DATA SHEET

T 2134 EN

Type 9 Temperature Regulator

Self-operated Temperature Regulators · ANSI version

CE

Application

Temperature regulators with mixing or diverting valve designed for plants that are heated or cooled using liquids
Control thermostats for set points from **15 to 480 °F/–10 to +250 °C** · Three-way valves in nominal sizes **NPS ½ to 6/DN 15 to 150** · Pressure rating **Class 150 and 300** · Temperatures up to **660 °F/350 °C**

Note

Typetested temperature regulators (TR), safety temperature monitors (STM) and safety temperature limiters (STL) are available.

The regulators consist of a three-way valve and 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
- Three-way valve with plug balanced 1) by a stainless steel bellows, optionally available with a plug arrangement to mix or divert liquids
- Flow rate across the port AB independent of the valve plug position
- Valve body optionally made of cast steel or cast stainless steel
- Versions with double adapter and manual adjuster for temperature limiters or attachment of a second control thermostat (▶ T 2036 for details)

Versions

Type 9 Temperature Regulator with three-way valve · Type 2119 Valve NPS ½ to 1: unbalanced · NPS 1½ to 6: balanced · Class 150 and 300 · Type 2231 to 2234 Control Thermostat
Three-way valves with optional plug arrangements for either mixing or diverting service. Further details on the application of thermostats can be found in Information Sheet ▶ T 2010.

Type 2119/2231 (Fig. 1) · With Type 2119 Valve and Type 2231 Control Thermostat · Suitable for liquids · Set points from 15 to 300 °F (–10 to +150 °C) · Set point adjustment at the sensor

Type 2119/2232 (Fig. 2) · With Type 2119 Valve and Type 2232 Control Thermostat · Suitable for liquids and steam · Set points from 15 to 480 °F (–10 to +250 °C) · Separate set point adjustment · With clamping gland for larger immersion depths

Fig. 1: *Type 9 Temperature Regulator with Type 2231 Control Thermostat*

Fig. 2: *Type 9 Temperature Regulator with Type 2232 Control Thermostat, version with separate set point adjustment*

Type 2119/2234 · With Type 2119 Valve and Type 2234 Control Thermostat · Suitable for liquids, air and other gases · Set points from 15 to 480 °F (–10 to +250 °C) · Separate set point adjustment

Special version

– 33 or 50 ft (10 or 15 m) capillary tube length
– Sensor of CrNiMo steel
– Capillary tube, copper with plastic coating
– Valve entirely of stainless steel (at least 1.4301)

1) NPS ½ to 1: not balanced

Principle of operation (see Fig. 3 and 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 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 (9) to a value which can be read off from the dial (10).
In the balanced valves (NPS 1½ to 6), the pressure at port B acts through a hole in the plug stem (5) onto the outer surface of the balancing bellows [1] (4.1), whereas the pressure at port A acts onto the inner bellows area. This equalizes the forces acting onto the valve plugs (3).
In mixing valves (see Fig. 3 with plug arrangement I), the process media to be mixed enter at valve ports A and B. The combined flow exits the valve at port AB. The flow rate from A or B to AB is determined by the area released between the seats (2) and plugs (3), i.e. by the position of the plug stem (5). When the temperature rises, port A opens and port B closes.
In diverting valves, in contrast, the process medium enters at the valve port AB and the partial flows exit at ports A or B. The flow rate from AB to A or B is determined by the position of the plug stem. Diverting valves have the plug arrangement II (see Fig. 4). When the temperature rises, port A closes and port B opens.

Installation

– **Valve**

The thermostat connection (6) must face downwards. Other mounting positions on request.
Make sure the direction of flow complies with the required service type, i.e. mixing or diverting service.

– **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 2" (50 mm).

– **Temperature sensor**

The temperature sensor can be installed in any position as required. 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.

– **Thermowell**

Type 2231
The sensor of the control thermostat can be used with or without a thermowell. The standard thermowell length is 290 mm/11.4".

Type 2232
The sensor of the control thermostat can be used with or without a thermowell. The standard thermowell length is 235 mm. The version with clamping gland can be used for larger immersion depths (max. 600 mm/23.6" possible with SAMSON thermowells). It is also possible to use non-SAMSON thermowells provided on site with different immersion depths. In this case, the immersion depth of the sensor can be varied as required depending on the length of the capillary tube.

For reasons of safety and because the function to seal the sensor is missing, the use of the clamping gland is only permitted with a thermowell.

Type 2234
The sensor of the control thermostat can only be used without a thermowell. The maximum sensor length is 460 mm/18.1".

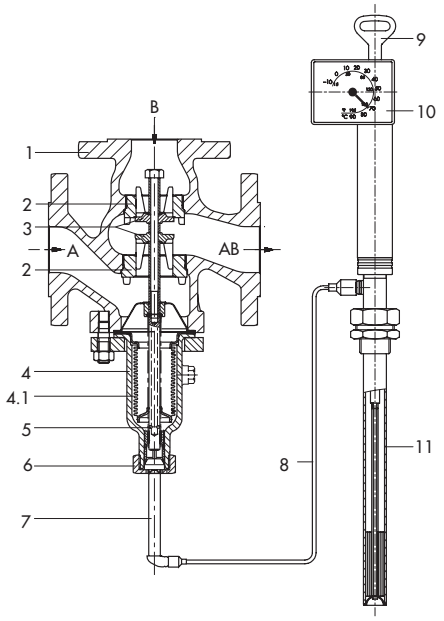


Fig. 3: *Type 9 Temperature Regulator with three-way valve (NPS 2) and Type 2231 Control Thermostat, three-way valve with plug arrangement I (the arrows indicate mixing service)*

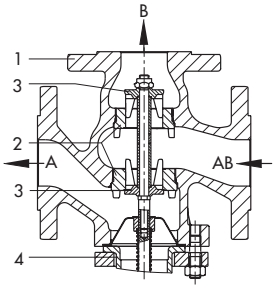


Fig. 4: *Type 9 Temperature Regulator with three-way valve, with plug arrangement II (the arrows indicate diverting service)*

Three-way valve	
1	Valve body
2	Seat (exchangeable)
3	Plug
4	Bottom section (bellows housing)
4.1	Balancing bellows
5	Plug stem with spring
6	Thermostat connection (threaded nipple with coupling nut)
Control thermostat	
7	Operating element
8	Capillary tube
9	Set point adjustment key
10	Set point dial
11	Temperature sensor (bulb sensor)

[1] Valves in NPS ½ to 1 have unbalanced plugs

Table 1: ***Technical data*** · *All pressures (gauge) The listed permissible pressures and differential pressures are restricted by the specifications in the pressure-temperature diagram and the pressure rating.*

Type 2119 Three-way Valve										
Pressure rating		Class 150 and 300								
K_{VS} coefficients and max. permissible differential pressures Δp in bar										
Connection	**NPS**	½	¾	**1**	**1 ½**	**2**	**2 ½**	**3**	**4**	**6**
Mixing valve	C_V in gal/min	5	7.5	9.4	23	37	60	94	145	230
	K_{VS} coefficient in m³/h	4	6.3	8	20	32	50	80	125	200
When p in B > p in A	Δp in psi	145			230		145			120
	Δp in bar	10			16		10			8
When p in A > p in B	Δp in psi	75			50		45			30
	Δp in bar	5			3.5		3			2
Diverting valve (when AB to A or B)	C_V in gal/min	5	7.5	9.4	23	37	50	77	117	185
	K_{VS} coefficient in m³/h	4	6.3	8	16	32	40	64	100	160
	Δp in psi	60			50		45			30
	Δp in bar	4			3.5		3			2
Permissible temperature of the valve		430 °F/660 °F (220 °C/350 °C)· See pressure-temperature diagram in ▶ T 2010								
Conformity		CE · EAC								
Type 2231 to 2234 Thermostat		**Size 150**								
Set point range (set point span 100 K)		15 to 195 °F, 70 to 250 °F or 120 to 300 °F · For Types 2232 and 2234 also 210 to 390 °F, 300 to 480 °F								
		–10 to +90 °C, 20 to 120 °C or 50 to 150 °C· For Types 2232, 2234 also 100 to 200 °C, 150 to 250 °C								
Perm. ambient temperature at the set point adjustment		–40 to +140 °F/–40 to +80 °C								
Perm. temperature at the sensor		100 K above the adjusted set point								
Perm. pressure at sensor	Type 2231	Without/with thermowell: Class 300 · Thermowell with flange: Class 150/300								
	Type 2232	Without/with thermowell: Class 300 [1] · Thermowell with flange: Class 150/300 [1]								
	Type 2234	Without thermowell: Class 300 · With flange on request								
Capillary tube length		16 ft (33 or 50 ft as special version/5 m (10 or 15 m as special version)								

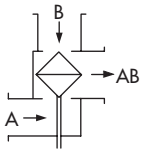
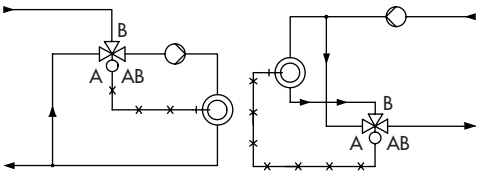
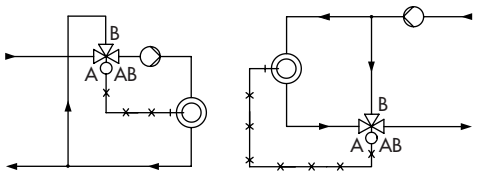
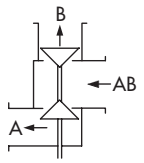
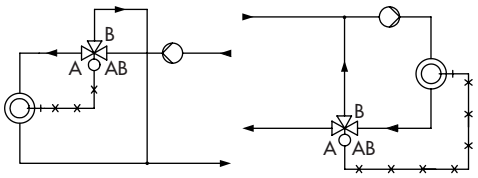
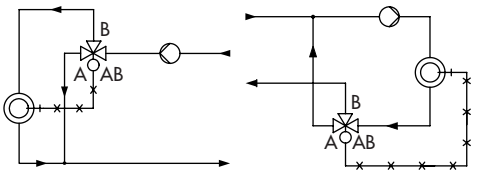
1) The version with clamping gland can be used for larger immersion depths (max. 600 mm/23.6" possible with SAMSON thermowells). It is also possible to use non-SAMSON thermowells provided on site with different immersion depths. In this case, the immersion depth of the sensor can be varied inside the thermowell as required.

Table 2: ***Materials*** · *Material numbers according to DIN EN*

Type 2119 Three-way Valve			
Nominal size		NPS ½ to 6	Up to NPS 4
Pressure rating		Class 150 and 300	
Body		Cast steel A216 WCC	Cast stainless steel A351 CF8M
Seat and plug		Steel 1.4006 (1.4301 in NPS 6)	1.4571
Plug stem/spring		1.4301/1.4310	
Balancing bellows [1]		1.4571	
Bellows housing		1.0425	1.4571
Seal		Graphite on metal core	
Extension piece/separating piece		Brass (special version: stainless steel 1.4301)	1.4301
Types 2231, 2232 and 2234 Thermostats			
Version		**Standard version**	**Special version**
Operating element		Nickel-plated brass	
Sensor	Type 2231	Bronze	–
	Type 2232	Bronze	CrNiMoTi steel
	Type 2234	Copper	
Capillary tube		Copper	Plastic-coated copper
Thermowell			
With threaded connection (1 NPT)	Thermowell	Bronze, steel, copper [2]	CrNiMoTi steel
	Threaded nipple	Brass · Steel	
With flanges	Thermowell	Steel	CrNiMoTi steel
	Threaded nipple	Steel	

1) NPS ½ to 1: without balancing bellows
2) Class 125 only

Arrangement of temperature regulators with three-way valves depending on the plug arrangement in valve · Schematics

Plug arrangement I for mixing service	Heating	Cooling
		
Port **B closes** and port **A opens** when the temperature rises	Mixing valve In the flow pipe In the return flow pipe	Mixing valve In the flow pipe In the return flow pipe
Plug arrangement II for diverting service	**Heating**	**Cooling**
		
Port **A closes** and port **B opens** when the temperature rises	Diverting valve In the flow pipe In the return flow pipe	Diverting valve In the flow pipe In the return flow pipe

Typetested safety devices

The register number is available on request.

The following versions are available:

Temperature regulators (TR) with a Type 2231, 2232 or 2234 Thermostat and a Type 2119 Three-way Valve in sizes NPS ½ to 6, for which the maximum operating pressure must not exceed the maximum permissible differential pressure Δp specified in the technical data.

Sensors without thermowell: applicable up to 600 psi (40 bar)

Sensors with thermowell: only use SAMSON 1 NPT version made of bronze or stainless steel 1.4571 up to 600 psi (40 bar).

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.

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 of SAMSON sensors operating according to different principles measured in water.

Table 3: *Dynamic behavior of SAMSON thermostats*

Principle of operation	Control thermostat Type	Time constant [s] Without Thermowell	Time constant [s] With Thermowell
Liquid expansion	2231	70 s	120 s
	2232	65 s	110 s
	2234	15 s	–[1]
	2213	70 s	120 s
Adsorption	2212	–[1]	40 s

[1] Not permissible

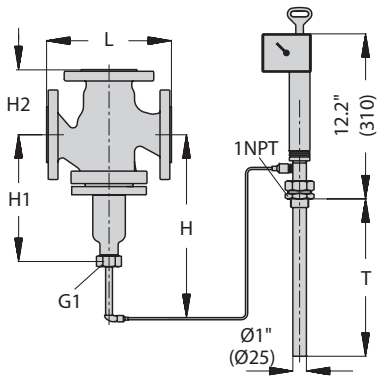
Table 4: *Dimensions in mm and weights*

Type 2119 Three-way Valve		NPS	½	¾	1	1½	2	2½	3	4	6
L	Class 150	inch	7.25			8.75	10	10.9	11.75	13.9	17.75
		mm	184			222	254	276	298	352	451
	Class 300	inch	7.5	7.6	7.75	9.25	10.5	11.5	12.5	14.5	18.6
		mm	190	194	197	235	267	292	318	368	473
H2	Class 150	inch	3.6			4.4	5	5.4	5.9	6.9	8.9
		mm	92			111	127	138	149	176	225.5
	Class 300	inch	3.8	3.8	3.9	4.6	5.3	5.8	6.3	7.2	9.3
		mm	95	97	98.5	117.5	133.5	146	159	184	236.5
H1	Up to 430 °F / Up to 220 °C Without extension piece	inch	9.25					12.2		14	19.3
		mm	235					310		355	490
	Up to 660 °F / Up to 350 °C With extension piece	inch	14.8					17.7		19.5	24.8
		mm	375					450		495	630
H	Up to 430 °F / Up to 220 °C Without extension piece	inch	20.7					23.6		25.4	30.7
		mm	525					600		645	780
	Up to 660 °F / Up to 350 °C With extension piece	inch	26.2					29.1		30.9	36.2
		mm	665					740		785	920
Weight [1], approx.		lb	13	15.5	17.5	33	46.5	68.5	75	110.5	231.5
		kg	6	7	8.5	15	21	31	34	50	105

Thermostat Type	2231	2232	2234
Immersion depth T	11.4″ (290 mm) [2]	9.25″ (235 mm) [2]	18.1″ (460 mm)
Weight, approx.	7 lb (3.2 kg)	8.8 lb (4.0 kg)	8.1 lb (3.7 kg)

1) +10 % for Class 300
2) Larger immersion depths on request

Type 2119 Three-way Valve with Type 2231 Control Thermostat



Type 2232/2234 Control Thermostat with separate set point adjustment

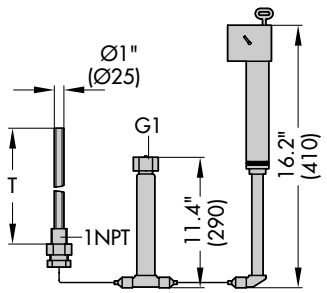
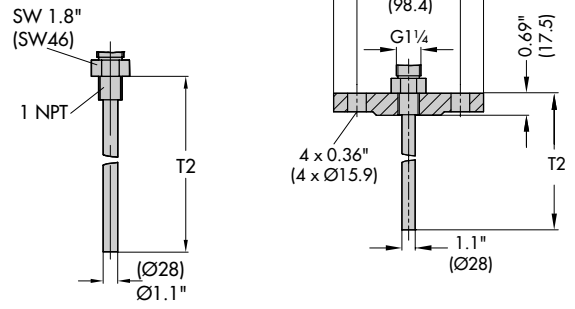


Fig. 5: *Dimensions · Valve and thermostats*

Accessories

Thermowells for Type 2231/2232

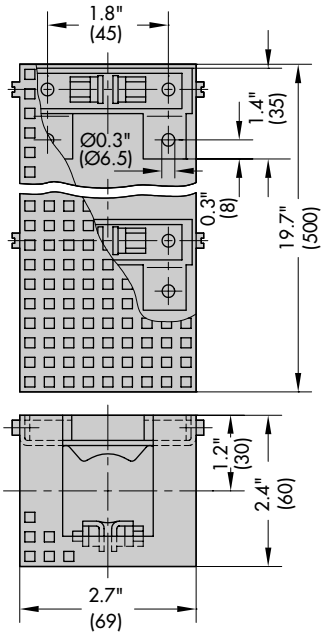
Thermostat	Type 2231	Type 2232
Length T2	12.6″	10″
	325 mm	250 mm



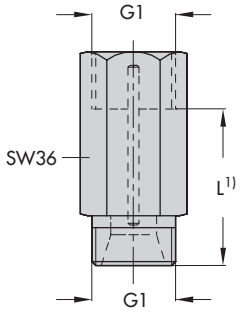
With **threaded connection**
1 NPT/Class 300

With **flanges**
NPS 1½/Class 300

Clamps and perforated cover for wall mounting (Type 2234) [2]



Extension piece/separating piece



Extension piece
Standard version
L = approx. 5.5″ (140 mm),
approx. 1.1 lb (0.5 kg),
With bellows seal (special version),
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)

Fig. 6: *Accessories*

[1] Add the dimension L to H and H1 when these accessories are used.
[2] Mounting position of sensor: pointing down

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 thermowell made of CrNiMo steel/steel

Mounting parts for Type 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 for NPS ½ to 4 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

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

Reversing device for NPS 2½ to 4 (item no. 1180-8098). Installed between thermostat connection and operating element with capillary tube. This allows the operating direction to be reversed when the regulator is installed incorrectly in the pipeline.

Ordering text

Type 9/… Temperature Regulator
NPS …,
Mixing or diverting valve,
Body material ..., Class …,
With Type ... Thermostat,
Set point range … °F (°C),
Capillary tube ... ft (m),
Optionally, special version ...
Optionally, accessories ...