

# Self-operated Temperature Regulators

## Type 1 Temperature Regulator

with unbalanced single-seated globe valve · Flanges



### ANSI version

### Application

Temperature regulator for heating installations with control thermostats for set points from 15 to 480 °F (-10 to +250 °C) · Valve sizes NPS ½ to 2 · Pressure rating Class 125 to 300 · Suitable for temperatures up to 660 °F (350 °C)  
The valve **closes** as the temperature rises.

### Note

Typetested temperature regulators (TR), temperature limiters (TL), safety temperature monitors (STM), and safety temperature limiters



The regulators consist of a balanced globe valve 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 easy adjustment of the set point indicated on a dial
- Unbalanced single-seated globe valves for use in applications with liquids, gases and vapors, especially for heat transfer fluids such as water, oil or steam
- Valve body optionally made of cast iron, cast steel or cast stainless steel
- Versions with double adapter or manual override for attachment of a second control thermostat. For details, refer to Data Sheet T 2036 EN.

### Versions

#### Type 1 Temperature Regulators

Valve size NPS ½ to 2 · Class 125 to 300 · Face-to-face dimensions according to ANSI B16.10 · Types 2231 to 2235 Control Thermostats (see Fig. 1)

For details on the application of the control thermostats, refer to Information Sheet T 2010 EN.

**Type 2111/2231** (Fig. 1) · With Type 2111 Valve and Type 2231 Control Thermostat for liquids · Set point adjustment at the sensor · Set points from 15 to 300 °F (-10 to +150 °C)

**Type 2111/2232** · With Type 2111 Valve and Type 2232 Control Thermostat for liquids and steam · Separate set point adjustment · Set points from 15 to 480 °F (-10 to +250 °C)

**Type 2111/2233** · With Type 2111 Valve and Type 2233 Control Thermostat for liquids, air and gases · Set points from 15 to 300 °F (-10 to +150 °C), set point adjustment at the sensor

**Type 2111/2234** · With Type 2111 Valve and Type 2234 Control Thermostat for liquids, air and gases · Separate set point adjustment · Set points from 15 to 480 °F (-10 to +250 °C)

**Type 2111/2235** · With Type 2111 Valve and Type 2235 Control Thermostat for 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 15 to 480 °F (-10 to +250 °C)

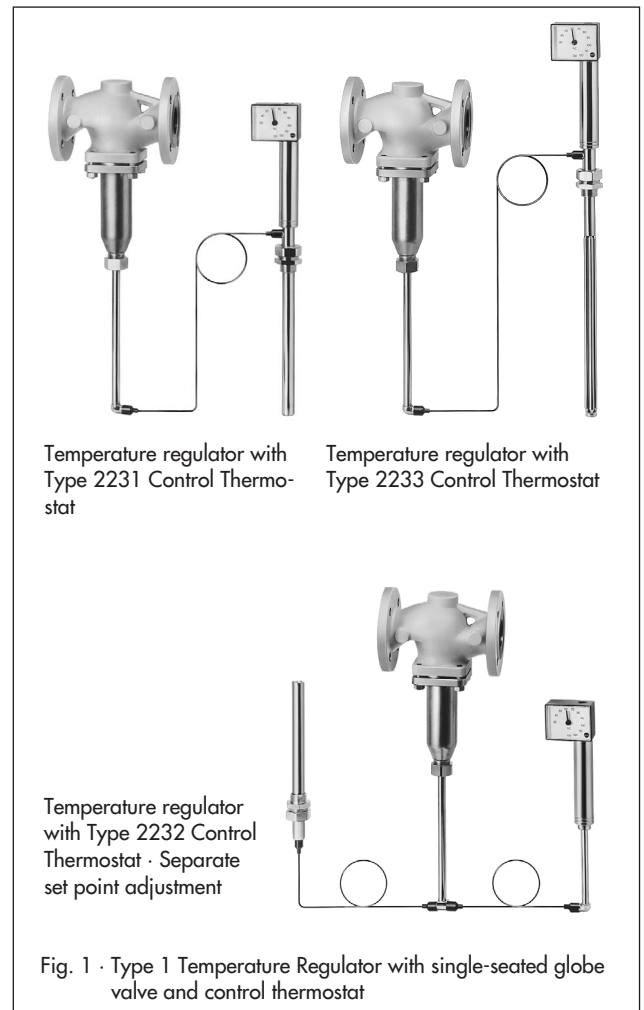


Fig. 1 · Type 1 Temperature Regulator with single-seated globe valve and control thermostat

### Special version

- Capillary tube of either 16, 33 or 50 ft (5 m, 10 m or 15 m)
- Sensor made of CrNiMo steel
- Capillary tube made of CrNiMo steel or plastic-coated copper
- Valve free of non-ferrous metal
- Valve made completely of stainless steel

### Principle of operation (Fig. 2)

The regulators operate according to the liquid expansion principle.

The temperature sensor (11), capillary tube (8) and operating element (7) are filled with an expanding liquid. The temperature-dependent change in volume of this liquid causes the 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.

The set point is adjustable with a key (9); the adjusted value can be read off the dial (10).

#### Valve

- 1 Valve body
- 2 Valve seat (exchangeable)
- 3 Valve plug
- 4 Lower part
- 5 Plug stem with spring
- 6 Connection for operating element (coupling nut)

#### Control thermostat

- 7 Operating element with bellows
- 8 Capillary tube
- 9 Key for set point adjustment
- 10 Set point dial
- 11 Temperature sensor (bulb sensor)

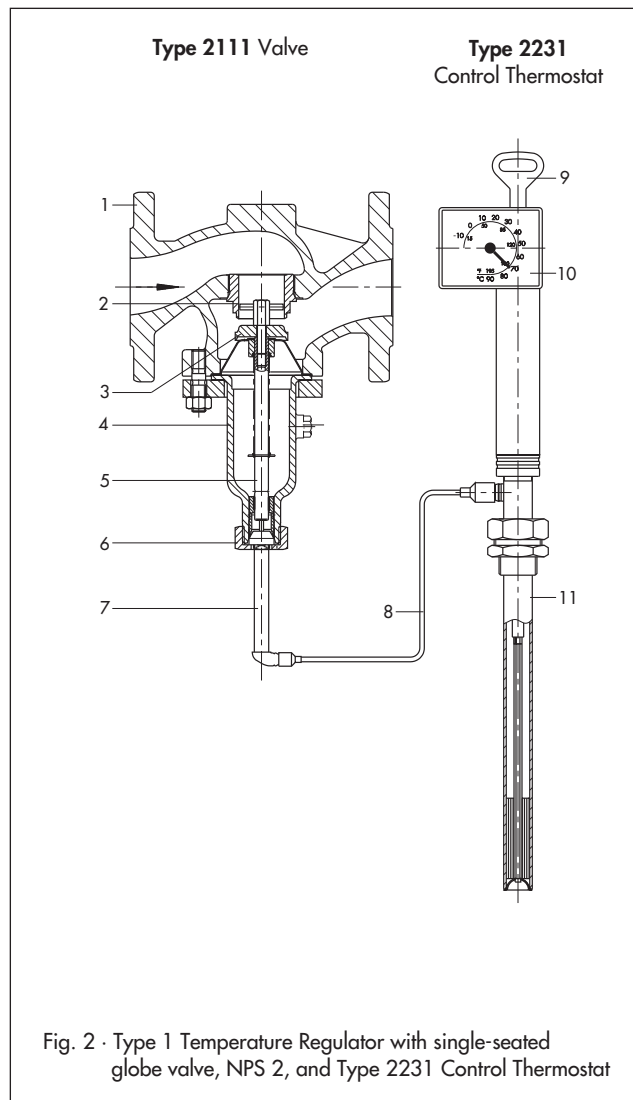


Fig. 2 · Type 1 Temperature Regulator with single-seated globe valve, NPS 2, and Type 2231 Control Thermostat

### Installation

#### • Valve

Install the valves in horizontal pipelines. The direction of flow must correspond with the arrow on the body. The connecting element must be vertically suspended.

#### • Capillary tube

Install the capillary tube such that it is not exposed to considerable temperature fluctuations and cannot be damaged. Make sure the permissible ambient temperature range is not exceeded. The smallest possible bending radius is 2" (50 mm).

#### • Temperature sensor

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

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.

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

Type 2111 Valve						
Pressure rating	Class 125 to 300					
C <sub>v</sub> (K <sub>vs</sub> ) coefficients, leakage rate and max. permissible differential pressures Δp in psi (bar)						
Standard version	NPS ½	NPS ¾	NPS 1	NPS 1 ½	NPS 2	
Flow coefficients	C <sub>v</sub>	5	7.5	9.4	23	37
	K <sub>vs</sub>	4	6.3	8	16	32
Max. permissible differential pressure Δp	psi	360	230	200	90	60
	bar	25	16	14	6	4
Leakage rate acc. to ANSI/FCI 70-2		≤ 0.05 % of C <sub>v</sub> (K <sub>vs</sub> ) coefficient				
Special version	NPS ½	NPS ¾	NPS 1	NPS 1 ½	NPS 2	
Flow coefficients	C <sub>v</sub>	3 · 1.2 · 0.5 · 0.2		5 · 1.2 · 0.5 · 0.2	9.4	20
	K <sub>vs</sub>	2.5 · 1 · 0.4 · 0.1		4 · 1 · 0.4 · 0.1	6.3	16
Max. permissible differential pressure Δp	psi	360		230	90	
	bar	25		16	6	
Permissible valve temperature		Max. 660 °F (350 °C) · See pressure-temperature diagram (T 2010 EN)				
Type 2231 to Type 2235 Thermostats						
Size 150						
Set point range (set point span 100 K)	°F	15 to +195 °F, 70 to 250 °F or 120 to 300 °F For Types 2232, 2234, 2235 also 210 to 390 °F, 300 to 480 °F				
	°C	-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				
Permissible ambient temperature at the set point adjustment head		-40 to +175 °F (-40 to +80 °C)				
Permissible temperature at the sensor		100 K above the adjusted set point				
Permissible pressure at the sensor of Types 2231, 2232, 2233 and 2234		With/without thermowell: Class 300 <sup>1)</sup> · With thermowell with flange: Class 300 <sup>1)</sup>				
Length of the capillary tube		10 ft (special version: 16, 33, 50 ft) · 3 m (special version: 5, 10, 15 m)				

<sup>1)</sup> Other pressure ratings for thermowells and flanges on request

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

Type 2111 Valve			
Valve size	NPS 1, 1 ½ and 2		NPS ½ to 2
Pressure rating	Class 125		Class 150 and 300
Body	Cast iron A126 Class B		Cast steel A216 WCC
Seat and plug	1.4305		1.4104/1.4112
Plug stem/spring			1.4301/1.4310
Lower part	1.0425		1.4571
Body gasket	Graphite on metal core		
Extension piece/ separating piece	Brass (special version: stainless steel 1.4301)		1.4301
Types 2231, 2232, 2233, 2234 and 2235 Control Thermostats			
Operating element		Nickel-plated brass	
Sensor	Type 2231 Type 2232	Nickel-plated bronze	Stainless steel 1.4571
	Type 2233 Type 2234	Nickel-plated copper	
	Type 2235	Copper	-
	Capillary tube	Nickel-plated copper	
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		
Flanged connection			
Immersion tube	Steel		Stainless steel 1.4571
Flange	Steel		

## Accessories

**Thermowells with threaded or flanged connections** for Types 2231 and 2232 Bulb Sensors · 1 NPT threaded connection, Class 300, made of bronze/steel or CrNiMo steel NPS 1½ flanged connection, Class 300, with immersion tube made of CrNiMo steel/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).

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.

Additionally, the following versions are available:

**Safety temperature monitors (STM)** and **safety temperature limiters (STL)**. For details, refer to Data Sheets T 2043 EN and T 2046 EN.

## 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 Type 2235 Thermostat and a Type 2111 Three-way Valve in sizes NPS ½ to 2.

**Sensors** without thermowell: applicable up to 600 psi (40 bar), max. test pressure 870 psi (60 bar)

Sensors with thermowell: only use SAMSON 1 NPT version made of bronze and stainless steel 1.4571 up to Class 300.

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

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

## Dynamic behavior of the thermostat

The dynamics of the regulator mainly depends on the dynamic behavior of the associated sensor with its characteristic time constant.

Table 3 lists the time constants of SAMSON thermostats operating according to different functional principles when measuring in water.

**Table 3** · Time constants of SAMSON thermostats

Functional principle	Control Thermostat	Time constant in seconds	
		Without thermowell	With thermowell
Liquid expansion	2231	70	120
	2232	65	110
	2233	25	– <sup>1)</sup>
	2234	15	– <sup>1)</sup>
	2235	10	– <sup>1)</sup>
	2213	70	120
Adsorption	2213	– <sup>1)</sup>	40

<sup>1)</sup> Not permissible

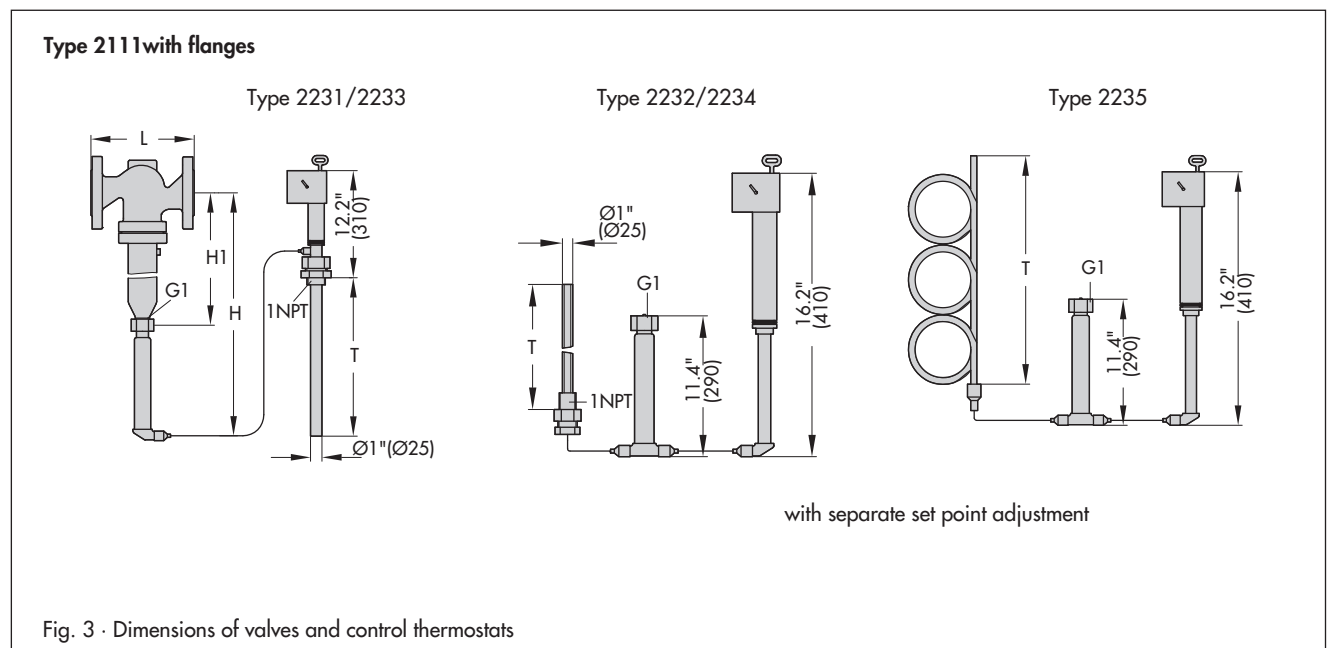
**Table 4** · Dimensions and weights

Type 2111 Valve		NPS 1/2	NPS 3/4	NPS 1	NPS 1 1/2	NPS 2	
Length L	Class 125	–	–	7.25"/184 mm	8.75"/222 mm	10"/254 mm	
	Class 150	7.25"/184 mm	7.25"/184 mm	7.25"/184 mm	8.75"/222 mm	10"/254 mm	
	Class 300	7.5"/191 mm	7.62"/194 mm	7.75"/197 mm	9.25"/235 mm	10.5"/267 mm	
H1	Without extension piece	8.9"/225 mm					
	With extension piece	14.4"/365 mm					
H	Without extension piece	20.3"/515 mm					
	With extension piece	25.8"/655 mm					
Weight, approx. (based on Class 125) <sup>1)</sup>	lb	8.8	9.9	12.1	22	29.7	
	kg	4	4.5	5.5	10 <sup>1)</sup>	13.5 <sup>1)</sup>	
Thermostat		Type	2231	2232	2233	2234	2235
Immersion depth T	inch		11.4 <sup>2)</sup>	9.25 <sup>2)</sup>	16.9	18.1	136.2
	mm		290 <sup>2)</sup>	235 <sup>2)</sup>	430	460	3460
Weight, approx.	lb		7	8.8	7.5	8.1	7.9
	kg		3.2	4.0	3.4	3.7	3.6

<sup>1)</sup> Body Class 150/300: +15 %

<sup>2)</sup> Larger immersion depths available on request

**Dimensions in mm** · Valves and control thermostats



**Ordering text**

**Type 1/... Temperature Regulator**

NPS ..., Class ...

Body material

With Control Thermostat Type ..., set point range ...°F (°C)

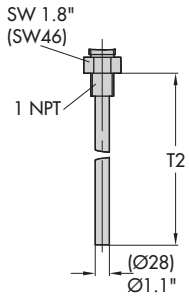
Capillary tube ... ft (m)

Special version, if required

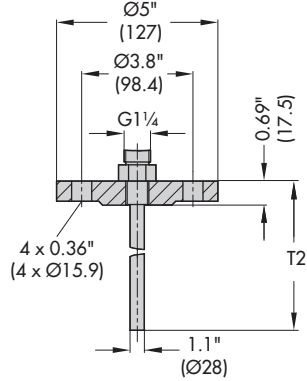
Accessories

Thermowells for Type 2231/2232

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

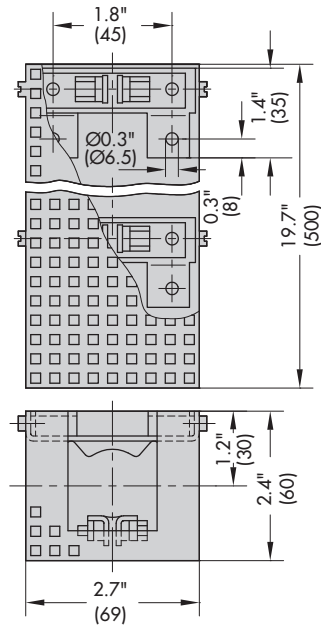


Thermowell with threaded connection  
1 NPT/Class 300



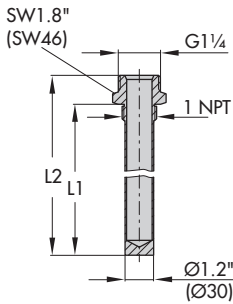
with flanged connection  
NPS 1 1/2/Class 300

Clamps and perforated cover for wall mounting



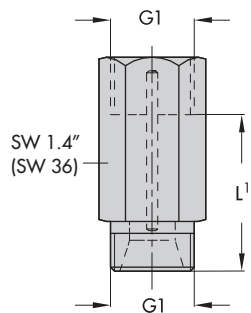
Thermowells for flammable gases, 1 NPT/Class 600

Control thermostat	Type 2231	Type 2232
Length L1	inch	12.4
	mm	314
Length L2	inch	13.4
	mm	340



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  
L = approx. 2.1" (55 mm),  
approx. 0.4 lb (0.2 kg)

<sup>1)</sup> When accessories are used, the H and H1 increase by the dimension L

Fig. 4 · Dimensions of accessories

Specifications subject to change without notice.

