DATA SHEET

T 2134 EN

Type 9 Temperature Regulator · ANSI version

Self-operated Temperature Regulators · With balanced three-way valve [1] · Flanged connections

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** · Three-way valves **NPS ½ to 6** · Pressure rating **Class 150 and 300** · Suitable for temperatures **up to 660 °F**

Note

Temperature regulators (TR), safety temperature monitors (STM) and safety temperature limiters (STL) tested according to DIN EN 14597 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. See Data Sheet ▶ T 2036 for details.

Versions

Type 9 Temperature Regulator with three-way valve · Type 2119 Valve NPS ½ to 1: not balanced · 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 and steam · Set points from 15 to 300 °F · 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 · 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 · Separate set point adjustment

Special version

- 33 or 50 ft capillary tube lengths
- Sensor of CrNiMo steel
- Capillary tube, copper with plastic coating
- Valve entirely of stainless steel (at least 1.4301)
- DIN version (▶ T 2133)

[1] NPS ½ to 1: not balanced

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Edition September 2025

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.

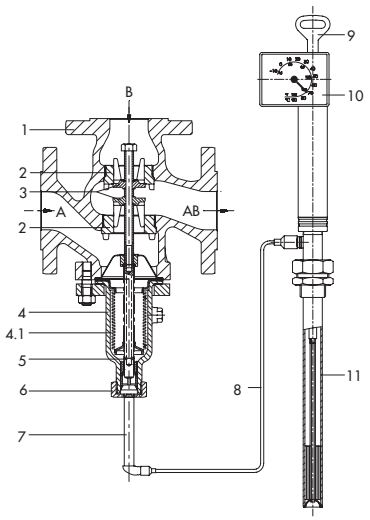


Fig. 3: *Type 9 Temperature Regulator with three-way valve (NPS 2) and Type 2231 Control Thermostat, three-way valve with plug arrangement I (the arrows indicate mixing service)*

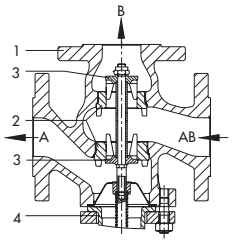


Fig. 4: *Type 9 Temperature Regulator with three-way valve, with plug arrangement II (the arrows indicate diverting service)*

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)

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″.

– **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 11.4″.

Type 2232

The sensor of the control thermostat can be used with or without a thermowell. The standard thermowell length is 9.3″.

The version with clamping gland can be used for larger immersion depths (max. 39″ 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 18.1″.

1) Valves in NPS ½ to 1 have plugs that are not balanced

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

Type 2119 Three-way Valve										
Pressure rating		Class 150 and 300								
C_V coefficients and **max. permissible differential pressures Δp** in psi										
Connection	**NPS**	**½**	**¾**	**1**	**1½**	**2**	**2½**	**3**	**4**	**6**
Mixing valve	CV in gal/min	5	7.5	9.4	23	37	60	94	145	230
When p in B > p in A	Δp	145			230		145			120
When p in A > p in B	Δp	75			50		45			30
Diverting valve (when AB to A or B)	CV in gal/min	5	7.5	9.4	23	37	50	77	117	185
	Δp	60			50		45			30
Permissible temperature of the valve		430 °F/660 °F · See pressure-temperature diagram in ▶ T 2010								
Leakage class according to IEC 60534-4		Metal seal: leakage rate I (≤0.05 % of C_V)								
Conformity		CE								
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, 2234 also 210 to 390 °F, 300 to 480 °F								
Perm. ambient temperature at the set point adjustment		–40 to +140 °F								
Perm. temperature at the sensor		100 K above the adjusted set point								
Perm. pressure at sensor	Type 2231 [1] · Type 2232 [1] [2]	Without/with thermowell: Class 300 · Thermowell with flange: Class 150/300								
	Type 2234	Without thermowell: Class 300 · With flange: on request								
Capillary tube length		16 ft (33 or 50 ft as special version)								

[1] Other pressure ratings for thermowell/flange on request

[2] The version with clamping gland can be used for larger immersion depths (max. 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.

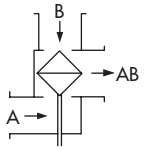
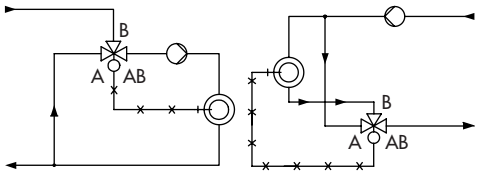
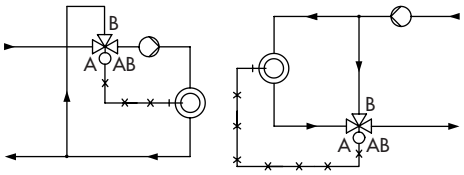
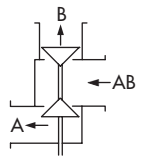
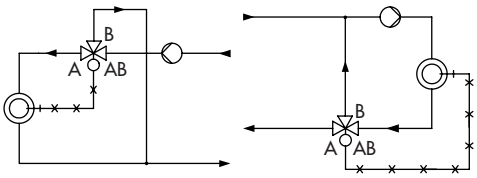
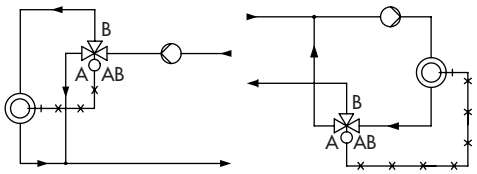
Table 2: ***Materials*** *· Material numbers according to DIN EN*

Type 2119 Three-way Valve			
Nominal size		NPS ½ to 6	NPS ½ to 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			
1 NPT threaded connection	Immersion tube	Bronze, steel, copper [2]	CrNiMoTi steel
	Threaded nipple	Brass · Steel	
Flange connection	Immersion tube	Steel	CrNiMoTi steel
	Threaded nipple	Steel	

[3] NPS ½ to 1: without balancing bellows

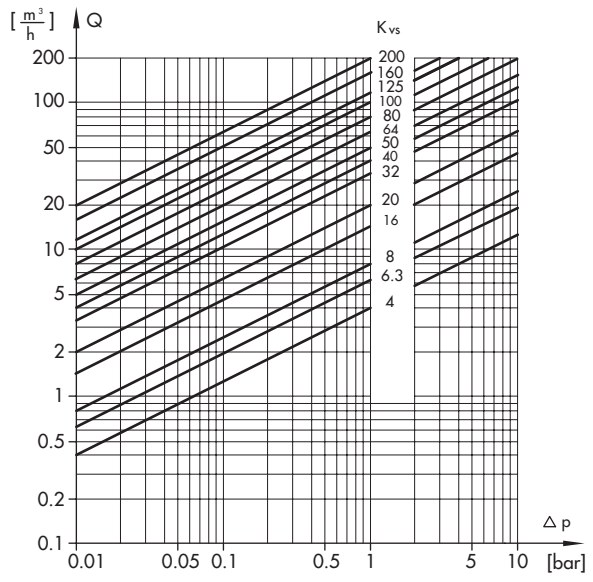
[4] Class 125 only

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 pipe	Mixing valve In the flow pipe In the return 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 pipe	Diverting valve In the flow pipe In the return pipe

Flow rate diagram for water

The specifications apply to a fully open valve



Terms for control valve sizing for other media according to IEC 60534-2-1: F_L = 0.95 and x_T = 0.75.

Fig. 5: *Flow rate diagram for water*

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 nominal 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

Sensors **with thermowell**: only use SAMSON 1 NPT version made of bronze, steel or stainless steel up to 600 psi, copper up to 230 psi.

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.

Dimensions · Type 2119 Three-way Valve with thermostat

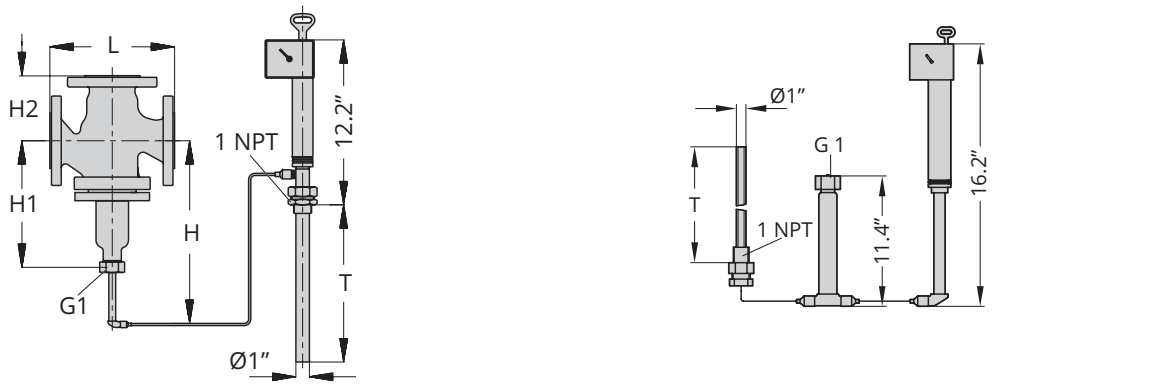


Fig. 6: *Dimensions in inches · Valve and thermostats · See Table 3*

Table 3: *Dimensions in inches and weights*

Type 2119 Three-way Valve	NPS	½	¾	1	1½	2	2½	3	4	5
Overall length L	Class 150	7.25			8.75	10	10.9	11.75	13.9	17.75
	Class 300	7.5	7.6	7.75	9.25	10.5	11.5	12.5	14.5	18.6
H2	Class 150	3.6			4.4	5	5.4	5.9	6.9	8.9
	Class 300	3.8		3.9	4.6	5.3	5.8	6.3	7.2	9.3
H1	Up to 430 °F (without extension piece)	9.25					12.2		14	19.3
	Up to 660 °F (with extension piece)	14.8					17.7		19.5	24.8
H	Up to 430 °F (without extension piece)	20.7					23.6		25.4	30.7
	Up to 660 °F (with extension piece)	26.2					29.1		30.9	36.2
Weight (Class 125 body) [1], approx.	lb	13	15.5	17.5	33	46.5	68.5	75	110.5	231.5

Thermostat	Type	2231	2232	2234
Immersion depth T		11.4 [2]	9.25 [2]	18.1
Weight, approx.	lb	7	8.8	8.1

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

Dynamic behavior of the thermostats

The dynamics of the regulator are mainly determined by the response of the temperature sensor with its characteristic time constant.

Table 4 lists the response times of SAMSON sensors operating according to different principles measured in water.

Table 4: *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

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, Class 125, made of copper · 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. 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 ..., Class ...

Mixing or diverting valve,

Body material ...

With Type ... Thermostat, set point range ... °F

Capillary tube ... ft

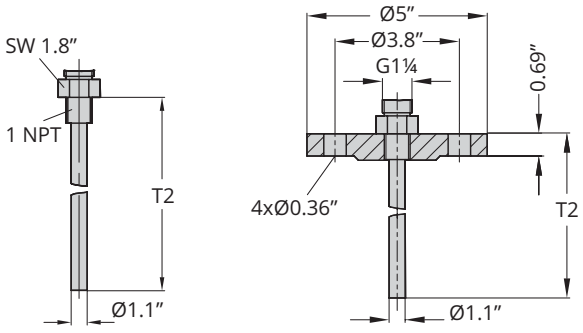
Optionally, special version ...

Optionally, accessories ...

Dimensions of accessories

Thermowells for Type 2231/2232

Thermostat	Type 2231	Type 2232
T2	12.6″	10″



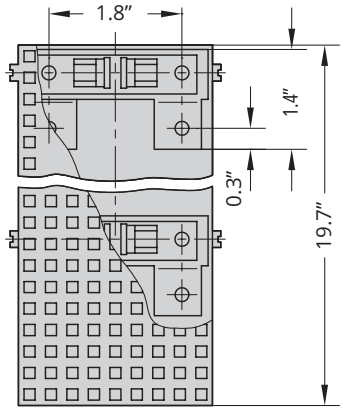
With threaded connection

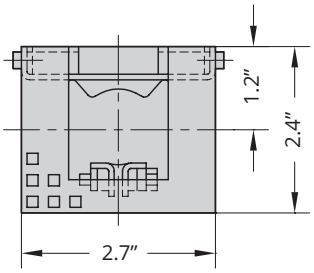
1 NPT for Class 300 · Copper thermowell: Class 125

With flanges

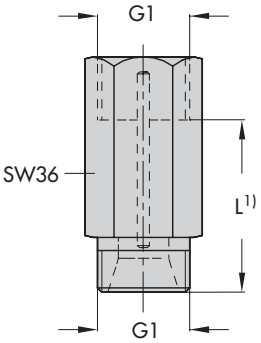
NPS 1½ for Class 300

Clamps and perforated cover for wall mounting (Type 2234) [1]





Extension piece/ separating piece



Extension piece
Standard version
L = approx. 5.5″, approx. 1.1 lb,
with bellows seal (special version),
L = approx. 7.1″, approx. 1.3 lb
Separating piece with seals,
L = approx. 2.1″, approx. 0.4 lb

[1] Add the dimension L to H and H1 when these accessories are used.
[2] Mounting position of sensor: pointing down Max. torque of clamp on the sensor: 2.5 Nm

Fig. 7: *Accessories · Dimensions in inches*