DATA SHEET

T 2123 EN

Self-operated Temperature Regulators · Type 4u Temperature Regulator

With balanced single-seated globe valve

Application

Temperature regulator for cooling installations with 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 **opens** when the temperature **rises.**

The regulators consist of a balanced globe valve with flanged connections and reversing device as well as 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
- Suitable for liquids, gases and vapors, especially for coolants, such as cooling brine or cooling water
- Valve body optionally available in cast iron, spheroidal graphite iron, cast steel or cast stainless steel

Versions

Type 4u 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 · Reversing device · Further details on the application of control thermostats can be found 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. 2) · 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** · 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

Fig. 1: *Type 4u with Type 2231 Control Thermostat*

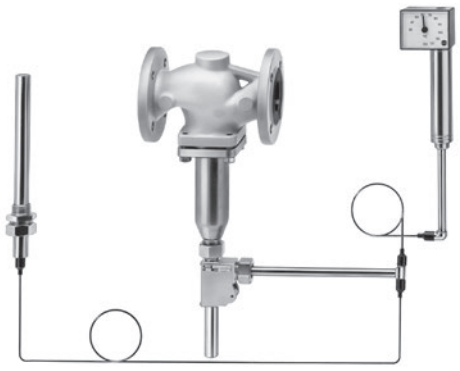

Fig. 2: *Type 4u Temperature Regulator with Type 2232 Control Thermostat, version with separate set point adjustment*

– **Type 2422/2234** · With Type 2422 Valve and Type 2234 Control Thermostat · Suitable for liquids, air and other gases · Separate set point adjustment · Set points from –10 to +250 °C

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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
- Reversing device version with travel adjuster (with adjustment of minimum flow rate)
- ANSI version (▶ T 2025)

Principle of operation (see Fig. 3)

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 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).

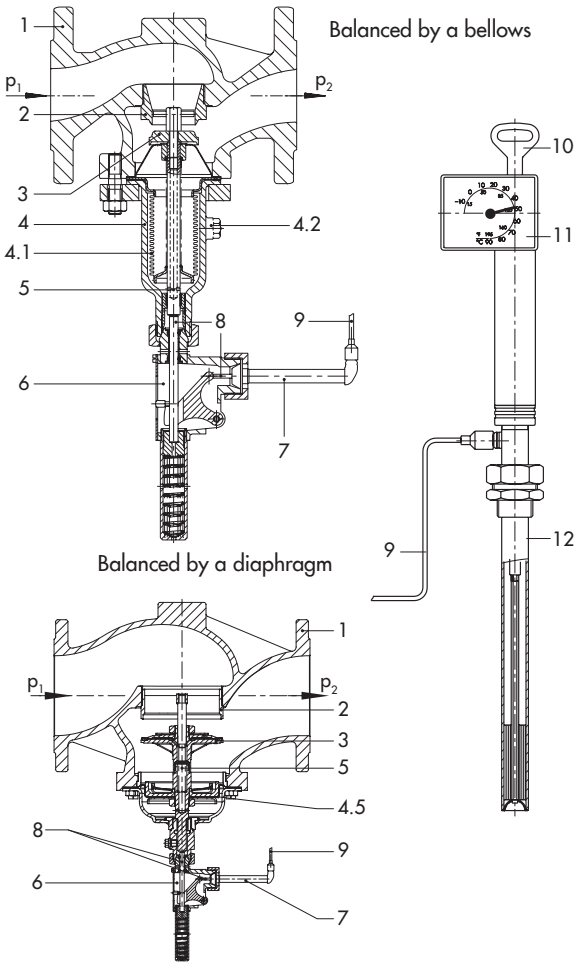
Accessories

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



Valve and reversing device

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
6	Reversing device with coupling nut to connect it to the valve

Control thermostat

7	Operating element with operating bellows and coupling nut for connection to reversing device
8	Pin of operating element
9	Capillary tube
10	Set point adjustment key
11	Set point dial
12	Temperature sensor (bulb sensor)

Fig. 3: *Type 4u 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)*

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 2213	70	120
Adsorption	Type 2212	– [1]	40

[1] Not permissible

Ordering text

Type 4u Temperature Regulator/....,

DN ..., PN ...,

Body material ...,

Balanced by a bellows or diaphragm

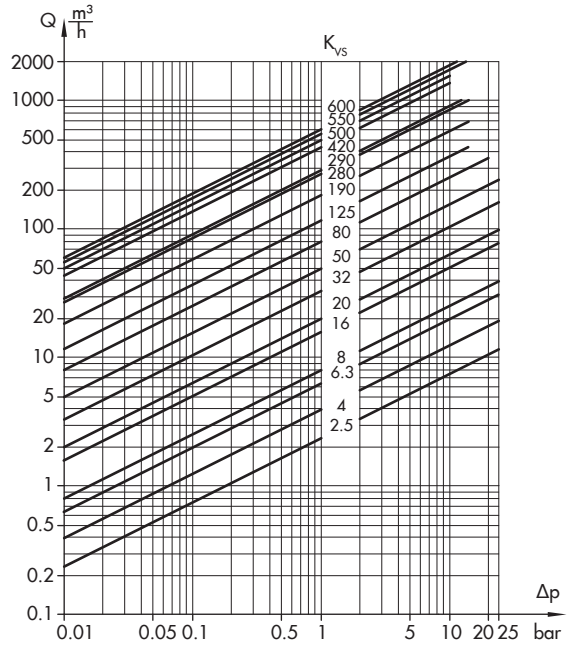
With Type ... Thermostat, set point range ... °C

Capillary tube ... m,

Optionally, special version ...,

Optionally, accessories ...

Flow rate diagram for water



Terms for control valve sizing for other media according to IEC 60534 Parts 2-1 and 2-2: $F_L = 0.95$ and $x_T = 0.75$.

The specifications apply to a fully open valve

Fig. 4: *Flow rate diagram for water*

Installation

- **Valves**
  Install the valve in horizontal pipelines. The thermostat connection must face downwards. The direction of flow must match the direction indicated by the arrow on the body. Other mounting positions on request.
- **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		
Permissible 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 2234 Thermostat		**Size 150**
Set point ranges		–10 to +90 °C, 20 to 120 °C or 50 to 150 °C For Type 2232, Type 2234 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 and Type 2234Thermostats			
		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	
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: $F_L = 0.95$, $X_T = 0.75$

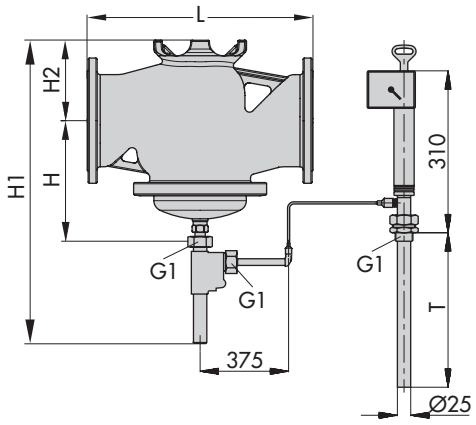
Type 2422 Valve · Balanced by a bellows												
Valve size	**DN**	**15**	**20**	**25**	**32**	**40**	**50**	**65**	**80**	**100**	**125**	**150**
Valve travel	mm	10						16			22	
Standard K_{VS} coefficient		4	6.3	8	16	20	32	50	80	125	190	280
Max. perm. differential pressure Δp		25 bar						20 bar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

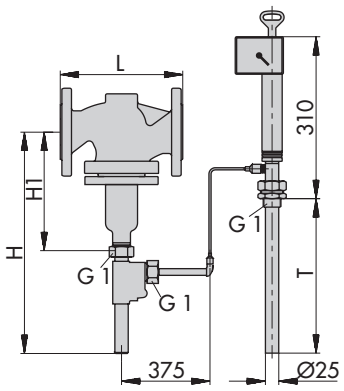
Dimensional drawings: Type 2422 Valve · Balanced by a bellows · Balanced by a diaphragm · With connection for Type 2231 to Type 2235 Thermostat

Thermostat with …

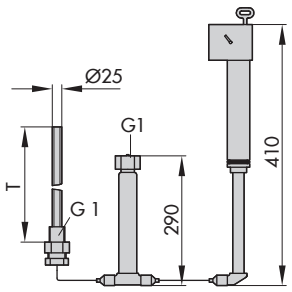
Integrated set point adjustment | Separate set point adjustment



Type 2231/Type 2233 Thermostat with Type 2422 Valve balanced by a diaphragm and reversing device



Type 2231/Type 2233 Thermostat with Type 2422 Valve balanced by a bellows and reversing device



Type 2232/2234 Thermostat

Fig. 5: *Dimensions in mm*

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	910
		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		201	202	218
H		589	590	626
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 2234 Control Thermostat*

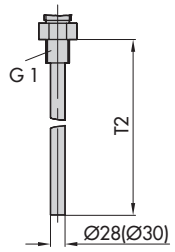
Control thermostat	**Type 2231**	**Type 2232**	**Type 2233**	**Type 2234**
Immersion depth T	290 [1]	235 [1]	430	460
Weight, approx. kg	3.2	4	3.4	3.7

[1] Larger immersion depths on request

Thermowells for Type 2231 and Type 2232

Table 8: *Thermowells for Type 2231 and Type 2232*

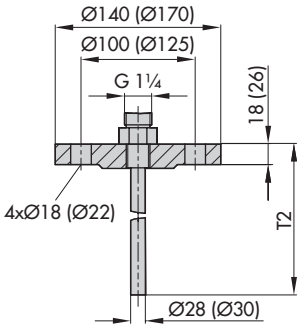
Control thermostat	Type 2231	Type 2232
Immersion depth T2	325 mm	250 mm



With threaded connection

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

Thermowell made of copper: PN 16



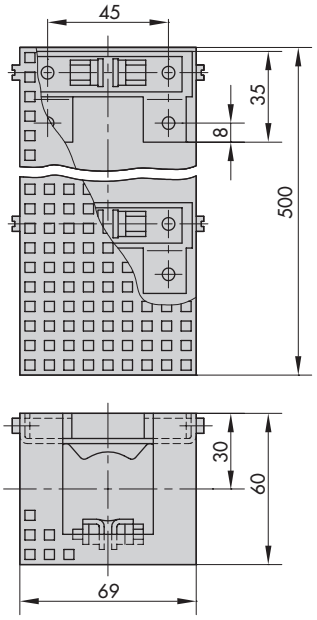
With flanges

DN 32 for PN 40

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

Mounting parts for Type 2233 and Type 2234

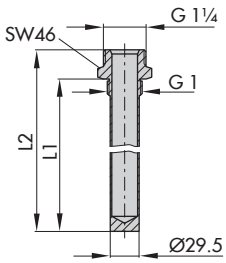
Clamps and perforated cover for wall mounting



Thermowells for Type 2231 and Type 2232

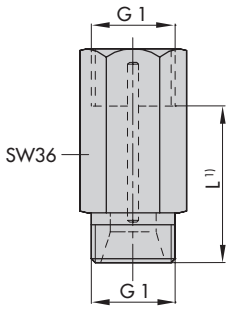
Table 9: *Thermowells for flammable gases (G 1/PN 100)*

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



Thermowells for flammable gases

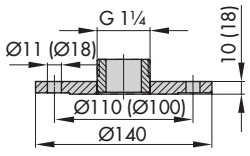
Extension piece/separating piece



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



Steel/CrNiMo steel

Flanges PN 6

140 mm outside diameter

Flange PN 40/DN 32 (dimensions in parentheses)