

T 2121 EN

Self-operated Temperature Regulators · Type 4 Temperature Regulator

With balanced single-seated globe valve



Application

Temperature regulators for heating installations · Control thermostats for set points from -10 to $+250$ °C · Nominal sizes **DN 15 to 150** · Nominal pressure **PN 16 to 40** · Suitable for temperatures up to **350** °C

The valve **closes** when the temperature **rises**.

The regulators consist of a balanced globe valve with flanged connections and a control thermostat with temperature sensor, set point adjuster with excess temperature protection, capillary tube and operating element.

Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment with a dial
- Single-seated valve with a plug balanced by a balancing diaphragm or stainless steel bellows
- Valve body optionally available in cast iron, spheroidal graphite iron, cast steel or cast stainless steel
- Versions with double adapter and manual adjuster for temperature limiters or attachment of a second control thermostat. See ▶ T 2036 for details.

Versions

Type 4 Temperature Regulator · Type 2422 Valve with flanged connections · Balanced by a bellows (DN 15 to 150) · Balanced by a diaphragm (DN 65 to 100) · PN 16 to 40
Type 2231 to 2235 Control Thermostat · Further details on control thermostats in Information Sheet ▶ T 2010.

- **Type 2422/2231** (Fig. 1) · With Type 2422 Valve and Type 2231 Control Thermostat · Suitable for liquids · Set point adjustment at the sensor · Set points from -10 to $+150$ °C
- **Type 2422/2232** (Fig. 3) · With Type 2422 Valve and Type 2232 Control Thermostat · Suitable for liquids and steam · Separate set point adjustment · Set points from -10 to $+250$ °C
- **Type 2422/2233** (Fig. 2) · With Type 2422 Valve and Type 2233 Control Thermostat · Suitable for liquids, air and other gases · Set point adjustment at the sensor · Set points from -10 to $+150$ °C
- **Type 2422/2234** · With Type 2422 Valve and Type 2234 Control Thermostat · Suitable for liquids, steam, air and other gases · Separate set point adjustment · Set points from -10 to $+250$ °C

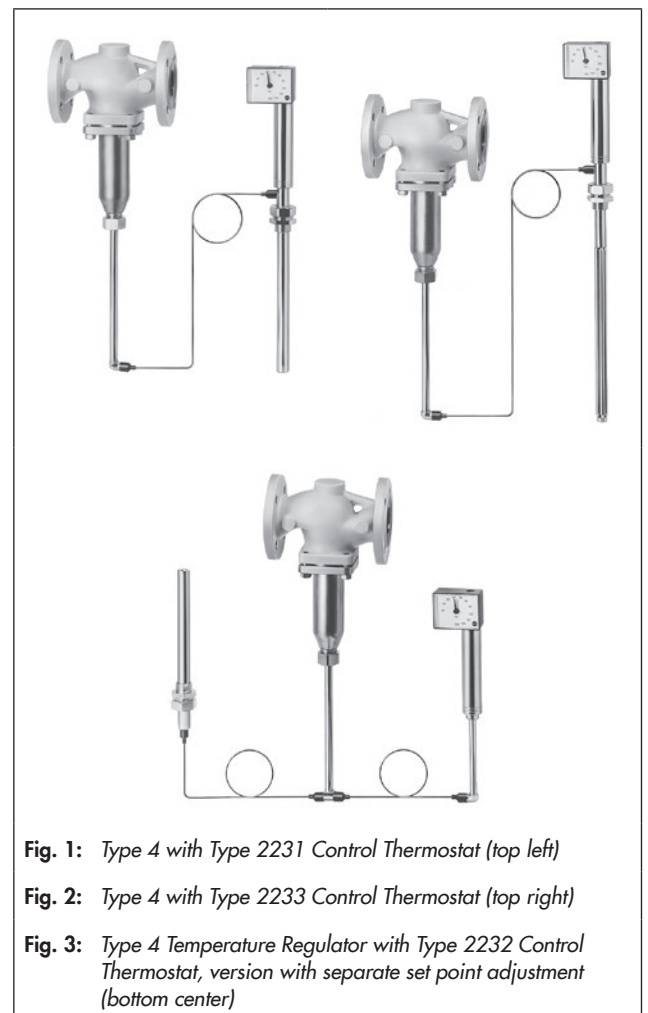


Fig. 1: Type 4 with Type 2231 Control Thermostat (top left)

Fig. 2: Type 4 with Type 2233 Control Thermostat (top right)

Fig. 3: Type 4 Temperature Regulator with Type 2232 Control Thermostat, version with separate set point adjustment (bottom center)

- **Type 2422/2235** · With Type 2422 Valve and Type 2235 Control Thermostat · Installation in air-heated storerooms as well as drying, climatic and heating cabinets · Separate set point adjustment and a sensor tube to be installed on site · Set points from -10 to $+250$ °C

Special versions

- 10 or 15 m capillary tube lengths
- Sensor of CrNiMo steel
- Capillary tube made of CrNiMo steel or plastic-coated copper
- Valve entirely of stainless steel
- Reduced K_{VS} coefficient
- Valve with flow divider for noise reduction with steam and non-flammable gases
- ANSI version (▶ T 2025)

Principle of operation (see Fig. 4)

The regulators operate according to the liquid expansion principle.

The temperature sensor (12), capillary tube (9) and operating element (7) are filled with an expansion liquid. The temperature-dependent change in volume of this liquid causes the operating bellows in the operating element (7) to move and, as a result, also moves the plug stem (5) with the attached plug (3).

The position of the plug determines the flow rate of the heat transfer medium across the area released between the seat (2) and plug (3).

The temperature set point is adjustable with a key (10) to a value which can be read off from the dial (11).

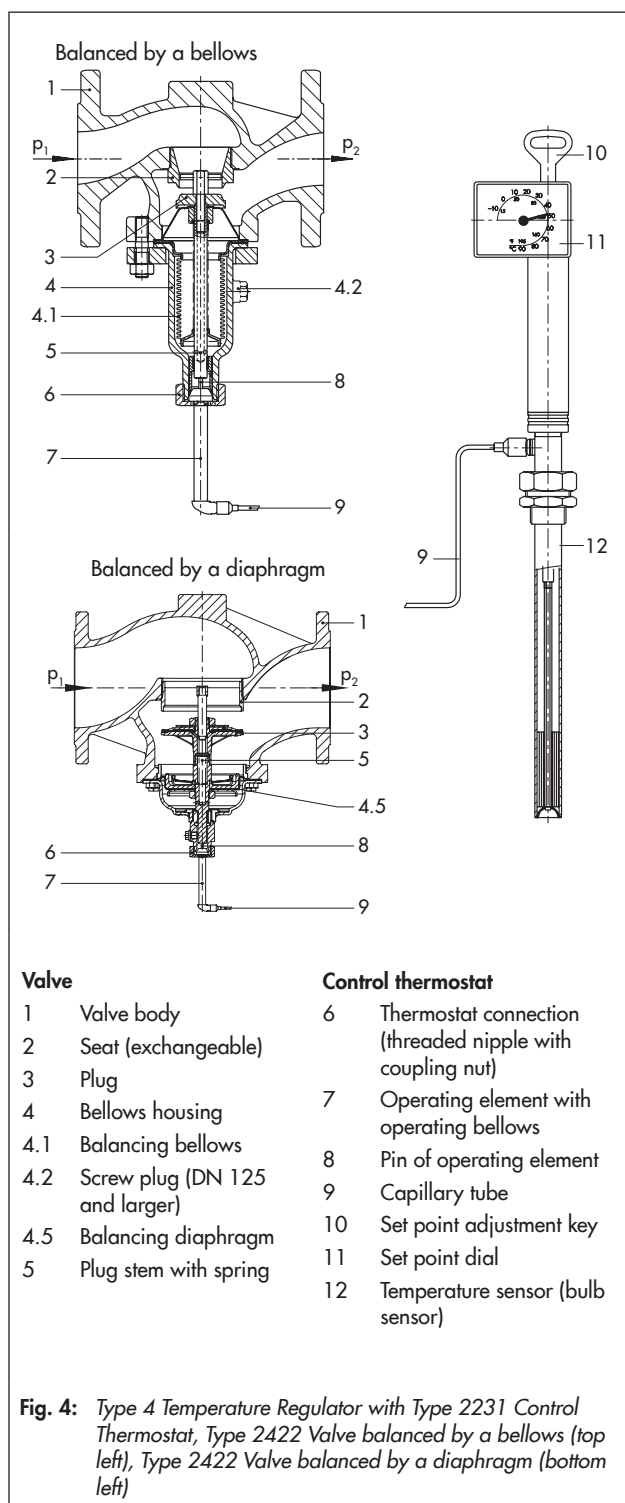
Accessories

- **Thermowells with threaded or flanged connections** for Types 2231 and 2232 Bulb Sensors · G 1 threaded connection, PN 40, made of bronze, steel or CrNiMo steel · Flanged connection, DN 32, PN 40, with thermowell made of CrNiMo steel/steel · Thermowell made of PTFE, PN 6 (flange PN 40)
- Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100
- **Mounting parts** for Types 2233 and 2234 · Clamps for wall mounting · Perforated cover for thermostat
- **Extension piece or separating piece** · To protect the operating element from inadmissible operating conditions, an extension piece or separating piece must be installed between the valve and the operating element.

An **extension piece** (for valves **balanced by a bellows**) is needed for temperatures over 220 °C. The standard version does not have sealing. The special version of the extension piece for DN 15 to 100 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

In combinations with valves made of cast iron or spheroidal graphite iron together with Type 2212 Safety Temperature Limiter or Type 2213 Safety Temperature Monitor, an extension piece is required for temperatures over 150 °C.

Separating piece made of brass (for water and steam) or CrNi steel (for water and oil). A separating piece must be used when a seal between thermostat and valve is



Valve

- | | |
|-----|--------------------------------|
| 1 | Valve body |
| 2 | Seat (exchangeable) |
| 3 | Plug |
| 4 | Bellows housing |
| 4.1 | Balancing bellows |
| 4.2 | Screw plug (DN 125 and larger) |
| 4.5 | Balancing diaphragm |
| 5 | Plug stem with spring |

Control thermostat

- | | |
|----|---|
| 6 | Thermostat connection (threaded nipple with coupling nut) |
| 7 | Operating element with operating bellows |
| 8 | Pin of operating element |
| 9 | Capillary tube |
| 10 | Set point adjustment key |
| 11 | Set point dial |
| 12 | Temperature sensor (bulb sensor) |

Fig. 4: Type 4 Temperature Regulator with Type 2231 Control Thermostat, Type 2422 Valve balanced by a bellows (top left), Type 2422 Valve balanced by a diaphragm (bottom left)

required. Separating pieces made of CrNi steel must be used when all wetted parts are to be free of non-ferrous metals.

In addition, it prevents the medium from leaking while the thermostat is being replaced.

- **Do2 double adapter** for second thermostat · DoS with electric signal transmitter
- **Manual adjuster Ma** with travel indicator · MaS with electric signal transmitter

Typetested safety devices

The register number is available on request.

The following versions are available:

- **Temperature regulators (TR)** with a Type 2231, 2232, 2233, 2234 or 2235 Thermostat and a Type 2422 Valve in DN 15 to 150, for which the maximum operating pressure must not exceed the maximum permissible differential pressure Δp specified in the technical data.
Sensors without thermowell: applicable up to 40 bar
Sensors with thermowell: only use SAMSON G 1 version made of bronze, steel or stainless steel up to 40 bar, copper up to 16 bar.
- Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100
- **Safety temperature monitors (STM) and safety temperature limiters (STL)**. Details in Data Sheets ▶ T 2043 and ▶ T 2046.

Further details on the selection application of typetested equipment can be found in Information Sheet ▶ T 2040.

Dynamic behavior of the thermostats

The dynamics of the regulator are mainly determined by the response of the sensor with its characteristic time constant.

Table 1 lists the response times of SAMSON sensors operating according to different principles measured in water.

Table 1: Dynamic behavior of SAMSON thermostats

Functional principle	Control thermostat	Time constant [s]	
		Without thermowell	With thermowell
Liquid expansion	Type 2231	70	120
	Type 2232	65	110
	Type 2233	25	– ¹⁾
	Type 2234	15	– ¹⁾
	Type 2235	10	– ¹⁾
Adsorption	Type 2212	– ¹⁾	40

¹⁾ Not permissible

Ordering text

Type 4/... Temperature Regulator

DN ..., PN ...

Body material ...

Balanced by a bellows or diaphragm

With Type ... Thermostat, set point range ... °C

Capillary tube ... m

Optionally, special version ...

Optionally, accessories ...

Flow rate diagram for water

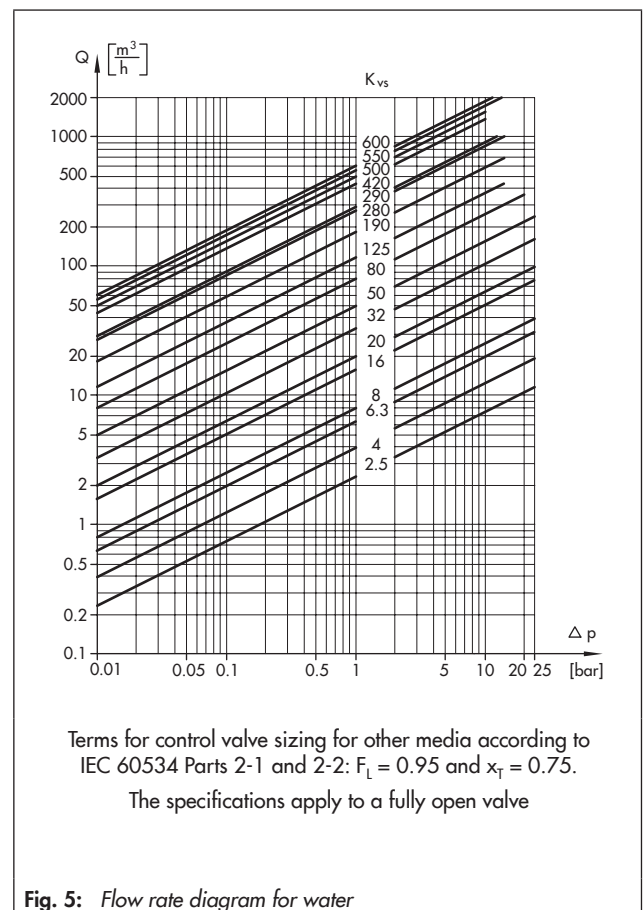


Fig. 5: Flow rate diagram for water

Installation

– Valves

Install the valves in horizontal pipelines. The thermostat connection (6) must face downwards. The direction of flow must match the direction indicated by the arrow on the body.

– Capillary tube

The capillary tube must be run in such a way that the ambient temperature range cannot be exceeded, any deviations in temperature cannot occur and that the tube cannot be damaged. The smallest permissible bending radius is 50 mm.

– Temperature sensor

The temperature sensor can be installed in any position as required. The entire temperature sensor must be immersed in the process medium.

It must be installed in a location where overheating or considerable idling times cannot occur.

Only the combination of the same kind of materials is permitted (e.g. a stainless steel heat exchanger with thermowells made of stainless steel 1.4571).

Table 2: Technical data · Valves · All pressures in bar (gauge)

Type 2422 Valve · Balanced by a bellows · Balanced by a diaphragm				
Valve size		DN 15 to 50	DN 65 to 100	DN 125 to 150
Nominal pressure		PN 16, 25, 40		
Perm. valve temperature	Balanced by a bellows	Max. 350 °C · See pressure-temperature diagram in ► T 2010		
	Balanced by a diaphragm	–	Max. 150 °C · See pressure-temperature diagram in ► T 2010	–
Leakage class according to IEC 60534-4	Balanced by a bellows	Metal seal: ≤0.05 % of K_{VS} coefficient		Soft seal: ≤0.01 % of K_{VS} coefficient
	Balanced by a diaphragm	–	Soft seal: ≤0.01 % of K_{VS} coefficient	–
Compliance		CE · EAC		

Table 3: Technical data · Control thermostats

Type 2231 to 2235 Thermostat	Size 150	
Set point ranges	–10 to +90 °C, 20 to 120 °C or 50 to 150 °C For Types 2232, 2234, 2235 also 100 to 200 °C, 150 to 250 °C	
Perm. ambient temperature at the set point adjustment	–40 to +80 °C	
Perm. temperature at the sensor	100 K above the adjusted set point	
Perm. pressure at sensor	Type 2231 and Type 2232	Without/with thermowell: PN 40 · Thermowell with flange: PN 40
	Type 2233 and Type 2234	Without thermowell: PN 40 · With flange on request
Capillary tube length	5 m (10 or 15 m as special version)	

Table 4: Materials · Material numbers according to DIN EN

Type 2422 Valve · Balanced by a bellows				
Valve size	DN 15 to 150			
Nominal pressure	PN 16	PN 16 and 25	PN 16, 25 and 40	
Valve body	Cast iron EN-GJL-250	Spheroidal graphite iron EN-GJS-400-18-LT	Cast steel 1.0619	Cast stainless steel 1.4408
Valve seat	Stainless steel 1.4104 or 1.4006			1.4404
Plug ⁴⁾	Up to DN 100 ²⁾	Stainless steel 1.4404		
	DN 125 to 250	1.4404, plug with PTFE seal		1.4404
Plug stem	1.4301			
Spring	1.4310			
Balancing bellows	1.4571 · DN 125: 1.4404			
Bellows housing	1.0425			1.4301
Body gasket	Graphite on metal core			
Extension piece/separating piece	Brass (for version free of non-ferrous metal: 1.4301)			1.4301
Type 2422 Valve · Balanced by a diaphragm				
Valve size	DN 65 to 100			
Nominal pressure	PN 16		PN 25	
Valve body	Cast iron EN-GJL-250		Spheroidal graphite iron EN-GJS-400-18-LT	
Valve seat	1.4408			
Plug	CW617N			
Diaphragm cases	1.0619			
Pressure balancing	Diaphragm plate 1.4301 · EPDM balancing diaphragm, max. 150 °C or NBR diaphragm, max. 80 °C			

1) DN 15, 25, 40 and 50 only

2) Optionally with soft seal with standard K_{VS} coefficients

3) Special version 1.4409

4) Soft-seated plug with EPDM ring for temperatures up to 150 °C

5) PN 16 only

Table 4: Materials · Material numbers according to DIN EN

Type 2231, Type 2232, Type 2233, Type 2234 and Type 2235 Thermostats			
		Standard version	Special version
Operating element		Nickel-plated brass	
Sensor	Type 2231 and Type 2232	Bronze	Stainless steel 1.4571
	Type 2233 and Type 2234	Copper	
	Type 2235	Copper	
Capillary tube		Nickel-plated copper	Plastic-coated copper or stainless steel 1.4571
Thermowell			
With G 1 threaded connection			
Thermowell		Bronze, steel, copper ⁵⁾	Stainless steel 1.4571
Threaded nipple		Brass	
With flanged connection (on request)			
Thermowell		Steel	Stainless steel 1.4571
Threaded nipple		Steel	

1) DN 15, 25, 40 and 50 only

2) Optionally with soft seal with standard K_{VS} coefficients

3) Special version 1.4409

4) Soft-seated plug with EPDM ring for temperatures up to 150 °C

5) PN 16 only

Table 5: K_{VS} coefficients, x_{FZ} values and max. permissible differential pressures Δp

Terms for control valve sizing according to IEC 60534, Parts 2-1 and 2-2: $F_L = 0.95$, $X_T = 0.75$

Type 2422 Valve · Balanced by a bellows													
Valve size	DN	15	20	25	32	40	50	65	80	100	125	150	
Valve travel	mm	10						16			22		
Standard K_{VS} coefficient		4	6.3	8	16	20	32	50	80	125	190	280	
Max. permissible differential pressure Δp		25 bar						20 bar		16 bar		12 bar	
Reduced K_{VS} coefficient		2.5 · 4 · 6.3			6.3	8	16	32		80		125	
Max. perm. differential pressure Δp		25 bar									20 bar		16 bar
x_{FZ} value		0.65	0.6	0.55		0.45	0.4		0.35				
Type 2422 Valve · Balanced by a diaphragm													
Valve size	DN	65			80			100					
Valve travel	mm	16											
K_{VS} coefficient		50			80			125					
Max. perm. differential pressure Δp		10 bar											
x_{FZ} value		0.4			0.35								

Dimensional drawings: Type 2422 Valve · Balanced by a bellows · Balanced by a diaphragm · With connection for Type 2231 to Type 2235 Thermostat

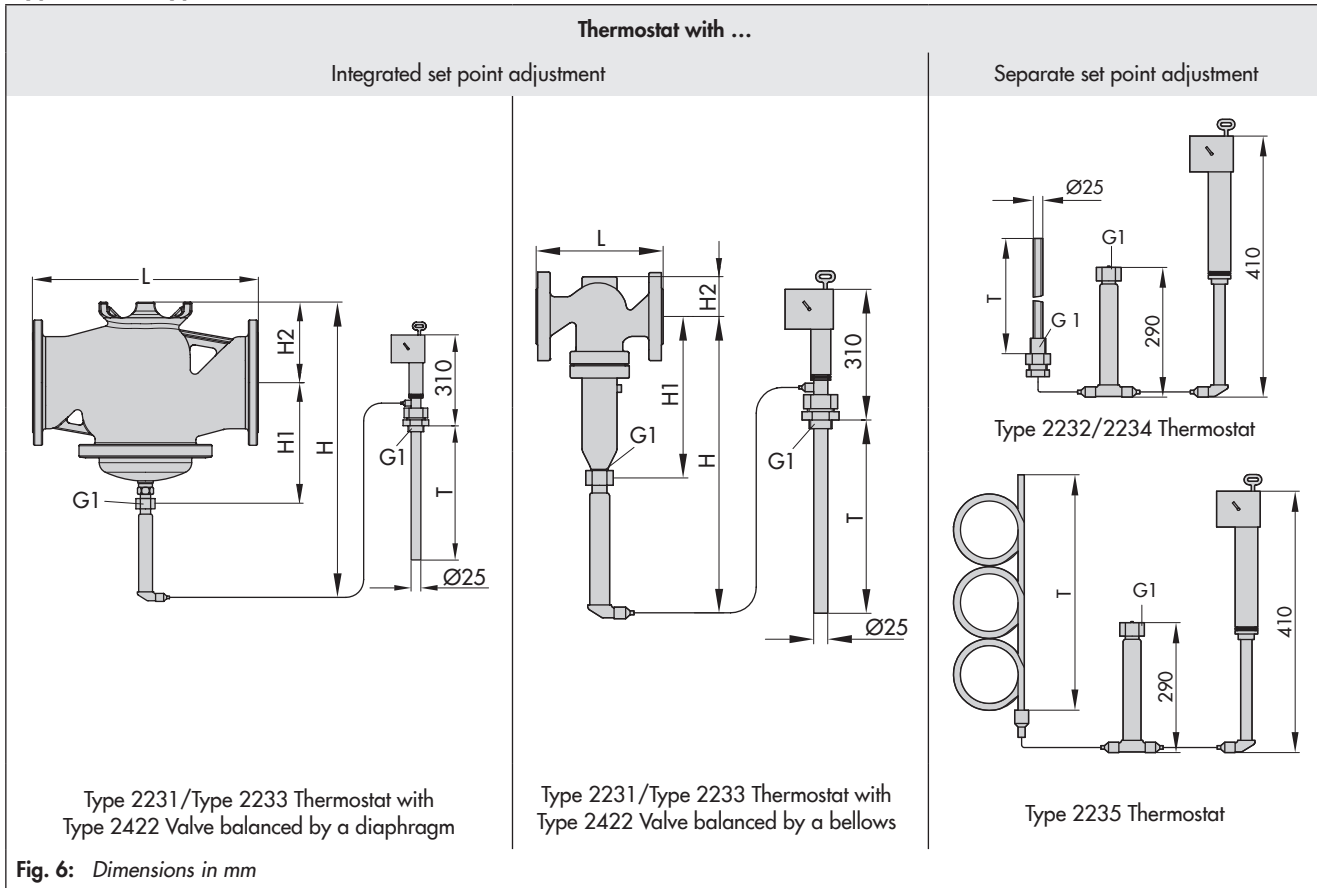


Table 6: Dimensions in mm and weights · Type 2422 Valve

Type 2422 Valve · Balanced by a bellows												
Valve size	DN	15	20	25	32	40	50	65	80	100	125	150
Length L		130	150	160	180	200	230	290	310	350	400	480
H2	Body	Forged steel	53	–	70	–	92	98	–			
		Other materials	55			72			100	120	145	175
H1		Up to 220 °C (without extension piece)	225						300	355	460	590
		Up to 350 °C (with extension piece)	365						440	495	600	730
H		Up to 220 °C (without extension piece)	515						590	645	750	880
		Up to 350 °C (with extension piece)	655						730	785	890	1020
Weight ¹⁾ , approx. kg		5	5.5	6.5	13	13.5	16	27	32	40	70	113
Type 2422 Valve · Balanced by a diaphragm												
Valve size	DN	65			80			100				
Length L		290			310			350				
H2		98						118				
H1		Up to 220 °C (without extension piece)			201			202			218	
		Up to 350 °C (with extension piece)			341			342			358	
H		Up to 220 °C (without extension piece)			589			590			626	
		Up to 350 °C (with extension piece)			729			730			766	
Weight ¹⁾ , approx. kg		30			37.5			45				

¹⁾ Based on PN 16 and without extension piece: +15 % for PN 25 and 40

Table 7: Types 2231 to 2235 Control Thermostat

Control thermostat	Type 2231	Type 2232	Type 2233	Type 2234	Type 2235
Immersion depth T	290 ¹⁾	235 ¹⁾	430	460	3460
Weight, approx. kg	3.2	4	3.4	3.7	3.6

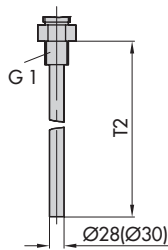
¹⁾ Larger immersion depths on request

Accessories

Thermowells for Type 2231 and Type 2232

Table 8: Thermowells for Type 2231 and Type 2232

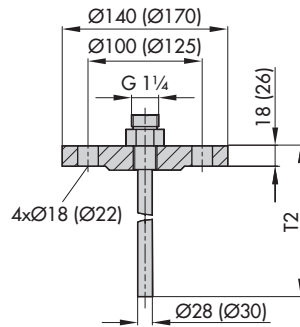
Control thermostat	Type 2231	Type 2232
Immersion depth T2	325 mm	250 mm



With threaded connection

G 1 for PN 40 and 100 (dimensions for PN 100 in parentheses)

Thermowell made of copper: PN 16

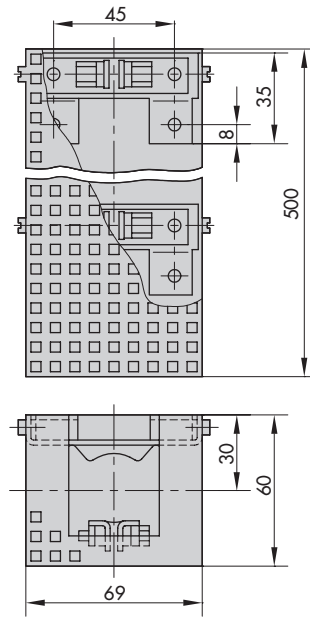


With flanges

DN 32 for PN 40
DN 40 for PN 100 (dimensions for PN 100 in parentheses)

Mounting parts for Type 2233 and Type 2234

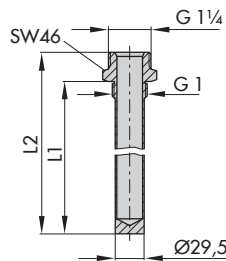
Clamps and perforated cover for wall mounting



Thermowells for Type 2231 and Type 2232

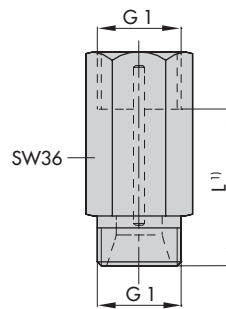
Table 9: Thermowells for flammable gases (G 1/PN 100)

Control thermostat	Type 2231	Type 2232
Length L1	315	255
Length L2	340	280



Thermowells for flammable gases

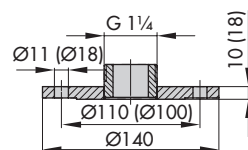
Extension piece/separating piece



Extension piece (standard)		
L (approx.)	mm	140
Weight, approx.	kg	0.5
With bellows seal (special version)		
L (approx.)	mm	180
Weight, approx.	kg	0.6
Separating piece with seals		
L (approx.)	mm	55
Weight, approx.	kg	0.2

¹⁾ Add the dimension L to H and H1 when these accessories are used.

Flange for Type 2233 and Type 2234



Flanges PN 6
140 mm outside diameter
Flange PN 40/DN 32 (dimensions in parentheses)

