

Application

Temperature controller for process engineering and industrial applications for liquids, gases and vapors · Measuring range from -40 to 300 °C



The controller directly measures the temperature of the process medium, compares the measured value to the set point and produces a pneumatic control signal of 0.2 to 1 bar (3 to 15 psi). The required supply pressure is 1.4 bar (20 psi) or an operating air pressure of 2.0 to 12 bar (30 to 180 psi). The controllers consist of a controller station, a controller module with the required control mode and a transmitter module with capillary sensor corresponding to the temperature set point.

Special features

- Controller and control valve form a unit to directly measure the temperature to be controlled which is easy to service and low in price
- Set point, controlled variable, system deviation and output pressure are visible at a glance; all required adjusters and switches can be operated on the front panel
- Can be equipped with modules for P, PI, PID or PD control modes and additional modules for special control tasks
- Housing suitable for wall, pipe and panel mounting (front frame 192 x 228 mm), optionally with lockable door of transparent plastic (IP 65) with conductive coating

Versions

Type 3430 Indicating Controller for Temperature consisting of a Type 3432 Controller Station, a control-specific Type 3433 or Type 3434 Controller Module and a Type 3436 Transmitter Module

Fixed set point controller (Fig. 2 and Fig. 3) · With capillary sensor, measuring ranges from -40 to 300 °C

Follower controller · Same as fixed set point controller, but with additional input for external reference variable $w_{ext} = 0.2$ to 1 bar, 3 to 15 psi, 0/4 to 20 mA · Without set point adjuster

Fixed set point and follower controller · Combination of fixed set point and follower controller, with w_{int}/w_{ext} selector switch to change between internal and external reference variable
Set point adjuster and differential pressure indication
Can optionally be equipped with one or two adjustable inductive limit switches and/or supply pressure regulator for operating air pressures of 2.0 to 12 bar

Controller stations with i/p converters and limit switches for hazardous locations available on request

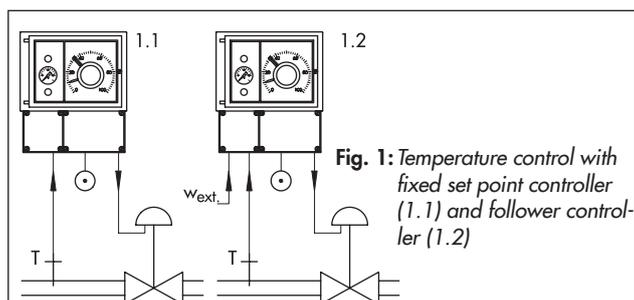


Fig. 1: Temperature control with fixed set point controller (1.1) and follower controller (1.2)

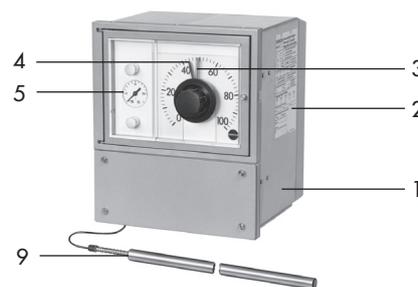


Fig. 2: Fixed set point controller for temperature with Type 3432-01 Controller Station

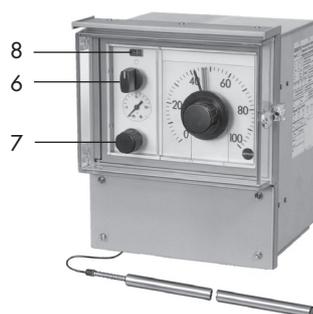


Fig. 3: Fixed set point controller for temperature with Type 3432-02 Controller Station and lockable door

- | | |
|---|---|
| 1 Controller station | 6 Manual/automatic switch |
| 2 Label | 7 Adjuster for manual mode |
| 3 Set point adjuster with set point display (w) | 8 Differential pressure indication for bumpless manual/automatic switchover |
| 4 Controlled variable display (x) | 9 Capillary sensor |
| 5 Output signal display (y) | |

Principle of operation (see Fig. 4 and Fig. 5)

The Series 430 Pneumatic Controllers with their modular design can be used in all kinds of automation applications. The temperature controllers consist of a Type 3432 Controller Station (as the basic module) with a Type 3433 or 3434 Controller Module with the required control mode and a Type 3436 Transmitter Module.

The medium temperature creates a pressure proportional to the temperature in the gas-filled sensor (2.1) of the transmitter module. This pressure opposes a force at the beam (2.4) which is generated at the feedback bellows (2.6) by the output pressure p_A . The supply air flows through the restriction (2.9) and nozzle (2.8) onto the flapper (2.7). An increase in temperature causes the flapper to come closer to the nozzle. As a result, the output pressure p_A applied to the bellows (2.6) rises until a new equilibrium is reached, i.e. until the output signal reaches a value proportional to the temperature. Zero can be set at the adjustment screw (2.11) and the span by moving the feedback bellows. The output pressure p_A proportional to the temperature is applied as a signal (controlled variable x) to the bellows measuring system of the controlled variable display (1.3) and controller module (3).

The controller station shown in Fig. 4 (fixed set point controller) includes a scale (1.2), controlled variable display (1.3), set point adjuster (1.4) and plug-in connections for a controller module (3). These pneumatic connections are self-sealing when the module is unplugged. The controlled variable signal x produces a deflection on the bellows measuring system of the controlled variable display (1.3) which is transmitted to the pointer over a gear mechanism. The set point (reference variable w) can be adjusted on a scale (1.2) at the controller front. The position of the set point adjuster is transmitted to the set point transmitter (1.4) over a gear mechanism. This servo system (1.41) converts the adjusted set point into a pneumatic set point signal (w), which is fed to the controller module. The controller module compares the controlled variable signal and the set point signal (x and w) and produces an output signal y_A based on the system deviation and the adjusted control parameters. The output signal is connected to the output signal display (1.5) and output port y .

The controller station (Fig. 5) largely corresponds to the one shown in Fig. 4. However, it additionally contains a manual/automatic switch (1.6), adjuster for manual mode (1.7) and differential pressure indication (1.8). When the switch is in AUTOMATIC position, the output signal display (1.5) and output port y are connected to the automatic output signal y_A . In MANUAL, the output signal display and output port y are connected to the manual output signal y_H set at the adjuster. Bumpless changeover from manual to automatic operation is possible when the differential pressure indication indicates that y_A and y_H are identical.

The follower controllers (not shown) have an additional pneumatic or electric input for the external reference variable w_{ext} (at input $w_{ext} = 0/4$ to 20 mA with integrated i/p converter). Details on the i/p converter in Data Sheet ▶ T 7045 EN.

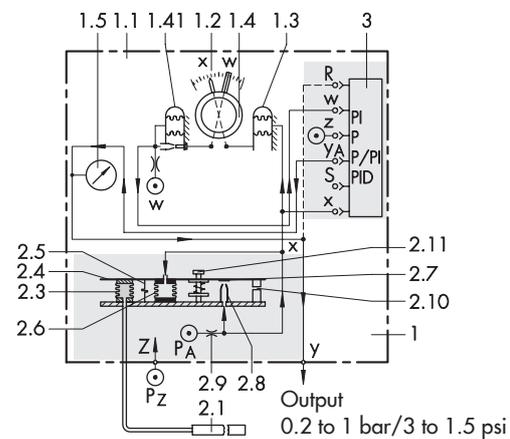
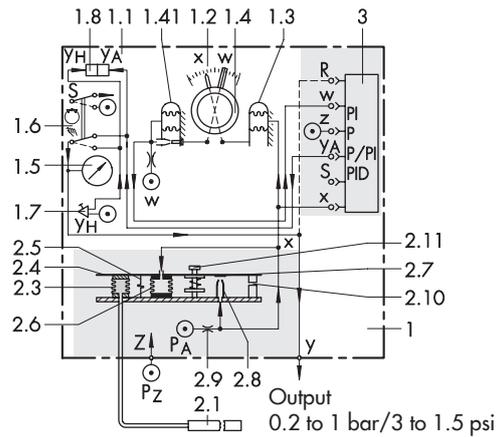


Fig. 4: Schematic drawing of fixed set point controller for temperature with Type 3432-01 Controller Station



Version with supply pressure regulator (1.9):

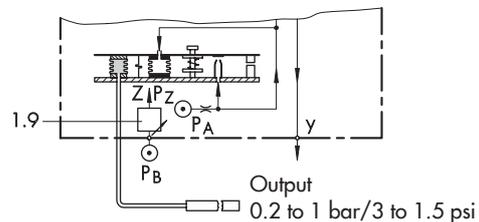


Fig. 5: Schematic drawing of fixed set point controller for temperature with Type 3432-02 Controller Station

- | | |
|--|---|
| 1 Controller station | 2 Transmitter module for temperature |
| 1.1 Housing with door | 2.1 Sensor |
| 1.2 Scale | 2.2 Capillary tube |
| 1.3 Controlled variable display with pointer, gear mechanism and bellows measuring system | 2.3 Measuring bellows |
| 1.4 Set point adjuster with pointer, gear mechanism and set point transmitter (1.41); follower controllers: set point display only | 2.4 Balance beam |
| 1.5 Output signal display | 2.5 Cross spring pivot |
| 1.6 Manual/automatic switch | 2.6 Feedback bellows |
| 1.7 Adjuster for manual mode | 2.7 Flapper |
| 1.8 Differential pressure indication for bumpless manual/automatic switchover | 2.8 Nozzle |
| 1.9 Supply pressure regulator | 2.9 Restriction |
| | 2.10 Damping |
| | 2.11 Zero adjustment |
| | 3 Controller module |

The controller stations can be equipped with suitable controller modules, e.g. Type 3434 for common P or PI temperature control, Type 3433 for P, PI, PID and PD control, and additional modules for special control tasks.

Details on controller and additional modules in Data Sheets ► T 7040 EN and ► T 7041 EN.

The controllers stations can optionally be equipped with one or two inductive limit switches adjustable at the scale. They are also available with supply pressure regulator (1.9, Fig. 5). This allows the device to be used with operating air pressures

from 2 to 12 bar. The additional supply pressure regulator reduces the operating air pressure (p_B) to the required supply pressure (p_Z) of 1.4 bar or 20 psi. The operating principle of this supply pressure regulator is similar to that of Type 708-5003. See Data Sheet ► T 8545 EN.

Table 1: Technical data

Type 3436 Transmitter Module										
Measuring ranges (standard)	-20 to 30 °C 0 to 50 °C		0 to 100 °C 50 to 150 °C		0 to 150 °C		0 to 200 °C			
Special measuring ranges Lower range value	150 to 250 °C -40 to 150 °C		-40 to 200 °C		-40 to 150 °C		-40 to 100 °C			
Span	50 K		100 K		150 K		200 K			
Overload limit	350 °C									
Perm. pressure at sensor	Without thermowell PN 16 · With thermowell PN 63 or 100									
Supply air	1.4 ± 0.1 bar (20 ± 1.5 psi)									
Output	0.2 to 1.0 bar (3 to 15 psi)									
Deviation from terminal-based linearity	0.6 % with terminal-based conformity									
Hysteresis	< 0.25 %									
Influence	Supply air	< 0.25 %/0.1 bar								
	Pressure at the sensor	< 0.6 %/10 bar	< 0.25 %/10 bar		< 0.15 %/10 bar					
	Ambient temperature	< 0.6 %/°C		< 0.03 %/°C						
Capillary tube	Length 3 m or 6 m · With/without metal protective hose · Filling medium: Nitrogen									
Type 3432 Controller Station										
Controlled variable display	Measuring range 0.2 to 1.0 bar (3 to 15 psi) · Accuracy class 1.6 · Scale length 212 mm									
Set point adjustment ¹⁾	Output 0.2 to 1.0 bar (3 to 15 psi) · Scale length 212 mm · Accuracy class 1.6									
Adjuster for manual mode	Output 0.2 to 1.0 bar (3 to 15 psi) · Max. 0.02 to 1.35 bar · Max. air delivery > 1.5 m ³ /h									
Inductive limit switches	1 or 2 SC 3,5-NO-YE proximity switches acc. to DIN EN 60947-5-6, Ex II 2 G Ex ia IIC T6									
i/p converter ²⁾	Input 0/4 to 20 mA (R _i = 200 W)									
Can be equipped with ...										
Controller module ³⁾	Type	3434-1	3434-2	3433-1	3433-2	3433-3	3433-4	3433-5	3433-6	3433-9
Controller action		P	PI	P	PI ⁴⁾	PID ⁴⁾	PD	P/PI	PD/PID	P ⁵⁾
Proportional-action coefficient K _p		1 to 20		0.2 to 20 oder 0.4 to 40						
Reset time T _n		-	0.05-20 min	0.03 to 50 min						
Derivative-action time T _v		-	-	0.01 to 10 min · Derivative-action gain of x: ≈ 10						
Optionally with Additional module ³⁾	Type	-		3437-1 Signal limiter	3437-2 Control mode selector switch		3437-3 Bumpless manual/automatic switchover			
Output		0.2 to 1 bar (3 to 15 psi) · Max. 0.02 to 1.35 bar								
Supply air	Standard version	Supply air 1,4 ± 0.1 bar (20 ± 1.5 psi) · Air consumption < 0.6 m ³ /h								
	Version with supply pressure regulator	Operating air 2.0 to 12 bar (30 to 180 psi) · Air consumption < 0.75 m ³ /h								
	Version with i/p converters	w _{ext} : +0.13 m ³ /h								
Air quality acc. to ISO 8573-1		Max. particle size and density: Class 3 · Oil content: Class 2 · Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected								
Permissible ambient temperature		-20 to 60 °C								
Degree of protection		IP 40, front with door: IP 65								
Total weight (approx.)		6 kg								

¹⁾ Version with follower controller: only set point display with 212 mm scale

²⁾ See Data Sheet ► T 7045 EN

³⁾ See Data Sheets ► T 7040 EN and ► T 7041 EN

⁴⁾ Optionally with feedback limitation

⁵⁾ With set-point-dependent operating point

Table 2: Controller station versions

Controller station	Type 3432-	01	02	03	04	05	06
Fixed set point controller		•	•				
Follower controller				•	•		
Fixed set point and follower controller						•	•
Equipped with ...							
Set point adjuster		•	•			•	•
Set point display		•	•	•	•	•	•
Controlled variable/output signal display		•	•	•	•	•	•
Manual/automatic switch			•		•		•
Manual adjuster/differential pressure indicator			•		•		•
w_{int}/w_{ext} selector switch						•	•
Transmitter module		•	•	•	•	•	•
Controller module	Type 3433-... ¹⁾		•	•	•	•	•
	Type 3434-...	•		•	•	•	•
Input wext	0.2 to 1 bar			•	•	•	•
	0/4 to 20 mA				•	•	•
i/p converter for w_{ext}					•	•	•
Can additionally be equipped with ...							
1 or 2 inductive limit switches		•	•	•	•	•	•
Type 3708-5003 Supply Pressure Regulator		•	•	•	•	•	•
Door IP 65, with conductive coating		•	•	•	•	•	•

¹⁾ Optionally with additional module

Table 3: Materials · Material numbers according to DIN EN

Capillary sensor ¹⁾	Stainless steel 1.4571
Housing	Die-cast aluminum, plastic-coated

¹⁾ As bulb sensor Ø 12 mm · Optionally, temperature sensor for air (outside Ø 20 mm) or temperature sensor for installation in T-union according to DIN 11857

Ordering text

Pneumatic Indicating Controller for Temperature

Type 3432-... / 3436

With Type 3434-... Controller Module /3433-...

Measuring range ... °C, measuring span ... °C

Control mode P, PI, PID, P/PI, PD/PID, P set point dependent
as fixed set point controller/follower controller/fixed set point
and follower controller

Output: 0.2 bar to 1 bar/3 to 15 psi

Capillary tube 3 or 6 m long, with/without protective hose

Optionally, special version .../accessories ...

Electrical connection

When additionally equipped with i/p converter for w_{ext} and/or inductive limit switches

Terminals for 0.5 to 1.5 mm² wires

Connect suitable switching amplifiers into the output circuit to operate inductive limit switches.

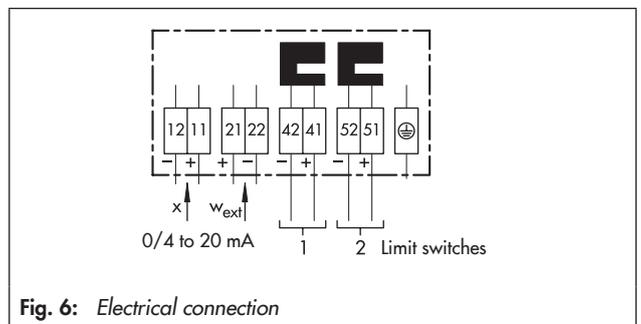


Fig. 6: Electrical connection

Dimensions in mm

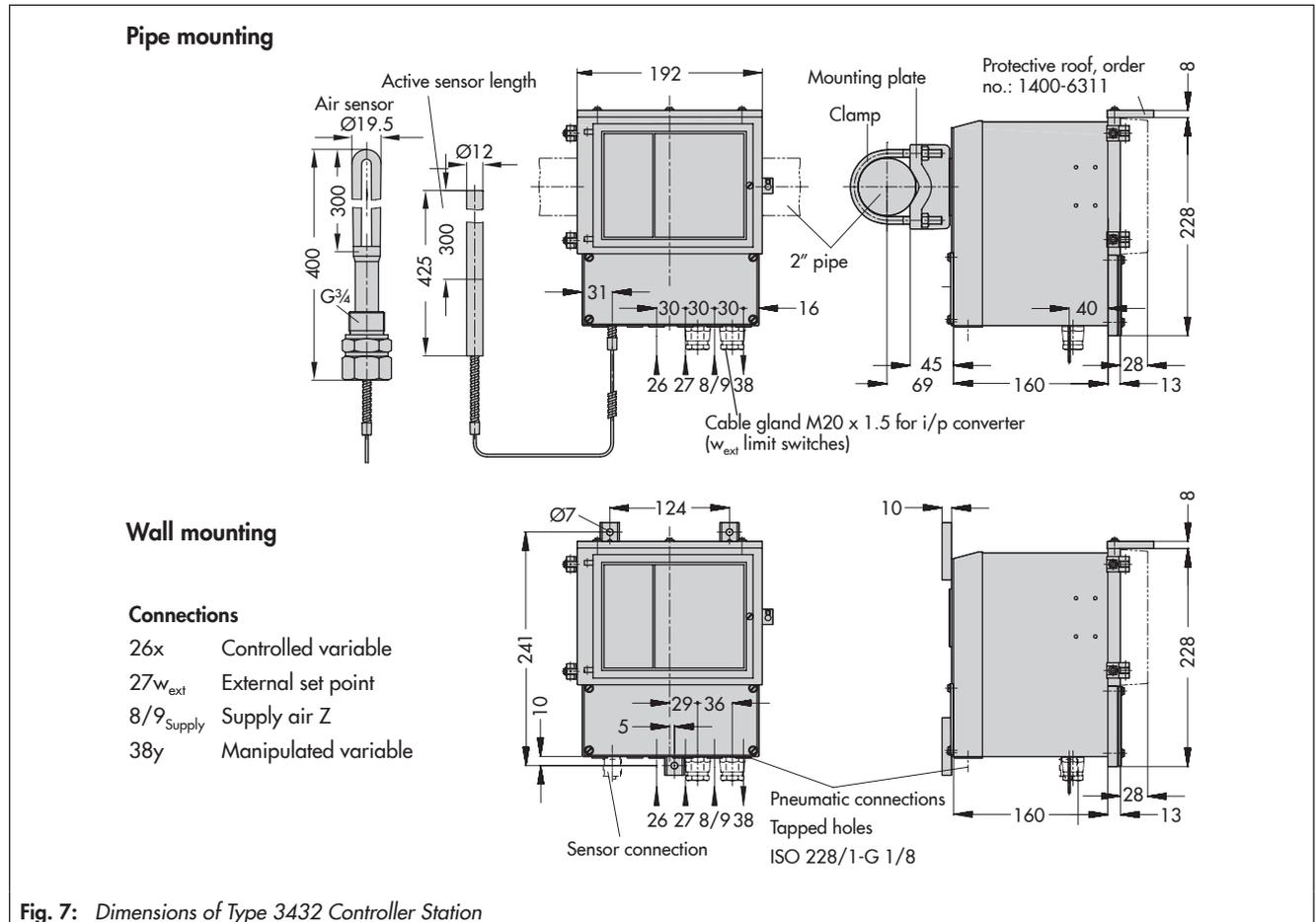


Fig. 7: Dimensions of Type 3432 Controller Station

Installation and connections

The following mounting positions are possible (see Fig. 7):

Pipe mounting With mounting part and clamp for attachment to a vertical or horizontal 2" pipe. Order no.: 1400-6302

Wall mounting: With three brackets for attachment to a wall. Order no.: 1400-6301

Panel mounting: With four C DIN 43835 fastening elements for attachment to the control panel · Cut-out for panel mounting 188⁺¹ x 255⁺¹ mm · Distance between center lines with door approx. 235 mm · Close-to-close arrangement in rows (without door) according to DIN 43700. Order no.: 1400-6300

Mounting position Controller station mounted in the upright position

Pneumatic connections

(output and supply) ISO 228/1-G 1/8 tapped holes

Bulb sensor Ø 12 mm, length 425 mm, active length 300 mm

The bulb sensor can be installed in any desired position. However, make sure its entire length is immersed in the process medium to be controlled. Choose a place of installation where neither overheating nor considerable dead times occur. Make sure no temperature fluctuations occur (ambient temperature approx. 20 °C). Install the capillary tube such that no mechanical damage can occur. The smallest permissible bending radius is 50 mm.

Accessories are part of the controller and must be ordered separately. Select accessories required for the operating conditions at the site of installation.

Materials of screw glands and thermowells: all wetted parts are made of stainless steel (1.4571).

Fastening parts for bulb sensor $d = 12$ mm, 425 mm long, active length 300 mm

Clamping flange

for wall mounting, e.g. depressurized tanks, ducts, etc.

Order no.: 1090-9547

Fasten the flange with two screws to the side and fasten the temperature sensor using two other screws in the flange.

Screw gland (PN 10)

G 1/2: order no. 1080-4881

G 3/4: order no. 1080-4882

Apply sealant to the screw gland. Push in sensor with screw gland and coupling nut. Tighten coupling nut.

Screw gland (PN 40) with clamping nut

G 1/2: order no. 1080-4884

G 3/4: order no. 1080-4885

Mount as described above, tighten clamping nut in place of the coupling nut.

Screw-in thermowell (PN 63)

G 1/2: order no. 1080-4888

G 3/4: order no. 1080-4889

A thermowell is recommended on exceeding the nominal pressure, or with corrosive media or when the plant is to remain in operation on changing the sensor.

Push sensor as far as it will go into the thermowell and tighten coupling nut.

Weld-in thermowell (PN 63)

Order no.: 1080-4890

Thermowell with flange

Order no.: 1080-4891 (PN 40)

1080-4892 (PN 100)

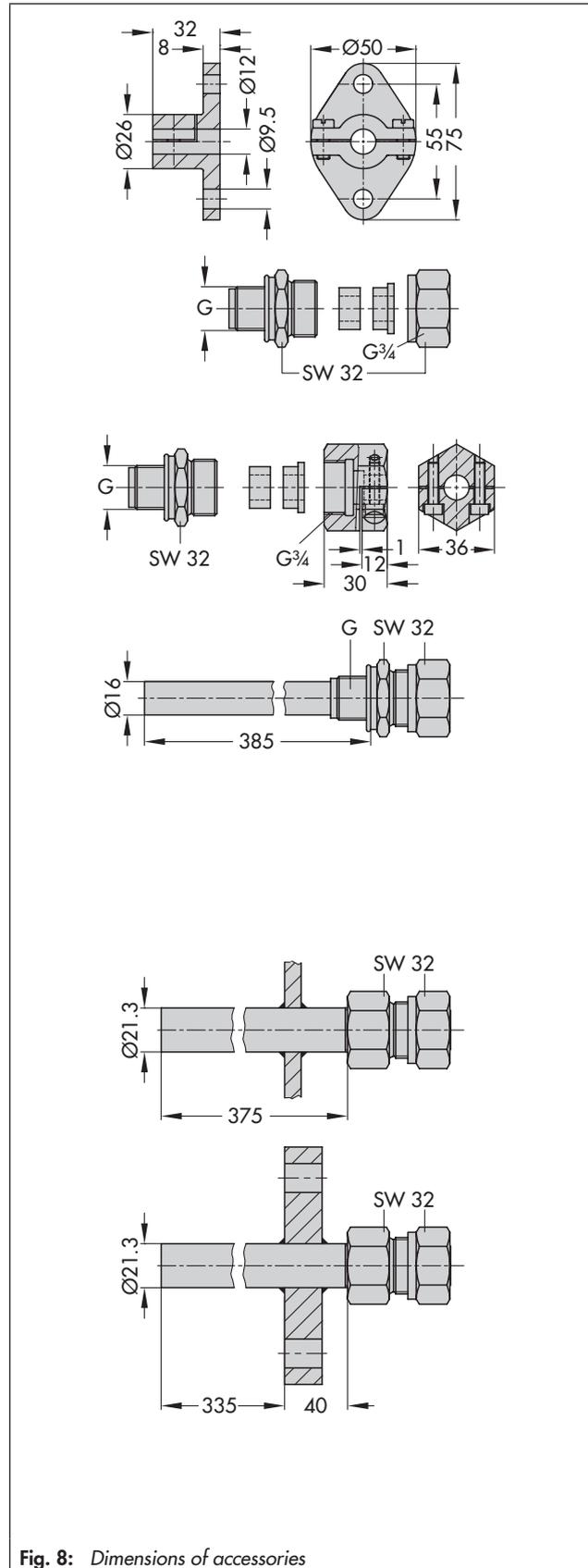


Fig. 8: Dimensions of accessories

Specifications subject to change without notice



SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main, Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
samson@samson.de · www.samson.de

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