DATA SHEET

T 2133 EN

Type 9 Temperature Regulator

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 **–10 to +250 °C** · Three-way valves **DN 15 to 150** · Pressure rating **PN 16 to 40** · Suitable for temperatures **up to 350 °C**

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 available in cast iron, 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).

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*

Versions

Type 9 Temperature Regulator with three-way valve · Type 2119 Valve · DN 15 to 25 (unbalanced) · DN 32 to 150 (balanced) · PN 16 to 40 · 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 –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 –10 to +250 °C · Separate set point adjustment · With clamping gland for larger immersion depths

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

Special version

- 10 or 15 m capillary tube lengths
- Sensor of CrNiMo steel
- Capillary tube, copper with plastic coating
- Valve entirely of stainless steel (at least 1.4301)
- ANSI version on request (▶ T 2134)

[1] DN 15 to 25 unbalanced

SAMSON AKTIENGESELLSCHAFT · Weismüllerstraße 3 · 60314 Frankfurt am Main, Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507 · samson@samsongroup.com · www.samsongroup.com

Edition June 2024

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 (DN 32 to 150), 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 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.

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. 990 mm 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.

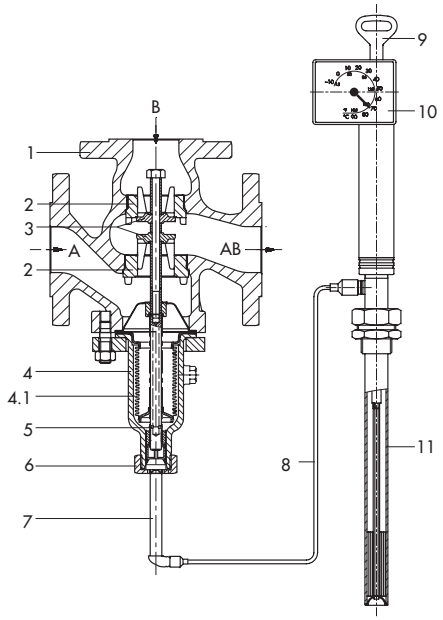


Fig. 3: *Type 9 Temperature Regulator with three-way valve (DN 50) and Type 2231 Control Thermostat, three-way valve with plug arrangement I (the arrows indicate mixing service)*

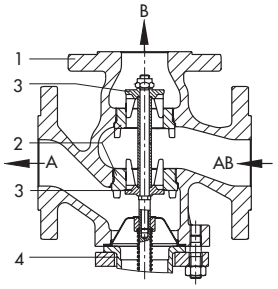


Fig. 4: *Type 9 Temperature Regulator with three-way valve, with plug arrangement II (the arrows indicate diverting service)*

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 DN 15 to 25 have unbalanced plugs

Table 1: *Technical data · All pressures in bar (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		PN 16 to 40										
K_{VS} coefficients and max. permissible differential pressures Δp in bar												
Connection	**DN**	**15**	**20**	**25**	**32**	**40**	**50**	**65**	**80**	**100**	**125**	**150**
Mixing valve	K_{VS} coefficient	4	6.3	8	16	20	32	50	80	125	160	200
When p in B > p in A	Δp	10			16			10				8
When p in A > p in B	Δp	5			3.5			3			2	
Diverting valve (when AB to A or B)	K_{VS} coefficient	4	6.3	8	16	20	32	40	64	100	125	160
	Δp	4			3.5			3			2	
Permissible temperature of the valve		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)		−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 +80 °C										
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: PN 40 · Thermowell with flange: PN 40										
	Type 2234	Without thermowell: PN 40 · With flange on request										
Capillary tube length		5 m (10 or 15 m 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. 990 mm 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.

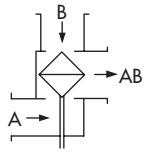
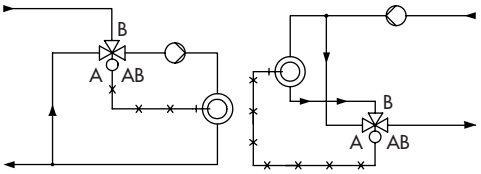
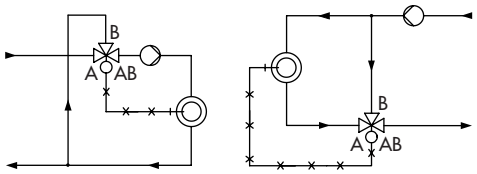
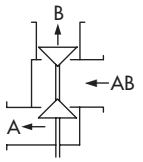
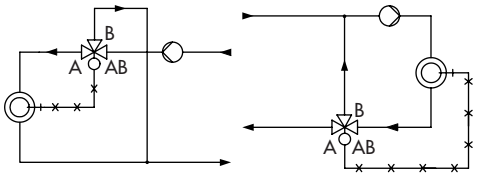
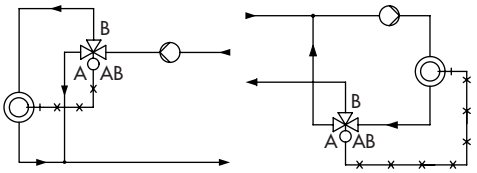
Table 2: ***Materials*** *· Material numbers according to DIN EN*

Type 2119 Three-way Valve				
Nominal size		DN 15 to 100	DN 15 to 150	
Pressure rating		PN 25	PN 16	PN 40
Body		Cast steel 1.0619		
		–	Cast iron EN-JL1040	Cast stainless steel 1.4408
Seat and plug		Steel 1.4006 (1.4301 for DN 125 and 150)		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				
G 1 threaded connection	Immersion tube	Bronze, steel, copper [2]		CrNiMoTi steel
	Threaded nipple	Brass · Steel		
Flange connection	Immersion tube	Steel		CrNiMoTi steel
	Threaded nipple	Steel		

1) DN 15 to 25: without balancing bellows

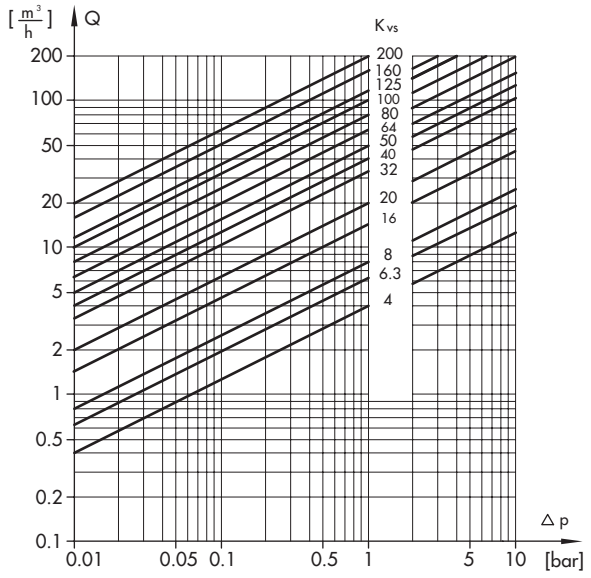
2) PN 16 only

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

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 DN 15 to 150, 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 40 bar

Sensors with thermowell: only use SAMSON G 1 version made of bronze, steel or stainless steel up to 40 bar, copper up to 16 bar.

Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100.

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

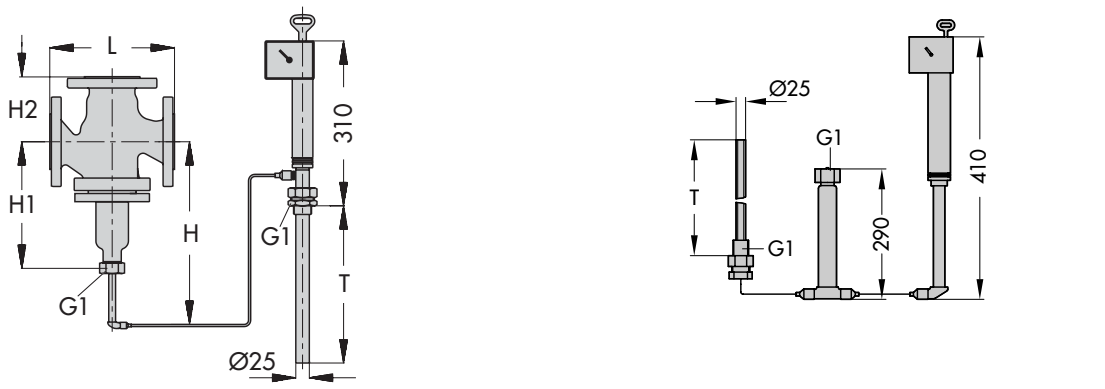


Fig. 6: *Dimensions in mm · Valve and thermostats · See Table 3*

Table 3: *Dimensions in mm and weights*

Type 2119 Three-way Valve	DN	15	20	25	32	40	50	65	80	100	125	150
Length L		130	150	160	180	200	230	290	310	350	400	480
H2		70	80	85	100	105	120	130	140	150	200	210
H1	Up to 220 °C (without extension piece)	235			240			310		355	390	490
	Up to 350 °C (with extension piece)	375			380			450		495	530	630
H	Up to 220 °C (without extension piece)	525			530			600		645	680	780
	Up to 350 °C (with extension piece)	665			670			760		785	820	920
Weight (PN 16 body) [1], approx.	kg	6	7	8.5	15	17	21	31	34	50	76	105

Thermostat	Type	2231	2232	2234
Immersion depth T		290 [2]	235 [2]	460
Weight, approx.	kg	3.2	4.0	3.7

1) +15 % for PN 25/40
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 | 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

Ordering text

Type 9/… Temperature Regulator

DN …, PN …,

Mixing or diverting valve,

Body material ...

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

Capillary tube ... m,

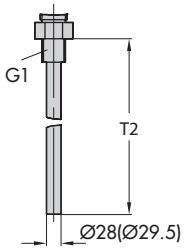
Optionally, special version ...

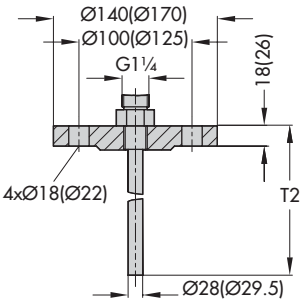
Optionally, accessories ...

Dimensions of accessories

Thermowells for Type 2231/2232

Thermostat	Type 2231	Type 2232
T2	325 mm	250 mm





With threaded connection

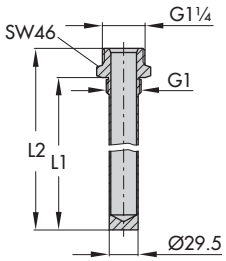
G 1 for PN 40, PN 100 (dimensions for PN 100 in parentheses), thermowell made of copper: PN 16

With flanges

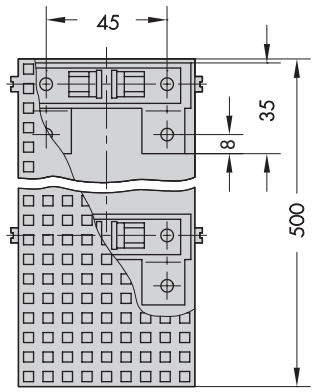
DN 32 for PN 40
DN 40 for PN 100 (dimensions in parentheses)

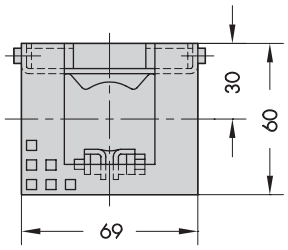
Thermowells for flammable gases (G 1/PN 100)

Thermostat	Type 2231	Type 2232
Length L1	315 mm	255 mm
Length L2	340 mm	280 mm

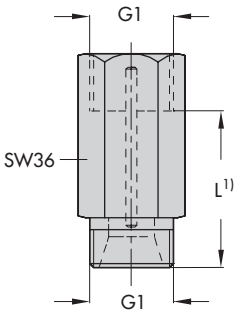


Clamps and perforated cover for wall mounting (Type 2234) [1]





Extension piece/separating piece



Extension piece

Standard version
L = approx. 140 mm, approx. 0.5 kg

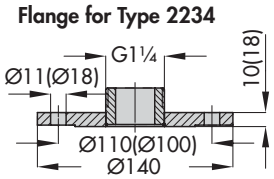
With bellows seal (special version), L = approx. 180 mm, approx. 0.6 kg

Separating piece with seals, L = approx. 55 mm, approx. 0.2 kg

–

[1] Add the dimension L to H and H1 when these accessories are used.

Flange for Type 2234



Flanged connection PN 6; 140 outside Ø

Flange PN 40/DN 32 (dimensions in parentheses)

Fig. 7: *Accessories · Dimensions in mm*

[1] Mounting position of sensor: pointing down

Accessories

Thermowells with threaded or flanged connections for Types 2231 and 2232 Bulb Sensors · G 1 threaded connection, made of bronze, steel or CrNiMo steel (PN 40) or made of copper (PN 16) · Flanged connection, DN 32, PN 40, with thermowell made of CrNiMo steel/steel · Thermowell made of PTFE, PN 6 (flange PN 40).

Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100.

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 220 °C. The standard version does not have sealing. The special version of the extension piece for DN 15 to 100 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

In combinations with valves made of cast iron or spheroidal graphite iron together with Type 2212 Safety Temperature Limiter or Type 2213 Safety Temperature Monitor, an extension piece is required for temperatures over 150 °C.

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 DN 65 to 100 (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.