Self-operated Temperature Regulators

Temperature Regulator Type 1 • Valve **closes** when the temperature **rises**.

Unbalanced single-seated globe valve

Application

Temperature regulator for heating installations.
Set point values from **15 °F** to **480 °F** (–10 °C to 250 °C)
Sizes ½" to 2" (15 to 50 mm)
Pressure ratings ANSI Class 125 to **300**
Temperatures up to **660 °F** (350 °C)

The regulators consist of an unbalanced control valve and a control thermostat, comprising a temperature sensor, a set point adjustment head with an excess temperature safety device, a capillary tube and an operating element.

Features

- Low-maintenance, proportional regulators requiring no auxiliary energy
- Wide set point range and easy adjustment of set point indicated on a dial
- Unbalanced single-seated globe valves
- Applicable for liquids, gases and vapours, especially for the heat transfer fluids water, oil and steam
- Valve body available in cast iron, carbon steel or stainless steel

Versions

Temperature Regulator Type 1 · With Type 2811 Valve and Type 2231 to 2235 Thermostat
· For heating installations (valve closes when temperature rises)
· Sizes ½" to 2" (15 to 50 mm)
· ANSI Class 125 to 300

Type 2811/2231 (Fig. 1) · With Type 2231 Thermostat
· For liquids
· Set points from 15 °F to 300 °F (–10 °C to 150 °C)
· Set point adjustment at the sensor.

Type 2811/2232 (Fig. 3) · With Type 2232 Thermostat
· For liquids and steam
· Set points from 15 °F to 480 °F (–10 °C to 250 °C)
· Separate set point adjustment.

Type 2811/2233 (Fig. 2) · With Type 2233 Thermostat
· For liquids, air and other gases
· Set points from 15 °F to 300 °F (–10 °C to 150 °C)
· Set point adjustment at the sensor.

Type 2811/2234 · With Type 2234 Thermostat
· For liquids, air and other gases
· Set points from 15 °F to 480 °F (–10 °C to 250 °C)
· Separate set point adjustment.

Type 2811/2235 · With Type 2235 Thermostat
· For air-heated storerooms, drying, and curing cabinets
· Set points from 15 °F to 480 °F (–10 °C to 250 °C)
· Separate set point adjustment and user-installable sensor tube.

For details on the application of the thermostats, see Associated Information Sheet T 2010.

For **DIN versions** see Technical Data Sheets T 2111 (flanged ends DN 15 to 100) and T 2112 (threaded ends G ½ to G 1).

Fig. 1 · Type 1 Regulator with Type 2231 Thermostat

Fig. 2 · Type 1 Regulator with Type 2233 Thermostat

Fig. 3 · Type 1 Temperature Regulator with Type 2232 Thermostat, with separate set point adjustment

Special versions

– Longer capillary tube: 16 ft, 32 ft or 50 ft (5, 10 or 15 m)
– Sensor and/or capillary tube of stainless steel
– Capillary tube armoured or plastic-coated
– Stainless steel valve version (flanges only)
– Valve with flow divider I for noise reduction with vapours, steam, and non-flammable gases

Accessories and combinations - see page 2

Principle of operation (Fig. 4)

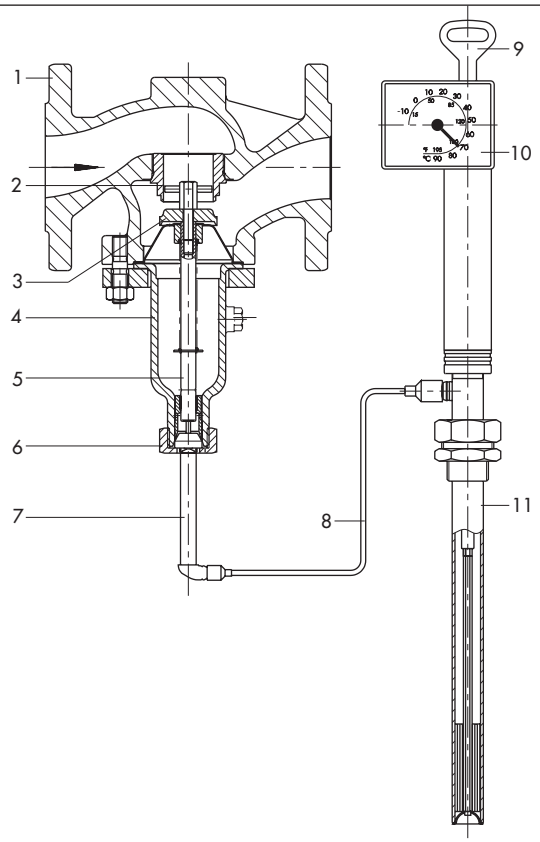
The regulators operate according to the liquid expansion principle. The temperature sensor (11), capillary tube (8) and operating element (7) are filled with an expansion liquid. The temperature-dependent change in volume of this liquid causes the operating element (7) to move and as a result also moves the stem (5) and the plug (3).

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

The set point is adjustable with a key (9) to a value read from the dial (10), which is calibrated after being placed in service, to match the installed conditions.

Accessories and combinations

- **Extension piece** for temperatures above **430 °F** (220 °C) (see Pressure-Temperature Diagram).
- **Distance piece** of brass or stainless steel to prevent leakage when the thermostat is removed and to isolate non-ferrous metal parts of the operating element from the process medium in the valve with stainless steel version. In versions for thermal oil, an additional FKM sealing ring is required.
- **Thermowells with threaded connection or flange** for Type 2231 and 2232 thermostats.
- **Thermowell with perforated case and clamp** for Type 2233 and 2234 thermostats.
- **Double adaptor (Do)** or **Manual adjuster (Ma)** for details see Technical Data Sheet T 2036.
- **Safety Temperature Monitor (STM)** Type 2213 for details see Technical Data Sheet T 2043.
- **Safety Temperature Limiter (STL)** Type 2212 for details see Technical Data Sheet T 2046.
- **Temperature Limiters (TL)** with a thermostat and a control valve as specified above and a double adapter Do (see Data Sheet T 2036 E).



Control valve

1 Valve body
2 Seat (exchangeable)
3 Plug
4 Bellows housing (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 sen-

Fig. 4 · Type 1 Temperature Regulator with Type 2231 Thermostat

Installation

Only the same kind of materials should be combined, for example thermowells of stainless steel AISI 316Ti (WN 1.4571) can be installed into heat exchangers of stainless steel.

• **Valve**

The valves are to be installed in horizontal pipelines. The direction of medium flow through the valve must coincide with the arrow on the body. The operating element of the thermostat must be vertically suspended.

• **Temperature sensor**

The temperature sensor may be installed in any desired position. Its whole length must be immersed in the medium to be controlled. It should be installed in a location where overheating or considerable idle times cannot occur.

• **Capillary tube**

The capillary tube must be laid in such a way that it is not exposed to large temperature fluctuations and cannot be damaged. The ambient temperature should not exceed the permissible limits (approximate temperature: 70 °F (20 °C)). The smallest permissible bending radius is 2″ (50 mm).

• **Temperature setpoint indicator**

The setpoint of the thermostat is adjusted in the field according to a separate temperature indicator provided by the customer. Once set, the thermostat needle of the dial is calibrated by the user to match. With ambient temperatures can occur below 32 °F (0 °C), the setpoint indicator should be located such that it is protected from precipitation or the possibility of condensation of moisture which may be subject to freezing.

Table 1a · Technical data · All pressures in psi (gauge). The permissible pressures and differential pressures specified are limited by the data given in the Pressure-Temperature Diagram and the pressure ratings (according to ANSI B16.34).

Type 2811 Valve Nominal pressure			Class 125 to 300				
C_V values, leakage rate and max. perm. differential pressures Δp[1]							
Nominal size		inch	½″	¾″	1″	1½″	2″
Standard version	C_V value	USGPM	5.0	7.5	9.4	23	37
	Differential press. Δp	psi	360	230	200	90	60
Special version	C_V value	USGPM	0.2; 0.5; 1.2; 3	0.2; 0.5; 1.2; 3.0; 5.0	0.2; 0.5; 1.2; 3.0; 5.0; 7.5	9.4	20
	Differential press. Δp	psi	360		230 [2]	200	90
Terms for valve sizing according to ISA-S75.0&-S75.02, IEC 534 parts 2-1&2-2.			F_L = 0.95, X_T = 0.75				
Leakage rate		% of C_V	≤ 0.05% of C_V value				
Permissible valve temperature			See Pressure-Temperature Diagram				

[1] For liquids, the differential pressure equals the pressure head of the pump
[2] C_V 0.2, 0.5, 1.2, 3.0 Δp 360 psi

Table 1b · Technical data · All pressures in bar (gauge). The permissible pressures and differential pressures specified are limited by the data given in the Pressure-Temperature Diagram and the pressure ratings (according to ANSI B16.34).

Type 2811 Valve Nominal pressure			Class 125 to 300				
K_{VS} values, leakage rate and max. perm. differential pressures Δp[1]							
Nominal size		inch (mm)	½″ 15	¾″ 20	1″ 25	1½″ 40	2″ 50
Standard version	K_{VS} value	m^3/h	4	6.3	8	20	32
	Differential press. Δp	bar	25	16	14	6	4
Special version	K_{VS} value	m^3/h	0.16; 0.4; 1.0; 2.5	0.16; 0.4; 1.0; 2.5; 4.0	0.16; 0.4; 1.0; 2.5; 4.0; 6.3	8	16
	Differential press. Δp	bar	25		16 [2]	14	6
Terms for valve sizing according to ISA-S75.0&-S75.02, IEC 534 parts 2-1&2-2.			F_L = 0.95, X_T = 0.75				
Leakage rate		% of K_{VS}	≤ 0.05% of K_{VS} value				
Permissible valve temperature			See Pressure-Temperature Diagram				

[1] For liquids, the differential pressure equals the pressure head of the pump
[2] K_{VS} 0.16, 0.4, 1.0, 2.5 and 4.0 Δp 25 bar

Conversion of valve sizing coefficients:
C_v (in U.S.-gallons/min) = 1.17 · K_{vs} (in m^3/h)
K_{vs} (in m^3/h) = 0.86 · C_v (in U.S.-gallons/min)

Table 2a · Technical data · All temperatures in °F

Type 2231 to Type 2235 Thermostats	Size 150
Set point range (set point span, each 180 °F)	15 to 195 °F 70 to 250 °F 120 to 300 °F For Types 2232, 2234, 2235 also: 210 to 390 °F 300 to 480 °F
Permissible ambient temperature at the set point adjuster	–40 to +175 °F
Perm. temperature at the sensor	180 R (180 °F) above the adjusted set point
Permissible pressure at the sensor Types 2231/..32/..33/..34	With/without thermowell: 580 psi (version with flanges or other nom. pressure: on request)
Length of capillary tube	10 ft (special version 16, 32 or 50 ft)

Table 2b · Technical data · All pressures in °C

Type 2231 to Type 2235 Thermostats	Size 150
Set point range (set point span, each 100 °C)	–10 to 90 °C +20 to 120 °C +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 adjuster	–40 to +80 °C
Perm. temperature at the sensor	100 K (100 °C) above the adjusted set point
Perm press. at the sensor Types 2231/..32/..33/..34	With/without thermowell: 40 bar (version with flanges or other nom. pressure: on request)
Length of capillary tube	3 m (special version 5, 10 or 15 m)

Table 3 · Materials

Type 2811 Control Valve				
Nominal size	½" to 2" (15 to 50 mm)			
Pressure rating	ANSI Class 125 and 250[1]	ANSI Class 150 and 300		
Body	Cast iron ASTM A 126 Class B	Cast carbon steel ASTM A 216 WCB	Cast stainless steel ASTM A 351 CF8M	
Seat and plug[2]	Stainless steel AISI 303 WN 1.4305		AISI 316 Ti WN 1.4571	
Plug stem/spring	Stainless steel AISI 304/301 WN 1.4301/WN 1.4310			
Bellows housing	Carbon steel ASTM A 106 Gr. A St 35.8 (WN 1.0305)		AISI 316 Ti WN 1.4571	
Body gasket	Graphite on metal core			
Reversing device (Type 1u)	Brass GK-CuZn37Pb			
Extension piece/distance piece	Brass special version: stainless steel AISI 304 (WN 1.4301)		AISI 304 WN 1.4301	

Types 2231, 2232, 2233, 2234 and 2235 Thermostat				
	Standard version		Special version	
Operating element	Brass, nickel-plated			
Sensor Types 2231/2	Bronze, nickel-plated		–	Stainless steel AISI 316 Ti WN 1.4571
Sensor Types 2233/4	Copper, nickel-plated			
Sensor Type 2235	Copper			
Capillary tube	Copper, nickel-plated		Copper, plastic-coated[3]	
Thermowell for Type 2231 and Type 2232				
Connection thread NPT 1"				
Immersion tube	Bronze, nickel-plated		Copper	AISI 316 Ti WN 1.4571
Threaded nipple	Brass, nickel-plated		Copper	AISI 316 Ti WN 1.4571
With flange on request				

[1] Class 125: 1" to 2" flat face flanged; Class 250: ½" to 2" female threaded NPT
[2] Nominal size ½" to 1": soft-sealed plug (with PTFE ring for temperatures up to 430 °F (220 °C))
[3] Plastic coating - for temperatures up to 175 °F (80 °C): PVC

Pressure-Temperature Diagram

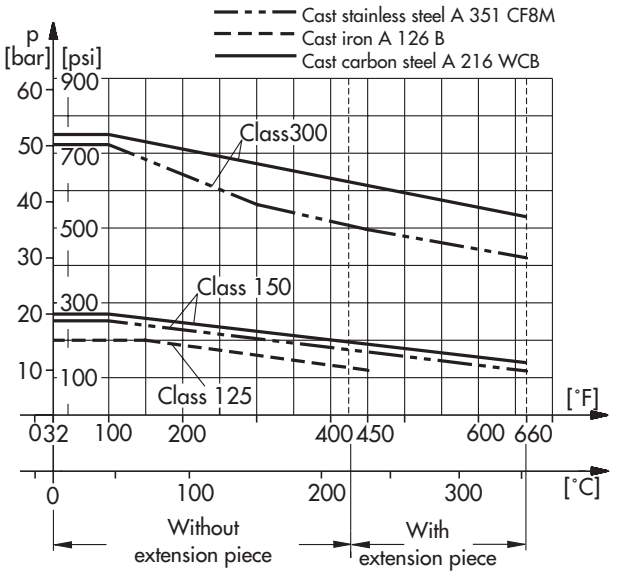


Fig. 5 · Pressure-Temperature Diagram (see Notes)

Notes regarding the Pressure-Temperature Diagram

The operating pressures specified are limited by the data given in the Pressure-Temperature Diagram. The values are as specified by ASME/ANSI Standards B16.34 for Classes 150 and 300, B16.1 for Class 125 and B16.4 for Class 250. The maximum operating pressure should also not exceed the maximum permissible differential pressure Δp specified in the table "Technical data".

Sensor without thermowell: Applicable up to 580 psi (40 bar).

With thermowell: Only use SAMSON version, NPT 1", of bronze and AISI 316Ti (WN 1.4571) stainless steel up to 580 psi (40 bar), of copper up to 230 psi (16 bar).

Table 4a · Dimensions and weights (inches and pounds)

Type 2811 Control Valve		**Size**	in	½″	¾″	1″	1½″	2
Length L	Class 125 FF		in	–	–	7.25	8.75	10
	Class 150 RF		in	7.25	7.25	7.25	8.75	10
	Class 250 NPT-female		in	6.00	6.00	6.00	8.00	9.25
	Class 300 RF		in	7.50	7.62	7.75	9.25	10.50
H1	Without	Extension	in	8.9				
	With	piece[1)]	in	14.4				
H	Without	Extension	in	20.3				
	With	piece[1)]	in	25.8				
Weight, approx. (body Class 125) [2)]			lb	9	10	12	25	30

Thermostat	Type	2231	2232	2233	2234	2235
Immersion depth T	in	11.4	9.25	16.9	18.1	136.2
Weight, approx.	lb	7	9	7.5	8	8

[1)] See Pressure-Temperature Diagram [2)] +15% for Class 150/300

Table 3b · Dimensions and weights (millimeters and kilograms)

Type 2111 Control Valve		**Size**	(mm)	½″ (15)	¾″ (20)	1″ (25)	1½″ (40)	2 (50)
Length L	Class 125 FF		mm	–	–	184	222	254
	Class 150 RF		mm	184	184	184	222	254
	Class 250 NPT-female		mm	152	152	152	203	235
	Class 300 RF		mm	191	194	197	235	267
H1	Without	Extension	mm	225				
	With	piece[1)]	mm	365				
H	Without	Extension	mm	515				
	With	piece[1)]	mm	655				
Weight, approx. (body Class 125) [2)]			kg	4	4.5	5.5	11.5	13.5

Thermostat	Type	2231	2232	2233	2234	2235
Immersion depth T	mm	290	235	430	460	3460
Weight, approx.	kg	3.2	4.0	3.4	3.7	3.6

[1)] See Pressure-Temperature Diagram [2)] +15% for Class 150/300

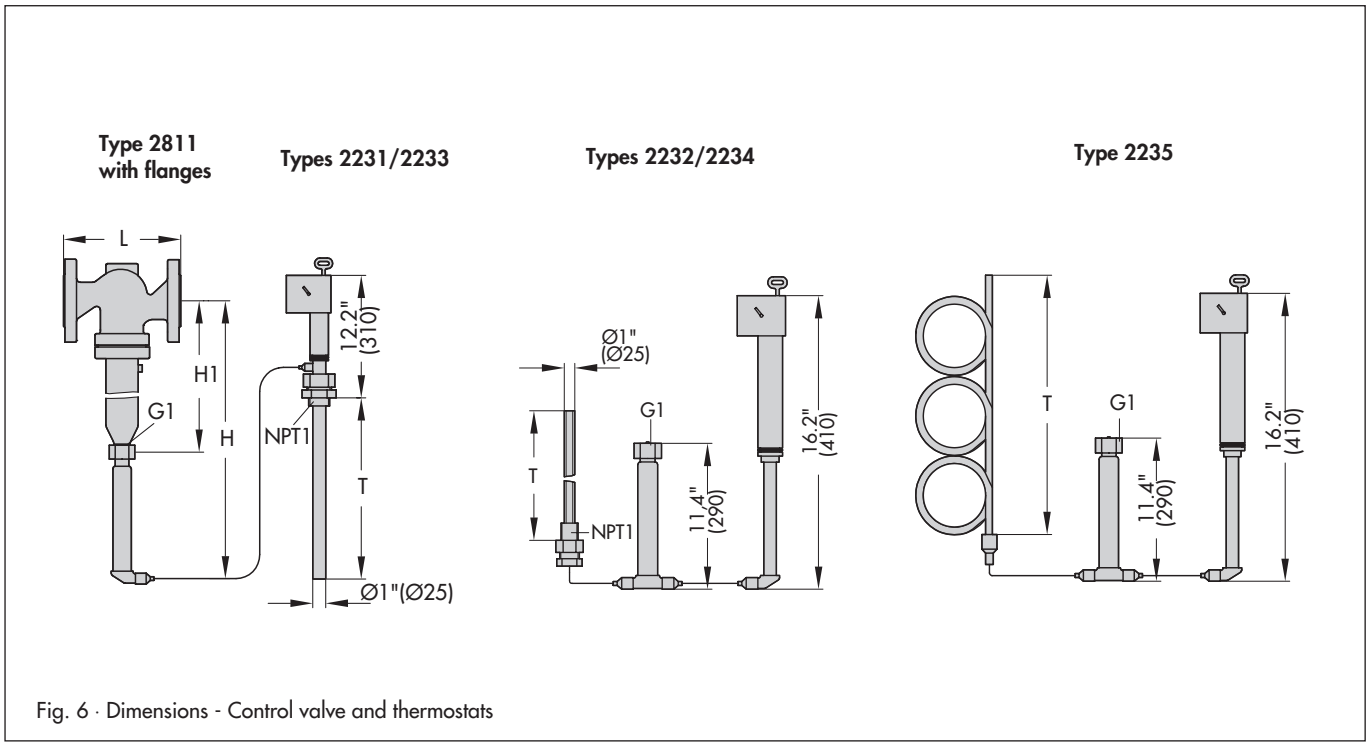
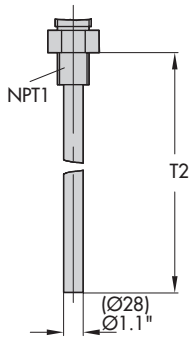


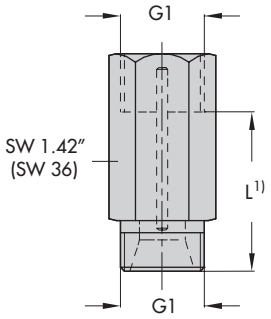
Fig. 6 · Dimensions - Control valve and thermostats

Thermowells for Types 2231/2232

Thermostat	Type	2231	2232
Imm. depth T2	inch	12.8″	10″
	mm	325	250



Distance piece
Extension piece



1) **Distance piece:**
L = 2.17″ (55 mm)
Weight approx. 0.5 lb/0.2 kg

Extension piece:
L = 5.51″ (140 mm)
Weight approx 1.1 lb/0.5 kg

Clamps and perforated cover for wall mounting

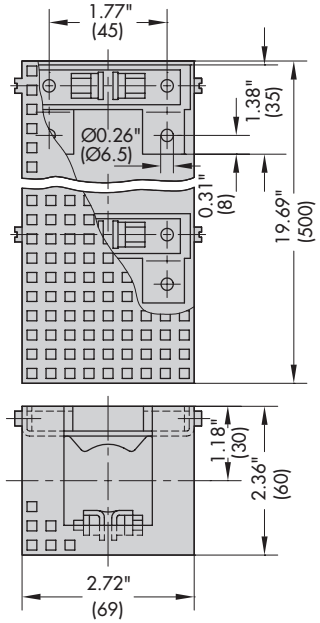


Fig. 7 · Dimensions - Accessories -

Ordering information

Temperature Regulator Type 1, Size ...,
ANSI Class ..., Body material ...,
With Thermostat Type ..., Set point range ... °F (°C),
Length of capillary tube ... ft (m),
Optional special version ..., Accessories...

Specifications subject to change without notice.

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