Self-operated Temperature Regulators

Temperature Regulator Type 4 · Valve **closes** when the temperature **rises**.

Temperature Regulator Type 4u · Valve **opens** when the temperature **rises**.

Balanced single-seated globe valve

Application

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

The regulators consist of a balanced control valve, optional reversing device 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
- Single-seated globe valves with plug balancing by means of a stainless steel bellows
- Applicable for liquids, gases and vapours, especially for the heat transfer fluids water, oil and steam
- Valve body available in cast iron, carbon or stainless steel

Versions

Temperature Regulator Type 4 · With Type 2114 Valve and Type 2231 to 2235 Thermostat
· For heating installations (valve closes when temperature rises)
· Sizes ½" to 10" (15 to 250 mm)
· ANSI Class 125 to 300

Temperature Regulator Type 4u · With Type 2114 Valve with reversing device and Type 2231 to 2235 Thermostat
· For cooling installations (valve opens when temperature rises)
· Sizes ½" to 10" (15 to 250 mm)
· ANSI Class 125 to 300

Type 2114/2231 (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 2114/2232 (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 2114/2233 (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 2114/2234 · 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 2114/2235 · 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 a user-installed sensor tube.

Fig. 1 · Type 4 Regulator with Type 2231 Thermostat

Fig. 2 · Type 4 Regulator with Type 2233 Thermostat

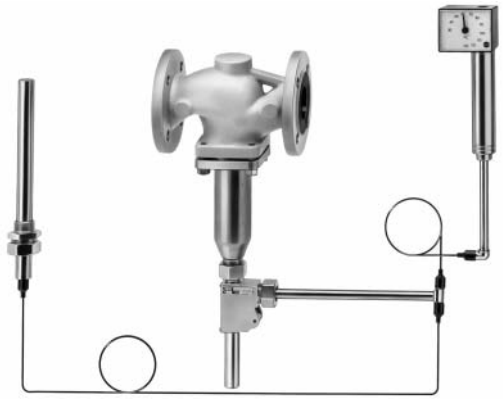


Fig. 3 · Type 4u Regulator with Type 2232 Thermostat, version with separate set point adjustment

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

Special versions, accessories, and combinations

– see page 2

For **DIN versions** see Technical Data Sheets T 2031E (Type 4) and T 2123E (Type 4u).

Principle of operation (Figs. 4 and 5)

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 bellows inside the operating element (7) to move and as a result also moves the stem (5) and plug (3) of the control valve.

With **Type 4** the pin of the operating element (8) acts on the stem (5) and moves the plug (3) towards the closed position on increasing temperature in the sensor.

With **Type 4u** the reversing device (7.1) allows the stem to retract on increasing temperature and move the plug towards the open direction.

The position of the plug determines the flow rate of the heat transfer medium across the free area between the seat (2) and plug (3).

The set point is adjustable with a key (10) to a value which can be read off the dial (11).

Special versions

– Longer capillary tube: 16, 32 or 50 ft (5, 10 or 15 m)
– Sensor and/or capillary tube of stainless steel
– Capillary tube armored or plastic-coated
– Reduced C_v (K_{vs}) values
– Version with reversing device with travel adjuster (for adjustment of minimum flow rate)

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

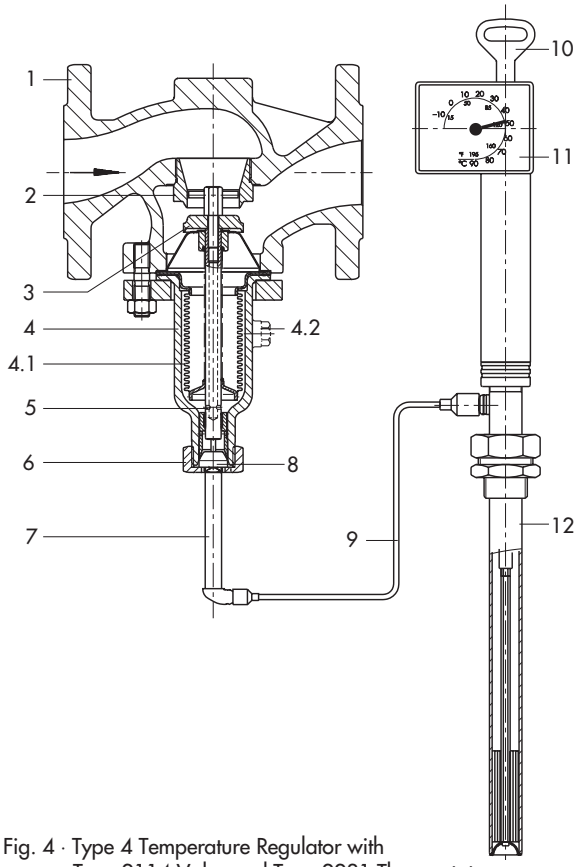


Fig. 4 · Type 4 Temperature Regulator with Type 2114 Valve and Type 2231 Thermostat

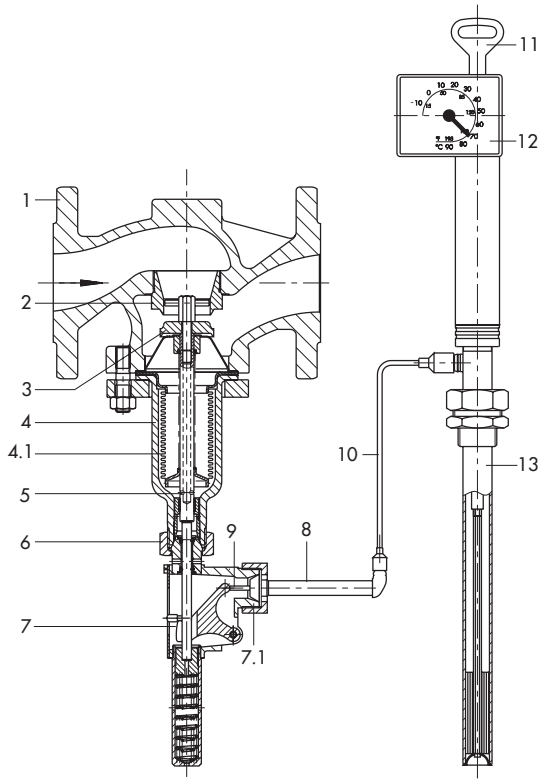


Fig. 5 · Type 4u Temperature Regulator with Type 2114 Valve, reversing device and Type 2231 Thermostat

Control valve

1 Valve body
2 Seat
3 Plug
4 Bellows housing
4.1 Balancing bellows
4.2 Vent screw (for 6" and larger)
5 Plug stem with spring
6 Connection for operating element of the thermostat

Control thermostat

7 Operating element with bellows
7.1 Reversing device
8 Pin of operating element
9 Capillary tube
10 Key for set point adjustment
11 Set point dial
12 Temperature sensor (bulb sensor)

Table 1a · Technical data · All pressures in psig (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 2114 Control Valve												
C_V values and max. permissible differential pressures Δp [1]												
Nominal size	in	½″	¾″	1″	1½″	2″	2½″	3″	4″	6″	8″	10″
C_V values	US gal/min	5	6	9.5	23	37	60	95	145	330	490	585
Max. differential pressure Δp	psi	360					300		240	175	145	
Special version	C_V values	–	1.2; 2.9;3.7	3.7; 6	9.5	15	23	37	60	–		
Max. differential pressure Δp	psi	360					300		240	–		
Terms for valve sizing according to IEC 534 parts 2-1 and 2-2, ISA S75.01and S75.02		F_L = 0.95, X_T = 0.75										
Permissible valve temperature		See Pressure-Temperature Diagram										

Type 2231 to Type 2235 Thermostats	Size 150	Size 250[2]
For nominal valve size	½″ - 6″	8″ - 10″
Set point ranges	15 to 195 °F 70 to 250 °F 120 to 300 °F For Types 2232, 2234, 2235: 210 to 390 °F 300 to 480 °F	35 to 160 °F 85 to 210 °F 120 to 250 °F 175 to 300 °F
Permissible ambient temperature at the set point adjuster	–40 to 150 °F	–5 to 175 °F
Permissible temperature at the sensor	180 °F above the adjusted set point	55 °F above the adjusted set point
Permissible pressure at the sensor of Types 2231, 2232, 2233 and 2234	With and without thermowell: ANSI Class 300 [3]	ANSI Class 125 [3]
Length of capillary tube	10 ft (special version: 16,33 or 50 ft)	

1) For liquids; the differential pressure equals the pressure head of the pump
2) Only Type 2231 is available in size 250
3) Versions with flange or other pressure ratings on request

Table 2a · Dimensions in inches and weights in lb (L, H1, H, T in reference to the figures found on page 6.)

Type 2114 Valve		in	½″	¾″	1″	1½″	2″	2½″	3″	4″	6″	8″ [3]	10″ [3]
Length L	Class 125	in	–	–	7.25	8.75	10	10.88	11.75	13.88	17.75	–	–
	Class 150	in	7.25	7.25	7.25	8.75	10	10.88	11.75	13.88	17.75	21.38	26.49
	Class 250	in	6.00	6.00	6.00	8.00	9.25	–	–	–	–	–	–
	Class 300	in	7.50	7.63	7.75	9.25	10.50	11.50	12.50	14.50	18.62	22.36	27.87
H 1	Without Extension		8.9					11.8		14.0	23.2	28.7	
	With piece [1]		14.4					17.3		19.5	28.7	34.3	
H Type 4	Without Extension		20.3					23.2		25.4	34.7	40.2	
	With piece [1]		25.8					28.7		30.9	40.2	45.7	
H Type 4u	Without Extension		20.3					21.5		22.4	35.8	41.3	
	With piece [1]		25.8					27.0		28.8	41.3	46.9	
Weight, approx.[2]		lb	12	13	15	301	37	62	73	90	254	562	661

Thermostat	Type	**2231(Size 150)**	**2231 (Size 250)**	**2232**	**2233**	**2234**	**2235**
Imm. depth T	in	11.4	38.6	9.3	17	18.1	136.2
Weight, approx	lb	7	14.3	9	7.5	8.2	8

[1] See Pressure-Temperature Diagram
[2] Class 150 +10%; Class 300 +15%
[3] Only with Type 2231 Thermostat, Size 250

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 2114 Control Valve												
K_{VS} values and max. permissible differential pressures Δp [1]												
Nominal size	in	½″	¾″	1″	1½″	2″	2½″	3″	4″	6″	8″	10″
K_{VS} values	m^3/h	4	5	8	20	32	50	80	125	280	420	500
Max. differential pressure Δp	bar	25					20		16	12	10	
Special version	K_{VS} values	–	1; 2.5; 3.2	3.2; 5	8	12.5	20	32	50	–		
Max. differential pressure Δp	bar	25					20		16	–		
Terms for valve sizing according to IEC 534 parts 2-1 and 2-2, ISA S75.01and S75.02		F_L = 0.95, X_T = 0.75										
Permissible valve temperature		See Pressure-Temperature Diagram										

Type 2231 to Type 2235 Thermostats	Size 150	Size 250[2]
For nominal valve size	½″ - 6″	8″ - 10″
Set point ranges (standard version)	– 10 to 90 °C 20 to 120 °C 50 to 150 °C For Types 2232, 2234, 2235: 100 to 200 °C 150 to 250 °C	0 to 70 °C 30 to 100 °C 50 to 120 °C 80 to 150 °C
Perm. ambient temperature at the set point adjustment head	–40 to 80 °C	–20 to 80 °C
Perm. temperature at the sensor	100 °C above the adjusted set point	30 °C above the adjusted set point
Perm. pressure at the sensor of Types 2231, 2232, 2233 and 2234	With and without thermowell: ANSI Class 300 [3]	ANSI Class 125 [3]
Length of capillary tube	3 m (special version: 5,10 or 15 m)	

1) For liquids; the differential pressure equals the pressure head of the pump
2) Only Type 2231 is available in size 250
3) Versions with flange or other pressure ratings on request

Table 2b · Dimensions in mm and weights in kg (L, H1, H, T in reference to the figures found on page 6.)

Type 2114			in	½″	¾″	1″	1½″	2″	2½″	3″	4″	6″	8″ [3]	10″ [3]
	Class 125		mm	–	–	184	222	254	276	298	352	451	–	–
	Class 150		mm	184	184	184	222	254	276	298	352	451	543	673
	Class 250		mm	152.4	152.4	152.4	203.2	235	–	–	–	–	–	–
	Class 300		mm	191	194	197	235	267	292	318	368	473	568	708
H 1	Without	Extension		225					300		355	590	730	
	With	piece [1]		365					440		495	730	870	
H Type 4	Without	Extension		515					590		645	880	1020	
	With	piece [1]		655					730		785	1020	1160	
H Type 4u	Without	Extension		515					545		570	910	1050	
	With	piece [1]		655					685		710	1050	1190	
Weight, approx.[2]			kg	5.5	6.0	7.0	14	17	28	33	41	115	255	300

Thermostat	Type	**2231(Size 150)**	**2231 (Size 250)**	**2232**	**2233**	**2234**	**2235**
Imm. depth T	mm	290	980	235	430	460	3460
Weight , approx.	kg	3.2	6.5	4	3.4	3.7	3.6

[1] See Pressure-Temperature Diagram
[2] Class 150 +10%; Class 300 +15%
[3] Only with Type 2231 Thermostat, Size 250

Table 3 · Materials

Type 2114 Control Valve				
Nominal size	1″ to 6″ (25 to 150 mm)		½″ to 10″ (15 to 250 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 410		WN 1.4006	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 4u)	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
	Types 2233/4	Copper, nickel-plated		
	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: " to 6" flat face flanged; Class 250: ½" to 2" female threaded NPT
[2] Optional soft-sealed plug with PTFE ring for temperatures up to 430 °F (220 °C) or with EPDM ring for temperatures up to 300 °F (150 °C)
[3] Plastic coating - for temperatures up to 175 °F (80 °C): PVC

Installation

Only compatible materials should be combined, for example thermowells of stainless steel should be installed into heat exchangers of stainless steel.

• **Valve**

The valves are to be installed in horizontal pipelines. The valve bonnet, including the operating element of the thermostat, should be oriented vertically downward. This promotes concentric guiding and prevents influence of temperature from the pipeline on the operating element. The direction of medium flow through the valve must coincide with the arrow on the body.

• **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 smallest permissible bending radius is 2″ (50 mm).

• **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.

• **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 to match. With ambient temperatures below 32 °F (0 °C), the setpoint indicator should be located such that it is protected from precipitation or other moisture.

Pressure – Temperature Diagram

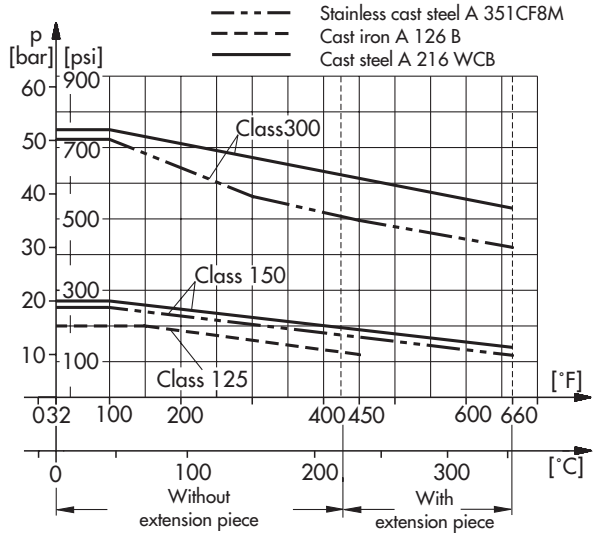
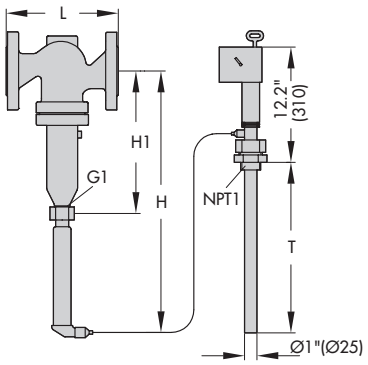


Fig. 6 · Pressure-Temperature Diagram

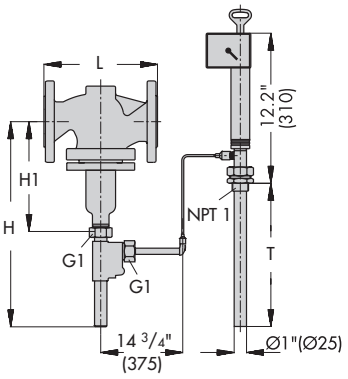
Maximum operating pressures

Maximum operating pressures must be within the limits stated in the applicable ANSI standard, but must not exceed the maximum differential pressure Δp specified in Table 1 "Technical data".

Type 2114 **Types 2231/2233**

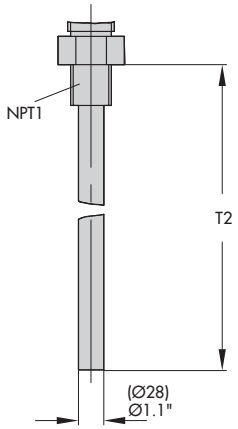


Type 2114 **Types 2231/2233**

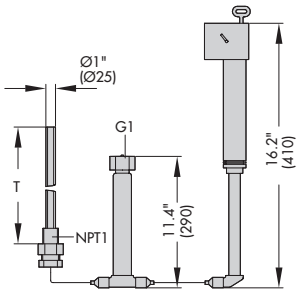


Thermowells for Types 2231/2232

Thermostat	Type	2231 (150)	2231 (250)	2232
Imm. depth T	in	12.8	39.2	10
	mm	325	995	250

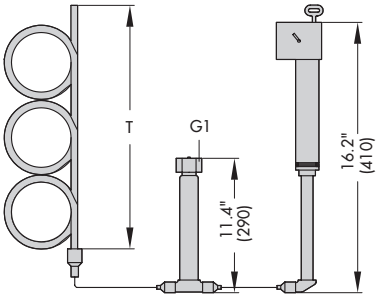


Types 2232/2234



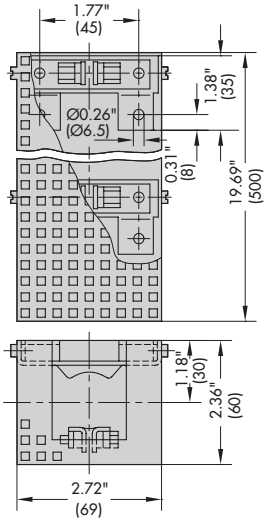
With separate set point adjustment

Type 2235

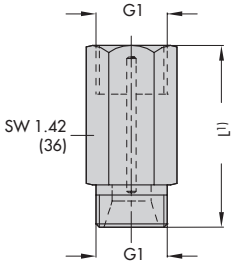


With separate set point adjustment

Clamps and perforated cover for wall mounting



Distance piece
Weight approx. 0.44 lb (0.2 kg)
Extension piece
Weight approx. 1.1 lb (0.5 kg)



When a distance piece is used, the overall heights are:
H1 + 2.17″ (55 mm) and
H + 2.17″ (55 mm).
For an extension piece these are:
H1 + 5.51″ (140 mm) and
H + 5.51″ (140 mm).
[1] Distance piece L = 2.2" (55 mm)
Extension piece L = 5.5" (140 mm).

Fig. 7 · Dimensions; dimensions in parentheses ( ) in mm

Ordering text

Temperature Regulator **Type 4/4u**,
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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