

# Series 46 and 47 Self-operated Regulators

## Type 46-7 and Type 47-5 Flow and Differential Pressure Regulators



For installation in the return flow pipe

## Type 47-1 and Type 47-4 Flow and Differential Pressure or Pressure Regulators

For installation in the flow pipe

### Application

Flow rate and differential pressure regulation or flow rate and pressure regulation in district heating supply networks and industrial plants

Valves in DN 15 to 50 · Nominal pressure PN 16 and 25 · Suitable for liquids up to 150 °C as well as nitrogen and air up to 150 °C <sup>1)</sup>

The valve closes when the differential pressure or flow rate rises.



The regulators consist of a globe valve with adjustable restriction and an actuator with two operating diaphragms. They control the flow rate to the set point adjusted at the restriction and the differential pressure or downstream pressure to the set point adjusted at the actuator. The largest signal is always used to control the regulator.

### Special features

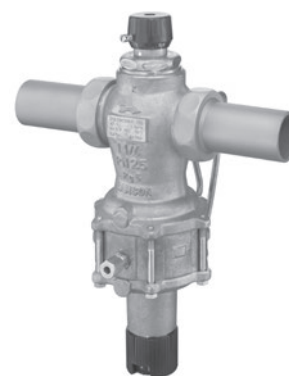
- Low-maintenance proportional regulators requiring no auxiliary energy
- Suitable for water and other non-flammable liquids or gases, provided these do not cause the materials used to corrode
- Single-seated valve with balanced plug
- Particularly suitable for district heating plants according to DIN 4747-1 (AGFW requirements for components in house substations)

### Versions

Flow and differential pressure regulators

- Valves DN 15 to 50 with connection nuts and welding ends
- Valves in DN 32, 40, and 50 also with flanged body made of spheroidal graphite iron
- With integrated restriction for adjusting the flow rate set point
- For **installation in the low-pressure pipe**, e.g. return flow pipe of a district heating substation:
  - **Type 46-7** (Fig. 2) · With adjustable flow rate and differential pressure set point · With internal overload protection (excess pressure limiter) in the actuator
  - **Type 47-5** · With fixed differential pressure set point · Adjustable flow rate set point · With internal overload protection (excess pressure limiter) in the actuator
- For **installation in the high-pressure pipe**, e.g. flow pipe of a district heating substation:
  - **Type 47-1** (Fig. 1) · With adjustable flow rate and differential pressure or pressure set point
  - **Type 47-4** · With fixed differential pressure set point · Adjustable flow rate set point

<sup>1)</sup> Diaphragm and seals made of FKM · PN 25 version



**Fig. 1:** Type 47-1 Flow and Differential Pressure or Pressure Regulator · With manual adjuster for adjustment of the  $\Delta p$  set point and scaled cap for adjustment of the flow rate set point



**Fig. 2:** Type 46-7 Flow and Differential Pressure Regulator Version with flanged body (DN 32 to 50)

### Further versions

- DN 15 to 50 with connection nuts and threaded ends or screw-on flanges
- With external scaled cap for adjustment of the flow rate set point (see Fig. 1) · DN 15 to 25 only
- PN 25 version: internal parts made of FKM, e.g. for use with mineral oils · Other oils on request
- Special  $K_{VS}$  coefficient in DN 15
- Intermediate insulating piece for better insulated pipes

### Principle of operation

The medium flows through the valve in the direction indicated by the arrow. The areas released by the restriction (1.2) and the valve plug (3) determine the flow rate and the differential pressure  $\Delta p$  or the pressure  $p_2$  at the body outlet.

The differential pressure  $\Delta p$  is converted by the first operating diaphragm (6.1) and the differential pressure based on the flow rate at the second operating diaphragm (6.3) into a positioning force. The largest signal is always used to control the regulator.

For example, if the differential pressure  $\Delta p$  rises, the positioning force at the first operating diaphragm (6.1) rises as well. This change in force causes the actuator stems (6.2 and 6.4) and the plug (3) to move in the closing direction. If the flow rate increases, the differential pressure at the restriction (1.2) and at the second operating diaphragm (6.3) increase. The second actuator stem (6.4) and the plug (3) move in the closing direction until the flow rate reaches the adjusted flow set point.

In Type 46-7 and Type 47-5, an overload protection (excess pressure limiter; 16) in the actuator protects the seat and plug from overload during exceptional operating conditions that could lead to valve or plant damage.

The differential pressure set point of Type 47-1 and Type 46-7 (DN 15 to 32 with set point range 0.2 to 0.6 bar and 0.2 to 1 bar) is adjusted using a manual adjuster with scaled cap. The required differential pressure can be adjusted precisely enough with the aid of a  $\Delta p$  set point diagram (without pressure gauge ▶ EB 3131).

### Flow control with Type 46-7, Type 47-5, Type 47-1, and Type 47-4

To control the flow rate, the low pressure downstream of the restriction (1.2) is transmitted through a hole in the plug (3) to the diaphragm chamber A. The high pressure is transmitted to the diaphragm chamber B through the control line (11) attached to the regulator.

### Differential pressure control with Type 46-7 and Type 47-5

To control the differential pressure, the high pressure of  $\Delta p$  is transmitted through the external control line (13) to the diaphragm chamber D. The low pressure of  $\Delta p$  is the same as the high pressure of the flow rate. It is transmitted over a hole between B and C to the diaphragm chamber C.

### Differential pressure control with Type 47-1 and Type 47-4

To control the differential pressure, the high pressure of  $\Delta p$  is transmitted through the control line (12) to the diaphragm chamber D. The low pressure of  $\Delta p$  is transmitted over the external control line (14) to the diaphragm chamber C.

### Pressure control with Type 47-1

When the Type 47-1 is used as a flow regulator and pressure reducer, the pressure connection of diaphragm chamber C remains open. The diaphragm chamber D is connected using the control line (12) to the downstream pressure  $p_2$ .

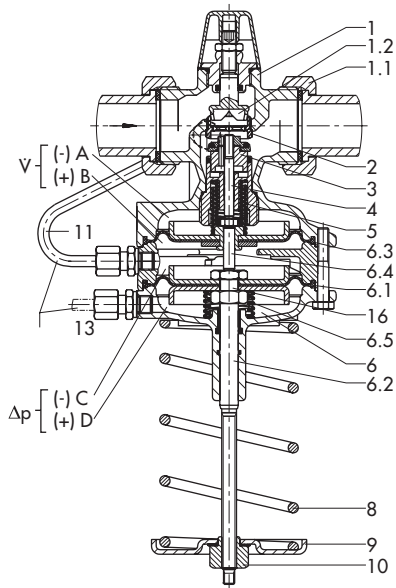


Fig. 3: Type 46-7

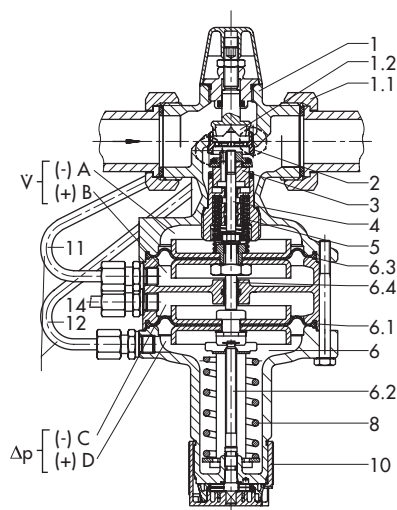


Fig. 4: Type 47-1 · DN 15 to 32

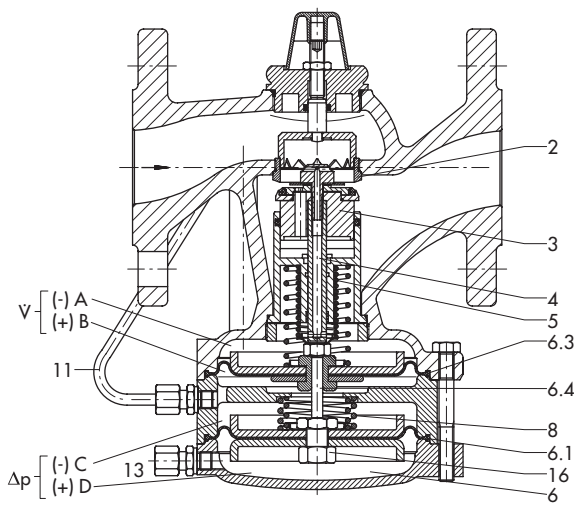


Fig. 5: Type 47-5 · Version with flanged valve body (DN 32 to 50)

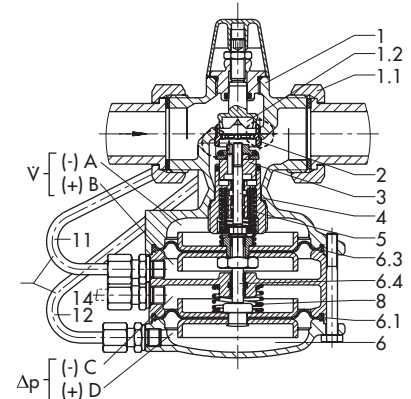


Fig. 6: Type 47-4

Legend for Fig. 3 to Fig. 6

- |  |   |
|--|---|
| 1 Valve body   | 6.5 Spring  |
| 1.1 Connection nut with seal and welding end           | 8 Set point spring  |
| 1.2 Restriction (orifice) to adjust the flow set point | 9 Spring plate  |
| 2 Seat   | 10 Set point adjustment for differential pressure         |
| 3 Plug   | 11 Control line   |
| 4 Plug stem  | 12 Control line   |
| 5 Valve spring   | 13 External control line (+)                              |
| 6 Actuator   | 14 External control line (-)                              |
| 6.1 Operating diaphragm                                | 16 Internal excess pressure limiter (overload protection) |
| 6.2 Actuator stem                                      | A to D Diaphragm chamber                                  |
| 6.3 Operating diaphragm                                |   |
| 6.4 Actuator stem                                      |   |

**Note on Fig. 3 to Fig. 6:** the control lines are turned into the plane of projection.

Table 1: Technical data

Nominal size DN	15				20	25	32 <sup>2)</sup>	40 <sup>2)</sup>	50 <sup>2)</sup>	
$K_{VS}$ coefficient	0.4 <sup>1)</sup>	1 <sup>1)</sup>	2.5	4 <sup>1)</sup>	6.3	8	12.5	16/20 <sup>2)</sup>	20/25 <sup>2)</sup>	
$x_{FZ}$ value	0.6					0.55	0.55/0.45 <sup>2)</sup>		0.45/0.4 <sup>2)</sup>	
Nominal pressure	PN 16/25						PN 25			
Max. permissible differential pressure $\Delta p$ across the valve	10 <sup>3)</sup> /20 bar							16 bar		
Max. permissible temperature	Liquids: 130 °C <sup>3)</sup> /150 °C · Air and nitrogen: 150 °C <sup>4)</sup>									
Pressure above adjusted differential pressure set point at which internal excess pressure limiter responds (Type 46-7 and Type 47-5)	0.5 bar									
Compliance	<b>CE · EAC</b>									
<b>Differential pressure set point ranges</b>										
Types 46-7 and 47-1: continuously adjustable	0.2 to 0.6 bar · 0.2 to 1 bar · 0.5 to 2 bar							0.2 to 0.5 bar · 0.2 to 1 bar · 0.5 to 2 bar		
Types 47-4 and 47-5: fixed set point	0.2 bar · 0.3 bar · 0.4 bar · 0.5 bar									
<b>Flow rate set point ranges for water in m<sup>3</sup>/h</b>										
Differential pressure at the restriction 0.2 bar	-	-	-	0.6 to 1.3 <sup>5)</sup>	0.8 to 2.3 <sup>5)</sup>	0.8 to 3.5 <sup>5)</sup>	2 to 5.8 <sup>5)</sup>	3 to 9.1 <sup>5)</sup>	4 to 14.1 <sup>5)</sup>	
	0.01 to 0.2	0.12 to 0.64	0.2 to 1.2	0.6 to 2.5	0.8 to 3.6	0.8 to 4.2 <sup>6)</sup>	2 to 10	3 to 12.5	4 to 15	

<sup>1)</sup> Special versions

<sup>2)</sup> Additional version: Valve with flanged body made of spheroidal graphite iron

<sup>3)</sup> For PN 16 version

<sup>4)</sup> Diaphragm and seals made of FKM · PN 25 version

<sup>5)</sup> An increase in noise level can be expected when the specified flow rates are exceeded, even if cavitation does not occur.

<sup>6)</sup> 5 m<sup>3</sup>/h with a differential pressure at the restriction of 0.3 bar (special version)

## Required differential pressure

The minimum required differential pressure  $\Delta p_{\min}$  across the valve is calculated as follows:

$$\Delta p_{\min} = \Delta p_{\text{restriction}} + \left( \frac{\dot{V}}{K_{VS}} \right)^2$$

$\Delta p_{\min}$	Minimum differential pressure across the valve in bar
$\Delta p_{\text{restriction}}$	Differential pressure in bar created at the restriction for measuring the flow rate
$\dot{V}$	Adjusted flow rate in m <sup>3</sup> /h
$K_{VS}$	Valve flow coefficient in m <sup>3</sup> /h

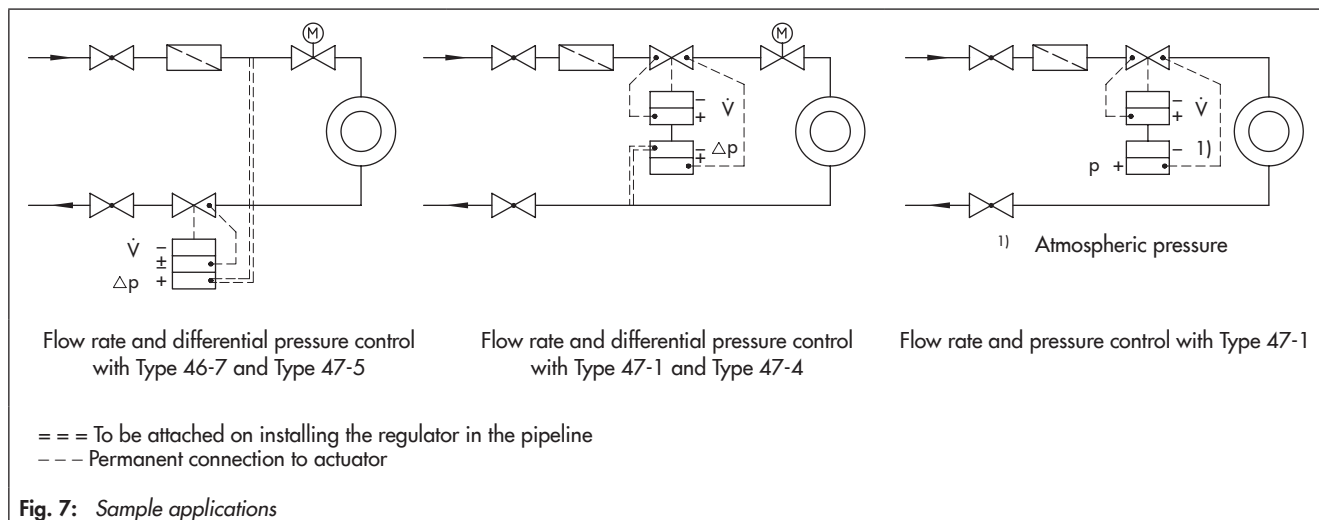
**Table 2:** Materials · Material numbers according to DIN EN

Body	Red brass CC491K/CC499K (Rg 5) · Spheroidal graphite iron EN-GJS-400-18-LT <sup>1)</sup>	
Seat	Stainless steel 1.4305	
Plug	PN 25	Brass, resistant to dezincification, with EPDM soft seal <sup>2)</sup>
	PN 16	Brass, resistant to dezincification, and plastic with EPDM soft seal
Valve springs	Stainless steel 1.4310	
Restriction	Brass, free of dezincification	
Operating diaphragm	EPDM with fabric reinforcement <sup>2)</sup>	
Seals	EPDM <sup>2)</sup>	

<sup>1)</sup> Additional version in DN 32, 40, and 50: valve with flanged body made of spheroidal graphite iron

<sup>2)</sup> Special version in PN 25, e.g. for mineral oils: FKM

## Application



**Fig. 7:** Sample applications

## Installation

The regulator is suitable for installation into horizontal pipes as well as vertical pipes.

Regulators in DN 32 or larger must only be installed horizontal pipes (with the actuator facing down).



Installation conditions:

- The direction of flow must match the direction indicated by the arrow on the body
- Connect external control lines at the side or on top of the main pipe
- If possible, install a strainer (e.g. SAMSON Type 1 NI) upstream of the valve, e.g. upstream of the transfer station.

Further details can be found in

► EB 3131.

## Flow rate diagram for water

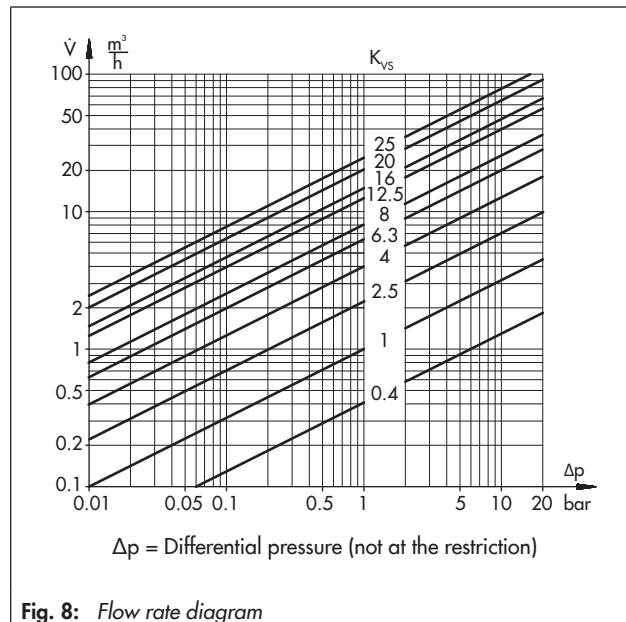


Fig. 8: Flow rate diagram

## Ordering text

Types 46-7, 47-1, 47-4, and 47-5 Flow and Differential Pressure Regulators

DN ..., PN ...

Permissible temperature ... °C

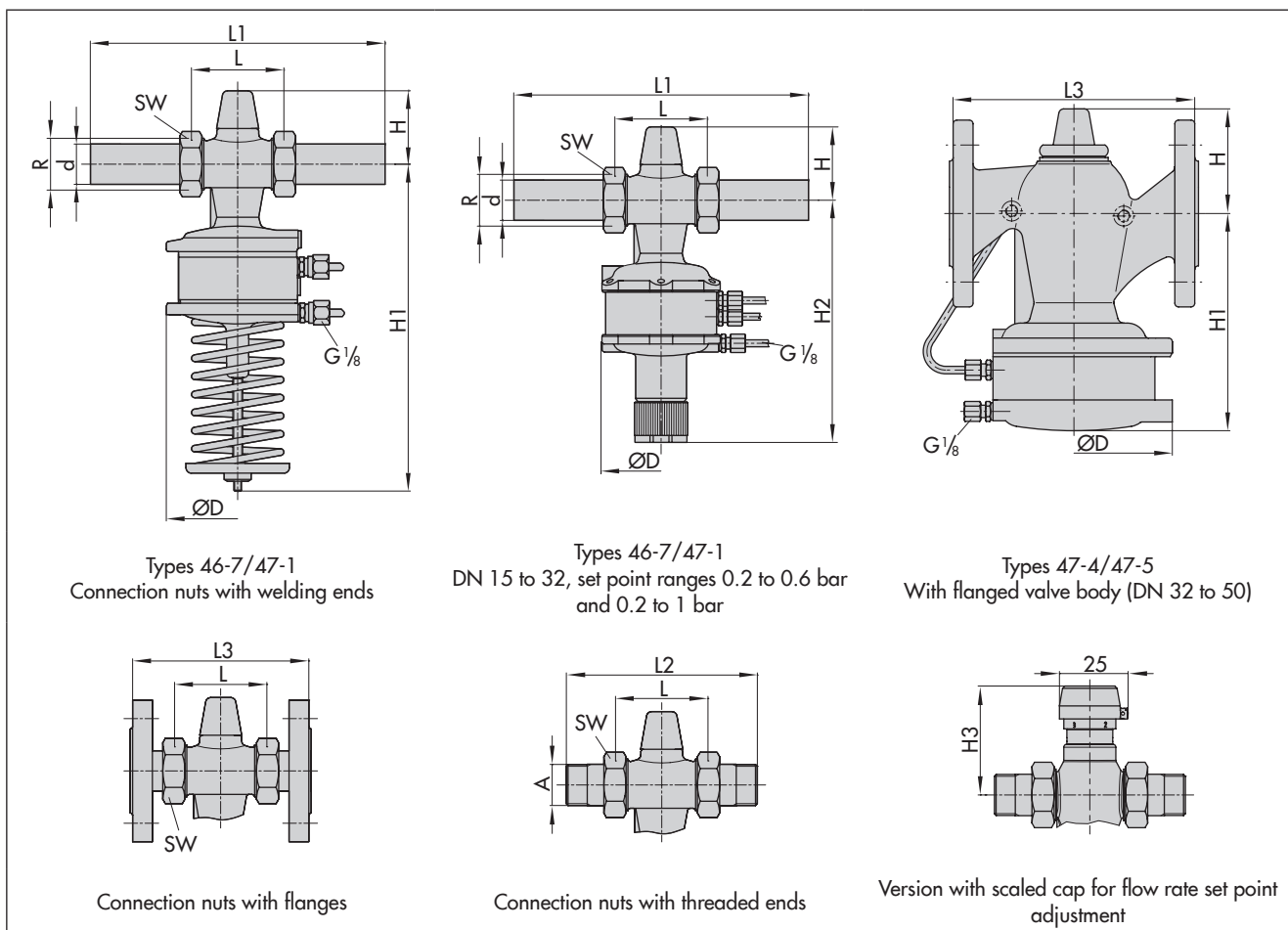
$K_{vs}$  ...

With welding ends, threaded ends, flanges or flanged valve body in DN 32, 40, and 50

Set point or set point range ... bar

Differential pressure at the restriction ... bar

Optionally, special version



Types 46-7/47-1  
Connection nuts with welding ends

Types 46-7/47-1  
DN 15 to 32, set point ranges 0.2 to 0.6 bar  
and 0.2 to 1 bar

Types 47-4/47-5  
With flanged valve body (DN 32 to 50)

Connection nuts with flanges

Connection nuts with threaded ends

Version with scaled cap for flow rate set point adjustment

**Table 3:** Dimensions in mm · Without connecting parts

Nominal size DN	15	20	25	32 <sup>1)</sup>	40 <sup>1)</sup>	50 <sup>1)</sup>
Pipe Ød	21.3	26.8	32.7	42	48	60
Connection R	G ¾	G 1	G 1¼	G 1¾	G 2	G 2½
Width across flats SW	30	36	46	59	65	82
L	65	70	75	100	110	130
H	65		85			
H1	Type 46-7	248	265	415		
	Type 47-1	265	285	425		
	Type 47-4	122	140	192		
	Type 47-5	108	125	175		
H2	Type 46-7	185	205	-		
	Type 47-1	200	220			
H3	75	95				
ØD	116			160		

<sup>1)</sup> Additional version: valve with flanged body

The dimensions and weights of valves with flanged bodies (DN 32, 40, and 50) are the same as valves with screwed-on flanges.

**Table 4:** Dimensions in mm and weights in kg · Including connecting parts

Nominal size DN	15	20	25	32	40	50	
<b>With welding ends</b>							
L1	210	234	244	268	294	330	
Weight	Type 46-7 Type 47-1	2.6	2.7	2.8	4	12	12.5
	Type 47-4 Type 47-5	2.2	2.3	2.4	3.5	6.2	6.7
<b>With threaded ends</b>							
L2	129	144	159	180	196	228	
Male thread A	G ½	G ¾	G 1	G 1¼	G 1½	G 2	
Weight	Type 46-7 Type 47-1	2.6	2.7	2.8	4	12	12.5
	Type 47-4 Type 47-5	2.2	2.3	2.4	3.5	6.2	6.7
<b>With flanges<sup>1) 2)</sup> or with flanged body (DN 32 to 50)</b>							
L3	130	150	160	180	200	230	
Weight	Type 46-7 Type 47-1	4.0	4.7	5.3	7.2	16.0	17.5
	Type 47-4 Type 47-5	3.6	4.3	4.9	6.7	10.2	11.7

<sup>1)</sup> PN 16/25

<sup>2)</sup> Flanges are already mounted on valves in DN 40 and 50.

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

**T 3131 EN**