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Panel-Mounted Thermostats, EM Series

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

Special features

- Available with 1-, 2-, 3- or 4-pole jump-switches
- Approved according to the latest standards

Brief description

Thermostats control and monitor thermal processes. The devices of the EM series are available as temperature controllers TR, temperature monitors TW, temperature limiters TB, safety temperature monitors STW (STB), and safety temperature limiter STB. In the event of a malfunction, the STB switches the monitored machine to a safe operating status.

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

Switching function

Temperature controller TR and safety temperature monitor STW

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

Restart lock for temperature limiter TB and safety temperature limiter STB

If the temperature on the temperature probe exceeds the set limit value, the electrical circuit is opened and the microswitch is mechanically locked.

The microswitch can be manually unlocked once the temperature has dropped by approx. 10 % of the scale range (approx. 15 % with a limit value setting > 350 °C).

For limit values exceeding 120 °C, the limit value set in the STB must be secured against incorrect adjustment (e.g. by a seal).

Self-monitoring for the safety temperature limiter STB and safety temperature monitor STW (STB)

If the measuring system is destroyed (i.e. if the expansion fluid leaks), the pressure in the diaphragm of the STB and STW (STB) drops and permanently opens the electrical circuit. Unlocking is then no longer possible.

The electrical circuit 1-2 opens when the probe of STW (STB) and STB cools down to the negative temperature range, but it closes again automatically if the temperature rises.

Use of the safety temperature monitor STW as a safety temperature limiter STB

The circuitry used with the thermostat must comply with DIN EN 14597 and VDE 0631.



Approvals and approval marks (see Technical data)



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Types and DIN registry numbers

DIN-tested up to max. 500 °C.

The DIN registry no. will become null and void if thermowells are used that are not specified in our data sheet 606710.

Version	Types	Switching function	DIN registry numbers
1 pole snap-action switches	EM-1 EM-2 EM-3 ^a EM-4 ^a EM-5	TR TW TW TB TB	TR 777 TW 778 TW 778 TB 780 TB 780
2 single-pole snap-action switches	EMF-13 EMF-23 EMF-33 ^a EMF-14 EMF-24 EMF-44 ^a EMF-54	TR/TW TW/TW TW/TW TR/TB TW/TB TB/TB TB/TB	TR 777 TW 778 TW 778 TR 777 TW 778 TB 780 TB 780
3 single-pole snap-action switches	EMF-133 EMF-134 EMF-233 EMF-234 EMF-333 ^a EMF-444 ^a EMF-544	TR/TW/TW TR/TW/TB TW/TW/TW TW/TW/TB TW/TW/TW TB/TB/TB TB/TB/TB	TR 777 TR 777 TW 778 TW 778 TW 778 TB 780 TB 780
4 single-pole snap-action switches	EMF-1333 EMF-2333 EMF-3333 ^a	TR/TW/TW/TW TW/TW/TW/TW TW/TW/TW/TW	TR 777 TW 778 TW 778
Fail-safe version	EM-40 ^a EM-50 EM-20 EM-30 ^a	STB STB STW (STB) STW (STB)	STB 782 STB 782 STW (STB) 775 S STW (STB) 775 S

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

Technical data

Table of control ranges and probes for TR, TW, TB – liquid-filled

Control range/ limit value range °C	Switching differential %	Max. probe temperature °C	Max. switching head temperature °C	Max. capillary length in mm	Max. sequence contact gap K	Probe length "L", probe Ø "d" in mm	
						Ø 6 (Standard)	Ø 8
-20 to 40	1	50	50	5,000	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			

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Table of control ranges and probes for TR, TW, TB – gas-filled

Control range/ limit value range °C	Switching differential %	Max. probe temperature °C	Max. switching head temperature °C	Max. capillary length in mm	Max. sequence contact gap K	Probe length "L", probe Ø "d" in mm	
						Ø 6 (Standard)	Ø 8
20 to 400	6	460	80	5,000	75	237	137
	10	500			200	127	81
20 to 500	3/5	575	80	1,000	48	278	158
	6				95	176	106
	10				250	95	65

Control ranges and temperature probes for STB and STW (STB) – liquid-filled

Setting range °C	Scale range °C	Max. probe temperature °C	Max. switching head temperature °C	Max. capillary length in mm	Limit value tolerance K	Probe length "L", probe Ø "d" in mm	
						Ø 6 (Standard)	Ø 8
75 to 100	78	125	80	5,000	+0 -7	84	63
85 to 110	78	135			+0 -7		
120 to 150	77	173			+0 -9	80	57
160 to 200	79	230			+0 -12	64	49
210 to 250	71	288			+0 -13	61	47
250 to 300	79	345			+0 -16	55	-

Control ranges and temperature probes for STB and STW (STB) – gas-filled

Setting range °C	Scale range °C	Max. probe temperature °C	Max. switching head temperature °C	Max. capillary length in mm	Limit value tolerance K	Probe length "L", probe Ø "d" in mm	
						Ø 6 (Standard)	Ø 8
300 to 400	70	460	80	3,000	+0 -23	148	92
350 to 500	72	575			+0 -29	127	81

When the switching points are permanently factory-set, the deactivation value must be specified in addition to the control range (e.g. control range 80 to 100 °C, permanently set to 95 °C).

Capillary and temperature probes

Type	Scale limit value	Capillary	Temperature probe	Notes
EM-..	Up to 200 °C	Copper (Cu) Ø 1.5 mm Material no. Cu-DHP	Copper (Cu) Material no. Cu-DHP Hard soldered	-
	Up to 350 °C	Copper (Cu) Ø 1.5 mm Material no. Cu-DHP	Stainless steel (CrNi) Material no. 1.4571 Hard soldered	-
	Up to 500 °C	Stainless steel (CrNi) Ø 1.5 mm	Stainless steel (CrNi) Material no. 1.4571 Welded	-
	Up to 350 °C	Stainless steel (CrNi) Ø 1.5 mm	Stainless steel (CrNi) Material no. 1.4571 Welded	Available at extra cost
Capillary length	Standard: 1,000 mm, max. 5,000 mm			
Min. bending radius of capillary	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 let us know the actual temperature values to which the thermostat is exposed.

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Electrical data

Switching element 1, 2, 3, or 4 single-pole snap-action switches	EM.-1... EM-20 EM.-2... EM-30 EM.-3...	EM.-4... EM-40 EM.-5... EM-50	EM.-4.../U EM-40/U EM.-5.../U EM-50/U
	Microswitch with changeover contact	Microswitch with N/C contact and restart lock	Microswitch with N/C contact, restart lock, and additional signal contact
Maximum contact rating	Switching function Switching differential	N/C contact, terminal 2	N/O contact, terminal 4
	TR, TW, STW (STB) 2.5 %, 5 %, 6 %, 7 %, 10 %	AC 230 V +10 % 16 (3) A, cos φ = 1 (0.6) DC 230 V +10 %, 0.25 A	AC 230 V +10 % 8 (1.5) A, cos φ = 1 (0.6) DC 230 V +10 %, 0.25 A
	TB, STB		AC 230 V +10 % 2 (1) A, cos φ = 1 (0.6) DC 230 V +10 %, 0.25 A
	TR, TW 1 %, 3 %	AC 230 V +10 %, 6 (2) A, cos φ = 1 (0.6) DC 230 V +10 %, 0.25 A	
	TR, TW 2.5 %	Microswitch with gold plating, extra code "702" AC/DC 24 V, 0.1 A	
Contact reliability	To ensure the greatest possible switching reliability we recommend a minimum load of: For silver contacts: AC/DC = 24 V, 100 mA For gold-plated contacts (abbreviation "702"): AC/DC = 10 V, 5 mA		
Rating surge voltage	2500 V (via the switching contacts 400 V)		
Overtoltage category	II		
Required fuse rating	See maximum switching capacity		
Electrical connection	Standard	Tab connector A 6.3 × 0.8 DIN 46244	
	Extra code 699	Screw connection up to 2.5 mm ² conductor cross section (available at extra cost), also suitable for retrofitting.	

Operating data

Switching differential in % from the control range/limit value range	Switching function	With liquid-filled measuring system		
		Rated value	Possible actual value	
	TR, TW	2.5	Approx. 2.5 to 3.5	Standard
		5	Approx. 5 to 6	Upon request
		7	Approx. 7 to 8	Upon request
		1	Approx. 1 to 2	Extra cost
	With gas-filled measuring system			
	STW (STB)	5	Approx. 5 to 11	Standard
		6	Approx. 6 to 14	Upon request
		10	Approx. 10 to 16	Upon request
3		Approx. 2.5 to 4	Extra cost	
With liquid-filled measuring system				
STW (STB)	5	Approx. 5 to 7	Standard	
	With gas-filled measuring system			
STW (STB)	6	Approx. 6 to 16	Standard	
	With switching differential	Sequence contact gap relative to scale range		
Sequence contact gap on multi-pole version	Minimum	Maximum	Switching point accuracy of the sequence contact gaps from the scale range	
	1 %	1 %	According to control range table	
	2.5 %	1 %	≤ 1 %	
	3 %, 5 %	2 %	≤ 1 %	
6 %, 7 %, 10 %	3 %	< 2 %		
< 3 %				
The spacing of the additional contacts can be specified in °C in relation to the setpoint of contact 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 synchronized version, specify "0" as the sequence contact gap.				

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Switching point accuracy in % of control rang/limit value range	Switching function	Switching differential		In the upper third of the scale or limit value
		Liquid-filled	Gas-filled	
	TR	1 %, 2.5 % 5 % 7 %	- 3 %, 5 % 6 %, 10 %	±1.5 % ±3 % ±4 %
	TW	1 %, 2.5 % 5 % 7 %	- 3 %, 5 % 6 %, 10 %	±1.5 % ±3 % ±4 %
	TB	-	-	0 % -5 %
STB, STW (STB)		See table for control ranges and probes on page 3.		

Mid ambient temperature influence For temperatures with scale limit value/limit value Switching differential in % Ambient temperature influence on the switching head in %/°C Ambient temperature influence on the capillary in %/m	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 temperatures = lower switching point Lower ambient temperature = higher switching point									
	TR, TW, TB		STW, STB		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 × °C × m		0.09 × °C × m		0.04 × °C × m		0.07 × °C × m		0.05 × °C × m		
Temperature compensation (TK)	For detailed information see diagram on page 9									
Temperatures	Allowable storage temperature: -50 to +50 °C					Allowable ambient temperature for use: Maximum 80 °C				
Nominal position (NL)	Any									

Housing

Housing: Galvanized sheet steel	Standard mounting	With 2 M3 screws, spaced 22 mm
	Extra code 704	With 2 M4 screws, spaced 28 mm
	Extra code 705	With 2 M3 screws, spaced 33 mm
	Extra code 710	Central mounting M10 × 1 with acorn nut (only for TB and STB)
Setpoint value setting	TR: Switching point adjustable from outside with rotary knob	TW, TB, STB, STW (STB): Switching point adjustable with screwdriver
	Types EM-3, EM-4, EM-33, EM-44, EM-444, EM-3333, EM-30, EM-40 Permanently set at the factory to customer requirements	
Setpoint adjuster	See data sheet 606715	
Scale range	Standard: 250° ∠ (for STB and STW (STB) see table for control ranges and probes on page 3)	
Protection type	IP00 according to EN 60529	
Weight	Approx. 0.3 kg	

Process connection

EM series with capillary	Plain cylindrical probe "10" (standard)	
	Screw-in protection tube "20" (upon request) Screw-in sleeve with screw-in spigot G 1/2 form A as per DIN 3852/2 and clamping piece with fixing screw for securing the probe	
Material	Protection tube	Up to 150 °C CuZn as standard Above 150 °C CrNi
Insertion length S	Standard lengths: 100, 120, 150, 200, or 300 mm (different 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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Approvals and approval marks

DIN Testing agency Certificates/certification numbers Inspection basis Valid for	DIN CERTCO/TÜV Süd TR777 DIN EN 14597 EM-1
DIN Testing agency Certificates/certification numbers Inspection basis Valid for	DIN CERTCO/TÜV Süd TW778 DIN EN 14597 EM-2, EM-3
DIN Testing agency Certificates/certification numbers Inspection basis Valid for	DIN CERTCO/TÜV Süd TB780 DIN EN 14597 EM-4, EM-5
DIN Testing agency Certificates/certification numbers Inspection basis Valid for	DIN CERTCO/TÜV Süd STW(STB)775 S DIN EN 14597 EM-20, EM-30
DIN Testing agency Certificates/certification numbers Inspection basis Valid for	DIN CERTCO/TÜV Süd STB782 DIN EN 14597 EM-40, EM-50
DIN Testing agency Certificates/certification numbers Inspection basis Valid for	TÜV Süd B _{10d} = 250.000 ^a DIN EN ISO 13849-1 EM-20, EM-30, EM-40, EM-50
PED Testing agency Certificates/certification numbers Inspection basis Valid for	TÜV Süd Z-IS-TAF-MUC-18-06-2652099-07102504 2014/68/EU EM-20, EM-30, EM-40, EM-50
UL Testing agency Certificates/certification numbers Inspection basis Valid for	UL E66358 UL 873, CSA-22.2 No. 24 EM-...
UL Testing agency Certificates/certification numbers Inspection basis Valid for	UL MH45736 UL 353, CSA-22.2 No. 24 EM-4, EM-5, EM-40, EM-50, EM-80, EM-14, EM-24, EM-44, EM-54, EM-134, EM-234, EM-444, EM-544, EM-1334, EM-2334, EM-4444, EM-5444

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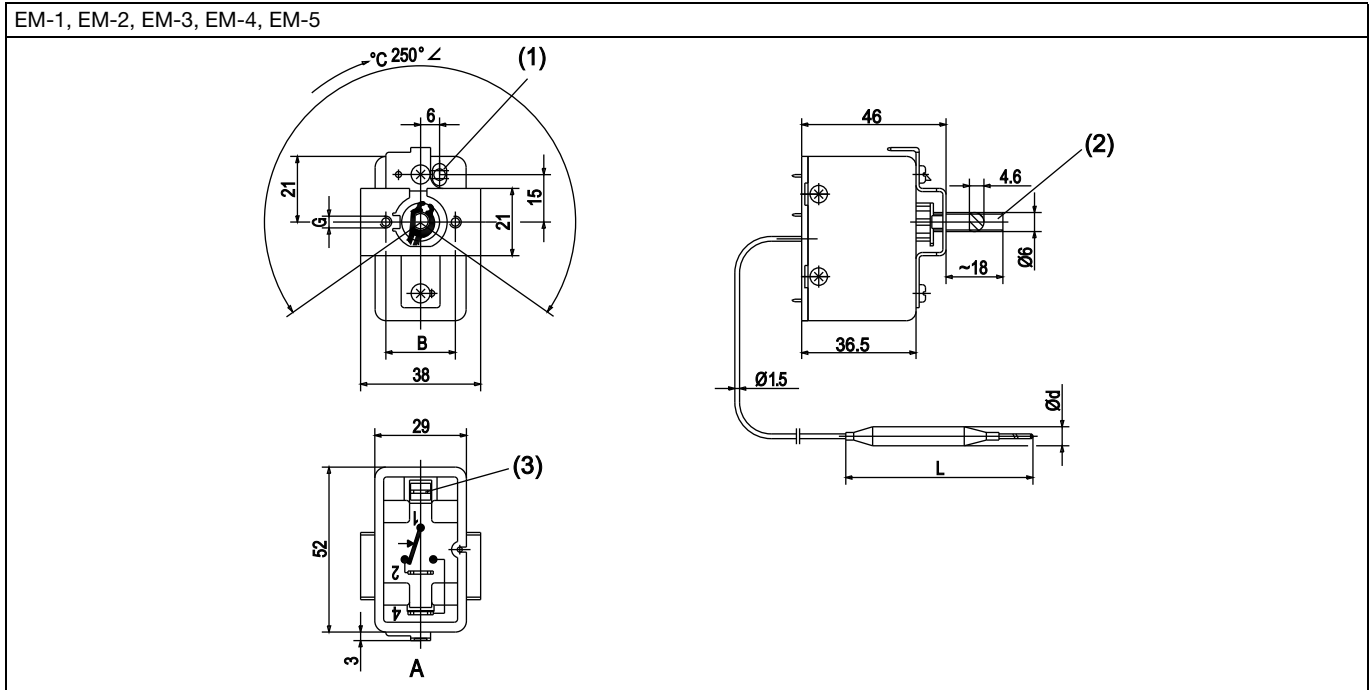


EAC ^b	
Testing agency	Gost Norm AG
Certificates/certification numbers	TC RU C-DE.AB98.B.00348
Inspection basis	Technical rules of the customs union Russia/Belarus/Kazakhstan
Valid for	EM-...
Railway application	
Testing agency	JUMO
Certificates/certification numbers	-
Inspection basis	EN 50155
Valid for	EM-... with extra code 950

^a For detailed information please refer to safety manual JUMO EM 602021, 602026

^b Russian documentation upon request.

Dimensions



- (1) Restart knob only with abbreviation 4 and 5
- (2) Not applicable with abbreviation 2, 3, 4, 5
- (3) Tab connector DIN 46244-A6,3-0,8

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

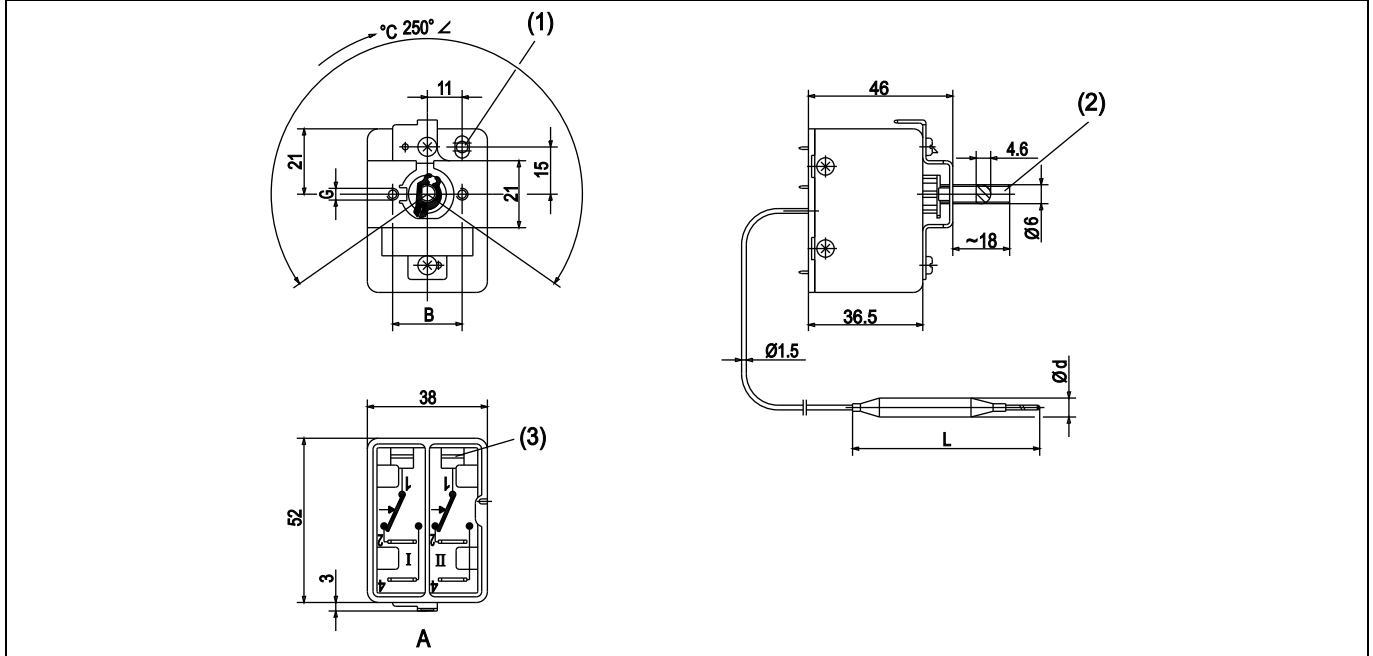
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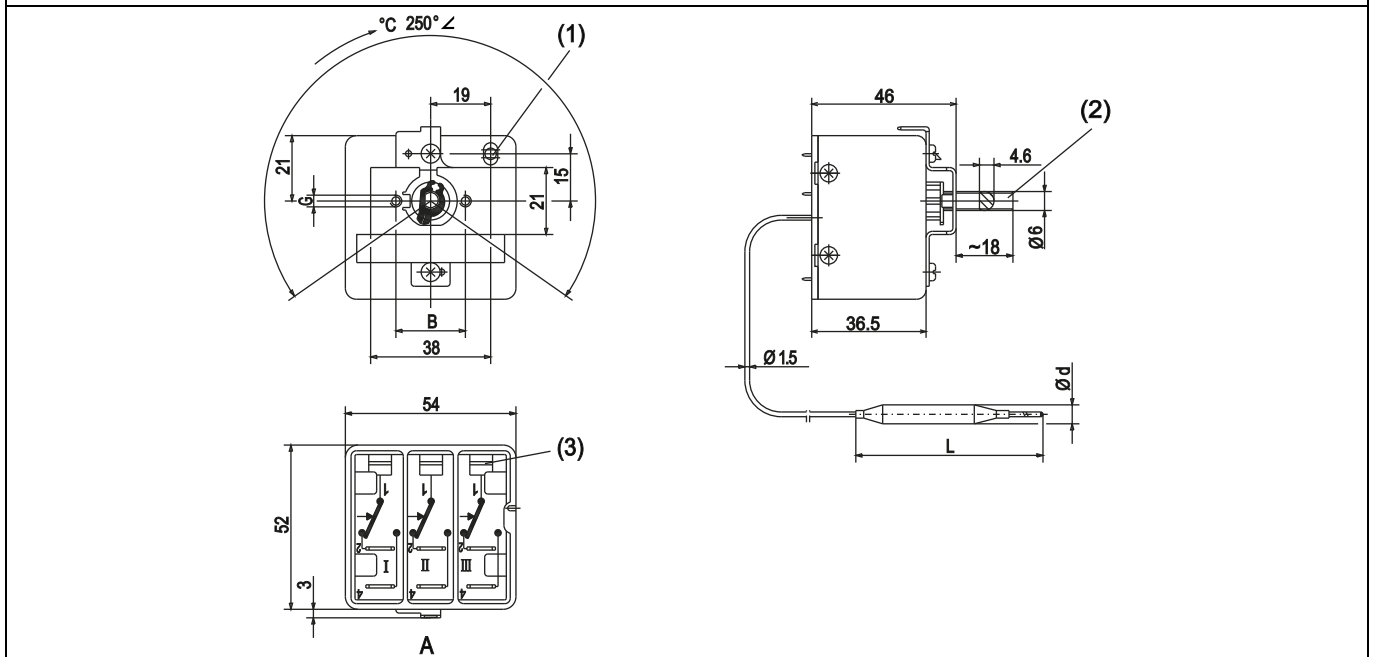
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- (1) Restart knob only with abbreviation 40, 44, 50 and 5
- (2) Not applicable with abbreviation 2, 3, 4, 5, 20, 30, 40 and 50
- (3) Tab connector DIN 46244-A6,3-0,8

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

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



- (1) Restart knob only with abbreviation 444, 544
- (2) Not applicable with abbreviation 2, 3, 4, 5
- (3) Tab connector DIN 46244-A6,3-0,8

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

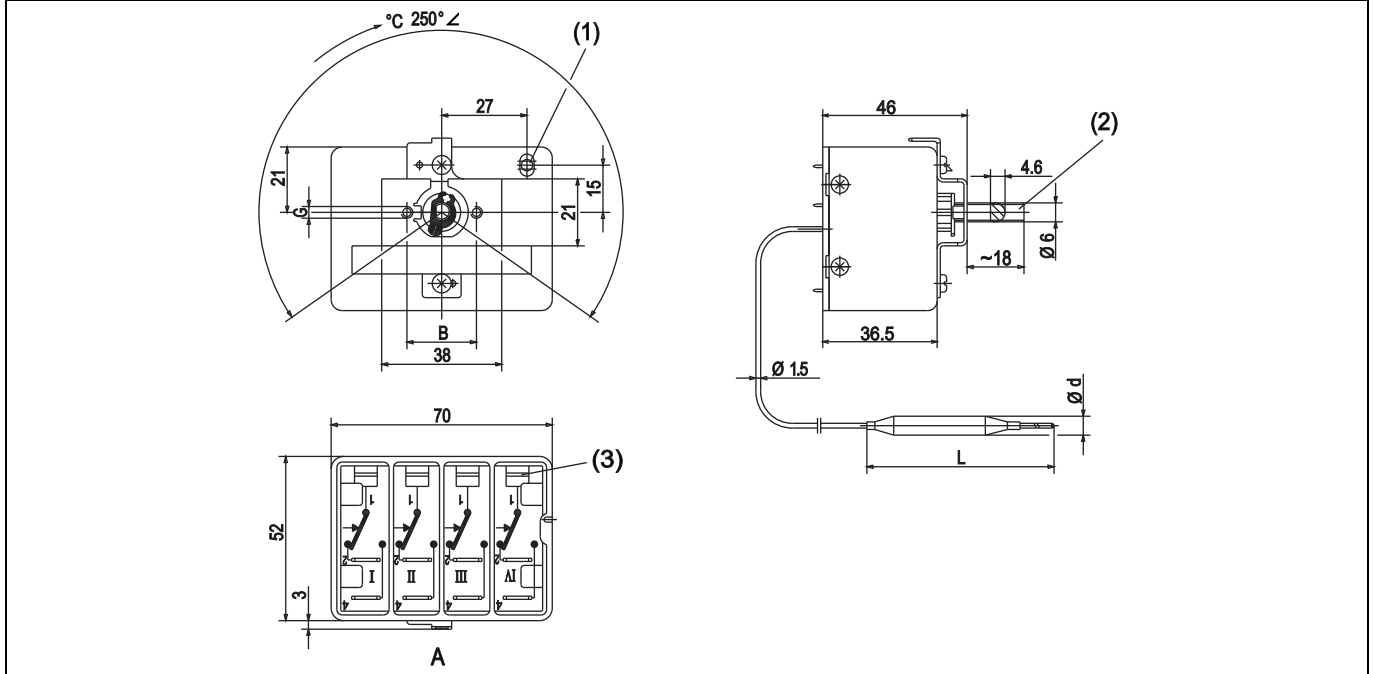
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EMF-1333, EMF-2333, EMF-3333



- (1) Restart knob only with abbreviation 4444
- (2) Not applicable with abbreviation 2, 3, 4, 5
- (3) Tab connector DIN 46244-A6,3-0,8

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

Schraubanschluss EM-1, extra code 699



Connection diagrams

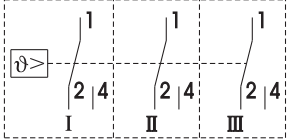
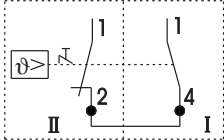
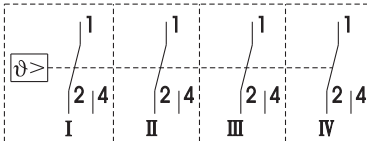
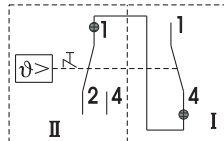
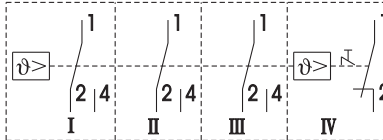
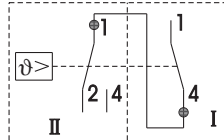
EM-1 EM-2 EM-3		EM-4 EM-5	
EMF-13 EMF-23 EMF-33 Setpoint value: I Sequence contact: II		EM-4/U EM-5/U	

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<p>EMF-133 EMF-233 EMF-333</p> <p>Setpoint value: I Sequence contact: II, III</p> 	<p>EM-40 EM-50</p> <p>I = N/C contact with system break and T < -10 °C: I II = Limit value: II</p> 
<p>EMF-1333 EMF-2333 EMF-3333</p> <p>Setpoint value: I Sequence contact: II, III, IV</p> 	<p>EM-40/U EM-50/U</p> <p>I = N/C contact with system break and T < -10 °C: I II = Limit value: II</p> 
<p>Example: EMF-1334</p> <p>For further type variants, combine the connection diagrams respectively</p> 	<p>EM-20 EM-30</p> <p>I = N/C contact with system break and T < -10 °C: I II = Limit value: II</p> 

Temperature compensation (TK)

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 (extra code "TK").

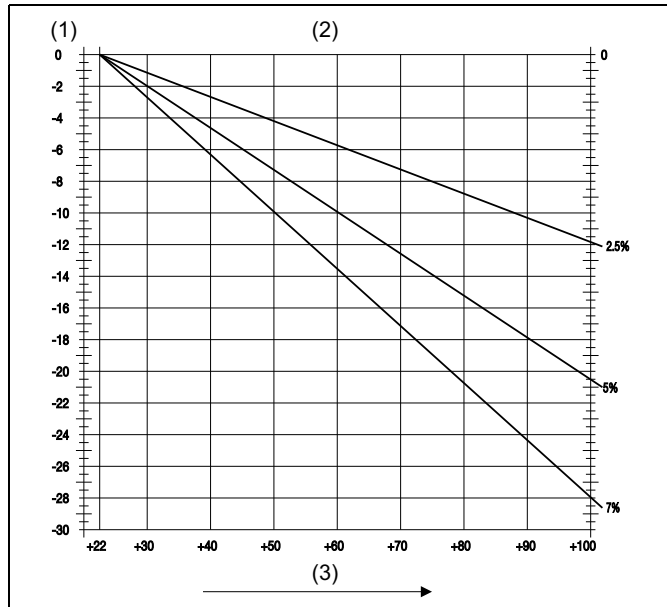
The switching point deviation depends on the ambient temperature at the switching head and takes the switching differential into consideration.

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

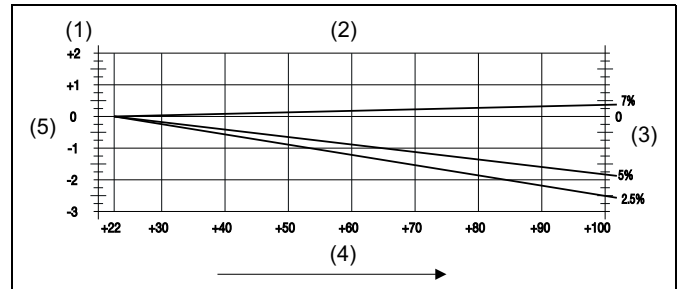


- (1) % of the control range scope
- (2) **Without temperature compensation**
- (3) Ambient temperature [°C]

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 scope
- (2) **With temperature compensation**
- (3) Switching differential
- (4) Ambient temperature [°C]
- (5) Switching point deviation

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Bestellangaben



(1) Basic type	
602021	Panel-Mounted Thermostats, EM Series
(2) Basic type extensions	
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
0020	EM-20 Safety temperature monitor (STW (STB))
0023	EM-23 Temperature monitor (TR/TB), 2-pole
0024	EM-24 Temperature monitor (TW/TB), 2-pole
0030	EM-30 Safety temperature monitor (STW(STB)), permanently set
0033	EM-33 Temperature monitor (TW/TW), 2-pole
0040	EM-40 Safety temperature limiter (STB), permanently set
0044	EM-44 Temperature limiter (TB/TB), 2-pole
0050	EM-50 Safety temperature limiter (STB)
0054	EMF-54 Temperature limiter (TB/TB), 2-pole
0133	EMF-133 Temperature controller (TR/TW/TW), 3-pole
0134	EMF-134 Temperature controller (TR/TW/TB), 3-pole
0233	EMF-233 Temperature monitor (TW/TW/TW), 3-pole
0333	EMF-333 Temperature monitor (TW/TW/TW), 3-pole
0444	EMF-444 Temperature limiter (TB/TB/TB), 3-pole
0544	EMF-544 Temperature limiter (TB/TB/TB), 3-pole
1333	EMF-1333 Temperature controller (TR/TW/TW/TW), 4-pole
2333	EMF-2333 Temperature monitor (TW/TW/TW/TW), 4-pole
3333	EMF-3333 Temperature monitor (TW/TW/TW/TW), 4-pole
(3) Control range (TW)	
000	For 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
075	75 to 100 °C
085	85 to 110 °C
090	120 to 150 °C
091	160 to 200 °C
092	210 to 300 °C
094	250 to 300 °C
095	300 to 400 °C
096	350 to 500 °C

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	(4) Limit value (STW/STB)	
000	For adjustable control range	
100	100 °C	
95	95 °C	
	(5) Switching differential	
00	None	
	With liquid-filled measuring system	
10	1 %	Only with TR and TW
25	2,5 %	Only with TR and TW
50	5 %	Only with TR, TW and STW
70	7 %	Only with TR, TW and STW
	With gas-filled measuring system	
30	3 %	Only with TR and TW
50	5 %	Only with TR, TW and STW
60	6 %	Only with TR and TW
01	10 %	Only with TR and TW
	(6) Capillary length	
0	None	
1000	1,000 mm	
2000	2,000 mm	
3000	3,000 mm	
4000	4,000 mm	
5000	5,000 mm	
	(7) Capillary material	
20	CrNi (stainless steel)	
40	Cu (copper)	
	(8) Process connection	
10	Plain cylindrical probe	
20	Screw-in protection tube	
	(9) Thread of process connection	
00	None	
13	G 1/2	
	(10) Process connection material	
00	None	
20	CrNi (stainless steel)	
40	CuZn (brass)	
	(11) Insertion length	
000	None	
100	100 mm	
120	120 mm	
150	150 mm	
200	200 mm	
300	300 mm	
	(12) Protection tube diameter	
00	None	
10	10 mm	
8	8 mm	
	(13) Probe diameter	
6	6 mm	
8	8 mm	

