

# Self-operated Temperature Regulators

## Type 1u Temperature Regulator



ANSI version

### Application

Temperature regulators for cooling installations · Control thermostats for set points<sup>1)</sup> from **15** to **480 °F** (–10 to 250 °C) · Valves in **NPS ½ to 2** · Pressure ratings **Class 125 to 300** · Suitable for liquids up to **300 °F** (150 °C) and gases up to **175 °F** (80 °C)

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

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

### Special features

- Low-maintenance P-regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment on a scale
- Globe valves with plug balanced by a bellows (NPS 1½ to 2)
- Suitable for liquids, particularly for cooling media, e.g. cooling water and brine

### Versions

**Type 1u Temperature Regulator** · With Type 2121 Valve with flanged connection · Class 125 to 300 · Type 2231 to 2234 Control Thermostat · Unbalanced valve (NPS ½ to 2) · Balanced valve (NPS 1½ to 2) · Opening

Refer to Information Sheet T 2010 EN for details on the application of control thermostats.

**Type 2121/2231** · With Type 2231 Control Thermostat for liquids · Set point adjustment at the sensor · Set points <sup>1)</sup> from 15 to 300 °F (–10 to +150 °C)

**Type 2121/2232** (Fig. 1) · With Type 2232 Control Thermostat for liquids and steam · Separate set point adjustment · Set points<sup>1)</sup> from 15 to 480 °F (–10 to +250 °C)

**Type 2121/2233** · With Type 2233 Control Thermostat for liquids, air and gases · Set point adjustment on the sensor · Set points from 15 to 300 °F (–10 to +150 °C)

**Type 2121/2234** · With Type 2234 Control Thermostat for liquids, steam, air and gases · Separate set point adjustment · Set points from 15 to 480 °F (–10 to +250 °C)



Fig. 1 · Type 1u Temperature Regulator with Type 2232 Control Thermostat

### Special versions

- Capillary tube 16, 33 or 50 ft (5, 10 or 15 m)
- Sensor of CrNiMo steel
- Capillary tube of CrNiMo steel or plastic-coated copper
- Version with minimum flow rate
- Plug with PTFE seal
- Valve free of non-ferrous metal
- Valve completely of corrosion-resistant material
- Version for oil at max. permissible temperature of 430 °F (220 °C)

<sup>1)</sup> Special versions for set points from –40 to 160 °F (–40 to 60 °C)

**Principle of operation** (see Fig. 2)

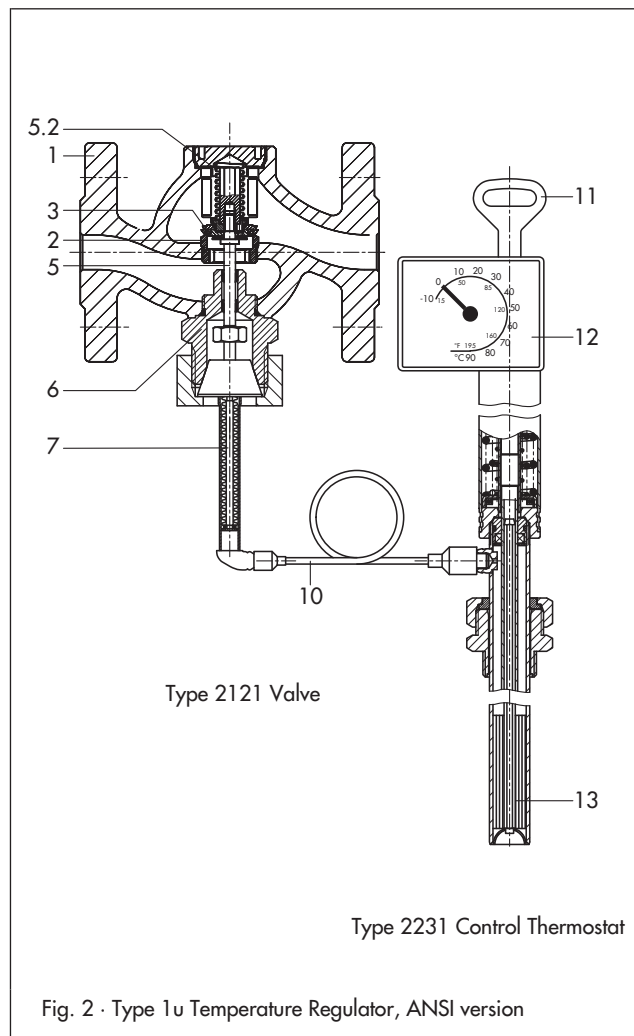
The regulators operate according to the liquid expansion principle.

Temperature sensor (13), capillary tube (10) and operating element (7) are filled with an expansion liquid.

The liquid changes its volume depending on the temperature, causing the operating element (7) and thus the valve's plug stem (5) with the plug (3) to move. The position of the plug determines the flow rate of the heat transfer medium across the area released between the plug and seat (2).

The temperature set point can be adjusted using a key (11) to a value that can be read off the dial (12).

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| <b>Valve</b>                        | <b>Control thermostat</b>           |
| 1 Valve body                        | 7 Operating element                 |
| 2 Seat (replaceable)                | 10 Capillary tube                   |
| 3 Plug                              | 11 Key for set point adjustment     |
| 5 Plug stem                         | 12 Set point dial                   |
| 5.2 Balancing bellows (NPS 1½ to 2) | 13 Temperature sensor (bulb sensor) |
| 6 Threaded nipple with coupling nut |                                     |



**Table 1 · Technical data** · All pressures in psi and bar (gauge)

Type 2121 Valve		Flanged connection				
Pressure rating		Class 125, 150 and 300				
Valve size	NPS	½	¾	1	1½	2
Cv and Kvs <sup>1)</sup>	Cv (US gal/min)	5	7.5	9.4	9.4 · 24	9.4 · 37
	Kvs (m³/h)	4	6.3	8	8 · 20	8 · 32
Permissible differential pressure Δp <sub>max</sub>	psi	175			120	
	bar	12			8	
Leakage rate acc. to ANSI/FCI 70-2		≤ 0.05 % of Cv (Kvs)				
Permissible temperature at the valve		Liquids: 300 °F (150 °C) · Gases: 175 °F (80 °C)				
<b>Types 2231 to 2234 Control Thermostats · Size 150</b>						
Set point ranges (set point span 100 K each)	Type 2231/2233	15 to 195 °F, 70 to 250 °F, 120 to 300 °F · -10 to 90 °C, 20 to 120 °C, 50 to 150 °C				
	Type 2232/2234	-40 to 140 °F (special version) <sup>3)</sup> , 15 to 195 °F, 70 to 250 °F, 120 to 300 °F, 210 to 390 °F <sup>2)</sup> or 300 to 480 °F <sup>2)</sup> -40 to 60 °C (special version) <sup>3)</sup> , -10 to 90 °C, 20 to 120 °C, 50 to 150 °C, 100 to 200 °C <sup>2)</sup> or 150 to 250 °C <sup>2)</sup>				
Permissible temperature at set point adjuster		-40 to 80 °C · -40 to 175 °F				
Permissible temperature at sensor		100 K above adjusted set point				
Permissible pressure at sensor	Type 2231/2233	Without thermowell: Class 300 · With thermowell: Class 300/Class 600 With thermowell with flange: Class 300/Class 600				
	Type 2232/2234	Without thermowell: Class 100 · With flange: Class 50/Class 100				
Length of capillary tube		10 ft (special version with 16, 33 or 50 ft) · 3 m (special version with 5, 10 or 15 m)				

**Table 2 · Materials** · Material designations according to ASTM and DIN EN

Type 2121 Valve				
Pressure ratings		Class 125	Class 150	Class 300
Valve size		NPS 1, 1½, 2		
Body		Cast iron A 126 B (EN-JL1040)	A 216 WCC (1.0619) <sup>2)</sup>	
Seat		Stainless steel 1.4301		
Plug		CW602N with EPDM soft seal <sup>1)</sup>		
Seal		Graphite with metal core		
Bonnet flange		Steel with brass bushing		
Separating piece		Brass (for sealing) · Stainless steel 1.4305 (for version free of non-ferrous metal)		
Types 2231, 2232, 2233, 2234 Control Thermostats		Standard version	Special version	
Operating element		Nickel-plated brass		
Sensor	Types 2231, 2232	Nickel-plated bronze	Stainless steel 1.4571	
	Types 2233, 2234	Nickel-plated copper		
Capillary tube		Nickel-plated copper	Plastic-coated copper or stainless steel 1.4571	
Thermowell				
Threaded connection 1 NPT				
Immersion tube		Nickel-plated bronze Nickel-plated steel	Stainless steel 1.4571	
Threaded nipple		Nickel-plated brass Nickel-plated steel		
Flange				
Immersion tube		Steel	Stainless steel 1.4571	
Flange		Steel		

<sup>1)</sup> Special version 1.4305 with EPDM or FPM soft seal or metal-seated

<sup>2)</sup> Stainless steel 1.4408 or CC499K (Rg 5) available on request

## Installation

### Valve

Install the valve in a horizontal pipeline. Make sure the direction of flow corresponds to the arrow on the body. The operating element must be suspended.

If necessary, the operating element can also be installed to point up (see EB 21 11/... 2123 EN).



### Temperature sensor

The temperature sensor can be installed in any desired position. Make sure, however, that its entire length is immersed in the process medium. Choose a place of installation where neither overheating nor considerable idle times occur.

### Capillary tube

Install the capillary tube so that it is not exposed to considerable temperature fluctuations and cannot be damaged. Make sure the permissible ambient temperature range (approx. ambient temperature of 70 °F/20 °C) is not exceeded. The smallest permissible bending radius is 2" (50 mm).

Only use the same kind of materials together, for example thermowells made of stainless steel 1.4571 can be installed in stainless steel heat exchangers.

## Accessories

**Thermowells with threaded or flanged connections** for Types 2231 and 2232 Bulb Sensors · 1 NPT threaded connection, Class 150, made of bronze/steel or CrNiMo steel · NPS 1½ flanged connection, Class 150, with immersion tube of CrNiMo steel

**Thermowells typetested by DVGW** for flammable gases, 1 NPT threaded connection, Class 600

**Mounting parts** for Types 2233 and 2234 · Clamps for wall mounting · Perforated cover for thermostat

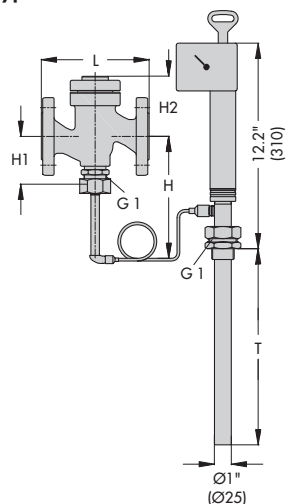
To protect the operating element from inadmissible operating conditions, an **extension piece** or **separating piece** must be installed between the valve and the operating element.

An **extension piece** is needed for temperatures over 430 °F (220 °C). The standard version does not have sealing. The special version of the extension piece is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

An extension piece is required for temperatures over 300 °F (150 °C) when valves with cast iron or spheroidal graphite iron bodies are used together with Type 2212 Safety Temperature Limiter or Type 2213 Safety Temperature Monitor.

A **separating piece** is made of brass (for water and steam) or CrNi steel (for water and oil).

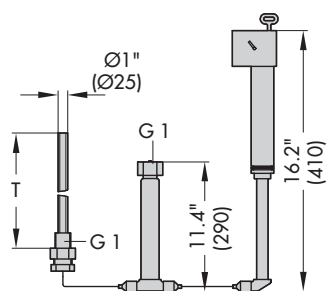
**Type 1u Temperature Regulator  
with Type 2231 or 2233 Control Thermostat**



Type 2121 with  
flanged connections

Type 2231/2233  
Control Thermostat

**Types 2232/2234 Control Thermostats**



Type 2232/2234 Control Thermostat  
with separate set point adjustment

**Dimensions and weights · Control thermostats**

Type ... Control Thermostat		2231	2232	2233	2234
Immersion depth T	in	11.4 <sup>1)</sup>	9.3 <sup>1)</sup>	16.9	18.1
	mm	290 <sup>1)</sup>	235 <sup>1)</sup>	430	460
Approx. weight	lb	7	8.8	7.5	8.1
	kg	3.2	4	3.4	3.7

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

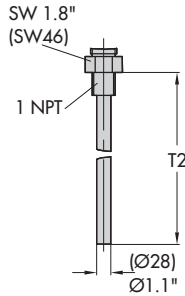
**Dimensions and weights · Valves**

Type 2121 Valve							
Valve size	NPS	½	¾	1	1½	2	
	DN	15	20	25	40	50	
Face-to-face length L	Class 125	inch	–	–	7.25	8.75	10
		mm	–	–	184	222	254
	Class 150	inch	7.25	7.25	7.25	8.75	10
		mm	184	184	184	222	254
	Class 300	inch	7.5	7.6	7.75	9.25	10.5
		mm	191	194	197	235	267
Height H	inch	14.4			15.6		
	mm	365			395		
Height H1	inch	3.0		4.1			
	mm	75		105			
Height H2	inch	3.4		3.8			
	mm	87		97			
Approx. weight	lb	9.9	11	13.2	25.3	30.8	
	kg	4.5	5	6	11.5	14	

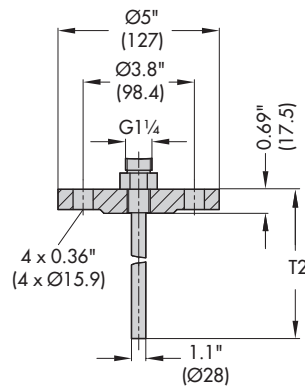
Fig. 3 · Dimensions of control thermostats, valves and accessories

Thermowells for Types 2231/2232

Control Thermostat Type ...	2231	2232
Immersion depth T2	12.6"	9.7"
	321 mm	246 mm



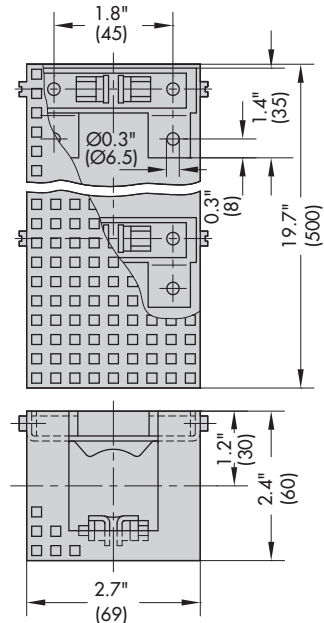
Thermowell with threaded connection  
1 NPT/Class 150



with flanged connection  
NPS 1 1/2/Class 150

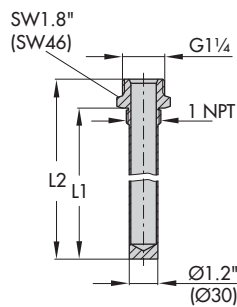
Mounting parts for Types 2233/2234

Clamps and perforated cover for wall mounting



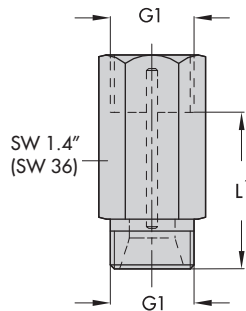
Thermowells for flammable gases, 1 NPT/Class 600

Control thermostat		Type 2231	Type 2232
Length L1	inch	12.4	10
	mm	314	254
Length L2	inch	13.4	11
	mm	340	280



Thermowell for flammable gases  
1 NPT/Class 600

Extension piece/separating piece



**Extension piece:**  
Standard version  
L = approx. 5.5" (140 mm),  
approx. 1.1 lb (0.5 kg)  
Special version (with bellows seal)  
L = approx. 7.1" (180 mm),  
approx. 1.3 lb (0.6 kg)  
**Separating piece:**  
with seals

1) When accessories are used, the H and H1 increase by the dimension L

Fig. 4 · Dimensions of accessories

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.

**Manual adjuster** Ma with travel indicator · MaS with electric signal transmitter

**Types 2231 and 2232 Bulb Sensors:** thermowells with threaded connection

**Types 2233 and 2234 Bulb Sensors:** clamps and perforated cover for wall mounting

#### Ordering text

Temperature Regulator **Type 1u**

NPS ...

Body in Class ... with flanged connection

Body material ...

With Type ... Control Thermostat, set point range ... °F (°C), capillary tube length ... ft (m)

Optionally, special version ...

Optionally, accessories ...

#### 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 3 lists the response times measured in water of SAMSON thermostats that operate according to different principles.

**Table 3** · Response times of SAMSON thermostats

Functional principle	Type ... Thermostat	Time constant in seconds	
		Without thermowell	With thermowell
Liquid expansion	2231	70	120
	2232	65	110
	2233	25	-1)
	2234	15	-1)
	2235	10	-1)
Adsorption	2212	-1)	40

1) Not permissible

Specifications subject to change without notice.

