

# Self-operated Temperature Regulators



## Type 4u Temperature Regulator

With balanced single-seated globe valve

### Application

Temperature regulator for cooling 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 **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 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 · DN 15 to 150 · PN 16 to 40 · Balanced by a bellows · Type 2231 to 2234 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

**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



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

### Special versions

- 5, 10 or 15 m capillary tube length
- 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)

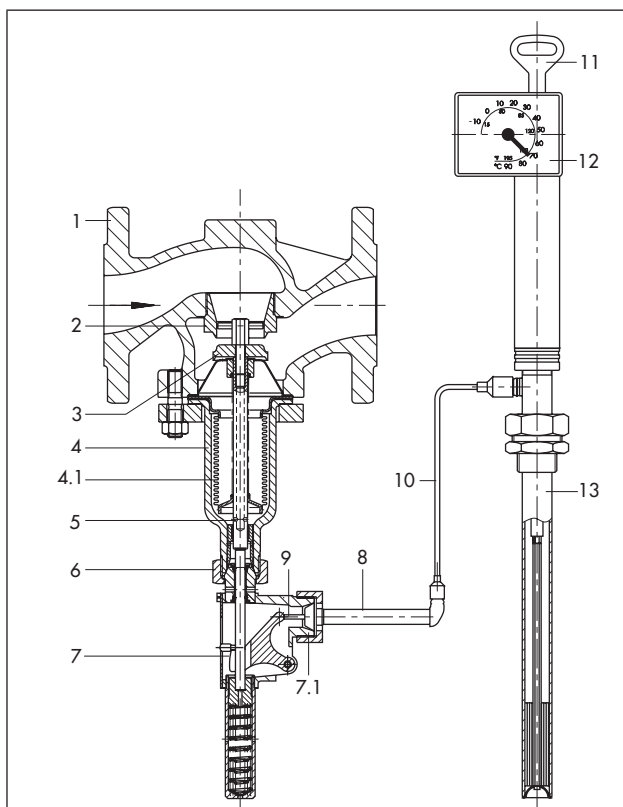
### Principle of operation (see Fig. 3)

The regulators operate according to the liquid expansion principle.

The temperature sensor (13), capillary tube (10), and operating element (8) 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 (11) to a value which can be read off from the dial (12).



#### Valve

- 1 Valve body
- 2 Seat (exchangeable)
- 3 Valve plug
- 4 Bellows housing
- 4.1 Balancing bellows
- 5 Plug stem with spring
- 6 Coupling nut (to connect reversing device and bellows housing)

#### Control thermostat

- 7 Reversing device
- 7.1 Coupling nut (to connect reversing device and operating element)
- 8 Operating element with operating bellows
- 9 Pin of operating element
- 10 Capillary tube
- 11 Set point adjustment key
- 12 Set point dial
- 13 Temperature sensor (bulb sensor)

**Fig. 3:** Type 4u Temperature Regulator with Type 2231 Control Thermostat, Type 2422 Valve balanced by a bellows

**Table 1:** Technical data · Type 2422 Valve · All pressures in bar (gauge)

Type 2422 Valve, balanced by a bellows													
Nominal size	DN	15	20	25	32	40	50	65	80	100	125	150	
Nominal pressure		PN 16 to 40											
$K_{VS}$ coefficient in $m^3/h$		4	6.3	8	16	20	32	50	80	125	190	290	
Leakage class according to IEC 60534-4		Metal seal: $\leq 0.05\%$ of $K_{VS}$ coefficient Soft seal: $\leq 0.01\%$ of $K_{VS}$ coefficient											
Max. perm. differential pressure $\Delta p$ in bar		25						20		16		12	
Special version													
$K_{VS}$ coefficient in $m^3/h$		2.5; 4; 6.3			6.3	8	16	20	32	80	-	-	
Max. perm. differential pressure $\Delta p$ in bar		25								16		-	
Permissible valve temperature		Max. 350 °C · See pressure-temperature diagram in ▶ T 2010											
Compliance		CE · EAC											

**Table 2: Technical data · Control thermostats**

Type 2231 to 2234 Thermostat	Size 150 (DN 15 to 150)
Set point ranges	-10 to +90 °C, 20 to 120 °C or 50 to 150 °C · For Types 2232 and 2234 also 100 to 200 °C, 150 to 250 °C
Perm. ambient temperature at the set point adjustment	-40 to +80 °C
Permissible temperature at sensor	100 K above the adjusted set point
Permissible pressure at sensor	Without/with thermowell: PN 40 · Thermowell with flange: PN 40
Type 2231/2232	
Type 2233/2234	Without thermowell: PN 40 · With flange on request
Capillary tube length	3 m (5, 10 or 15 m as special version)

**Table 3: Materials · Material numbers according to DIN EN**

Type 2422 Valve, balanced by a bellows				
Nominal pressure	PN 16	PN 16/25	PN 16, 25, and 40	
Body	Cast iron EN-GJL-250	Spheroidal graphite iron EN-GJS-400-18-LT	Cast steel 1.0619	Cast stainless steel 1.4408
Seat and plug <sup>1)</sup>	Up to DN 100	Cast stainless steel 1.4006, 1.4104, 1.4112		1.4404
	DN 125 to 150	1.4404 · Plug with PTFE seal		1.4404
Plug stem/spring	1.4301/1.4310			
Balancing bellows	1.4571			
Bellows housing	1.0425			1.4301
Gasket	Graphite on metal core			
Extension piece/separating piece	Brass (for version free of non-ferrous metal: 1.4301)			1.4301
Types 2231, 2232, 2233, and 2234 Thermostat				
	Standard version		Special version	
Operating element	Nickel-plated brass			
Sensor	Type 2231/2232	Bronze	Stainless steel 1.4571	
	Type 2233/2234	Copper		
Capillary tube	Nickel-plated copper		Plastic-coated copper or stainless steel 1.4571	
Thermowell				
With G 1 threaded connection				
	Thermowell	Bronze, steel, copper <sup>2)</sup>		Stainless steel 1.4571
	Threaded nipple	Brass		
With flanges				
	Thermowell	Steel		Stainless steel 1.4571
	Flange	Steel		

<sup>1)</sup> Optionally soft-seated plug with PTFE ring for temperatures up to 220 °C or with EPDM ring for temperatures up to 150 °C.

<sup>2)</sup> PN 16 only

## Typetested safety devices

The register number is available on request.

### The following versions are available:

**Temperature regulators (TR)** with a Type 2231, 2232, 2233 or Type 2234 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  $\Delta p$  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.

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

Additionally, the following are available:

**Safety temperature monitors (STM)** and **safety temperature limiters (STL)**. Details in Data Sheets ► T 2043 and ► T 2046.

## Accessories (see Fig. 5)

**Thermowells** with threaded or flanged connections for Types 2231 and 2232 Bulb Sensors · G 1 threaded connection, made of bronze, steel or CrNiMo steel (PN 40), made of copper (PN 16) · Flanged connection, DN 32, PN 40, with thermowell made of CrNiMo steel or 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

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** 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. 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

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

**Table 4:** Dynamic behavior of SAMSON thermostats

Functional principle	Control thermostat Type	Time constant [s]	
		Without Thermowell	With Thermowell
Liquid expansion	2231	70 s	120 s
	2232	65 s	110 s
	2233	25 s	– <sup>1)</sup>
	2234	15 s	– <sup>1)</sup>
	2235	10 s	– <sup>1)</sup>
Adsorption	2213	70 s	120 s
	2212	– <sup>1)</sup>	40 s

<sup>1)</sup> Not permissible

## Installation

### Valve

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

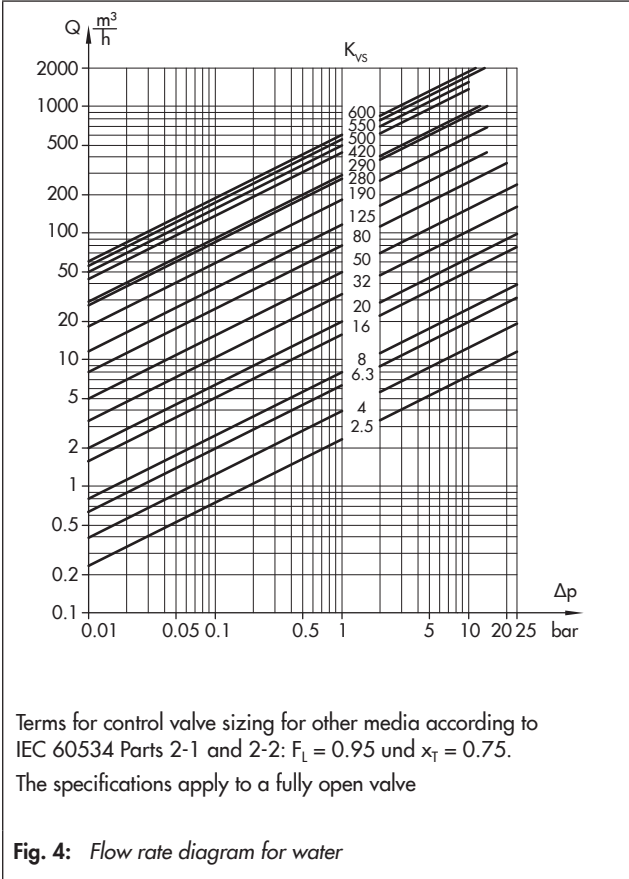
The capillary tube must be run in such a way that the ambient temperature range cannot be exceeded, any deviations in temperature cannot occur and that the tube cannot be damaged. The smallest permissible bending radius is 50 mm.

### Temperature sensor

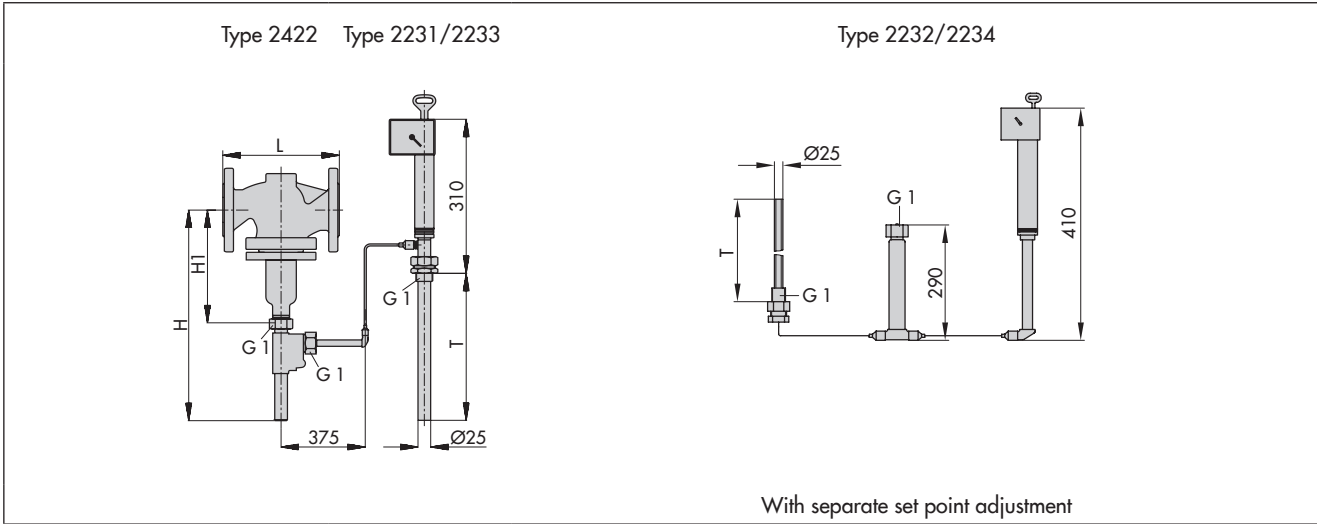
The temperature sensor may be installed in any position. Its entire length must be immersed in the medium. It must be installed in a location where overheating or considerable idling times cannot occur.

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.

**Flow rate diagram for water**



**Dimensions · Type 2422 Valve balanced by a bellows**



**Table 5:** Dimensions in mm and weights · Type 2422 Valve, balanced by a bellows

Nominal 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
H1		225						300		355	460	590
H		515						545		570	675	910
Weight <sup>1)</sup> , approx.	kg	5	5.5	6.5	13	13.5	16	27	32	40	70	113

<sup>1)</sup> Based on PN 16: +15 % for PN 25 and 40

**Table 6:** Types 2231 to 2234 Control Thermostat

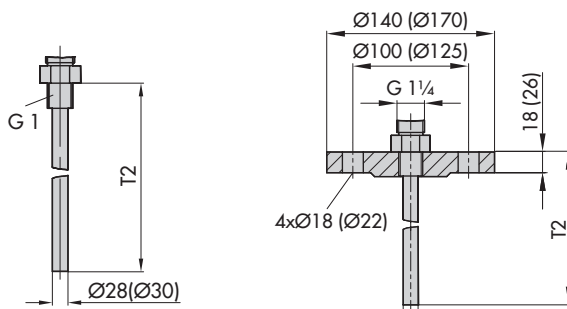
Control thermostat	Type 2231	Type 2232	Type 2233	Type 2234
Immersion depth T	290 <sup>1)</sup>	235 <sup>1)</sup>	430	460
Weight, approx. kg	3.2	4	3.4	3.7

<sup>1)</sup> Larger immersion depths on request

## Accessories

### Thermowells for Type 2231/2232 (thread/flange)

Thermostat	Type 2231	Type 2232
T2	325 mm	250 mm



#### With threaded connection

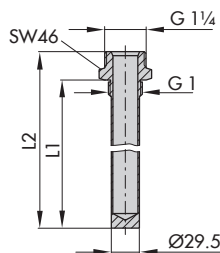
G 1 for PN 40, PN 100  
(dimensions for PN 100 in parentheses), thermowell made of copper: PN 16

#### With flanges

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

### Thermowells for flammable gases (G 1/PN 100)

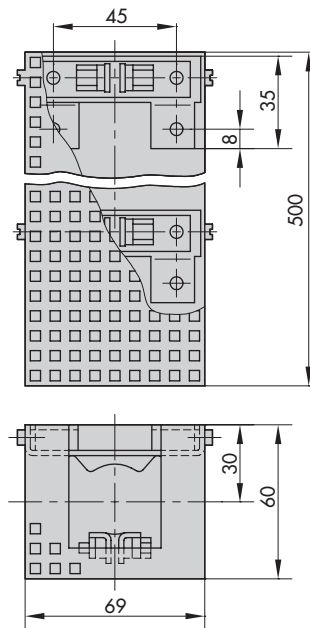
Thermostat	Type 2231	Type 2232
Length L1	315 mm	255 mm
Length L2	340 mm	280 mm



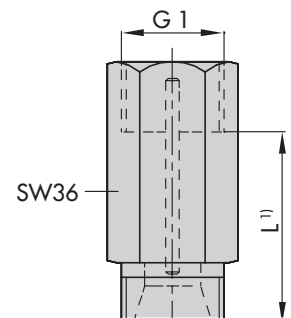
All dimensions in mm

Fig. 5: Accessories

### Clamps and perforated cover for wall mounting



### Extension piece/separating piece



#### Extension piece

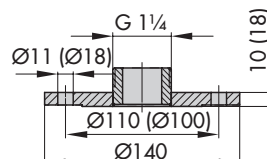
Standard version  
L = approx. 140 mm, approx. 0.5 kg

With bellows seal (special version),  
L = approx. 180 mm, approx. 0.6 kg

Separating piece with seals,  
L = approx. 55 mm, approx. 0.2 kg

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

### Flange for Type 2233 and Type 2234 (steel/CrNiMo steel)



Flanged connection PN 6; 140 outside Ø  
Flange PN 40/DN 32 (dimensions in parentheses)

## Ordering text

Type 4u Temperature Regulator/....,

DN ..., PN ...

Body material ...

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

Capillary tube ... m

Optionally, special version ...

Optionally, accessories ...

Specifications subject to change without notice



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