

# Compressed air counter

## Instruction manual

0699 6446/xx Standard

0699 6447/xx With probe removal under pressure





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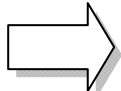



# 1 Introduction

## 1.1 Notes on the instruction manual

This instruction manual offers you, the user of the compressed air counter, 0699 6446 / 0699 6447 support during the installation, operation and maintenance.

### Characters and symbols

The following characters and symbols are used in this instruction manual to emphasize text passages that need special attention.

	<b>Notes</b> This arrow points out specifics that must be observed during operation.
	<b>Warning</b> This character brings attention to text passages which, if not complied with or not followed specifically, may lead to damages to or destruction of parts of the system.
	<b>Caution!</b> This character is placed before text passages which may be hazardous to one's health or life if not complied with.
	<b>Reference</b> The character points out further information in other handbooks, chapters or sections.

## 1.2 Receiving inspection, transport, storage

- Take note of undamaged packaging!  
Communicate damages to the packaging to your supplier.  
Retain the damaged packaging until the matter is settled.
- Take note of undamaged contents!  
Communicate damages to the contents to your supplier.  
Retain the damaged goods until the matter is settled.
- Check the scope of delivery for completeness using the shipping documents and your order.
- The instrument is to be packaged for storage and transport in such a way that it is secured against impact and protected from moisture. The original packaging offers optimum protection. Furthermore, the permissible ambient conditions must be maintained (☞ Section 3.2.1).
- Please direct any further questions to your supplier or their sales office.

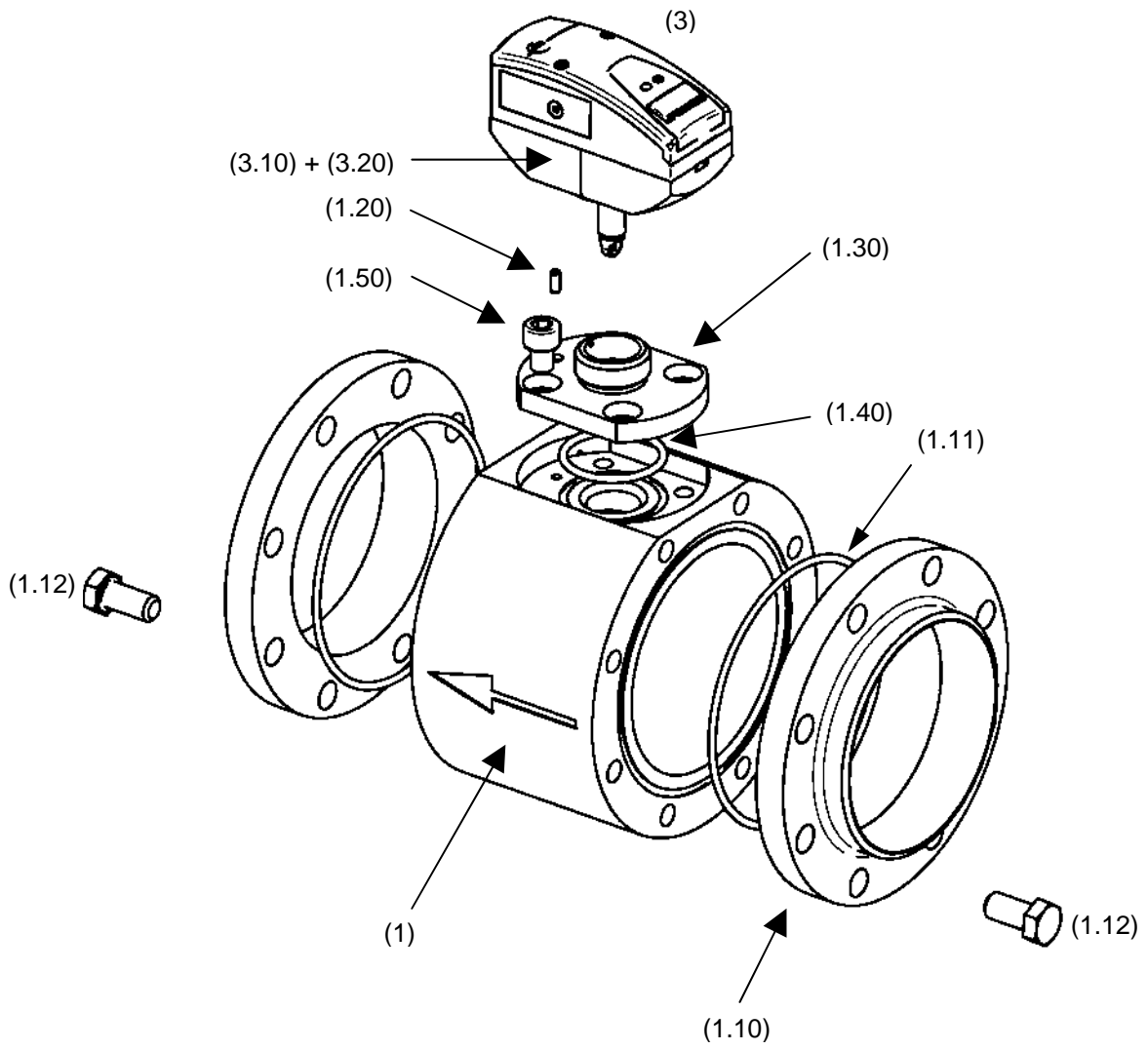
## 1.3 Scope of delivery

Check the scope of delivery using the following table. The designations of the individual components can also be found in the following exploded view. **The items 1, 3, and 4, marked in bold, are assembled and are to be checked.**

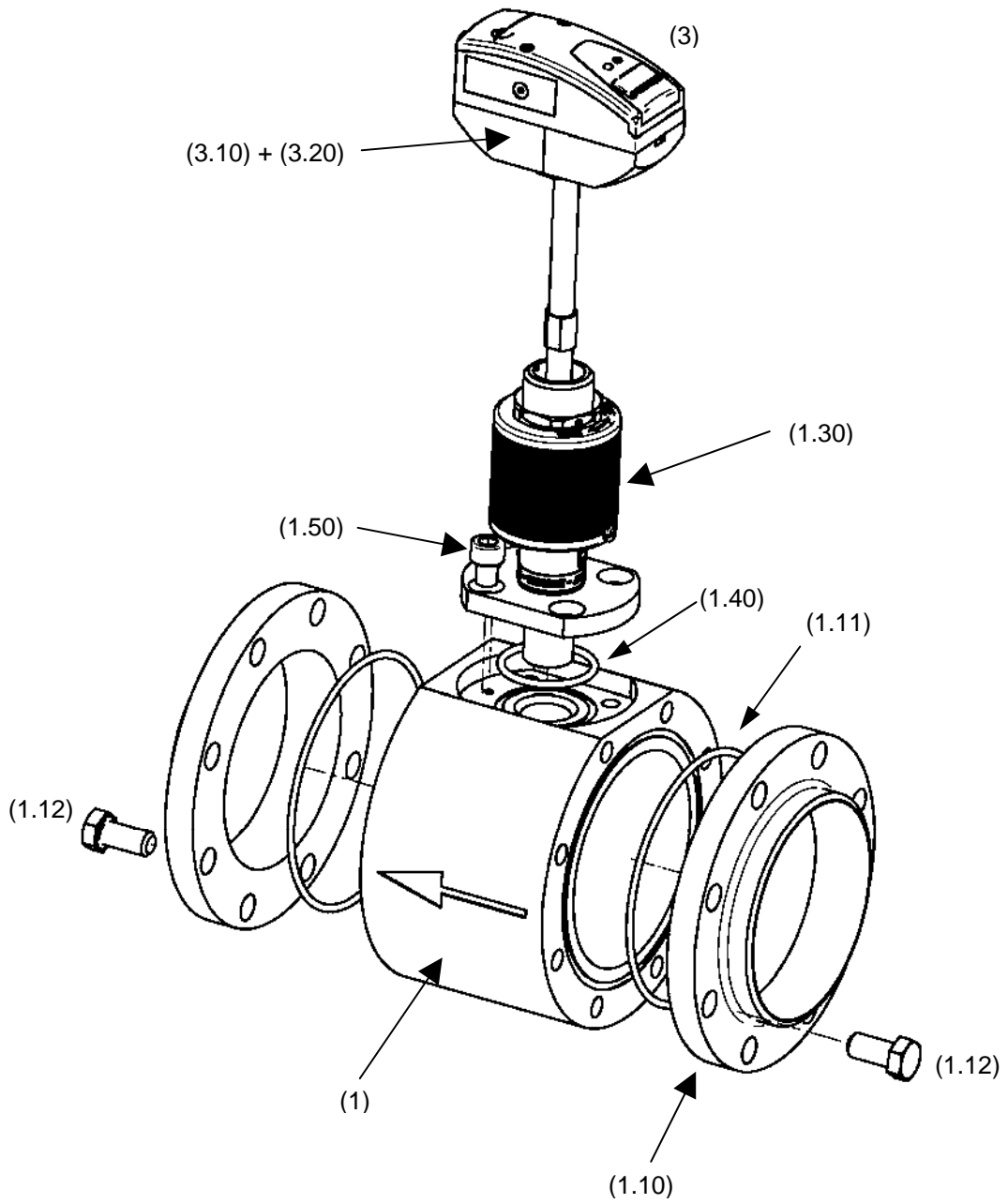
Item	Assembled at item	Qty.	Designation
<b>1</b>		<b>1</b>	<b>Measuring block</b> nnn = Nominal width material: SVZ = Galvanized steel, 0699 6446/0x or 0699 6447/0x EST = Stainless steel, 0699 6446/0x or 0699 6447/1x
1.10	1	2	Compac welding neck flange nnn = Nominal width material: SVZ = Steel, 0699 6446/0x or 0699 6447/0x EST = Stainless steel, 0699 6446/0x or 0699 6447/1x
1.11	1.10	2	DN 65: Viton 3.53 x 82.1 DN 80: Viton 3.53 x 94.8 DN 100: Viton 3.53 x 120.25 DN 125: Viton 3.53 x 136.12 DN 150: Viton 3.53 x 171.05 DN 200: Viton 3.53 x 274 DN 250: Viton 3.53 x 319.2
1.12	1.10	16 16 16 16 24 24	DN 65: M12 x 20 - 8.8 galv. DIN 931 DN 80: M12 x 22 - 8.8 galv. DIN 931 DN 100: M12 x 25 - 8.8 galv. DIN 931 DN 125 – DN 150 : M16 x 30 - 8.8 galv. DIN 912 DN 200: M16 x 30 - 8.8 galv. DIN 912 DN 250: M20 x 35 - 8.8 galv. DIN 912
1.20	1	1	Z alignment pin 4 x 10 DIN 7
1.30	1	1	0699 6446: PBCompac conical nipple without groove  Interchangeable fitting WA140 material: SVZ = Steel, 0699 6447/0x EST = Stainless steel, 0699 6447/1x
1.40	1	1	O-ring, Viton 3.53 x 40.87
1.50	1.30	4	Socket head cap screw M10 x 12 - 8.8 galv.
<b>2</b>	<b>1</b>	<b>Option</b>	<b>Sealing cap and O-ring</b>
2.10	2	Option	O-ring, Viton 70 Shore, 30 x 2.5
<b>3</b>		<b>1</b>	<b>Electronic sensor assembly</b>
3.10	3	4	Roll pin
3.20	3.10	1	Hood
3.30	3	1	Protection cap for sensor tip during transport
<b>4</b>			<b>Instruction manual</b>

Please direct any further questions to your supplier or their sales office.

0699 6446 Standard



0699 6447 With probe removal under pressure





## 2 Warranty

The instruments are built in compliance with the applicable regulations and have left the factory in a properly-functioning state.

However, if our product should give you reason for complaint, we will rectify deficiencies caused by errors in the factory free of charge. This is conditional upon an immediate report of these deficiencies within our granted warranty period.

Damages that have occurred as a result of improper use or non-compliance with the instruction manual are excluded from this warranty.

The warranty period lasts 24 months. Unless otherwise stated, 12 months are applicable for accessories. Warranty repairs do not extend the period of warranty.

The warranty is voided if the interchangeable fitting or the electronic sensor assembly has been opened (unless this is expressly described in the instruction manual for maintenance purposes) or if the serial numbers on the device have been changed, damaged or removed.

If repairs, adjustments or the like have been performed in addition to the warranty repairs, the warranty repairs will be free of charge but the other work will be charged as well as the transport and packaging.

Further or other claims are void, particularly for damages that have occurred that do not pertain to the delivered components where liability is not expressly specified by law.

### Services after the warranty period

Of course, we will remain at your service after the expiry of the warranty period. In the event of malfunctions, send us your instrument with a brief description of the fault. Please also give us your telephone number for any inquiries.

## 3 Description of the instrument

### 3.1 Task and areas of application

#### Measuring block with Compac welding neck flange

The measuring block with Compac welding neck flanges enables the mechanical and position-accurate fixture of the electronic mass flow sensor. The measuring block is welded into the pipelines with the Compac welding neck flanges. The nominal width of the measuring block and welding neck flanges must coincide with the nominal width of the pipeline (☞ Section 1.3). The measuring block is designed for pipeline nominal widths from DN 65 up to DN 250.



The operation of the pipeline without the electronic sensor assembly is made possible with the 0699 6447 by using the interchangeable fitting. (☞ Section 6.1.2).  
With 0699 6446, only with the optional sealing cap (☞ Section 3.3.1).

#### Electronic sensor

The sensor records the standard volumetric flow rate of the working compressed air according to the calorimetric measurement principle. The measurement value of the standard volumetric flow rate is calculated based on the DIN ISO 2533 (1013 hPa, 15 °C and 0 % relative humidity).

The general operating conditions of compressed air systems apply. The air quality of the working compressed air influences the accuracy of the measurement:

Quality class acc. to ISO8573-1 Particle – humidity - oil	Measurement inaccuracy
1-4-1	± (3 % of meas. value + 0.3 % of meas. range final value)
3-4-4	± (6 % of meas. value + 0.6 % of meas. range final value)

#### Analysis

- Current volumetric flow rate
- Current consumption quantity (pulse output module and totaliser)

#### Display

- Current volume flow in Nm<sup>3</sup>/min (NI/min) (LED1) or Nm<sup>3</sup>/h (Nm<sup>3</sup>/h x 1000) (LED2) (4-digit display).  
For nominal widths as of DN 65 Nm<sup>3</sup>/min are shown instead of NI/min.  
For nominal widths as of DN 125 Nm<sup>3</sup>/h x 1000 are shown instead of Nm<sup>3</sup>/h.
- Current consumption quantity in Nm<sup>3</sup> (4-digit display between 0.001 Nm<sup>3</sup> and 4294\*10<sup>3</sup> Nm<sup>3</sup>). For values > 9999 Nm<sup>3</sup>, 1/1000 of the measurement value is displayed and the 10<sup>3</sup> (LED3) display indicates that the value must be multiplied by a factor of 1000
- Consumption quantity before the last reset in Nm<sup>3</sup>. During the display of this value, Nm<sup>3</sup> (LED3) flashes

- The display °C (LED4) cannot be selected.

#### Signal output 1

- Switch signal is the limit value for volume flow, hysteresis or window function as NO or NC contact
- Pulse sequence for consumption quantity with 1 pulse/standard litre (pulse length 2 ms) and 1 pulse/Nm<sup>3</sup> (pulse length 100 ms)

#### Signal output 2

- Switch signal is the limit value for volume flow, hysteresis or window function as NO or NC contact
- Analog signal (4 - 20 mA) for corresponding volume flow
- Pulse sequence for consumption quantity with 1 pulse/standard litre (pulse length 2 ms) and 1 pulse/Nm<sup>3</sup> (pulse length 100 ms)

	Measuring range	Recording/display range
Relative meas. range (%)	0,33% (0,4%) - 100%*	0% - 120%*
	() : Value shown in display	

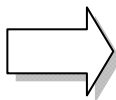
\* Absolute measuring range depends on the nominal width (see following table)

### Compressed air counter

The compressed air counter may only be used for measuring the volume flow of working compressed air with up to 16 bar positive pressure.

Nominal width	Meas. range*	Recording/display range
DN 65	6,7 – 2000 m <sup>3</sup> /h	0 – 2400 m <sup>3</sup> /h
DN 80	9,2 – 2750 m <sup>3</sup> /h	0 – 3300 m <sup>3</sup> /h
DN 100	15 – 4440 m <sup>3</sup> /h	0 – 5320 m <sup>3</sup> /h
DN 125	23 – 7000 m <sup>3</sup> /h	0 – 8400 m <sup>3</sup> /h
DN 150	33 – 10,000 m <sup>3</sup> /h	0 - 12.0 (x 1000) m <sup>3</sup> /h
DN 200	58 – 17,500 m <sup>3</sup> /h	0 - 21.0 (x 1000) m <sup>3</sup> /h
DN 250	92 – 27,500 m <sup>3</sup> /h	0 - 33.0 (x 1000) m <sup>3</sup> /h

\*Specifications acc. to DIN ISO 2533 (15 °C, 1013 hPa and 0 % rel. humidity)



When using the totaliser function (consumption meter m<sup>3</sup>), the display value must be multiplied by 1000.  
As of DN 150 the display range with 4-digit representation of the m<sup>3</sup>/h is insufficient. The display value is to be multiplied by 1000.

Based on the small size, the sensor only has a small contact surface. The pressure loss is thus negligible (typ. 1 mbar).

## 3.2 Technical data

### 3.2.1 Measuring block

0699 6446 Standard

Material	SVZ = Galvanized steel, 0699 6446/0x EST = Stainless steel, 0699 6446/1x								
Dimensions									
Part no.	Nominal width	L (mm)	D1 (mm)	D2 (mm)	S (mm)	H1	N	SL	W1* (kg)
0699 6446/01	DN 65	124	125	70.3	2.9	185	8	13	8.3
0699 6446/02	DN 80	160	141	82.5	3.2	201	8	13	10.6
0699 6446/03	DN 100	160	165	107.1	3.6	225	8	13	12.7
0699 6446/04	DN 125	172	205	131.7	4	265	8	17	20.6
0699 6446/05	DN 150	180	235	159.3	4.5	295	8	17	25.4
0699 6446/06	DN 200	180	290	207.3	5.9	350	12	17	36.0
0699 6446/07	DN 250	196	355	260.4	6.3	415	12	21	48.4
*W1: Weight of the mechanism, with sensor									

## 0699 6447 With probe removal under pressure

Material	SVZ = Galvanized steel, 0699 6447/0x EST = Stainless steel, or 0699 6447/1x								
Dimensions 0699 6447									
Part no.	Nominal width	L (mm)	D1 (mm)	D2 (mm)	S (mm)	H1	N	SL	W1* (kg)
0699 6447/01	DN 65	124	125	70.3	2.9	279	8	13	9.3
0699 6447/02	DN 80	160	141	82.5	3.2	295	8	13	11.6
0699 6447/03	DN 100	160	165	107.1	3.6	319	8	13	13.7
0699 6447/04	DN 125	172	205	131.7	4	359	8	17	21.6
0699 6447/05	DN 150	180	235	159.3	4.5	389	8	17	26.4
0699 6447/06	DN 200	180	290	207.3	5.9	444	12	17	37.0
0699 6447/07	DN 250	196	355	260.4	6.3	509	12	21	49.4
*W1: Weight of the mechanism, with electronic sensor assembly									

### 3.2.2 Thermal mass flow sensor

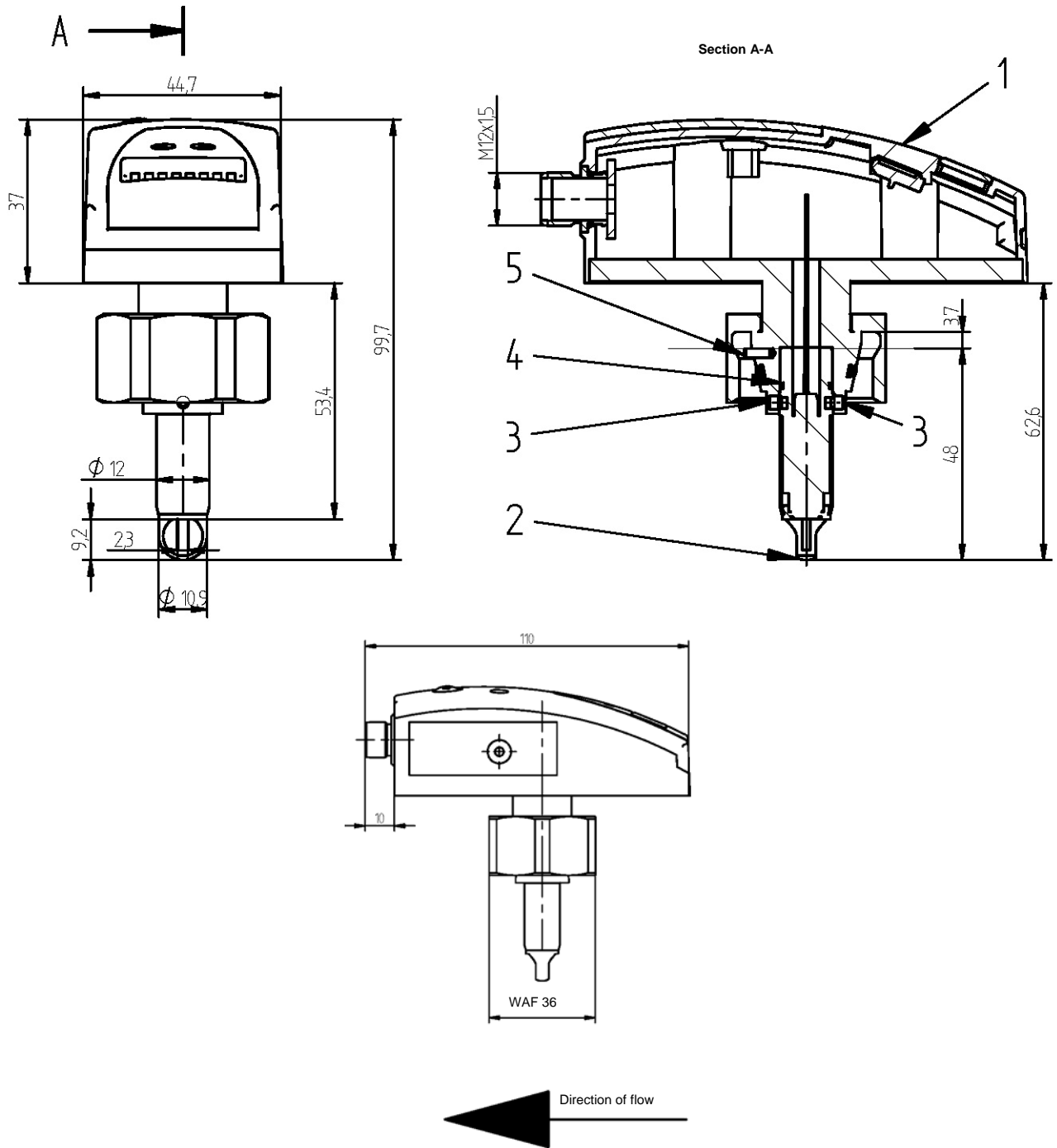
The thermal mass flow sensor for the compressed air volume flow measurement is independent of the process pressure and the media temperature.

The electronic sensor assembly is adjusted to the data of the measurement block (diameter/medium). For this reason, only an identically adjusted model can be used when replacing the component. When ordering spares, the data of the measurement block must be stated.

Sensor	Thermal, glass passivated ceramic sensor
Media	Compressed air, with special calibration also CO <sub>2</sub> , N <sub>2</sub>
Accuracy	for compressed air quality classes (ISO 8573: Particle - humidity - oil) 1-4-1: $\pm 3$ % of reading $\pm 0.3$ % of final value for compressed air quality classes (ISO 8573: Particle - humidity - oil) 3-4-4: $\pm 6$ % of reading $\pm 0.6$ % of final value
Display, operation	4-digit alphanumeric display, two operating buttons, operation menu, LED (4x green for phys. units, 3x yellow for "Display x 1000" and switch statuses)
Display units*	Nm <sup>3</sup> /min (NI/min), Nm <sup>3</sup> /h, Nm <sup>3</sup>
Measuring dynamics	1:300
Response time	< 0.1 s
Pressure-tight	up to 16 bar positive pressure
Media contact	V2A (1.4301), glass passivated ceramic, PEEK, polyester, Viton, anodized aluminium
Housing materials	PBT-GF 20, PC (APEC), Makrolon, V2A (1.4301), Viton
Protection class	IP65 / III
Medium temperature	0 - +60 °C (rel. humidity max. 90 %)
Perm. ambient temperature	0 - +60 °C
Perm. storage temperature	-25 - +85 °C
Electrical connection	M12 x 1 connector, can be loaded to 250 mA, short-circuit-proof
Voltage supply	19 - 30 VDC, power consumption < 100 mA
<b>Output signals</b>	
Analog output	4 - 20 mA, measuring range scaleable max. load 500 ohm
Switch output	2 switch signals can be parameterized (dependent on volume flow, hysteresis or window function as NO or NC contact)
Pulse output	DN 65 – DN 80: 1 pulse/m <sup>3</sup> DN 100 – DN 250: 1 pulse/10 m <sup>3</sup>
Current carrying capacity	2 x 250 mA, short-circuit-proof, protected against polarity reversal, overload-proof
Readiness delay	0.5 s
<b>CE</b>	
EU Directive	2004/108/EC

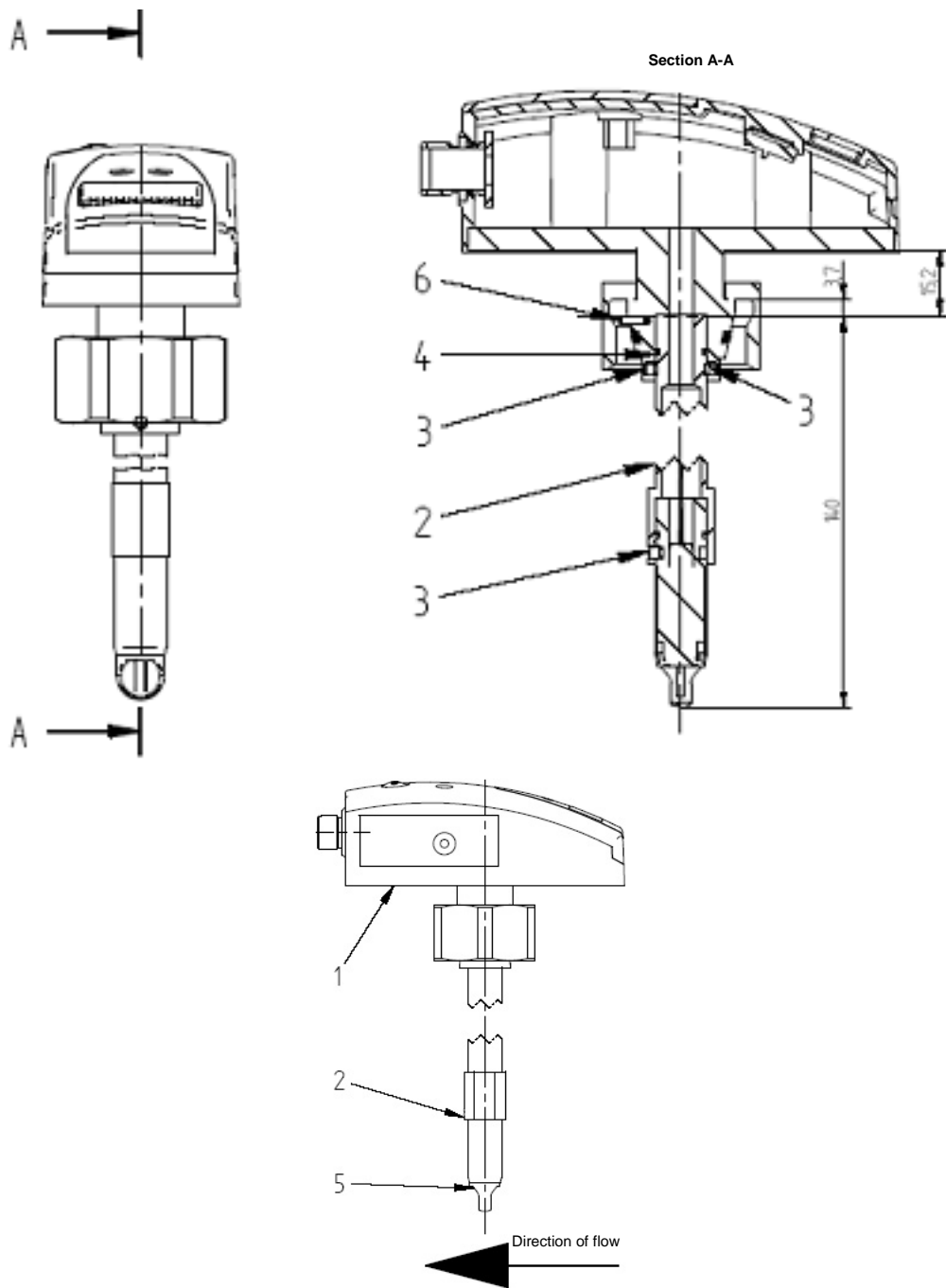
\* The measurement, display and adjustment ranges are related to the standard volumetric flow according to DIN ISO 2533 (15 °C, 1013 mbar and 0 % rel. humidity) if not otherwise entered in the calibration protocol of the electronic sensor assembly

Dimensions 0699 6446 Standard



Item 1	Sensor display
Item 2	Sensor probe component
Item 3	Threaded pin
Item 4	O-ring
Item 5	Cylindrical pin for alignment in the direction of the flow
Sensor weight	428 g

Dimensions 0699 6447 With probe removal under pressure



Item 1	Head of the electronic sensor assembly
Item 2	Extension
Item 3	Threaded pin
Item 4	O-ring
Item 5	Cylindrical pin for alignment in the direction of the flow
Item 6	Sensor
Electronic sensor assembly weight	560 g

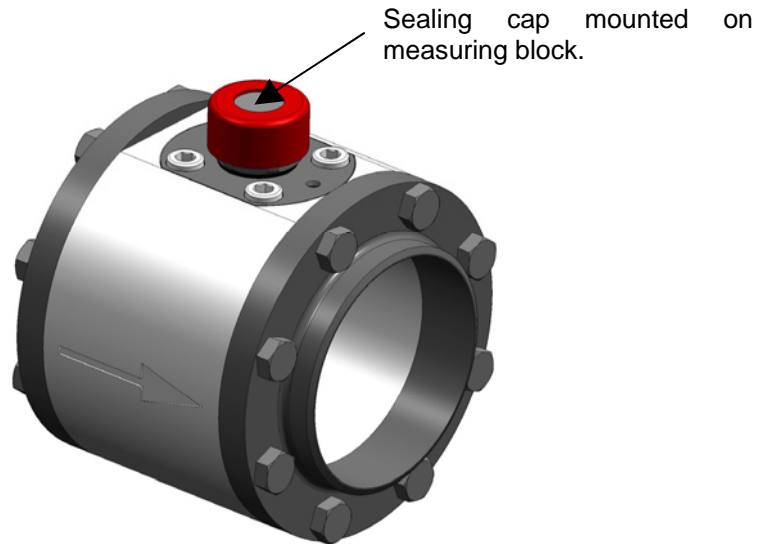


## 3.3 Accessories

### 3.3.1 Sealing cap (0699 6446/41)

Only for 0699 6446 Standard version.

The sealing cap with internal thread is used for operating the pipeline without the mass flow sensor.



### 3.3.2 Connecting cable with electrical isolator (0699 6446/42)

Uniform for all versions.

A connecting cable with an electrical isolator integrated into the connector is available as an accessory. The cable is 5 m long and is used for the galvanic isolation of the signal output to the electronics to which it is attached. The cable is delivered with an appropriate connector for the mass flow sensor on one side and with open cable ends on the other side.

### 3.3.3 Replacement for electronic sensor assembly (0699 6446/31 or 0699 6447/31)

The electronic sensor assembly is adjusted to the data of the measurement block (diameter/medium). For this reason, only an identically adjusted model can be used when replacing the component. When ordering spares, the data of the measurement block must be stated.

The replacement for the electronic sensor assembly is used as a backup in the event of damage to or loss of the original mass flow sensor or the entire assembly.

When ordering, the nominal width must be given for the calibration of the electronic sensor assembly.

### **3.3.4 Additional ISO calibration points (0699 6447/22)**

Uniform for all versions.

Other measurement points are calibrated for the ISO basic calibration. You must specify the number of required additional calibration points when ordering.

### **3.3.5 DAkkS calibration (0699 6447/23)**

Uniform for all versions.

The mass flow sensor receives a 2-point calibration from a DAkkS certified calibration laboratory. This is documented on the electronic sensor assembly by means of an inspection label.

### **3.3.6 Additional DAkkS calibration points (0699 6447/24)**

Uniform for all versions.

Other measurement points are calibrated in addition to the DAkkS basic calibration. You must specify the number of additional calibration points when ordering.

## 4 Security measures

### 4.1 Intended purpose

The compressed air counter is intended exclusively for use in pipe systems for working compressed air, provided that the calibration certificate does not explicitly allow using for other gases.

Thanks to the design, operation in systems that are under pressure up to PN16 is possible.



The system must be depressurized before beginning the drilling and welding work.

0699 6446: Before assembling or dismantling the sensor or the sealing cap (available as an accessory), the system status must be at zero pressure.

Use which deviates from that described endangers the safety of people and of all of the measuring equipment and is thus not permissible.

The manufacturer accepts no liability for damages that occur as a result of improper or inappropriate use or installation.

To avoid damage to the instrument or health hazards, no manipulation using tools may occur on the measuring units that is not expressly defined in this operating manual.

0699 6446: Changing the sensors while in operation is not possible.

0699 6447: If all necessary operation steps are observed, changing the electronic sensor assembly while in operation is possible thanks to the interchangeable fitting.

The compressed air counter may only be operated under the ambient conditions specified in the technical data. Otherwise, inaccurate measurements occur or instrument malfunctions become possible.

To ensure the safety of the user and the operability of the instruments, the commissioning steps, checks and maintenance work recommended by the manufacturer are to be complied with and carried out.

These instructions do not contain complete detailed information for the sake of transparency.

Should you require further information or should a specific problem occur that is not comprehensively handled in the instructions, you can request the required information directly from the manufacturer.

Read these operating instructions before commissioning the fitting. Store these operating instructions in a location that is accessible for all users at all times. Please support us in improving these operating instructions. We are grateful for any ideas you may have.

## 4.2 Assembly, commissioning and operation

The compressed air counter was reliably built and checked according to state-of-the-art technology and left the factory in a properly secure state.

As the user, you are responsible for the compliance with all valid safety regulations, including:

- Installation specifications
- Local standards and regulations.

The manufacturer has undertaken all necessary measures to ensure safe operation. The user must ensure that the instruments are set up and installed in such a way that safe use is not impacted.

The instruments are factory-tested and were delivered in a reliable state.

These operating instructions contain information and warnings that must be followed by the user in order to ensure safe operation.

- Assembly, commissioning, operation and maintenance of the measuring unit may only be performed by trained authorized personnel. The personnel must be authorized for the named functions by the system operator.
- The authorized personnel must have read and understood these operating instructions and comply with the directions in these operating instructions.
- Check all connections for correctness before the commissioning of the complete measuring point.
- Do not commission damaged products and keep these from being inadvertently commissioned. Mark the damaged products as defective.
- Faults at the measuring point are only to be corrected by authorized and specially trained personnel.
- If faults cannot be corrected, the products must be taken out of operation and secured from inadvertent commissioning.
- Repairs that are not described in these operating instructions may only be carried out directly by the manufacturer or by the service organization.

Exclusion of liability:

Liability of the manufacturer and its assistants exists only in the event of deliberate acts or gross negligence. The extent of liability is limited to the value of the respective order placed with the manufacturer.

The manufacturer accepts no liability for damages that occur due to non-observance of the safety instructions or noncompliance with the instruction manual or the operating conditions. Consequential damages are excluded from the liability.

## 5 Installation

### 5.1 Description of PBCOMPAC<sup>®</sup> flange

The groove designed for holding the sealing element (O-ring) is dimensioned in such a way that the erection bolts can be tightened to the point of full-surface contact with the contact areas.

COMPAC<sup>®</sup> flange connections behave differently than conventional DIN flange connections with flat gaskets and do not need to be attached as tightly. A complete sealing is achieved using weaker screw tightening forces. With the establishment of the full-surface contact of the contact areas, a noticeable resistance can be felt which signals the proper assembly and sufficient screw tightening forces.

During the assembly of the COMPAC<sup>®</sup> flange connections, there is thus no danger that the screws will be overstrained when being assembled.

Furthermore, the sealing element is automatically subjected to the correct conditions (forming and compression) with the establishment of the full-surface contact of the contact areas, whereby unintended damage to or overloading of the sealing element is impossible.

The groove for holding the sealing element is extensively protected during storage, transportation and assembly.

Light scratches on the flange contact areas, even in the area of the groove, can be borne by the COMPAC<sup>®</sup> sealing system without impacting the seal effect because there is an enormous compressive force pressing against the sealing element on the flange surface lying opposite the groove and the sealing element can thus fill up scratches or depressions with the sealing material.

Principle of the COMPAC<sup>®</sup> sealing system:



This new flange generation is indispensable for the interaction between mechanical engineering and measuring technology. The COMPAC<sup>®</sup> flange is the joining element to the measuring technology and fulfils all requirements for recording an accurate reading.

With a lighter design and smaller installed size, the new flanges offer more sealing efficiency and security against leakage.

*Example:*

- Previous DIN flange DN 250, PN 100, weight 81.40 kg  
COMPAC<sup>®</sup> flange DN 250, PN 100, weight 15.22 kg
- Previous ANSI DN 25 with blank flange, PN 200, weight 8.0 kg  
PBCOMPAC<sup>®</sup> DN 25 with blank flange, PN 200, weight 2.0 kg.

## 5.2 Welded connection to pipeline with PBCOMPAC<sup>®</sup> flange

To avoid a dissimilar metal weld when welding to the pipeline, the material of the flange must be steel or stainless steel, according to the pipeline.

COMPAC<sup>®</sup> flanges must be welded without warping so that the tightness achieved after assembly is optimal. The first welding spots should ideally be made when already assembled (flange with measurement block). In order to complete welding, the measurement block can then be removed.



Remove the O-ring from the groove before welding!  
Before inserting the O-ring, ensure that the groove is clean.  
Then clean the affected working area.  
After welding, clean the welding seams and ensure a smooth interior in the pipeline. A smooth transition from the pipeline to the measuring block guarantees a high level of measuring accuracy.

## 5.3 Determining the installation point

The installation point should be easily accessible and experience only low vibrations. The ambient temperature may not exceed the values given in the technical data (☞ Section 3.2.2) (watch for potential heat radiation).

The pipeline must be depressurized before assembling or dismantling!

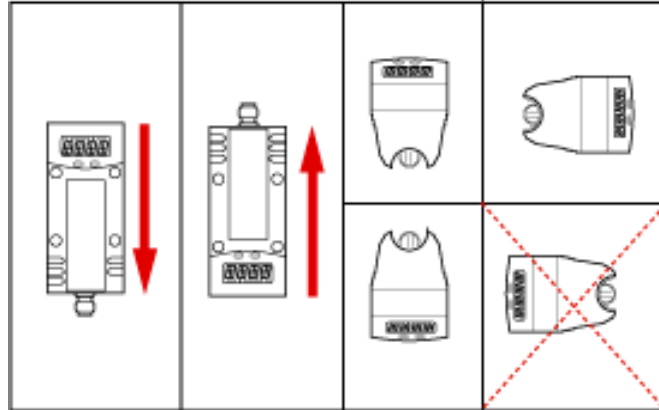
Please note that an assembly clearance or at least 120 mm (0699 6446) or 300 mm (0699 6447) above the pipeline piece is required for dismantling the electronic sensor assembly.

Note the direction of flow when installing (☞ Section 5.3.3)

Also consider the installation point with regard to the specified technical data in section 3.2.2. The medium may not be in a condensed state at the installation point. For this reason, the location in a working compressed air network can only be behind a suitable compressed air dryer which provides a suitable pressure dew point; otherwise the specified measurement accuracy is not guaranteed.

### 5.3.1 Installation position

Do not install the electronic sensor assembly in the crossed-out installation positions shown in the following graphic. In the event of a limited flow, the specified accuracy cannot be maintained.



The arrow shows the direction of flow for the medium.

### 5.3.2 Required measurement route

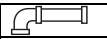
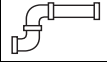
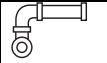
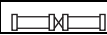
Bear in mind the required inflow and outflow routes in order to achieve the specified measurement accuracy. The inflow route refers to the pipeline length in front of the mass flow sensor and the outflow route to the pipeline length behind the mass flow sensor, as seen in the direction of flow for the medium.

Total measurement stretch = Inflow route + Outflow route

Outflow route =  $5 \times D$

$D$  = pipe diameter [mm]  
 $B$  = total stilling pipe

Inflow route =  $15 \times D + B$

	90° elbow	$B = 5 \times \text{pipe diameter } (D)$
	two 90° elbows one level	$B = 10 \times \text{pipe diameter } (D)$
	two 90° elbows two levels	$B = 15 \times \text{pipe diameter } (D)$
	Valve, slider	$B = 35 \times \text{pipe diameter } (D)$

### 5.3.3 Direction of flow

The direction of flow must be taken into account when installing the measuring block. This is shown on the measuring block by means of an arrow. The arrow points in the direction in which the medium in the pipeline flows.



0699 6446

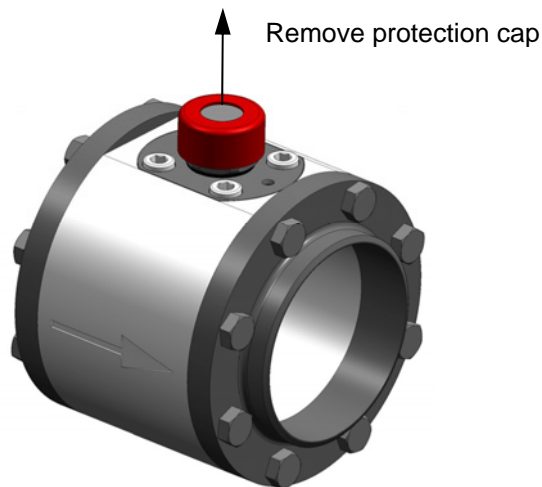
0699 6447

The electronic sensor assembly can only be mounted on the PBCOmpac® connection (0699 6446) or the interchangeable fitting (0699 6447) in one direction. The head (display) of the electronic sensor assembly points in the flow direction.

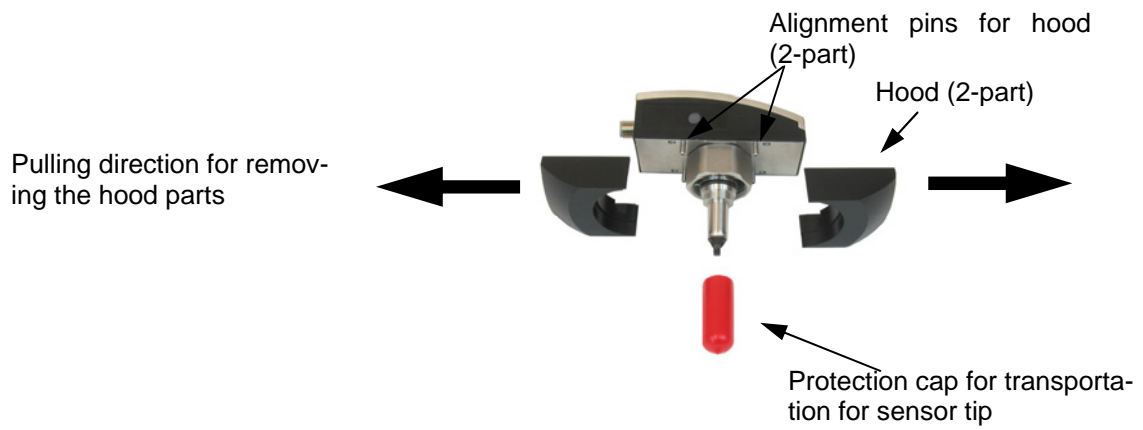
## 5.4 Installation of the electronic sensor assembly in the measuring block (version 0699 6446)



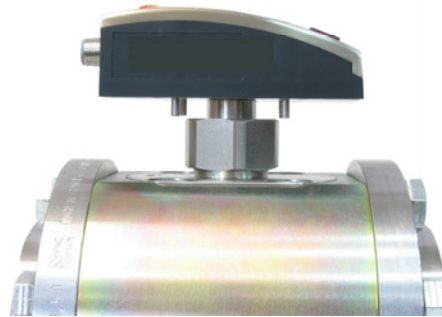
If the optional sealing cap (☞ Section 3.3.1) is mounted, the first thing to do is ensure that the pipeline is depressurized. Never remove the sealing cap from a pipeline which has not been depressurized, as this is extremely dangerous.







- Remove the two-piece hood from the sensor.
- Remove the protection cap for transportation from the sensor element.

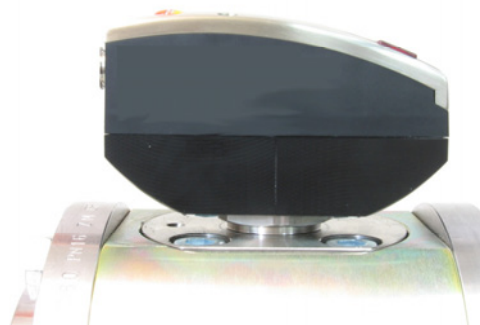


- Mount the sensor on the measuring block. Take notice of the correct installation position of the sensor.



The sensor can only be screwed on in one position as a result of the cylindrical pin.

- Fasten the sensor to the measuring block using a socket wrench (size 36).



- Latch both halves of the hood back between the sensor and the measuring block in the roll pins.

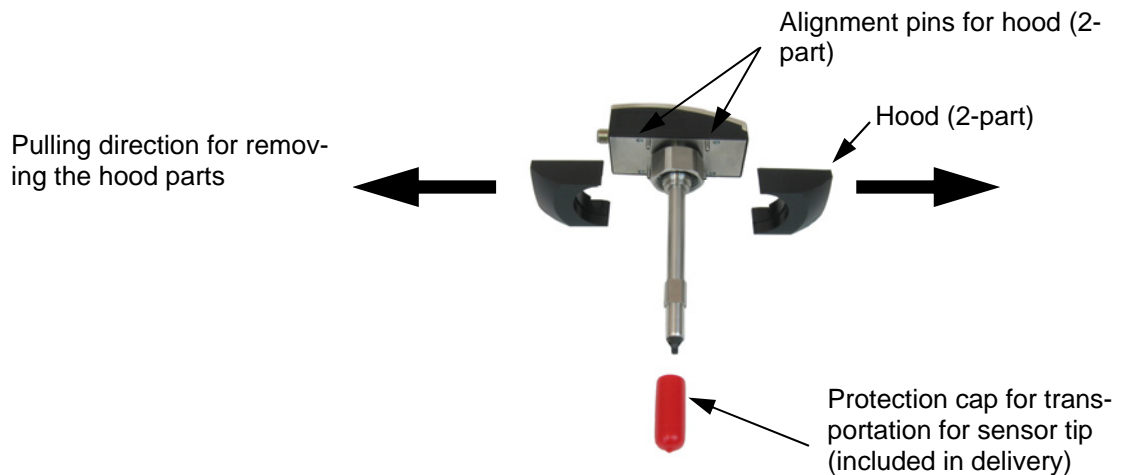
The mechanical assembling of the sensor is thus finished

## 5.5 Installation of the electronic sensor assembly in the interchangeable fitting (version 0699 6447)



Check tightness of the 4 screws that fasten the interchangeable fitting

- Check the 4 screws that connect the interchangeable fitting to the measuring block for a solid seating using an 8 mm Allen key.



- Remove the two-piece hood from the electronic sensor assembly.
- Remove the protection cap for transportation from the sensor element.
- Turn the interchangeable fitting **using only your hand** into the position **CLOSE**. This means that the interchangeable fitting seals off the interior of the pipeline.



- Insert the electronic sensor assembly without sensor protection cap into the interchangeable fitting. Ensure the correct alignment. The electronic

sensor assembly can only be inserted in its correct position in the interchangeable fitting. The display of the electronic sensor assembly points in direction from which the flow in the pipe comes.

- Check the correct seating of the electronic sensor assembly. It must engage in place in such a way that it cannot turn.



The electronic sensor assembly can only be screwed on in one position as a result of the cylindrical pin. The position is defined by the pin which fits into the notch. However, the pin only fits into the notch after several turns.

- Fasten the electronic sensor assembly by tightening the union.
- Latch both halves of the hood back between the electronic sensor assembly and the interchangeable fitting in the roll pins.

The mechanical assembling of the electronic sensor assembly is thus finished.

- Bring the electronic sensor assembly into measurement position (OPEN), as described in chapter 6.1.1.

## 5.6 Electrical connection

The instrument may only be installed by a qualified electrician. Follow the national and international regulations regarding the installation of electro-technical systems. The voltage supply is to be laid out in accordance with EN50178, SELV, PELV. To meet the "limited voltage" requirements according to UL 508, the instrument must be supplied from a galvanically isolated source and protected against short-circuits by means of an overcurrent device.

If you use the 5-wire connection cable with potential-free pulse output that is available as an option (☞ See section 3.3.2), proceed according to ☞ section 5.6.2 when connecting the electronic sensor assembly.



If you directly connect the electronic sensor assembly or use a 4-wire connecting cable, proceed according to ☞ section 5.6.1.

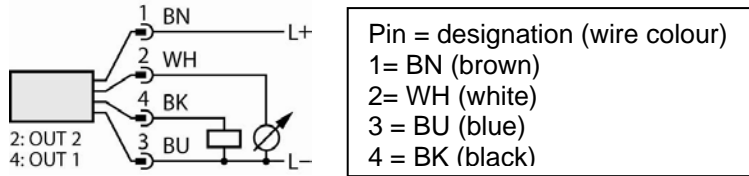
### 5.6.1 4-wire pin assignment

If you do **not** use the connecting cable available as an option for the electrical isolation at OUT1(☞ See section 3.3.2), the following line assignment is valid for the connecting cable or the connector pin assignment directly at the electronic sensor assembly.

Pin no.	Wire colour	Assignment
1	Brown	+L (19 - 30 V DC)
2	White	OUT2
3	Blue	0 V DC (GND)
4	Black	OUT1

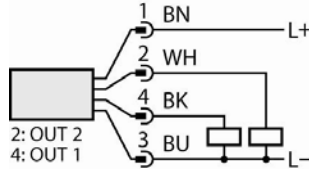
### 5.6.1.1 1 x switch output, 1 x analog output (condition at delivery)

The OUT1 output is used as a PNP signal output (switch signal) and the OUT2 output is used as an analog output. This is the configuration in which the electronic sensor assembly is delivered.



### 5.6.1.2 2 x switch outputs or pulse output

Both of the available OUT1 and OUT2 outputs are each used as a PNP signal output (switch signal or alternative OUT2 for pulse sequence).



## 5.6.2 5-wire pin assignment (accessory)

If you use connecting cable available as an option for the electrical isolation (☞ See section 3.3.2), the following line assignment is valid for the connecting cable.

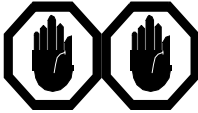
Wire colour	Assignment
Brown	+L (19 - 30 V DC) voltage supply
Pink	+ potential-free pulse output (collector) OUT1
White	- potential-free pulse output (emitter) OUT1
Green	OUT2
Black	0 V DC (GND)

The potential-free pulse output OUT1 is specified for this connecting cable as follows:

Line type	LiYCY
Length	5 m
Switching capacity	500 mA
Max. switching voltage	36 V
Min. switching voltage	5 V
Switch contact resistance	0.21 Ohm
Insulation voltage	5.3 kV
Protected against polarity reversal	Yes

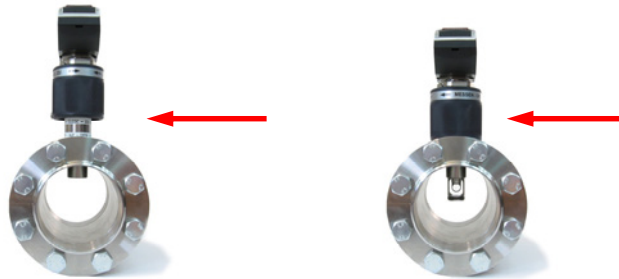
## 6 Operation

### 6.1 Removal of the electronic sensor assembly under pressure (only 0699 6447)



The removal of the electronic sensor assembly while the interchangeable fitting is in the **OPEN** position, meaning turned into the pipe, can be extremely dangerous.

The interchangeable fitting is to be operated only by hand, not using tools. Do not damage the interchangeable fitting by using a tool.



CLOSE position

OPEN position

#### 6.1.1 Electronic sensor assembly in the measurement position (OPEN)

It is essential that you have mounted the electronic sensor assembly in the interchangeable fitting properly, as described in section 5.5.

- Slowly and evenly turn the interchangeable fitting into the pipeline **only by hand**, without tools, (to the right) in the direction of the arrow **OPEN**.
- The position-specific alignment of the sensor element is important for ensuring the specified measuring accuracy, which is why you must always turn the interchangeable fitting in all the way.
- Never handle an interchangeable fitting improperly by means of tools or other objects in a line that is under pressure.

## 6.1.2 Remove electronic sensor assembly (CLOSE)

- Slowly and evenly turn the interchangeable fitting out of the pipeline **only by hand**, without tools, (to the left) in the direction of the arrow **CLOSE**.
- Only when the interchangeable fitting is completely in the **CLOSE** position does the O-ring seal off the electronic sensor assembly from the pressurized line.
- Slowly detach the top union nut from the head of the interchangeable fitting. Slowly let the air escape and make sure that it was only a short discharge pressure and that the interchangeable fitting is securely sealed.
- Completely remove the union nut and remove the electronic sensor assembly by pulling it out upwards in a vertical position.

Take note of the sensitive sensor tip and use the protection cap for transportation and storage.

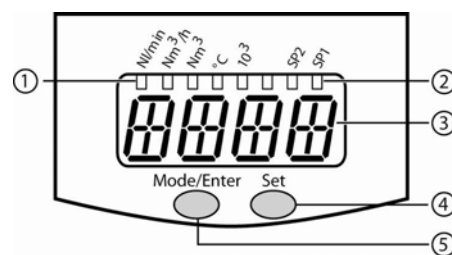
## 6.2 Thermal mass flow sensor

Familiarize yourself with the operation and programming of the electronic sensor assembly. The electronic sensor assembly is calibrated ex factory and provided with default settings for each nominal width. Changes can be made only by the manufacturer.

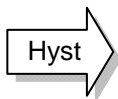
### 6.2.1 Operation and display elements

The following picture shows the control and display unit of the electronic sensor assembly from above.

The LED display with the °C marking cannot be activated.



	Type	Description
①	4 x LED, green	Illuminated LED = display unit set LED1 = volumetric flow rate [Nm <sup>3</sup> /min (NI/min)] LED2 = volumetric flow rate [Nm <sup>3</sup> /h (Nm <sup>3</sup> /h * 1000)] LED3 = quantity counter [Nm <sup>3</sup> ] LED4 blinking = quantity counter before last reset
②	4 x LED, yellow	Display functions: 10 <sup>3</sup> = the displayed value must be multiplied by 1000 SP1/SP2 = display of the switch status: LED illuminates when the respective output is switched through
③	4-digit alphanumeric display	Display of the current volumetric flow Display of the current consumption quantity Display of the parameters and parameter values
④	Programming button SET	Setting the parameter values Changing the display unit in run mode
⑤	Programming button MODE/ENTER	Selection of the parameters and confirmation of the parameter values



As of DN 65, Nm<sup>3</sup>/min applies for LED 1 instead of NI/min. As of DN 150, Nm<sup>3</sup>/h x 1000 applies for LED 2 instead of Nm<sup>3</sup>/h.

## 6.2.2 Types of operation

### 6.2.2.1 Run mode

After switching on the supply voltage, the instrument is in run mode. It carries out its measurement and evaluation functions and provides output signals according to the set parameters.

The display shows the current measurement values and the yellow LEDs show the switch status of the outputs.

The display unit can be temporarily changed (press the "Set" button briefly). After 15 s, the instrument returns to the display unit that was set in the **UNI** menu item).

The totaliser (consumption quantity counter) periodically (every 10 minutes) stores interim values as well as the amount of time elapsed of the automatic reset. The Display Totalizer is called up by briefly pressing the Set button 2x. After a drop in voltage, this value is available as the current status of the totaliser (the possible loss of data can amount to a maximum of 10 minutes).

### 6.2.2.2 Display mode

Display of the parameters and set parameter values

The instrument is switched to display mode by briefly pressing the **Mode/Enter** button. Internally, it remains operational.

The set parameter values can be read independent of this:

- Briefly pressing the **Mode/Enter** button scrolls through the parameters
- Briefly pressing the **Set** button displays the respective parameter value for approx. 15 s. After a further 15 s, the instrument returns to run mode

### 6.2.2.3 Programming mode

Setting the parameter values

The instrument is switched to programming mode if a parameter is selected and the **Set** button is pressed for longer than 5 s (the parameter value is displayed flashing, then continuously increased).


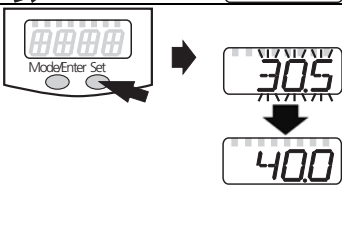
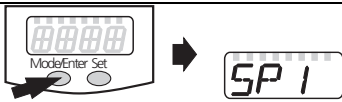
Here too, the instrument remains operational.

It continues to carry out its monitoring functions with the existing parameters until the alteration is completed.

You can change the parameter value using the **Set** button and confirm using the **Mode/Enter** button.

The instrument returns to measurement mode if no buttons are pressed for 15 s afterwards.

### 6.2.3 Programming

1		Press the <b>Mode/Enter</b> button several times until the <b>desired parameter</b> appears in the display.
2		Press the <b>Set</b> button and hold it down. The current <b>parameter value</b> is displayed <b>flashing</b> for 5 seconds. <b>After this it increases*</b> (in steps by pressing singly or continuously by pressing and holding the button).
3		<b>Briefly</b> press the <b>Mode/Enter</b> button (= confirmation). The parameter is displayed again; the new <b>parameter value is active</b> .
4	<b>Changing further parameters:</b> Start again with step 1.	<b>End programming:</b> Wait 15 s or press the Mode/Enter button until current reading reappears.

\*Lowering value: Allow the display to run through to the maximum setting value. After this, the run-through starts again from the minimum setting value.

Set the display unit (**Uni**) **before** you determine the values for the **SPx**, **rPx**, **ASP** and **AEP** parameters. That way you avoid rounding up/down errors in the internal conversion into other units and are provided with exactly the values required. Condition at delivery: **Uni = nm3h**.

If no button is pressed for 15 s during the setting process, the instrument returns to the run mode with unchanged values.



## 6.2.4 Adjustable parameters

<p>SP 1 SP 2</p>	<p><b>Switch point 1/2</b> Upper limit value at which the output changes its switch status. SP 2 is only active if <b>OU2 = Hno, Hnc, Fno or Fnc</b> (see below)</p>
<p>rP 1 rP 2</p>	<p><b>Return switch point 1/2</b> Lower limit value at which the output changes its switch status. rPx is always smaller than SPx. Values can only be entered which are lower than SPx. When the switch point is changed, the return switch point changes with it (the interval between SPx and rPx remains constant). If the interval is larger than the new switch point, it is automatically reduced (rPx is set to the minimum setting value). rP2 is only active if <b>OU2 = Hno, Hnc, Fno or Fnc</b>. (See below)</p>
<p>OU 1</p>	<p><b>Configuration for output 1</b> 5 functions can be set:</p> <ul style="list-style-type: none"> <li>• <b>Hno</b> = Hysteresis function/normally open (NO contact)</li> <li>• <b>Hnc</b> = Hysteresis function/normally closed (NC contact)</li> <li>• <b>Fno</b> = Window function/normally open (NO contact)</li> <li>• <b>Fnc</b> = Window function/normally closed (NC contact)</li> </ul> <p>Output signal for consumption quantity:</p> <ul style="list-style-type: none"> <li>• <b>ImP</b> = Pulse (value depends on the nominal width, see electronic sensor assembly identification plate)</li> </ul>
<p>OU 2</p>	<p><b>Configuration for output 2</b> 6 functions can be set: Output signals for flow measurement:</p> <ul style="list-style-type: none"> <li>• <b>Hno</b> = Hysteresis function/normally open (NO contact)</li> <li>• <b>Hnc</b> = Hysteresis function/normally closed (NC contact)</li> <li>• <b>Fno</b> = Window function/normally open (NO contact)</li> <li>• <b>Fnc</b> = Window function/normally closed (NC contact)</li> <li>• <b>I</b> = Analog signal (4 - 20 mA)</li> </ul> <p>Output signal for consumption quantity:</p> <ul style="list-style-type: none"> <li>• <b>ImP</b> = Pulse (value depends on the nominal width, see electronic sensor assembly identification plate)</li> </ul>
<p>ASP</p>	<p><b>Analog starting point</b> Measurement value at which 4 mA are output. ASP is only active if <b>OU2 = I</b></p>
<p>AEP</p>	<p><b>Analog end point</b> Measurement value at which 20 mA are output. Minimum distance between ASP and AEP = 25 % of the measuring range final value. AEP is only active if <b>OU2 = I</b>.</p>

<p><i>ImPS</i></p>	<p><b>Pulse setting</b> 2 settings can be selected:</p> <ul style="list-style-type: none"> <li>• <b>nL</b> = 1 pulse per standard litre (pulse length: 2 ms)</li> <li>• <b>nm<sup>3</sup></b> = 1 pulse per Nm<sup>3</sup> (pulse length: 100 ms)</li> </ul> <p><b>ImPS</b> is only active if <b>OU1 = ImP</b> or <b>OU2 = ImP</b></p>
<p><i>EF</i></p>	<p><b>Extended functions</b> This menu point contains a submenu with further parameters. For access to these parameters, briefly press the SET button.</p>
<p><i>HI</i> <i>LO</i></p>	<p><b>Min-Max storage for flow</b></p> <ul style="list-style-type: none"> <li>• <b>HI</b>: Display of the highest flow value measured</li> <li>• <b>LO</b>: Display of the lowest flow value measured</li> </ul> <p>Clearing the storage:</p> <ul style="list-style-type: none"> <li>- Press the "Mode/Enter" button until HI or LO appears.</li> <li>- Press the "SET" button and hold down until "- - -" appears in the display.</li> <li>- Then briefly press the "Mode/Enter" button.</li> </ul> <p>It is a good idea to clear the storage as soon as the instrument is used for the first time under normal working conditions.</p>
<p><i>rTo</i></p>	<p><b>Resetting the quantity counter</b> After a set period of time, the counter is automatically cleared and a new counting interval begins. The following time spans can be set:</p> <ul style="list-style-type: none"> <li>• <b>1h - 23h</b> (Reset after 1 - 23 hours)</li> <li>• <b>1d - 6d</b> (Reset after 1 - 6 days)</li> <li>• <b>1w - 8w</b> (Reset after 1 - 8 weeks)</li> </ul> <p>Additionally:</p> <ul style="list-style-type: none"> <li>• <b>OFF</b> = Reset after counter overflow (32 bit number overflow, i.e. overflow at 4,294,967.295 Nm<sup>3</sup>).</li> <li>• <b>rES</b> = Manual reset: The counter is manually cleared and a new counting interval begins: <ul style="list-style-type: none"> <li>○ Press the "SET" button until rES.T appears.</li> <li>○ Then briefly press the "Mode/Enter" button.</li> </ul> </li> </ul> <p>Manual reset can also be carried out when a time period for an automatic reset has been set.</p>
<p><i>d1 S</i></p>	<p><b>Setting the display</b> 7 settings can be selected:</p> <ul style="list-style-type: none"> <li>• <b>d1</b> = Measurement value update every 50 ms</li> <li>• <b>d2</b> = Measurement value update every 200 ms</li> <li>• <b>d3</b> = Measurement value update every 600 ms</li> </ul> <p>The measurement value update affects only the display. It has no effect on the outputs.</p> <ul style="list-style-type: none"> <li>• <b>rd1, rd2, rd3</b> = Display as with d1, d2, d3, but rotated by 180°</li> <li>• <b>OFF</b> = The measurement value display is deactivated in run mode. By pressing one of the buttons, the current measurement value is displayed for 15 s. Pressing the "Mode/Enter" button again opens the display mode. The LED's remain switched on even when the display is deactivated.</li> </ul>

#### Display unit

3 settings can be selected:

- Lmin = Flow in l/min or Nm<sup>3</sup>/min
  - nm<sup>3</sup>h = Flow in Nm<sup>3</sup>/h or Nm<sup>3</sup>/h x 1000
  - nm<sup>3</sup> = Quantity counter in standard cubic metres
- Set the display unit before you set the values for the SPx, rPx, ASP and AEP parameters. That way you avoid rounding up/down errors in the internal conversion into other units and are provided with exactly the values required.

#### Hysteresis function

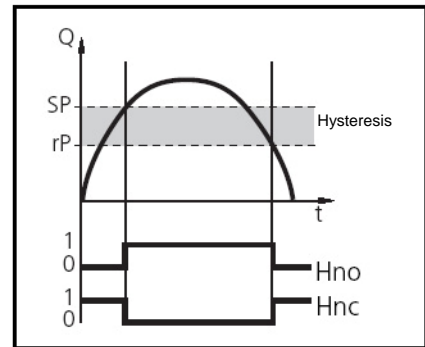
The hysteresis keeps the switch status of the output stable if the flow is fluctuating around the nominal value.

With increasing flow, the output switches upon reaching the switch point (SPx).

If the flow decreases again, the output only switches back when the return switch point (rPx) is reached.

The hysteresis is adjustable:

First the switch point is determined, then the return switch point at the desired distance.



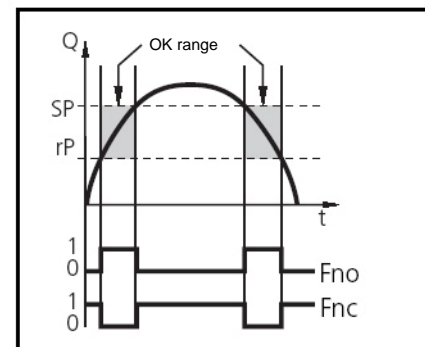
#### Window function

The window function allows a defined OK range to be monitored.

If the flow is fluctuating between switch point (SPx) and return switch point (rPx), the output is switched through (window function/NO contact) or opened (window function/NC contact).

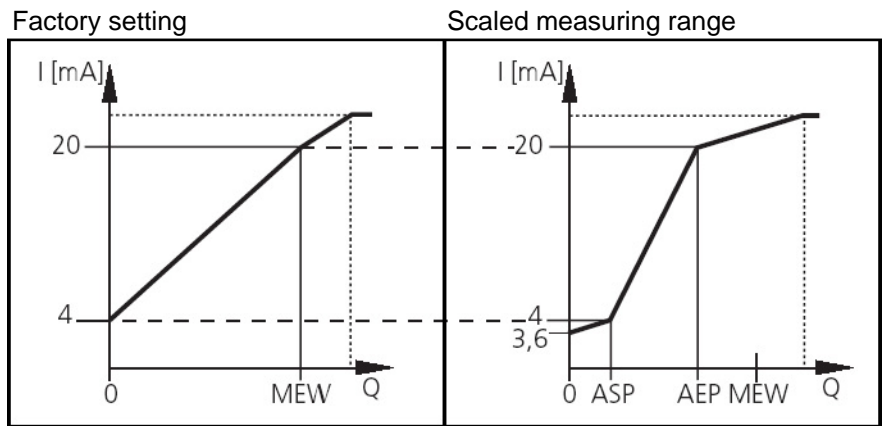
The size of the window is adjustable by the distance between SPx and rPx.

SPx = upper value; rPx = lower value.



### 6.2.4.1 Scaling the measuring range

- With the parameter analog starting point (ASP), you determine at which measurement value the output signal is 4 mA.
- With the parameter analog end point (AEP), you determine at which measurement value the output signal is 20 mA.
- Minimum distance between ASP and AEP = 25 % of the measuring range final value



MEW = Measuring range final value

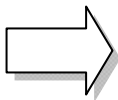
The output signal is between 4 and 20 mA in the set measuring range.  
Further signals are:

- Flow above the measuring range: Output signal > 20 mA
- Flow below the measuring range: Output signal between 3.6 and 4 mA.

### 6.2.5 Error messages

OL	<b>Recording range exceeded</b> (Flow > 120 % of the measuring range final value)
SC 1	<b>Flashing:</b> Short-circuit in switch output 1*
SC 2	<b>Flashing:</b> Short-circuit in switch output 2*
SC	<b>Flashing:</b> Short-circuit in both switch outputs *
Err	<b>Flashing:</b> Malfunction in probe

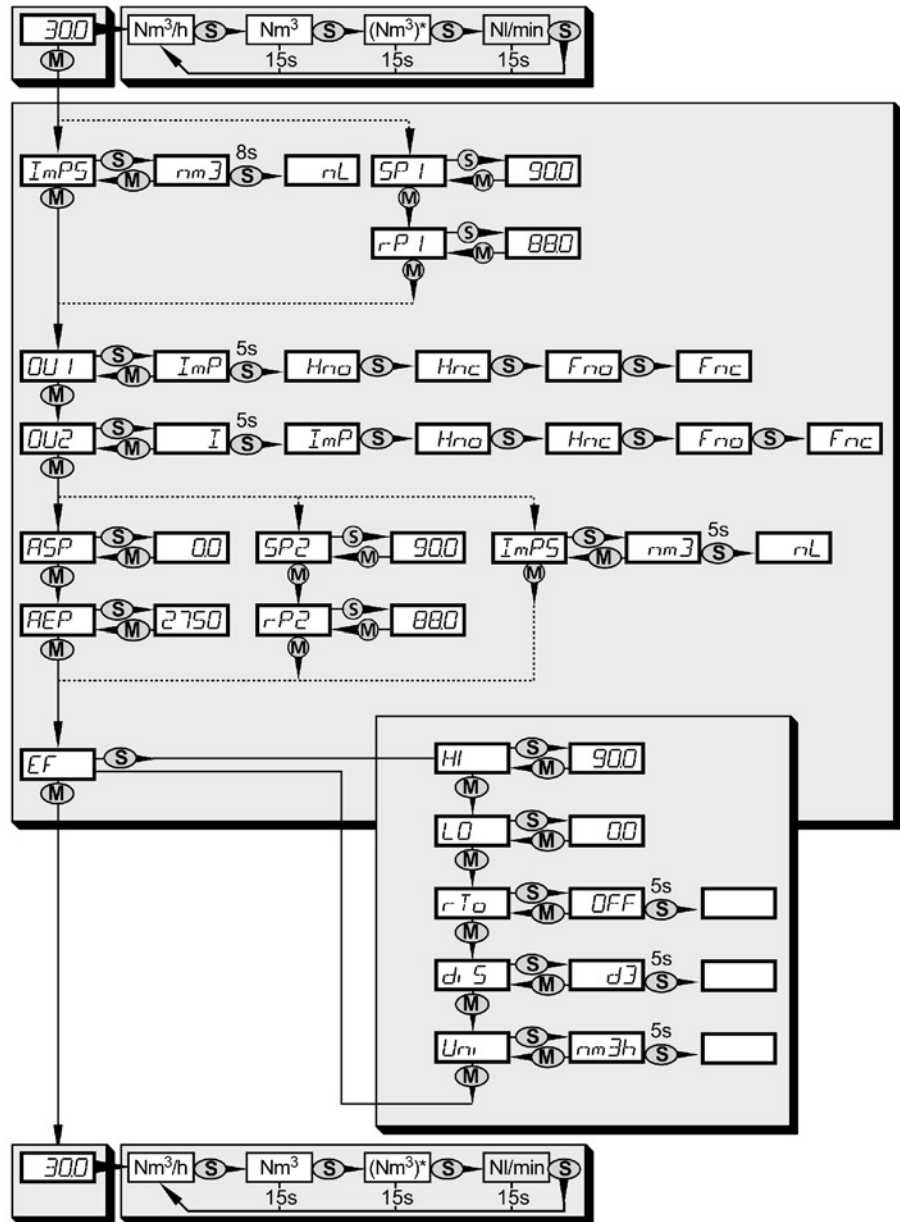
\* The affected output is switched off as long as the short-circuit lasts.



These messages are shown even when the display is deactivated.

## 6.2.6 Menu overview

In the menu overview, **(S)** stands for the Set button and **(M)** for the Mode button on the electronic sensor assembly.



(Nm<sup>3</sup>)\* = Volume flow amount before the last reset.

## 6.3 Changing the electronic sensor assembly (version 0699 6446)

The removal of the mounted electronic sensor assembly may be necessary for maintenance, cleaning and calibration purposes.



Make sure that the pipeline is ventilated. Removing the sensor from a line that has not been depressurized can be extremely dangerous.

- Remove the electrical connecting cable by unscrewing the connector from the sensor by hand. Protect the connector from contamination and moisture.
- Disconnect both halves of the hood from the sensor in the longitudinal direction by hand.
- Loosen the sensor from the measuring block using a jaw wrench (size 27) and pull out the sensor upwards in a vertical position.



Take care not to damage the sensor tip. Use the protection cap for the sensor tip as soon as the sensor is no longer mounted on the measuring block.

Use the sealing cap that is available as an option (☞ Section 3.3.1) when the pipeline is to be operated without a sensor.

## 6.4 Changing the electronic sensor assembly (version 0699 6447)

The removal of the mounted electronic sensor assembly may be necessary for maintenance, cleaning and calibration purposes.



Removing the electronic sensor assembly from the interchangeable fitting without this having been properly operated and not being in the CLOSE position can be extremely dangerous on a line that is under pressure.

- Remove the electrical connecting cable by unscrewing the connector from the electronic sensor assembly by hand. Protect the connector from contamination and moisture.
- Slowly and evenly turn the interchangeable fitting out of the pipeline **only by hand**, without tools, (to the left) in the direction of the arrow **CLOSE**.
- Only when the interchangeable fitting is completely in the **CLOSE** position does the O-ring seal off the electronic sensor assembly from the pressurized line.
- Slowly detach the top union nut from the head of the interchangeable fitting. Slowly let the air escape and make sure that it is only a short discharge pressure and that the interchangeable fitting is securely sealed.
- Completely remove the union nut and remove the electronic sensor assembly by pulling it out upwards in a vertical position.



Take care not to damage the sensor tip. Use the protection cap for the sensor tip as soon as the electronic sensor assembly is no longer mounted in the interchangeable fitting.

## 6.5 Cleaning the sensor

The sensor is cleaned by the service provider/manufacturer before each calibration. It is recommended, however, that the operator regularly checks the sensor for residual dirt during operation, cleaning if necessary. Oil residues, for example, falsify the measurement results.

You can remove the electronic sensor assembly and clean it manually. In the model 0699 6447, this can be carried out during operation (installation/deinstallation: [☞](#) chapter 6.1).



- Always clean the sensor using only approved cleaning agents ([☞](#) Section 6.6).
- Do not use any chafing (abrasive) cleaning agents. These can lead to irreparable damages to the sensor.
- Carry out a new inspection after the cleaning, as required.

## 6.6 Cleaning agents

For cleaning the sensor, use agents containing surfactants (alkaline) or water-soluble organic solvents (e.g. ethanol).

Isopropanol is recommended for cleaning various contamination, especially greases and oils.



Do not use organic solvents containing halogens or acetone. These solvents can destroy plastic parts of the electronic sensor assembly and some are also believed to be carcinogenic (e.g. chloroform).

## 6.7 Calibration

Because of contamination (e.g. oil, water, particles), an annual recalibration of the electronic sensor assembly is recommended, and one must take place at least every 24 months. This is mandatory for accounting purposes, please contact Testo.

0699 6477: Thanks to the interchangeable fitting, the calibration and service tasks for the electronic sensor assembly are also possible at any time without interruption of operation. However, please note the operating notes for secure handling under operating conditions in section 6.1 and the following.

## 7 Troubleshooting

### 7.1 Service address

Please refer questions regarding the product, accessories or spare parts to our support team (German /English speaking):  
Telephone: +49 (7653) 681-650  
email: applicationsupport@testo.de

### 7.2 Exchange of damaged parts



Damages to the compressed air counter that impact the pressure security may only be remedied by authorized personnel.  
After each repair, the technical data of the specifications must be checked by authorized personal, e.g. pressure test (pressure tests on the unit measurement block/electronic sensor assembly up to the permitted operating pressures).

Exchange all of the other damaged parts immediately. When ordering, please use the information in section 1.3 or contact your supplier.

### 7.3 Exchange of O-rings and sealing ring

- Keep the sealing surfaces clean during installation/deinstallation
- Occasionally remove any surface adhesions
- In the event of leakage, contact your supplier



Danger of the medium escaping!  
An exchange of the seals may only be performed by authorized personnel.

### 7.4 Return shipment

In the case of repairs, send the electronic sensor assembly or the interchangeable fitting to the supplier. Use the original packaging for the return shipment.

### 7.5 Disposal



The compressed air counter must be disposed of in accordance with its materials. Please observe the local regulations.

The sensor is designed for the best possible environmental compatibility. According to the EU directive 2002/96/EC, compressed air counters must be conveyed to a separate collection for electro- and electronic devices or may be sent to the supplier for disposal.

They may not be added to the unsorted municipal waste.









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