Self-operated Temperature Regulators
Temperature Regulator Type 1

with unbalanced single-seated globe valve · Flanges

Application

Temperature regulators for heating installations with control thermostats for set points from **–10** to **+250 °C** · Nominal sizes **DN 15** to **DN 50** · Nominal pressure **PN 16** to **PN 40** · Suitable for temperatures up to **350 °C**

The valve closes when the temperature rises.

Note

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

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

Special features

- Low-maintenance P regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment indicated on a dial
- Unbalanced single-seated globe valves for use in applications with liquids, gases and vapors, especially for the heat transfer fluids such as water, oil or steam
- Valve body optionally made of cast iron, spheroidal graphite iron, cast steel or stainless cast steel
- Versions with double adapter available for attachment of a temperature limiter or a second control thermostat. See Data Sheet T 2036 EN for details.

Versions

Temperature Regulators with Type 1 Globe Valve

Nominal sizes DN 15 to 25 · PN 25 to 40 · DN 32 to 50 · PN 16 to 40 · Types 2231 to 2235 Control Thermostats
For details on the application of the control thermostats, refer to Information Sheet T 2010 EN.

Type 2111/2231 (Fig. 1.1) · With Type 2111 Valve and Type 2231 Control Thermostat for liquids · Set points from –10 to +150 °C · Set point adjustment at the sensor

Type 2111/2232 (Fig. 1.3) · With Type 2111 Valve and Type 2232 Control Thermostat for liquids and steam · Set points from –10 to +250 °C · Separate set point adjustment

Type 2111/2233 (Fig. 1.2) · With Type 2111 Valve and Type 2233 Control Thermostat for liquids, air and other gases Set points from –10 to +150 °C · Set point adjustment at the sensor

Type 2111/2234 · With Type 2111 Valve and Type 2234 Control Thermostat for liquids, steam, air, and other gases · Set points from –10 to +250 °C · Separate set point adjustment

Type 2111/2235 · With Type 2111 Valve and Type 2235 Control Thermostat for air-heated storerooms, drying, climatic and heating cabinets · Set points from –10 to +250 °C · Separate set point adjustment and capillary tube installed on site

Versions with screwed ends **G ½** to **G1** female thread can be found in Data Sheet T 2112 EN

Fig. 1.1
Valve DN 25
Type 2231 Control Thermostat

Fig. 1.2
Valve DN 50
Type 2233 Control Thermostat

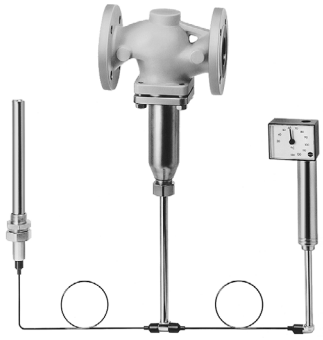


Fig. 1.3
Valve DN 50
Type 2232 Control Thermostat · Separate set point adjustment

Fig. 1 · Type 1 Temperature Regulator with single-seated globe valve and control thermostat

Special version

- Capillary tube 5 m, 10 m, 15 m
- Sensor made of CrNiMo steel
- Capillary tube made of CrNiMo steel or plastic-coated Cu
- Valve free of non-ferrous metal
- Valve in corrosion-resistant version
- Valve with flow divider I for noise reduction when controlling steam and non-flammable gases (only 1.0619 and stainless cast steel 1.4581)
- Dimensions and materials in accordance with ANSI (see Data Sheet T 2115 EN)

Principle of operation (see Fig. 2)

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 liquid changes its volume depending on the temperature, causing the operating element (7) and thus the plug stem (5) with the plug (3) of the valve to move.

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

The temperature set point can be adjusted with a key (9) to a value that can be read off the dial (10).

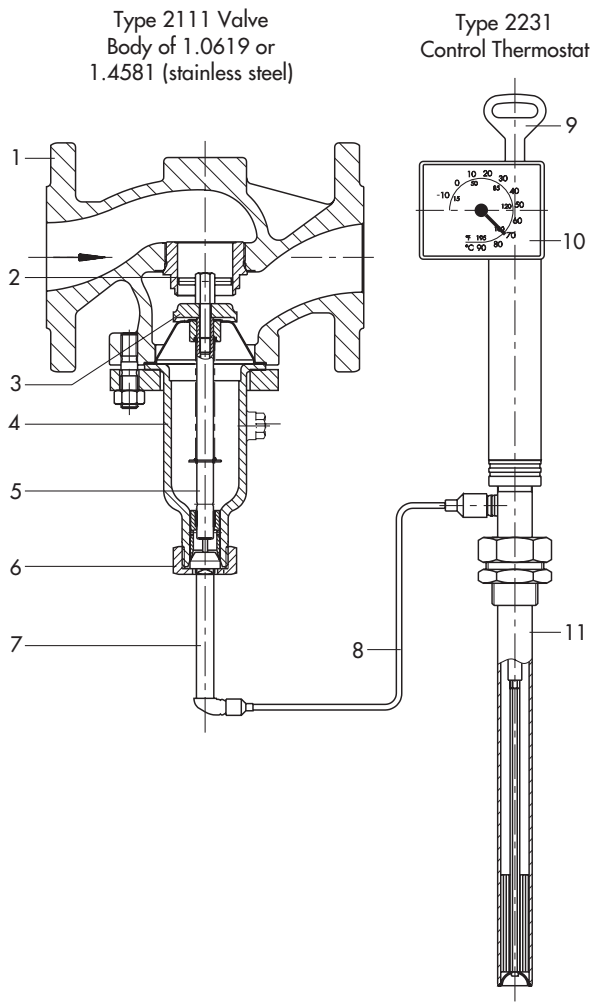


Fig. 2 · Type 1 Temperature Regulator with single-seated globe valve in DN 50, body material of cast steel or stainless cast steel, and Type 2231 Control Thermostat

Valve

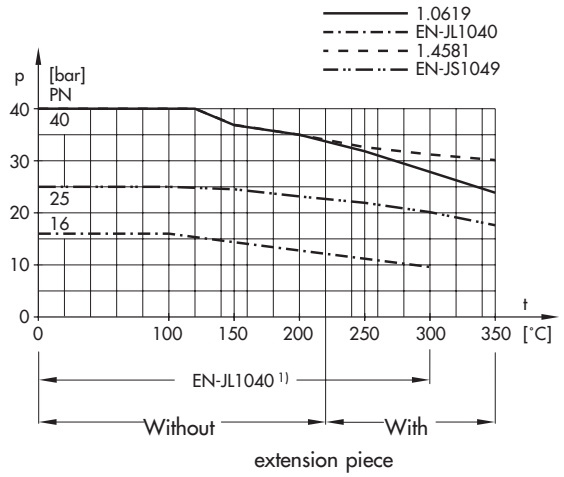
1 Valve body
2 Valve seat (replaceable)
3 Valve plug
4 Lower part (only for 1.0619 and stainless steel 1.4581)
5 Plug stem with spring

Control thermostat

6 Connection for operating element
7 Operating element with bellows
8 Capillary tube
9 Key for set point adjustment
10 Set point dial
11 Temperature sensor (bulb sensor)

Pressure-temperature diagram - acc. to DIN EN 12516-1 -

The pressures listed in the technical data section are limited by the values in the pressure-temperature diagram.



1) with extension piece

Fig. 3 · Pressure-temperature diagram

Installation

Valve

Install the valves in horizontal pipelines. The direction of flow must correspond with the arrow on the body. The connecting element must be vertically suspended.

Capillary tube

Install the capillary tube such that it is not exposed to considerable temperature fluctuations and cannot be damaged. Make sure the permissible ambient temperature range is not exceeded. The smallest possible bending radius is 50 mm.

Temperature sensor

The temperature sensor can be installed in any desired position. Nevertheless, its entire length must be immersed in the process medium. Choose a place of installation where neither overheating nor considerable idle times occur.

Only use the same kind of materials together; thermowells made of stainless steel 1.4571, for example, can be installed in stainless steel heat exchangers.

Table 1 · Technical data · All pressures in bar (gauge).

The specified permissible pressures and differential pressures are limited by the values given in the pressure-temperature diagram and the nominal pressure ratings (acc. to DIN EN 12516-1).

Type 2111 Valve							
Nominal pressure		PN 16 to PN 40					
K_{VS}, leakage rate, and max. permissible differential pressures Δp [1] in bar							
Standard version	Connection DN	15	20	25	32	40	50
K_{VS}		4 [2]	6.3 [2]	8	16	20	32
Differential pressure	Δp_{max}	25	16	14	6	6	4
Leakage rate		≤ 0.05 % of K_{VS}					
Special version	Connection DN	15	20	25	32	40	50
K_{VS}		2.5 · 1 · 0.4 · 0.1		4 [2] · 1 · 0.4 · 0.1	6.3 [2]	8	16
Diff. pressure	Δp_{max}	25			16	14	6
Permissible valve temperature		See pressure-temperature diagram					
Types 2231 to 2235 Thermostats		**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, 2235 also 100 to 200 °C, 150 to 250 °C					
Permissible ambient temperature at the set point adjustment head		−40 to +80 °C					
Permissible temperature at the sensor		100 K above the adjusted set point					
Permissible pressure at the sensor	Type 2231/2232	Without thermowell: PN 40 · With thermowell: PN 40 or PN 100 With thermowell with flange: PN 40/DN 32 or PN 100/DN 40					
	Type 2233/2234	Without thermowell: PN 40 · With flange PN 6 (external Ø 140) or PN 40/DN 32					
Length of the capillary tube		3 m (special version: 5 m, 10 m, or 15 m)					

[1] The differential pressure corresponds to the pressure head of the pump for liquids

[2] For spheroidal graphite iron and for K_{VS} 4 and 6.3: Δp_{max} = 14 bar

Table 2 · Materials · Material numbers according to DIN EN

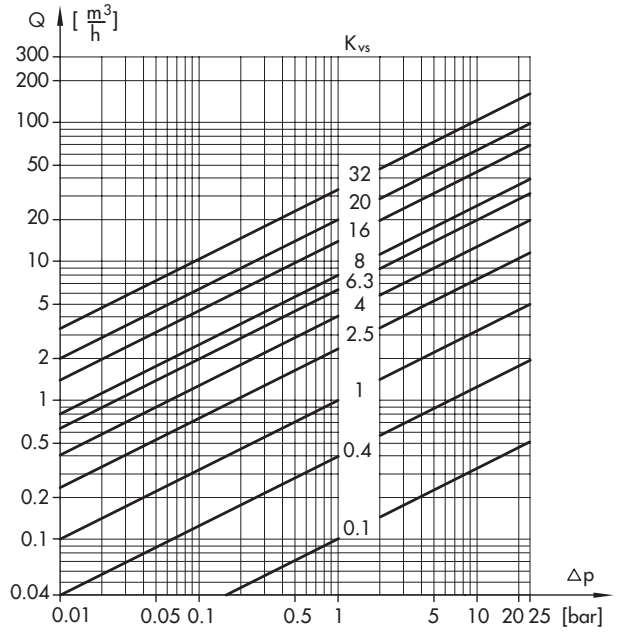
Type 2111 Valve				
Nominal size	DN 32 to DN 50	DN 15 to DN 50		
Nominal pressure	PN 16	PN 25	PN 40	
Body	Cast iron EN-JL1040 (GG-25)	Spheroidal graphite iron EN-JS1049 (GGG-40.3)	Cast steel 1.0619 (GS-C 25)	Stainless cast steel 1.4581
Seat and plug	1.4305			Stainless steel 1.4571
Plug stem/spring	Steel 1.4301/1.4310			
Lower part	1.0425 (St 35.8) [1]			Stainless steel 1.4571
Body gasket	Graphite on metal core			
Extension piece/ distance piece	Brass (special version: stainless steel 1.4301)			Stainless steel 1.4301

Types 2231, 2232, 2233, 2234, and 2235 Thermostats [2]			
	Standard version	Special version	
Operating element	Brass, nickel-plated		
Sensor Type 2231/2232	Bronze, nickel-plated	–	Stainless steel 1.4571
Sensor Type 2233/2234	Copper, nickel-plated		
Sensor Type 2235	Copper		
Capillary tube	Copper, nickel-plated	Plastic-coated copper	
Thermowell with threaded connection			
Immersion tube	Bronze, nickel-plated	Copper	Stainless steel 1.4571
Threaded nipple	Brass, nickel-plated		
... with flange			
Immersion tube	Steel	Plastic-coated steel or PTFE [3]	Stainless steel 1.4571
Flange			

[1] EN-JL 1040 and EN-JS 1049 with brass bushing · [2] Type 2235 not available in corrosion-resistant version

[3] Plastic coating (for temperatures up to 80 °C) · PVC or PPH coating. PTFE version · Immersion tube: PTFE · Flange: steel with PTFE sleeve

Flow diagram for water



Valve sizing for other media according to DIN EN 60534-2-1 with the terms: F_L = 0.95 and x_T = 0.75.

Fig. 4 · Flow diagram for water

Accessories

To protect the operating element from inadmissible operating conditions, an extension piece and/or distance piece is to be installed between the valve and the operating element.

The **extension piece** is needed for temperatures over 220 °C (see pressure-temperature diagram).

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

A **distance piece** is used in the stainless steel version to separate the non-ferrous metals of the operating element from the process medium flowing through the valve. In addition, it prevents the medium from leaking when the thermostat is replaced.

For Types 2231 and 2232 Control Thermostats: thermowells with threaded connection or flanges

For Types 2233 and 2234 Control Thermostats: clamps and protective cover for wall mounting

Also available:

Safety temperature monitors (STM) and safety temperature limiters (STL). For details refer to Data Sheets T 2043 EN and T 2046 EN.

Typetested safety devices available

The register no. is available on request.

Temperature regulators (TR) with a Type 2231, 2232, 2233, 2234 or 2235 Thermostat and a Type 2111 Valve in nominal sizes DN 15 to DN 50. The max. operating pressure in the valve must not exceed the max. permissible differential pressure Δp specified in the technical data section.

Sensor without thermowell: up to 40 bar

Sensor with thermowell: only in SAMSON version G1, bronze and 1.4571 up to 40 bar

Thermowell for flammable gases typetested by DVGW (German Technical and Scientific Association on Gas and Water), threaded connection G1, PN 100

Temperature limiters (TL) with thermostat and valve according to the above specifications and with a double adapter Do (see Data Sheet T 2036 EN).

For further details on typetested devices see Data Sheet T 2040 EN.

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 (right) lists the response times of SAMSON sensors operating on different principles when tested in water.

Table 3 · Time constants of SAMSON thermostats

Functional principle	Type … Control Thermostat	Time constant in seconds	
		Without thermowell	With thermowell
Liquid expansion	2231	70	120
	2232	65	110
	2233	25	–[1]
	2234	15	–[1]
	2235	10	–[1]
	2213	70	120
Adsorption	2213	–[1]	40

[1] Not permissible

Table 3 · Dimensions in mm and weights

Type 2111 Valve	**DN**	**15**	**20**	**25**	**32**	**40**	**50**
Length L		130	150	160	180	200	230
Body material of cast iron (EN-JS 1040) and spheroidal graphite iron (EN-JL 1049)							
H1		82			152		
H		372			442		
Weight (body PN 16)	Approx. kg	4			10 [1]		
Body material of cast steel (1.0619) and stainless steel (1.4581)							
H1	Up to 220 °C (without extension piece)	225					
	Up to 350 °C (with extension piece)	365					
H	Up to 220 °C (without extension piece)	515					
	Up to 350 °C (with extension piece)	655					
Weight (body PN 16)[2]	Approx. kg	4	4.5	5.5	10 [1]	11.5 [1]	13.5 [1]

Thermostat	**Type**	**2231**	**2232**	**2233**	**2234**	**2235**
Immersion depth T		290 [2]	235 [2]	430	460	3460
Weight	Approx. kg	3.2	4.0	3.4	3.7	3.6

[1] Body PN 16; +15 % for PN 25/PN 40 · [2] Greater immersion depths available on request

Dimensions in mm · Valves and control thermostats

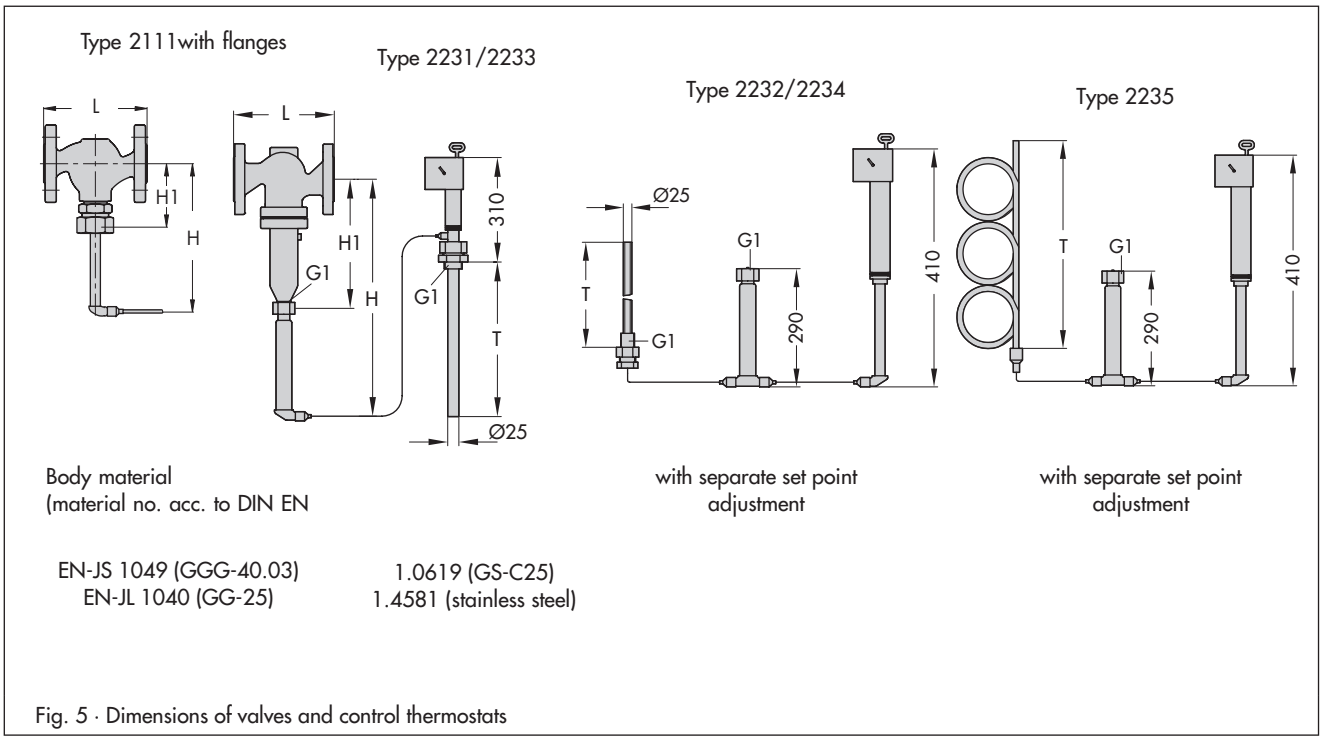


Fig. 5 · Dimensions of valves and control thermostats

Ordering text
Temperature Regulator Type 2111/...
DN … / G ..., PN 25
With flanged body/female thread
Body material
With Control Thermostat Type ..., set point range ...°C
Capillary tube … m,
Special version if required, accessories

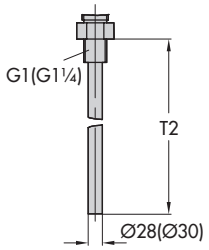
Conversion of valve sizing coefficients
C_V (in US gallons/min) = 1.17 · K_{VS} (in m^3/h)
K_{VS} (in m^3/h) = 0.86 · C_V (in US gallons/min)

Specifications subject to change without notice.

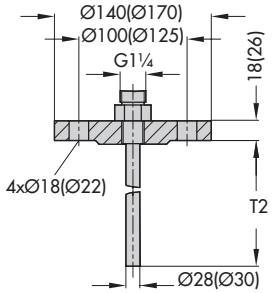
Accessories

Thermowells for Types 2231/2232

Control thermostat	Type 2231	Type 2232
Immers. depth T2 in mm	325	250

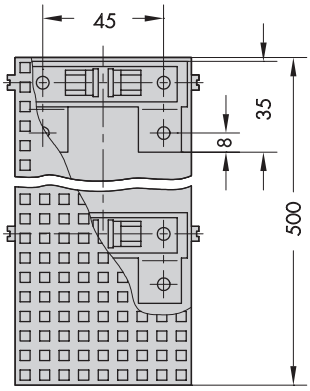


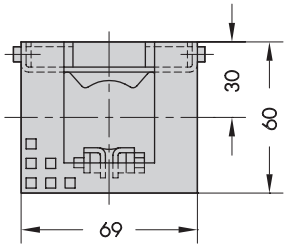
Threaded connection
G 1/PN 40 or PN 100
(version of copper in PN 16)



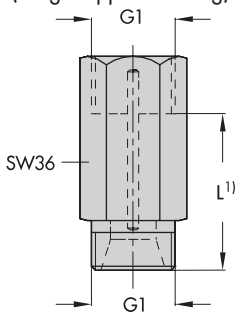
Flanged connection
DN 32/PN 40
DN 40/PN 100
(dimensions in parentheses)

Clamps and **perforated cover**
for wall mounting





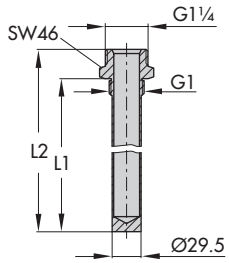
Distance piece
(weight approx. 0.2 kg)
Extension piece
(weight approx. 0.5 kg)



1) Distance piece:
L = 55 mm
Extension piece:
L = 140 mm

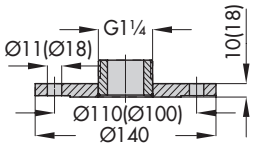
Thermowells for flammable gases (PN 100/PN 63)

Control thermostat		Type 2231	Type 2232
Length L1	mm	315	255
Length L2	mm	340	280



Thermowell for flammable gases
G 1/PN 100

Flange for Type 2233 and Type 2234



Flange PN 6, 140 outside Ø

Flange PN 40/DN 32
(dimensions in parentheses)

Fig. 6 · Dimensions of accessories

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