
	2.5	115			14	210	127
	5	140			35	121	82
	7	175			70	91	67
0 to 100	1	125	80	10	157	100	
	2.5	125		20	157	100	
	5	165		50	94	68	
	7	200		100	73	58	
30 to 110	1	135	80	8	188	116	
	2.5	135		16	188	116	
	5	170		40	110	76	
	7	200		80	84	63	
0 to 150	1	173	80	15	113	78	
	2.5	173		30	113	78	
	5	200		75	72	57	
0 to 200	1	230	80	20	113	78	
	2.5	230		40			
50 to 200	1	230	80	15	139	92	
	2.5	230		30			
50 to 250	1	288	80	20	105	70	
	2.5	288		40	105	70	
	5	300		100	64	49	
50 to 300	1	345	80	25	87	61	
	2.5	345		50			

For TR, TW, TB – gas-filled

Control range/ limit value range °C	Switching differential %	Max. probe tem- perature °C	Max. switching head tempera- ture °C	Max. capillary length in mm	Max. sequence con- tact gap K	Probe length "L", probe Ø "d" in mm	
						Ø 6 (Standard)	Ø 8
20 to 400	5	460	80	5000	75	237	137
	10	500			200	127	81
20 to 500	3/5	575	80		48	278	158
	6				95	276	106
	10				250	95	65

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Capillary and temperature probe

Scale limit value	Capillary	Probe
Up to 200 °C	Copper (Cu), mat. no. Cu-DHP, Ø 1.5 mm	Copper (Cu), mat. no. Cu-DHP, hard soldered
Up to 350 °C	Copper (Cu), mat. no. Cu-DHP, Ø 1.5 mm	Stainless steel (CrNi), mat. no. 1.4571, hard soldered
Up to 500 °C	Stainless steel (CrNi), Ø 1.5 mm	Stainless steel (CrNi), mat. no. 1.4571, welded
Up to 350 °C	Stainless steel (CrNi), Ø 1.5 mm	Stainless steel (CrNi), mat. no. 1.4571, welded
Up to 650 °C	Stainless steel (CrNi), Ø 1.5 mm	Stainless steel (CrNi), mat. no. 1.4841, welded
Capillary length	Standard 1,000 mm, max. 5,000 mm	
Bending radius of capillary	Min. 5 mm	

NOTE:

Upon request the capillary length can be increased up to a maximum of 5,000 mm if the allowable temperature on the sensor, capillary, and switching head is not reached.

Please state the actual temperature values occurring at the thermostat.

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Electrical data

Switching element	Snap-action switch with single-pole changeover contact
Max. switching capacity On the NC contact (contact deck 1 to 2) TR, TW, STW (STB), STB, TB On the NO contact (contact deck 1 to 2) TR, TW, STW (STB) STB, TB With switching differential TR, TW 1 %, 3 % TR, TW, 2,5 % TB, STB with microswitches with gold-plating (type suffix 702)	AC 24...400 V +10 %, 0,1...10 A, AC 24...230 V +10 %, 0,1...16 (3)a A, cos φ= 1 (0,6) DC 24...230 V +10 %, 0,25 A AC 24...400 V +10 %, 0,1...2 A, AC 24...230 V +10 %, 0,1...8 (1,5) A, cos φ= 1 (0,6) DC 24...230 V +10 %, 0,25 A AC 24...230 V +10 %, 0,1...2 (1) A, cos φ = 1 (0,6) DC 24...230 V +10 %, 0,25 A, (only with extra code 574) AC 24...230 V +10 %, 0,1...6 (2) A, cos φ = 1 (0,6) DC 24...230 V +10 %, 0,25 A AC/DC 10...24 V, 0,005...0,1 A
Rated surge voltage	2500 V (via the switching contacts 400 V)
Overvoltage category	II
Required fuse protection	Refer to maximum switching capacity
Electrical connection Standard Extra code 699	Tab connector A 6.3 – 0.8 DIN 46244 Screw connection up to 2.5 mm ² cable cross-section (can be retrofitted)

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Operating data

Switching differential in % from the control range/limit value range	Measuring system				
	Liquid-filled		Gas-filled		
	Nominal value	Possible actual value	Nominal value	Possible actual value	
Switching function TR, TW, TB	2.5	Approx. 2.5 to 3.5	5	Approx. 5 to 11	Standard
	5	Approx. 5 to 6	6	Approx. 6 to 14	Upon request
	7	Approx. 7 to 8	10	Approx. 10 to 16	Upon request
	1	Approx. 1 to 2	3	Approx. 2.5 to 4	Extra cost

Sequence contact gap in multi-pole versions	Switching differential	Sequence contact gap from the scale range		Switching point accuracy of the sequential gaps from the scale range
		Minimum	Maximum	
	1 %	1 %	As per control range table	≤ 1 %
2.5 %	1 %	≤ 1 %		
3 %, 5 %	2 %	≤ 1 %		
6 %, 7 %, 10 %	3 %	≤ 1 %		
The sequence contact gap is specified in K relative to the setpoint of contact path I. (The contact track no. is stamped on the back of the housing par.)				
Prefix - = switching before reaching the setpoint value Prefix + = switching after reaching the setpoint value For the synchroized version, specify "0" as the sequence contact gap.				

Switching point accuracy in % of control range/limit value range	Switching differential		In the upper third of the scale or limit value
	Liquid-filled	Gas-filled	
Switching function TR	1 %, 2.5 %	-	±1.5 %
	5 %	3 %, 5 %	±3 %
	7 %	6 %, 10 %	±4 %
TW	1 %, 2.5 %	-	±1.5 %
	5 %	3 %, 5 %	±3 %
	7 %	6 %, 10 %	±4 %
TB	-	-	+0 % -5 %

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Medium ambient temperature influence	Deviation of the ambient temperature at the switching head and/or capillary from the 22 °C calibration ambient temperature produces a switching point offset. Higher ambient temperature = low switching point Lower ambient temperature = higher switching point										
For temperatures with scale limit value/ limit value Switching differential in % Ambient temperature influence on the switching head in %/K Ambient temperature influence on the cap- illary in %/m	TR, TW, TB				STW, STB		TR, TW, TB			STW, STB	
	< 200 °C				≥ 200 °C ≤ 350 °C			≥ 400 °C ≤ 500 °C			
	1/2.5	5	7	7/-	1/2.5	5	7/-	3/5	6	10	
	0.15	0.26	0.34	0.43	0.12	0.21	0.35	0.12	0.17	0.24	
	0,05 · K · m		0,09 · K · m		0,09 · K · m		0,07 · K · m		0,05 · K · m		
Temperature compensation (TK)	For detailed information see diagram.										
Temperatures											
Admissible storage temperature	-50 bis +50 °C										
Admissible ambient temperature for use	Max. 80 °C										
Nominal position (NL)	Any										
Operating medium	Water, oil, air, superheated steam										
Time constant $t_{0,632}$											
In water	≤ 45 s										
In oil	≤ 60 s										
In air or superheated steam	≤ 120 s										
Mode of operation	According to DIN EN 14597 (DIN EN 60730-2-9)										
TR, TW	2 BL										
TB	2 BFHLPV										
STW (STB)	2 BKLNVP										
STB	2 BFHKLNPV										

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Housing

Material	Galvanized sheet steel
Fastening	
Standard	With 2 M3 screws, spaced 22 mm
Extra code 704	Switching head mounting with 2 M4 screws, spaced 28 mm
Extra code 705	Switching head mounting with 2 M3 screws, spaced 33 mm
Extra code 710	Central mounting M10 × 1 with acorn nut (for TB and STB only)
Setpoint value adjustment	
TR	Switching point adjustable from outside with rotary knob.
TW, TB, STB, STW (STB)	Switching point adjustable with screwdriver.
Type EM-3, EM-4, EM-33, EM-44, EM-444, EM-3333	Permanently factory-set
Setpoint adjuster	See data sheet 606715
Scale range	Standard 250°∠ (for STB and STW (STB)), see table for control ranges and probes
Protection type	IP00 according to EN 60529
Weight	Approx. 300 g

Process connection

Material	
Protection tube up to 150 °C	CuZn (standard)
Protection tube above 150 °C	CrNi
Capillary	Plain cylindrical probe (standard) Screw-in protection tube (upon request) Screw-in sleeve with screw-in spigot G 1/2, form A, according to DIN 3852/2 and clamping piece with fixing screw for securing the probe
Insertion length S	
Standard	100, 120, 150, 200, or 300 mm (other lengths upon request)
Protection tube Ø	D = 8 mm, D = 10 mm

For further process connections and protection tubes see data sheet 606710.

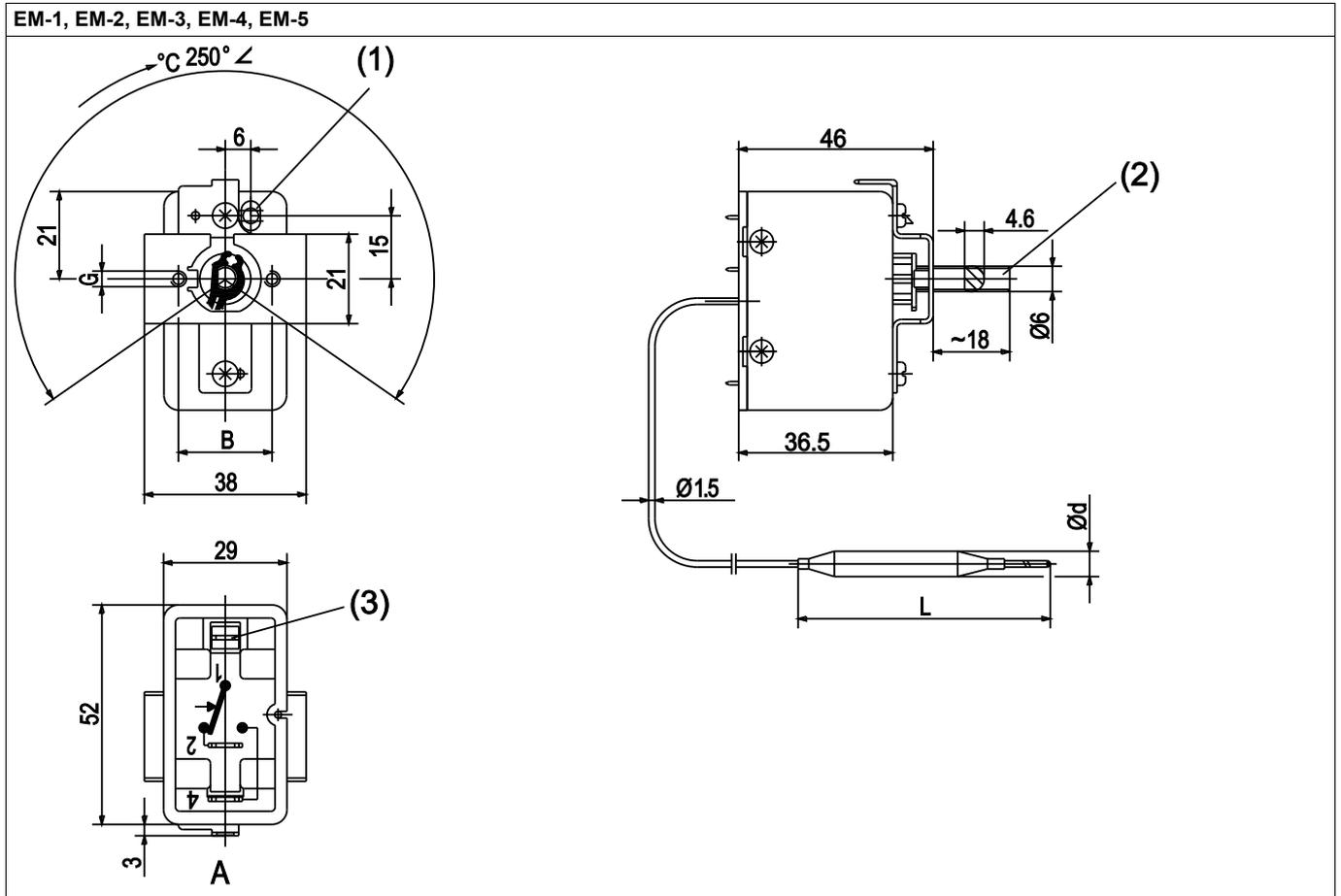
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Dimensions



- 1 Restart knob only for EM-4 and EM-5
- 2 Not applicable for EM-2, EM-3, EM-4, EM-5
- 3 Tab connector DIN 46244-A6,3-0,8
- A Rear view

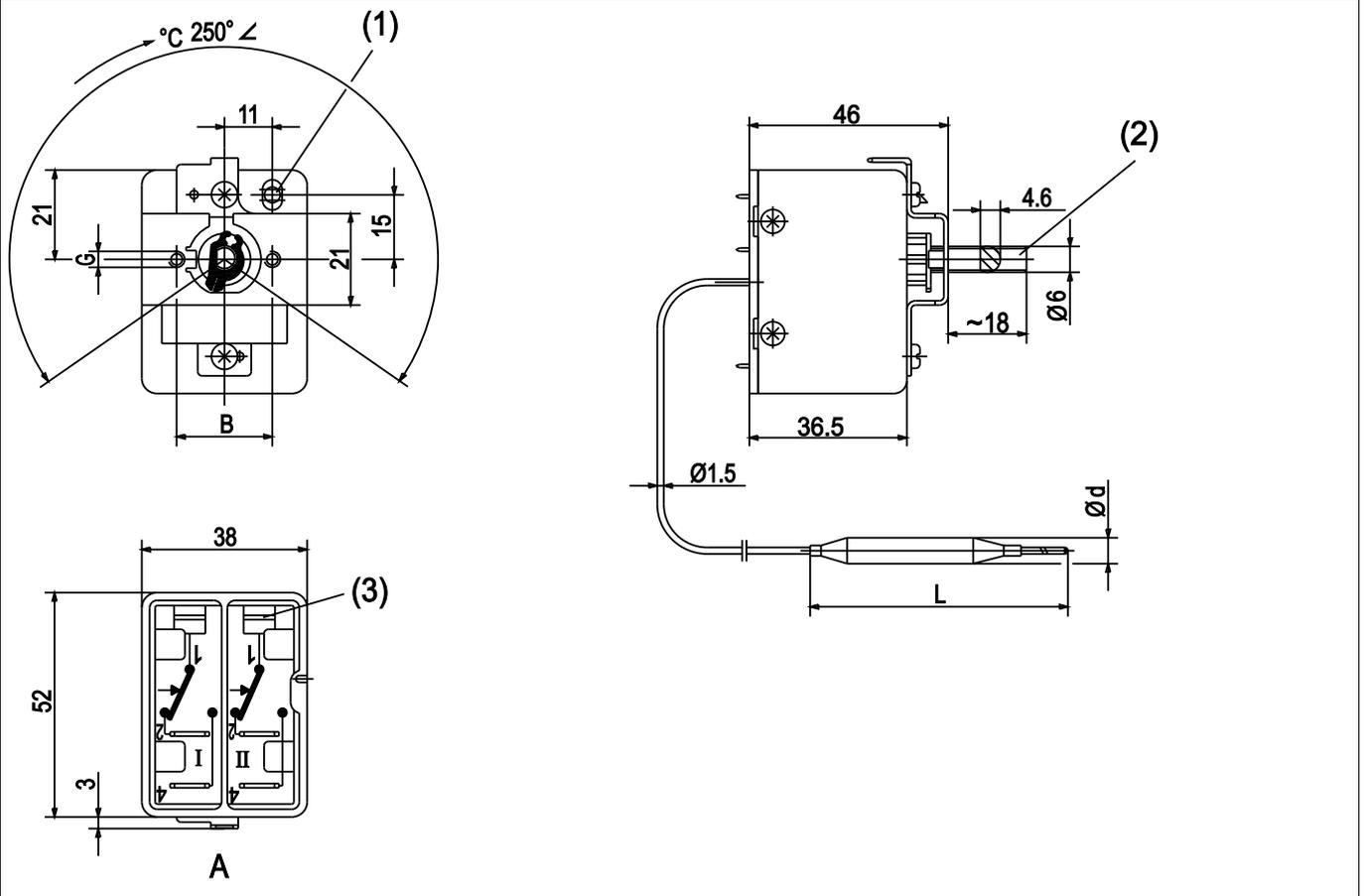
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EM-13, EM-14, EM-23, EM-24, EM-33, EM-44, EM-54



- 1 Restart knob only for EM-14, EM-24, EM-44, EM-50 and EM-54
- 2 Not applicable for EM-23, EM-24, EM-33, EM-44 and EM-54
- 3 Tab connector DIN 46244-A6,3-0,8
- A Rear view

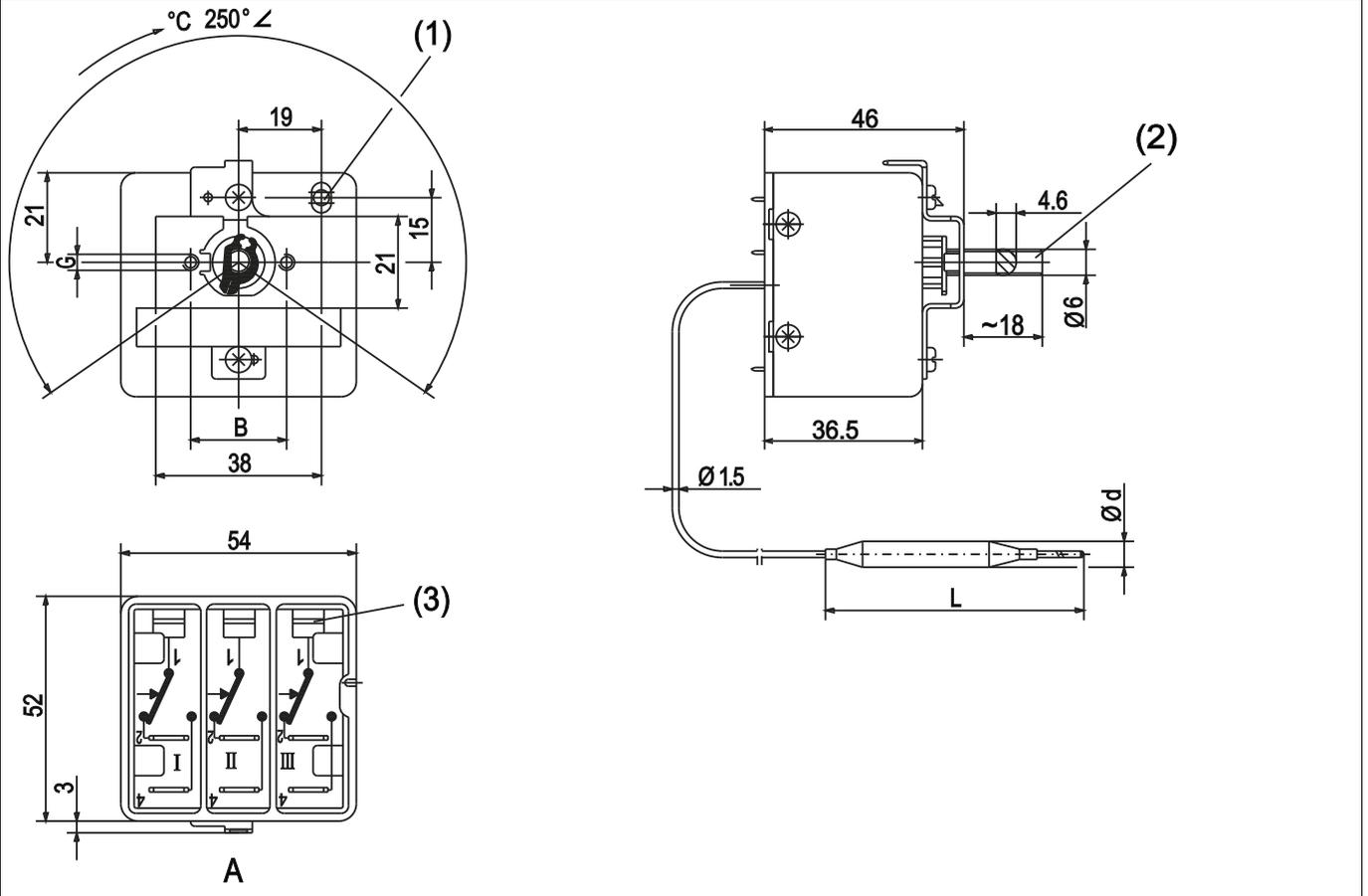
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EM-133, EM-134, EM-233, EM-234, EM-333, EM-444, EM-544



- 1 Restart knob only for EM-134, EM-234, EM-444, EM-544
- 2 Not applicable for EM-233, EM-234, EM-333, EM-444, EM-544
- 3 Tab connector DIN 46244-A6,3-0,8
- A Rear view

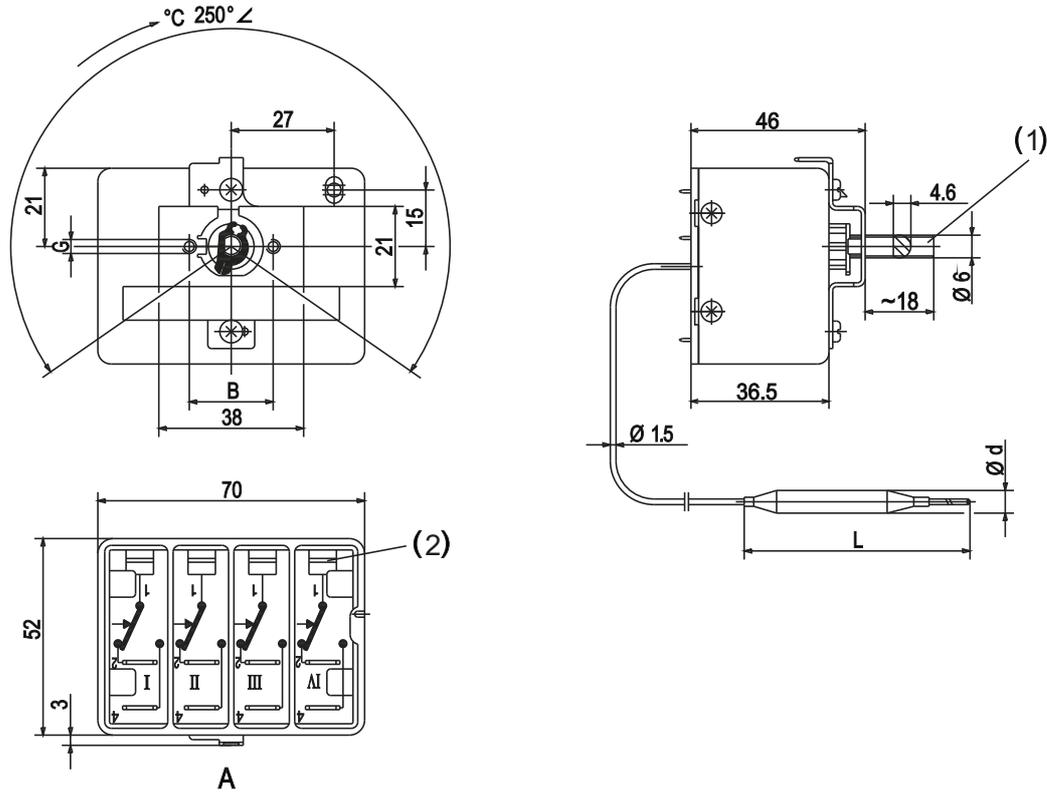
JUMO GmbH & Co. KG
 Delivery address: Mackenrodtstraße 14
 36039 Fulda, Germany
 Postal address: 36035 Fulda, Germany
 Phone: +49 661 6003-0
 Fax: +49 661 6003-607
 Email: mail@jumo.net
 Internet: www.jumo.net

JUMO UK LTD
 JUMO House
 Temple Bank, Riverway
 Harlow, Essex, CM20 2DY, UK
 Phone: +44 1279 63 55 33
 Fax: +44 1279 62 50 29
 Email: sales@jumo.co.uk
 Internet: www.jumo.co.uk

JUMO Process Control, Inc.
 6724 Joy Road
 East Syracuse, NY 13057, USA
 Phone: +1 315 437 5866
 Fax: +1 315 437 5860
 Email: info.us@jumo.net
 Internet: www.jumousa.com



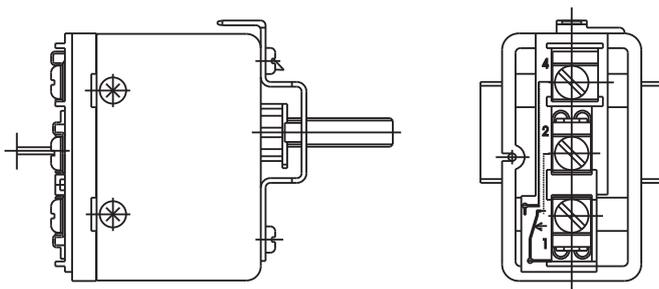
EM-1333, EM-2333, EM-3333



- 1 Not applicable for EM-2333, EM-3333
- 2 Tab connector DIN 46244-A6,3-0,8
- A Rear view

	B	G
Standard	22	M3
Extra code 704	28	M4
Extra code 705	33	M3

Screw connection EM-1, extra code 699

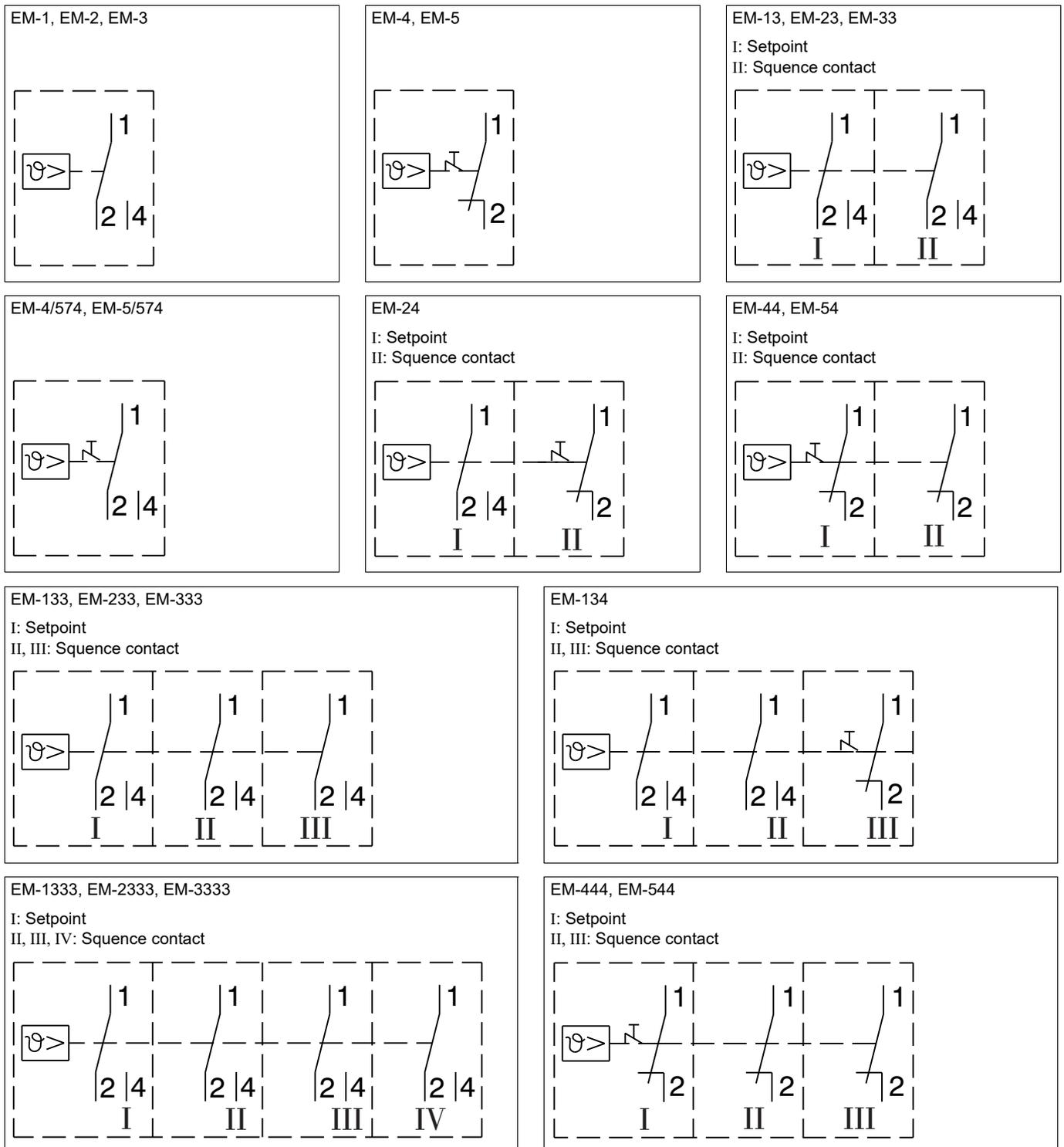




Connection diagram

The connection diagram in the data sheet provides information on product selection.

For the electrical connection, only use the installation instructions or the operating manual.



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Temperature compensation

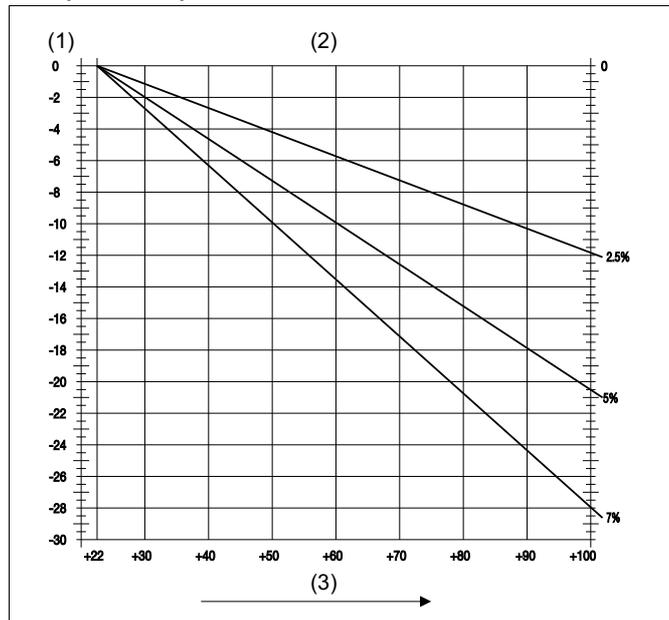
Any change in the temperature at the switching head from the 22 °C calibration ambient temperature will produce a deviation of the switching point. For ambient temperatures that fluctuate strongly, it is advisable to use thermostats with temperature compensation (TK; extra code 707).

The switching point deviation depends on the ambient temperature at the switching head and takes the switching differential into consideration. **The temperature influence on the capillary is not yet taken into account and can result in an additional error.**

Version **without** temperature compensation

Scale limit value < 200 °C

EM 1-pole, EM 2-pole

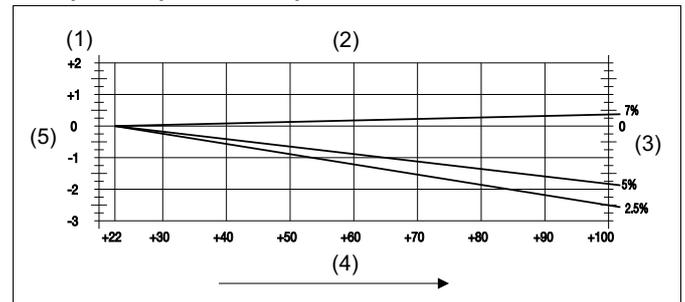


- 1 % of the control range
- 2 **Without temperature compensation**
- 3 Ambient temperature [°C]

Version **with** temperature compensation

Scale limit value < 200 °C

EM 1-pole temperature compensation TK



Note:

Additional graphs of the temperature compensation TK with higher scale limit values and for the EM 2-pole version are available upon request.

- 1 % of the control range
- 2 **With temperature compensation**
- 3 Switching differential
- 4 Ambient temperature [°C]
- 5 Switching point deviation

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Order details

	(1) Basic type	
602021	JUMO Panel-Mounted Thermostats EM	
	(2) Basic type extension	
0001	EM-1	Temperature controller (TR), 1-pole
0002	EM-2	Temperature monitor (TW), 1-pole
0003	EM-3	Temperature monitor (TW), permanently set, 1-pole
0004	EM-4	Temperature limiter (TB), permanently set, 1-pole
0005	EM-5	Temperature limiter (TB), 1-pole
0013	EM-13	Temperature controller (TR/TW), 2-pole
0014	EM-14	Temperature controller (TR/TB), 2-pole
0023	EM-23	Temperature monitor (TW/TW), 2-pole
0024	EM-24	Temperature monitor (TW/TB), 2-pole
0033	EM-33	Temperature monitor (TW/TW), 2-pole, permanently set
0044	EM-44	Temperature limiter (TB/TB), 2-pole, permanently set
0054	EM-54	Temperature limiter (TB/TB), 2-pole
0133	EM-133	Temperature controller (TR/TW/TW), 3-pole
0134	EM-134	Temperature controller (TR/TW/TB), 3-pole
0233	EM-233	Temperature monitor (TW/TW/TW), 3-pole
0333	EM-333	Temperature monitor (TW/TW/TW), 3-pole, permanently set
0444	EM-444	Temperature limiter (TB/TB/TB), 3-pole, permanently set
0544	EM-544	Temperature limiter (TB/TB/TB), 3-pole
1333	EM-1333	Temperature controller (TR/TW/TW/TW), 4-pole
2333	EM-2333	Temperature monitor (TW/TW/TW/TW), 4-pole
3333	EM-3333	Temperature monitor (TW/TW/TW), 4-pole, permanently set
	(3) Control range 1	
000	With permanently set limit value	
013	-20 to +40 °C	
021	0 to 50 °C	
025	0 to 100 °C	
027	0 to 150 °C	
028	0 to 200 °C	
041	20 to 90 °C	
045	20 to 400 °C	
046	20 to 500 °C	
052	30 to 110 °C	
062	50 to 200 °C	
063	50 to 250 °C	
064	50 to 300 °C	
093	230 to 650 °C (without DIN and UL certification)	
	(4) Limit value	
000	With adjustable control range	
100	100 °C	
95	95 °C	

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	(5) Switching differential
00	None
01	10 %
10	1 %
25	2.5 %
30	3 %
50	5 %
60	6 %
70	7 %
	(6) Capillary length
0	None
1000	1000 mm
2000	2000 mm
3000	3000 mm
4000	4000 mm
5000	5000 mm
	(7) Capillary material
20	CrNi (stainless steel 1.4571)
40	Copper (Cu)
	(8) Process connection
10	Plain cylindrical probe
20	Screw-in thermowell
	(9) Process connection
00	None
13	G 1/2
	(10) Process connection material
00	None
20	CrNi (stainless steel)
46	CuZn (brass)
	(11) Insertion length
000	None
100	100 mm
120	120 mm
150	150 mm
200	200 mm
300	300 mm
	(12) Immersion tube diameter
00	None
10	10 mm
8	8 mm
	(13) Probe diameter
6	6 mm
8	8 mm
	(14) Extra codes
000	None
025	Central mounting M10 × 1, metall
574	Microswitch with N/C contact, restart lock, and additional signal contact (only for STB)

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Stock versions

Order code	Control range (TW)	Capillary length	Probe-Ø	Part no.
602021/0001-013-000-25-2000-40-10-00-00-000-00-6/000	-20 to +40 °C	2000 mm	6 mm	60001231
602021/0001-021-000-25-1000-40-10-00-00-000-00-6/000	0 to 50 °C	1000 mm	6 mm	60000492
602021/0001-041-000-70-1000-40-10-00-00-000-00-6/000	20 to 90 °C	1000 mm	6 mm	60000493
602021/0001-025-000-25-1000-40-10-00-00-000-00-6/000	0 to 100 °C	1000 mm	6 mm	60000494
602021/0001-025-000-25-2000-40-10-00-00-000-00-6/000	0 to 100 °C	2000 mm	6 mm	60000219
602021/0001-052-000-70-1000-40-10-00-00-000-00-6/000	30 to 110 °C	1000 mm	6 mm	60000285
602021/0001-027-000-25-1000-40-10-00-00-000-00-6/000	0 to 150 °C	1000 mm	6 mm	60000921
602021/0001-027-000-25-2000-40-10-00-00-000-00-6/000	0 to 150 °C	2000 mm	6 mm	60000217
602021/0001-028-000-25-1000-40-10-00-00-000-00-6/000	0 to 200 °C	1000 mm	6 mm	60001141
602021/0001-028-000-25-2000-40-10-00-00-000-00-6/000	0 to 200 °C	2000 mm	6 mm	60000220
602021/0001-064-000-25-1000-40-10-00-00-000-00-6/000	50 to 300 °C	1000 mm	6 mm	60000495
602021/0001-064-000-25-2000-40-10-00-00-000-00-6/000	50 to 300 °C	2000 mm	6 mm	60000923
602021/0001-046-000-50-1000-20-10-00-00-000-00-8/000	20 to 500 °C	1000 mm	8 mm	60002083
602021/0002-021-000-25-1000-40-10-00-00-000-00-6/000	0 to 50 °C	1000 mm	6 mm	60000214
602021/0002-027-000-25-1000-40-10-00-00-000-00-6/000	0 to 150 °C	1000 mm	6 mm	60000497
602021/0002-027-000-25-2000-40-10-00-00-000-00-6/000	0 to 150 °C	2000 mm	6 mm	60000213
602021/0002-028-000-25-1000-40-10-00-00-000-00-6/000	0 to 200 °C	1000 mm	6 mm	60001263
602021/0002-064-000-25-1000-40-10-00-00-000-00-6/000	50 to 300 °C	1000 mm	6 mm	60001380
602021/0002-046-000-50-1000-20-10-00-00-000-00-8/000	20 to 500 °C	1000 mm	8 mm	60002084
602021/0002-046-000-50-2000-20-10-00-00-000-00-8/000	20 to 500 °C	2000 mm	8 mm	60002112
602021/0005-027-000-25-1000-40-10-00-00-000-00-6/000	0 to 150 °C	1000 mm	6 mm	60000924
602021/0005-028-000-25-1000-40-10-00-00-000-00-6/000	0 to 200 °C	1000 mm	6 mm	60000929
602021/0005-064-000-25-1000-40-10-00-00-000-00-6/000	50 to 300 °C	1000 mm	6 mm	60000211
602021/0005-046-000-50-1000-20-10-00-00-000-00-8/000	20 to 500 °C	1000 mm	8 mm	60002085