measuringSYSTEM RO-Ri

Sensor Unit Ri
MPI RO

OPERATING INSTRUCTIONS

POSTBERG + Co. GmbH

COMPRESSED AIR AT ITS BEST

Postberg + Co. offers an allround range around the energy-efficient use of compressed air in industry

From efficiency consulting to customized product development of measuring and sensor technology – also customer-specific as OEM – up to professional support on all service and outsourcing levels – **Postberg + Co. offers you compressed air efficiency packaged under one roof.**

Please read these Operating Instructions before you start up the measuringSYSTEM. These Operating Instructions must be kept at a place that is accessible to all users at any time.

NOTES ON THE OPERATING INSTRUCTIONS

Notes
This arrow highlights **special issues** that are to be observed during operation.

WARNING
This symbol marks instructions where the failure to follow them will pose a **risk to the health and life of persons**.

CAUTION
This symbol draws your attention to instructions where the failure to follow them exactly may lead to damage or **destruction of the measuring system**.

Reference
This symbol makes a reference to **further information** in other manuals, chapters or sections.

CONTENTS

RO-Ri and Ri
V 1.2 BT
valid from 1216

1 GENERAL

1.1 Incoming goods inspection, transport and storage

- **Please make sure that the packaging is undamaged!**
  Please notify any damage on the packaging to your supplier.
  Hold on to the damaged packaging until clarification is achieved.

- **Please make sure that the content is undamaged!**
  Please notify any damage on the packaging to your supplier.
  Keep the damaged item until clarification is achieved.

- **Check the scope of supplies** against the delivery documents and your order for completeness.

- **For storage and transport, the device shall be packed in an impact-resistant manner and protected against moisture.**
  The original packaging offers optimum protection. In addition, the permissible ambient conditions shall be ensured (☞ Section 4 Technical Data p. 13).

- **In the case of queries, please contact your supplier or his central sales office.**

2 SAFETY PRECAUTIONS

Please read these Operating Instructions before you start up the measuringSYSTEM. These Operating Instructions must be kept at a place that is accessible to all users at any time.

2.1 Intended use

The measuringSYSTEM is exclusively intended for use in piping line systems for operating compressed air, unless its permission for the use with other gases is expressly stated on the calibration certificate.

Due to its design, it can be operated in pressure systems up to PN 16.

CAUTION

Any other use than the one described does not ensure the safety of persons and the entire measuring device and is not permitted.
The manufacturer shall not be liable for damage that occurs as a result of improper or not intended use or installation.
To avoid damage to the devices or health risks, **no manipulations with tools** on the measuring devices are allowed unless they are expressly described in these Operating Instructions.

The measuringSYSTEM must not be operated or assembled and dismantled under the ambient conditions indicated in the technical data. Otherwise, measurement inaccuracies occur or device failures cannot be excluded.

To ensure the safety of the user and the function of the devices, the start-up steps, inspections and maintenance activities recommended by the manufacturer shall be observed and conducted.

For reasons of clarity, these Operating Instructions do not include the complete detail information. Should you wish to obtain further information or should any special problems occur which are not described in detail in these Operating Instructions, the required information can be requested directly from the manufacturer.

2.2 Installation, start-up and operation

The measuringSYSTEM was manufactured and tested for reliable operation and left the factory in a fault-free safe condition.

As user, you shall be responsible for compliance with all applicable safety regulations, e.g.:

- **Installation regulations**
- **Local standards and regulations.**

  The manufacturer has taken every effort to ensure safe operation. The user has to make sure that the devices are placed and installed in such a way that their safe use is not affected.
  The devices were factory-tested and delivered in reliable operating condition. The present Operating Instructions include information and warnings that must be followed by the user to enable safe operation.

- Installation, start-up, operation and maintenance of the measuring device may **only be performed by trained and qualified personnel**. This qualified personnel must be authorised by the plant operator to perform the described activities.
- **The qualified personnel must have read and understood these Operating Instructions and must follow the mentioned instructions.**
- Check before starting up of the overall measuring point if all connections have been made correctly.
- **Any damaged products must not be started up and shall be safeguarded against unintended start-up.** The damaged product must be marked as defective.
- Any failure on the measuring point may only be remedied by authorised and trained personnel.
- If failures cannot be remedied, the products must be taken out of operation and safeguarded against unintended start-up.
- Any repairs which are not described in these Operating Instructions may only be performed directly by the manufacturer or the service organisation.

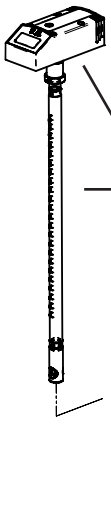
2.3 Disclaimer

In general, the manufacturer and his vicarious agents shall only be liable in the case of intent or gross negligence. The scope of liability shall be limited to the value of the relevant order placed to the manufacturer. The manufacturer shall not be liable for damage that occurs due to failure to follow the safety instructions, non-compliance with these Operating Instructions or the operating conditions. Any consequential damages shall be excluded from the liability.

3 FUNCTIONS AND APPLICATIONS | SCOPE OF SUPPLIES **Components List**

measuringSYSTEM RO-Ri

Sensor unit Ri



Sensor unit Ri

☞ 3.1 | p. 9

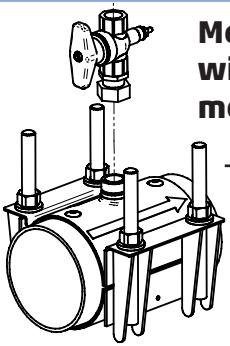
Consisting of

- Evaluation electronics
- Sensor extension
  - Up to DN 65 300 mm
  - From DN 80 450 mm

PB+CO®ver kickback protection

☞ 3.2 | p. 11

MeasuringPointInterface Tapping Clamp RO



Measuring armature with output for parallel measurement ☞ 3.3 | p. 11

Tapping clamp of stainless steel

☞ 3.4 | p. 12

Furthermore, the following is included in the scope of supplies:

- Calibration certificate according to ISO/IEC 17025
- Optional: Test badge for recalibration on the device

3.1 Electrical sensor Ri

With the aid of the calorimetric measuring principle, the sensor detects the standard volume flow of the operational compressed air.
To this end, the standard volume flow is calculated on the basis of DIN ISO 2533 (1013.25 mbar, 15 °C and 0 % relative humidity) if not indicated otherwise in the calibration certificate. The unit of this is Nm^3/h or Nl/min.

Please observe the General Operating Conditions of compressed air systems. The air quality of the operational compressed air has the following impact on the measuring accuracy:

Quality grades as per ISO 8573-1 Particles – moisture - oil	Measuring failure
1-4-1	± (3 % of measured value + 0.3 % of end value of measuring range)
3-4-4	± (6 % of measured value + 0.6 % of end value of measuring range)

Measuring signals

The instrument shows the current process values on display.
It generates 2 output signals according to the parameter assignment.

- Current flow rate
- Current consumption rate (impulse output and totalizer)

Display

- A Current flow rate in Nm^3/h or Nl/min
- Current consumption rate in Nm^3
- Current mean velocity in Nm/s
- Current media temperature in °C
- Switching conditions of the relevant outputs

Sensor output 1

- Switching signal as limit value for flow rate or flow speed, hysteresis or window function as normally open or normally closed contact.
- Quantity control by preselection meter.

Sensor output 2

- Switching signal as limit value for flow rate, flow speed or temperature, hysteresis or window function as normally open or normally closed contact.
- Analog signal (4...20 mA) for corresponding volume flow, flow speed or temperature.

Relative measuring range (%)

Measuring range	Detection range / display range
0.33 % (0.4 %) - 100 %	0 % - 120 %

The absolute measuring range is depending on the nominal width (see table below).

Absolute measuring range

WARNING

The compressed air meter may be used for volume flow measurements of **operating compressed air up to an overpressure of 16 bar.**

Nominal width	Measuring range	Detection / display range
DN 40	2.1-620 m³/h	0-744 m³/h
DN 50	3.3-1000 m³/h	0-1200 m³/h
DN 65	6.7-2000 m³/h	0.11-2400 m³/h
DN 80	9.2-2750 m³/h	0.15-3300 m³/h
DN 100	15-4400 m³/h	0.24-5280 m³/h
DN 125	23-7000 m³/h	0.39-8400 m³/h
DN 150	33-10000 m³/h	0.55-12000 m³/h

Nominal width	Measuring range	Detection / display range
DN 200	58-17500 m³/h	0.97-21000 m³/h
DN 250	92-27500 m³/h	1.53-33000 m³/h
DN 300	130-39000 m³/h	2.16-46800 m³/h

Data according to DIN ISO 2533 (15 °C, 1013 mbar and 0 % rel. humidity).

3.2 PB+CO®ver kickback protection

The **PB+CO®ver** connects three functions in one unit:

- **Protection against return**, i.e. the sensor can only be moved in one direction during assembly.
- **Sealing against the process**, i.e. compressed air cannot escape thanks to an enclosed O-ring.
- **Fixable position** so that a precise immersion depth and alignment is possible similar to the pressure point on a car clutch. A 360 ° alignment (turning of the sensor) is possible at any time.

WARNING

The PB+CO®ver kickback protection must not be dismantled (function loss) and can be used up to a pressure of max. 16 bar.

3.3 Measuring armature with output for parallel measurement

The brass measuring armature patented by Postberg + Co. is equipped with an integrated safety ball valve. As a result, it enables the shutoff of the pressure line at any time and an easy replacement of the sensor. Sections of the pressure system can be depressurized that are currently not in operation / not needed. Consequently, leakage losses on the consumer are excluded during downtimes.

WARNING

The measuring armature must not be dismantled (function loss) and can be used up to a pressure of max. 16 bar.

3.4 **Tapping clamp** of stainless steel

The tapping clamp allows the sensor to be installed precisely using a drilling unit **without the need for welding**. The corresponding supply line **may be under pressure** (normal operating conditions) when installing the tapping clamp or when repairing / replacing the sensor.

WARNING

Assembly of the tapping clamp under pressure should only be made by **trained personnel**, and is permitted for a maximum pressure of 16 bar (up to DN 200) and 10 bar (DN 250 and DN 300).

Tolerance range of the outside diameter of the piping line for the use of tapping clamps:

Nominal width	Tolerance range
DN 40/50	47-67 mm
DN 65	73-80 mm
DN 80	86-106 mm
DN 100	107-127 mm
DN 125	128-148 mm
DN 150	149-171 mm
DN 200	216-238 mm
DN 250	260-280 mm
DN 300	315-335 mm

3.5 ISO calibration points

The **RO-Ri measuringSYSTEM** has been calibrated to your nominal width before delivery. At least six measuring points with defined nominal width, standard temperature and pressure are parameterized, started up on the test stand and checked regarding the standard volume. The calibration certificate according to ISO/IEC 17025 is included in the scope of supplies. Optionally, a test badge is attached to the device.

4 TECHNICAL DATA

4.1 Thermal mass flow sensor

The thermal mass flow sensor for the compressed air volume flow measurement depends on the process pressure and the fluid temperature.

Sensor	Thermal, glass-passivated ceramic sensor
Fluids	Compressed air, with special calibration also CO_2, N_2
Accuracy	for compressed air quality classes (ISO 8573: particle-moisture-oil) 1-4-1: ±3 % of measured value, ±0.3 % of end value for compressed air quality classes (ISO 8573) 3-4-4: ±6 % of measured value ±0.6 % of end value
Temperature control	± 2 °C
Reproducibility	±1.5 % of measured value
Display, operation	4-digit alphanumeric display, two operating buttons, operating menu, 5 x LED green (phys. units), 1 x LED green (10^3), 2 x LED yellow (switching conditions)
Display units *	Nl/min, Nm^3/h, Nm/s, Nm^3, °C
Measurement dynamics	1:300
Response time	< 0.1s
Pressure-resistant	Up to 16 bar overpressure
Medium temperature	0 ... + 60 °C (max. 90 % rel. humidity)
Ambient temperature	0 ... + 60 °C
Storage temperature	-25 ...+ 60 °C
Fluid contact	V2A (1.4301), ceramic glass-passivated, PEEK, polyester, Viton, anodized aluminium
Housing materials	PBT-GF 20, PC (APEC), Makrolon, V2A (1.4301), Viton
Degree of protection / protection class	IP65 / III
Electrical connection	M12 x 1-plug, capacity up to 250 mA, short-circuit proof
Voltage supply	19 ... 30 VDC, current input < 100 mA
Delay before start	1 s

* The measuring, display and setting ranges refer to, unless indicated otherwise in the calibration report of sensor, to the standard volume flow according to DIN ISO 2533 (15 °C, 1013 mbar and 0 % rel. humidity).

Notes

Due to its small size, the sensor has a very small surface for attack. Consequently, the pressure loss can be neglected (typically 1 mbar).

Output signals

Analog output	4...20 mA, measuring range scalable max. load 500 Ω
Impulse output	DN 40 - DN 80: 1 Imp./1 Nm^3 DN 100 - DN 300: 1 Imp./10 Nm^3
Current load capacity	2 x 250 mA, short-circuit proof, protected against polarity reversal, overload-proof

EMV

IEC 1000/4/2 ESD	4 / 8 kV
IEC 1000/4/3 Hf radiated	10 V/m
IEC 1000/4/4 Burst	2 kV
IEC 1000/4/6 Hf line-bound	10 V

4.2 Mechanism

4.2.1 Measuring armature

The measuring armature is brass nickel-plated and has a pipe clamp connection DN 20 / internal thread as well as a DN 15 connection for a quick coupling for further measuring points (e.g. pressure or pressure dew point).

4.2.2 Tapping clamp

Material: Tapping clamp of stainless steel 304/A2, rubber insert of Perbunan (NBR), nuts and screws of stainless steel.

The tapping clamp allows the sensor to be installed precisely using a drilling unit without the need for welding. The corresponding supply line may be under pressure (normal operating conditions) when installing the tapping clamp or when repairing / replacing the sensor.

4.3 Accessories

4.3.1 Installation tool

The installation tool consists of a drilling tool **for the installation under pressure** and an end stop clamping ring for the electronic sensor system.

4.3.2 Connecting line with potential isolation

As accessory, a connecting line with a potential isolation integrated in the plug is available. The line has a length of 5 m and serves for galvanic isolation between sensor output and connected electronic system. The line will be delivered with an appropriate connection plug for the mass flow sensor on one side and open line ends on the other side.

4.3.3 Replacement sensor

The replacement sensor serves as spare part in the case of damage or loss of the original mass flow sensor.

Notes

Please make sure to indicate the certificate no. of the damaged sensor when ordering a new one. This ensures factoring the customized measuring conditions while calibrating.

4.3.4 Calibration options

- **ISO certificate**
  An ISO certificate of the manufacturer documents six measuring points incl. measuring conditions.

- **Test badge for next recalibration**
  By request a test badge as a reminder of the annual recalibration can be fixed to the sensor.

- **Sensor parametrization on CO_2 and N_2**
  At least six measuring points with defined nominal width, standard temperature and pressure for nitrogen or carbon dioxid are parameterized, started up on the test stand and checked regarding the stand volume.

calibrationSERVICE

Safeguard the measuring quality and, with this, the implementation of **ISO 9001 and ISO 50001** through an annual recalibration – on request with immersion sensor to minimize the downtime. Further support modules ☞ S. 47

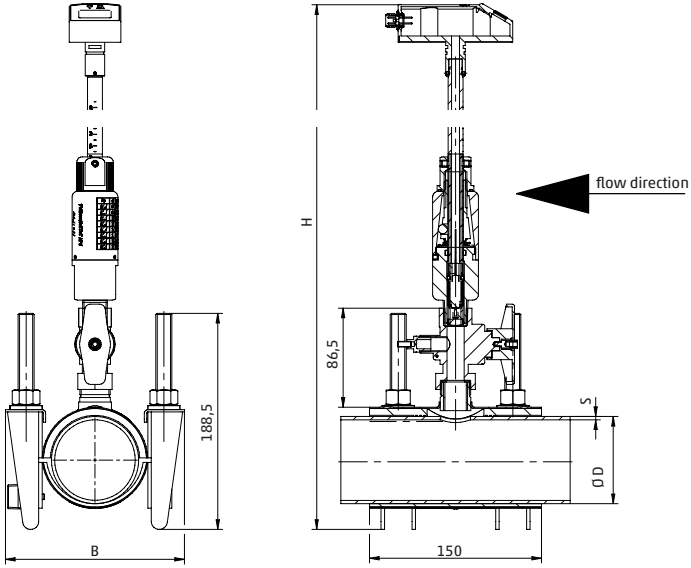
5 INSTALLATION

5.1 Identifying the installation position

For the installation position, it is necessary to observe the specified technical data (☞ Section 4.1 | p. 13).
At site the following points must be observed:

- **Fluid at the installation position must be non-condensing**, the measurement location can, for this reason, only be arranged behind a suitable compressed air drier that provides a suitable pressure dew point. Otherwise, the specified measuring accuracy is not ensured.
- **Ambient temperature of max + 60 °C** (possible heat radiation must be taken into account).
- **Consider the required measuring distance** (☞ 5.4 | p. 19).
- **Observe the inflow direction during the installation** (☞ 5.5 | p. 19).
- **Easily accessible and low in vibrations**.
- **Installation-free space of at least 600 mm** is required for dismantling the sensor.

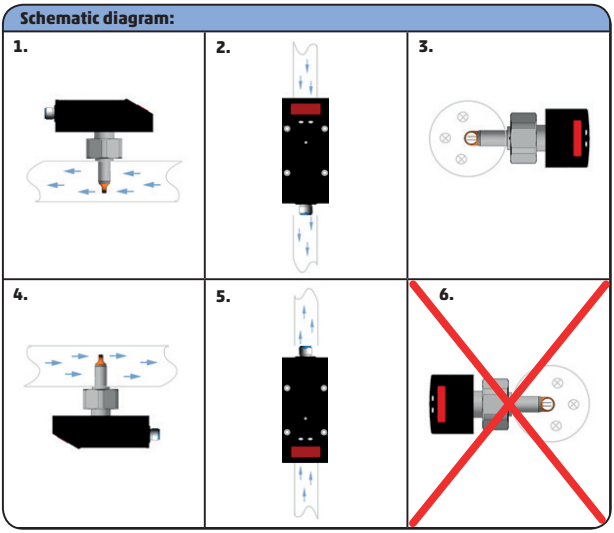
5.2 Linear dimension of the measuringSYSTEM



Inch	DN	Ø D	S	B	H
		mm	mm	mm	mm
1 ½"	40	60.3	2.9	140	558
2"	50	60.3	2.9	140	558
2 ½"	65	76.1	2.9	156	566
3"	80	88.9	3.2	161	718
4"	100	114.3	3.6	186	731
5"	125	139.7	4	211	757
6"	150	168.3	4.5	240	788
8"	200	219.1	6.3	291	839
10"	250	273	6.3	329	893
12"	300	323.9	7.1	372	944

5.3 Installation position

The sensor must not be installed as shown in the crossed-out representation in the schematic diagram below. If the flow rate is low, the specified accuracy cannot be adhered to.



The marking arrow shows the flow direction of the fluid.

1: Installation position vertical, flow direction horizontal to the left, sensing element downwards
2: Installation position horizontal, flow direction vertical downwards, sensing element to the rear
3: Installation position horizontal, flow horizontal to the rear, sensing element to the left (heated sensing element upwards)
4: Installation position vertical, flow direction horizontal to the right, sensing element upwards
5: Installation position horizontal, flow direction vertical upwards, sensing element to the rear
~~**6:**~~ Installation position horizontal, flow horizontal to the rear, sensing element to the right (heated sensing element downwards, problems may occur with low flow rates)

5.4 Required measuring distance

Notes

Please observe the **required inlet and outlet distance** to reach the specified measuring accuracy. The inlet distance is the piping line length **upstream** of the measuringSYSTEM, the outlet distance the piping line length **downstream** of the measuringSYSTEM with the flow direction of the fluid.

Total measuring distance = inlet distance + outlet distance
Outlet distance = 5 x D
Inlet distance = 15 x D + B

D = pipe diameter [mm]
B = Additional flow calming section

	Diminution	B = 5 x pipe diameter
	90° elbow	B = 5 x pipe diameter
	Two 90° elbows, one level	B = 10 x pipe diameter
	Two 90° elbows, two levels	B = 15 x pipe diameter
	Valve, gate	B = 35 x pipe diameter

5.5 Flow direction

For the installation of the **measuringSYSTEM**, the flow direction must be observed. This is represented by an **arrow on the tapping clamp**. The arrow shows the direction of the fluid flow in the piping line.

Notes

Consider the **marking arrow** which is printed on the black housing of the electric sensor unit. It is pointing in the direction of the fluid flow.

5.6 Installation of the tapping clamp

The installation of the tapping clamp is executed by qualified employees of Postberg + Co. or by your own personnel trained by Postberg + Co.

5.6.1 Preparations on site

The installation position must be accessible and sufficient working space must be present in the area of the line.

WARNING

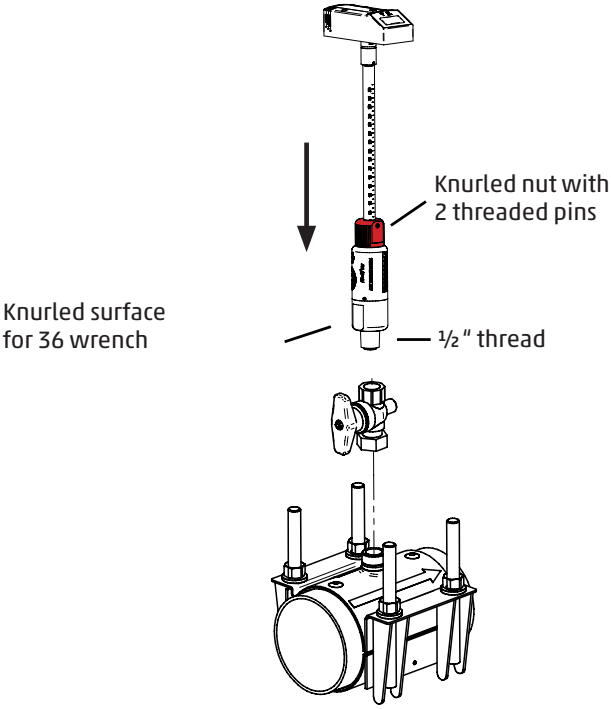
For the mounting activities in a **height of maximally 2.5 m above the floor (height of the line), a stable stepladder** is required. For greater heights, a **lifting platform** must be provided. If the area of the measuring point is not accessible using a lifting platform, a **safe working platform** in the **form of a scaffolding** or similar must be provided.

5.7 Installation of the sensor unit into the tapping clamp

At the point of delivery, the sensor unit and the PB+CO®ver kickback protection are already mounted.

CAUTION

Do not carry out any manipulations on the measuringSYSTEM which are not expressly described in the Operating Instructions. The failure to observe or accurately follow the Operating Instructions may lead to damage or leakages on the measuringSYSTEM or even to health hazards. The manufacturer shall not be liable for damage that is attributable to an improper or unintended use or installation.



1. Seal the **PB+CO®ver** kickback protection on the ½ " thread.
2. Screw it to the measuring armature and fix it by collaring a 36 wrench above the thread and counter at the same time.
3. Release the threaded pins (hexagon socket 3 mm) and the knurled nut manually.
4. Open the measuring armature.
5. Insert the sensor until it reaches the back of the pipe.
6. Then align it towards the piping line and according to the flow direction. See the direction arrow on tapping clamp and sensor unit.
7. Tighten the knurled nut manually und secure it with the threaded pins.

5.8 Sensor exchange

The withdrawal of the mounted sensor may be required for maintenance, cleaning and calibration purposes.

1. Remove the electrical connection line by manually unscrewing the connecting plug from the sensor. Protect the connecting plug against contaminations and humidity.
2. Detach the threaded pins (hexagon socket) and the knurled nut manually.

WARNING

Make sure that your standing position on a ladder or lifting platform is stable – the sensor immediately releases a pressure shot up to the end stop from the measuring position.
Apply counter-pressure for damping on the sensor unit and move away from the line of the pressure shot.

3. Hold the sensor in position, applying counter-pressure.
4. Press the knurled nut slightly downwards against the spring pressure until the kickback protection retreats.
5. The sensor unit returns under pressure to the end stop.

WARNING

If the sensor is changed, firstly make sure that the measuring armature is closed.
Never remove the sensor with opened measuring armature – this can pose a danger to life.

6. **Close the measuring armature on the ball valve to depressurize the line area.**
7. Detach the **PB+CO®ver** kickback protection with a 36 wrench and counter the measuring armature.
8. For a safe transport of the sensor, fully retract the sensor tip into the **PB+CO®ver** kickback protection.

5.9 Electrical connections

Disconnect the voltage supply before making the connections.

WARNING

The device may **exclusively be installed by a trained electrician**. Follow the national and international regulations for the installation of electrical systems. The voltage supply system shall be designed according to EN50178, SELV, PELV. In order to meet the "limited voltage" requirements according to UL 508, the device must be fed from a galvanically isolated source and equipped with an overcurrent facility.

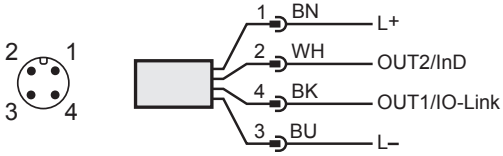
NOTES

If you connect the sensor directly or use a **4-core connection line, proceed according to 5.9.1.**

If you use the optionally available **4-core connecting cable** with potential-free impulse output (☞ 4.3.2) **proceed according to 5.9.2 for the connection of the sensor.**

5.9.1 4-core pin assignment

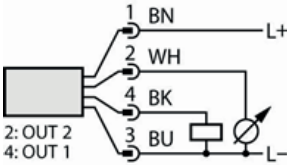
If you do not use the optionally available connecting line for potential isolation, the following line assignment applies to the connecting line or plug assignment directly on the sensor.



Pin Nr.	Aderfarbe	Belegung
1	Brown	+L (19...30 V DC)
2	White	OUT2
3	Blue	0 V DC (GND)
4	Black	OUT1

5.9.1.1 1 x impulse output, 1 x analog output (delivery condition)

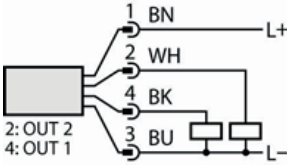
The output OUT1 is used as pnp signal output (impulse) and the output OUT2 as analog output. The sensors are delivered in this condition.



Pin = designation (core colour)
1 = BN (brown)
2 = WH (white)
3 = BU (blue)
4 = BK (black)

5.9.1.2 2 x impulse output

The two existing outputs OUT1 and OUT2 are used as pnp signal output (impulse).



5.9.2 5-core pin assignment (accessories)

If you use the optionally available connecting line for potential isolation (☞ 4.2.2) the following pin assignment applies to the connecting line.

Pin Nr.	Aderfarbe	Belegung
1	Brown	+ L (19...30 V DC) sensor supply
2	Pink	+ potential-free impulse output (collector) OUT1
3	White	- potential-free impulse output (emitter) OUT1
4	Green	OUT2
5	Black	0 V DC (GND)

The potential-free impulse output OUT1 is specified with this connecting line as follows:

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

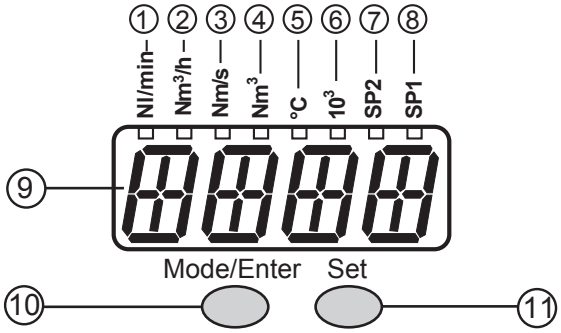
6 OPERATION

Thermal mass flow sensor

Make yourself familiar with the operation and programming of the sensor. The sensor is factory-calibrated and provided with preliminary settings per nominal width.

6.1 Operating and display elements

The following image shows the operating and display unit of the sensor in a top view.



	Type	Description
① to ⑧	Indicator LEDs	LED on = set display unit
	LED 1	Current flowrate (Nl/min)
	LED 2	Current flowrate (Nm^3/h)
	LED 3	Current flow velocity (Nm/s)
	LED 4	Current consumption rate **since** last reset (Nm^3)
	LED 4 **flashing**	Consumption rate **before** last reset (Nm^3)
	LED 4 and 6	Current consumption rate **since** last reset in 10^3 (Nm^3) (Values > 9999 are displayed in 10^3 exponential mode)
	LED 4 and 6 **flashing**	Consumption rate **before** last reset in 10^3 (Nm^3) (Values > 9999 are displayed in 10^3 exponential mode)
	LED 6	= 10^3-exponential mode
	LED 5	Current medium temperature in °C
	LED 7 SP2	Switching condition of the relevant output (also in the case of an active external reset, the LED indicates the status of the input),
	LED 8 SP1	switching condition of the relevant output
⑨	4-digit alpha-numerical display	• Display of the current flow rate (with setting **Uni** = **Lmin** or **nm3h** and **SELd** = **FLOW**) • Display of the current flow rate (with setting **Uni** = **nmS** and **SELd** = **FLOW**) • Display of the meter reading (with setting **SELd** = **TOTL**) • Display of the current fluid temperature (with setting **SELd** = **TEMP**) • Display of parameters and parameter values
⑩	Key **Mode / Enter**	Selection of parameters and confirmation of parameter values
⑪	Programming key **Set**	• Setting of parameter values • Change of display unit in run mode

6.2 Operating modes

6.2.1 Run mode

After switching on the supply voltage, the device is in the **run mode**.
It performs its measuring and evaluation function and provides output signals according to the set parameters.
The display shows the actual measured values, the yellow LEDs provide signals on the switching conditions of the outputs.
The display unit can be changed temporarily (shortly press the **Set** key).
After 15 s, the device returns to the display unit that was set under the menu item **Uni**.

The totalisator (consumption rate meter) saves intermediate values every 10 minutes as well as the time of the automatic reset that has lapsed by then. After a voltage drop, this value is available as the current totalisator status (the potential data loss may be max. 10 minutes).

6.2.2 Display mode

Display of the parameters and the set parameter values.
By shortly pressing the key **Mode / Enter**, the device goes to the **display mode**. Internally, it remains in the working mode.
Irrespective of this, the set parameters can be read:

- By shortly pressing the key **Mode / Enter**, the parameters are browsed.
- By shortly pressing the key **Set**, the associated parameter value is indicated for approx. 15 s. After further 15 s, the device returns to the run mode.

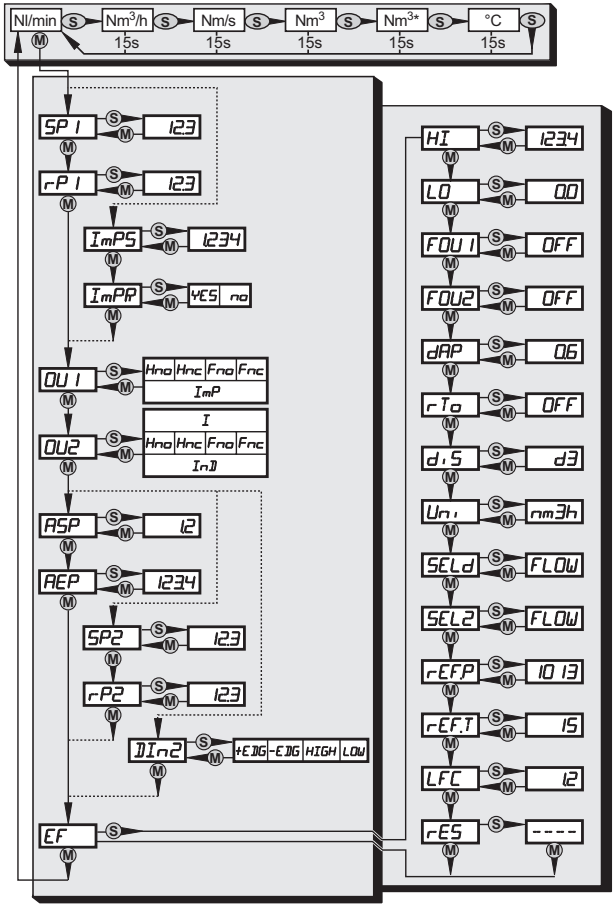
6.2.3 Programming mode – setting of parameters

The device goes to the **programming mode** if a parameter is selected and then the **Set** key is pressed and held for more than 5 s (the parameter value is displayed flashing and then increased continuously). The device again remains internally in the working mode.
It continues to execute its monitoring function with the existing parameters until the change is completed.
You can change the parameter value with the aid of the key **Set** and confirm with the **Mode / Enter** key.
The device returns to the measuring mode if no key is pressed after that for 15 s.

7 MENU

7.1 Menu Overview

In the menu overview (S) is the **Set** key and (M) the **Mode** key on the sensor.



(Nm³)* = volume flow rate before last reset

The parameter values in the form of numbers are factory settings or arbitrary examples.

7.2 Menu explanation

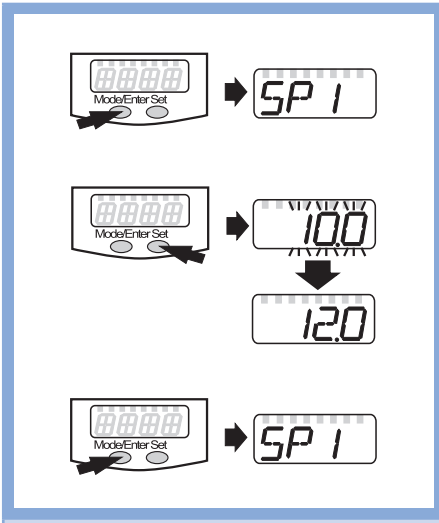
SP1 / rP1	**S**witching **p**oint or **r**eset **p**oint Upper / lower limit value for flow rate
ImPS	Impulse valence
ImPR	Impulse repetition **yes** = **active** = Impulse output or **nO** = **not active** = Function preselection counter
OU1	Output function for **OUT1** (flow rate or consumption rate): - Switching signal for limit values: Hysteresis function **Hno** or **Hnc** or window function **Fno** or **Fnc** o = normally open, c = normally closed - Impulse switching signal for volume meter
OU2	Output function for **OUT2** (flow rate or temperature): - Switching signal for the limit values: Hysteresis function or window function, normally open or normally closed - Analog signal: 4-20 mA [**I**] **Alternative**: **OUT2** (Pin2) as input for external reset signal Configure: Setting: **OU2** = **InD**
SP2 / rP2	**S**witching **p**oint or **r**eset **p**oint Upper / lower limit values for flow or temperature **SP2** and **rP2** are only active if **OU2 = Hno, Hnc, Fno or Fnc**
ASP / AEP	**A**nalog **s**tarting **p**oint / **A**nalog **e**nd **p**oint for flow rate or temperature
DIn2	Configuration of input (Pin2) for counter reset
EF	**E**xtended **f**unctions / opening of menu level 2
HI / LO	Maximum value memory / minimum value memory for flow rate
FOU1	Behaviour of output 1 in the case of an **internal fault**
FOU2	Behaviour of output 2 in the case of an **internal fault**
dAP	Measured value damping / damping constant in seconds
rTo	Counter reset: Manual reset / time-controlled reset
diS	Updating rate and orientation of display
Uni	Standard dimension for flow rate: Nl/min, Nm^3/h or Nm/s
SELd	Standard measured value of display: Flow rate value, counter reading or media temperature

SEL2	Standard measured variable for evaluation through **OUT2**: - Limit value signal or analog signal for flow rate - Limit value signal or analog signal for temperature
rEF.P	Standard pressure which the measured and display values for flow rate refer to
rEF.T	Standard temperature which the measured and display values for flow rate refer to
LFC	**L**ow **f**low **c**ut-off
rES	Reset factory setting

8 PROGRAMMING + PARAMETER SETTING

8.1 Programming

Every parameter setting requires 3 steps:
Select parameter – adjust value – confirm

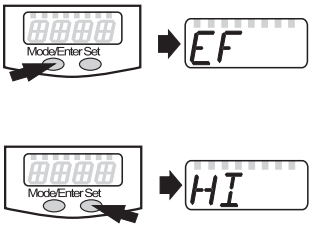


Press the **Mode / Enter**, key until the **desired parameter** appears in the display.
Press the **Set** key and hold it.
The current **parameter value is displayed flashing for 5 s. After that**, it is **increased** * (stepwise by single pressing or continuously by holding the key).
Briefly press the key **Mode / Enter** (= confirmation). The parameter will be displayed again, the new **parameter value has become effective.**

Change further parameters:	Start again with Step 1.
End programming:	Wait 15 s or press the **Mode / Enter**-key until the current measured value appears.

* **Reduce value:**
Let the display run up to the maximum setting.
After that, it starts again from the minimum setting.
Adjust the display unit **Uni** before you determine the values for the parameters **SPx, rPx, ASP** and **AEP**. As a result, you avoid rounding errors in the internal conversion to other units and exactly obtain the desired values. Delivery condition: **Uni = nm3h**.
If no key is pressed for 15 s during the setting process, the device returns to the run mode with unchanged values.

Change from menu level 1 to menu level 2

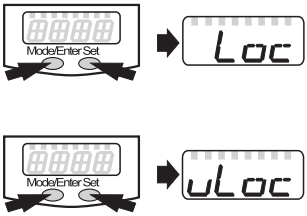


Press the **Mode / Enter** key until **EF** is displayed.

Shortly press **Set**.

The first parameter of the submenu is displayed: **HI**.

Locking – unlocking
To avoid unintended incorrect entries, the device can be locked electronically. **Delivery condition: unlocked.**



Make sure that the device is in normal working condition.
Press **Mode / Enter** + **Set** keys for 10 s.
Loc is displayed.
During the operation, **Loc** is displayed briefly when the attempt is made to change the parameter values.
Press **Mode / Enter** + **Set** keys for 10 s.
Loc is displayed.

If **SLoc** is displayed during the attempt to change a parameter value, either an IO-link communication is active (preliminary locking) or the sensor is durably locked through the software. This locking can only be released with the aid of a parameter setting software.

8.2 Parameter setting scenarios

8.2.1 Settings for flow rate monitoring

8.2.1.1 Configure limit value monitoring with OUT1

Uni	Select and define measuring unit (☞ 8.2.4 | p. 36).
OU1	Select and set switching function. **Hno**= Hysteresis function / normally open **Hnc** = Hysteresis function / normally closed **Fno** = Window function / normally open **Fnc** = Window function / normally closed
SP1	Select and set value where the output will switch.
rP1	Select and set value where the output will switch back.

8.2.1.2 Configure limit value monitoring with OUT2

Uni	Select and define measuring unit (☞ 8.2.4 | p. 36).
SEL2 **FLOW** **OU2**	Select and set. Select and set switching function. **Hno** = Hysteresis function / normally open **Hnc** = Hysteresis function / normally closed **Fno** = Window function / normally open **Fnc** = Window function / normally closed
SP2	Select and set value where the output will switch.
rP2	Select and set value where the output will switch back.

8.2.1.3 Configure analog value for flow rate

Uni	Select and define measuring unit (☞ 8.2.4 | p. 36).
SEL2 **FLOW** **OU2**	Select and set. Select and set function. **I** = flow rate proportional current signal (4...20 mA)
ASP	Select and set value where the **minimum value** is provided.
AEP	Select and set value where the **maximum value** is provided.

8.2.2 Settings for consumption rate monitoring

8.2.2.1 Configure volume monitoring through impulse output

OU1 **ImP**	Select and set.
ImPS	Select and set flow rate where 1 impulse is provided (☞ 8.2.6 | p. 39).
ImPR **YES**	Select and set. > Impulse repetition is active. **Output 1** always gives a counting impulse if the value set in **ImPS** is reached.

8.2.2.2 Configure volume monitoring through preselection counter

OU1 **ImP**	Select and set.
ImPS	Select and set flow rate where **Output 1** will switch (☞ 8.2.6 | p. 39).
ImPR **NO**	Select and set. > Impulse repetition is not active. The output switches **ON**, when the value set in **ImPS** is reached. It remains switched-on until the counter is reset.

8.2.2.3 Configure program-controlled counter reset

rTo	Select, continue with **a)** or **b)** **a)** Manually reset counter
Set	Press until **rES.T** is displayed, then briefly press **Mode / Enter**. **b)** Enter value for time-controlled reset
Set	Press until the desired value is displayed (intervals from 1hour to 8 weeks), then briefly press **Mode / Enter**
Set	Press until **rES.T** is displayed, then briefly press **Mode / Enter**.

8.2.2.4 Deactivate counter reset

rTo **OFF**	Select and set. The counter is only reset after overflow (= factory setting). Overflow: After the maximum value (9 999 999 Nm^3), the counter is reset to 0.

8.2.2.5 Configure counter reset by external signal

OU2 **InD**	Select and set.
Din2	Select and set reset signal. **HIGH** = Reset with high signal **LOW** = Reset with low signal **+EDG** = Reset with rising flank **-EDG** = Reset with falling flank

The LED 7 (☞ 6.1. Operating and display elements | p. 25) shows the input status also in the case of an active external reset.

8.2.3 Settings for temperature monitoring

8.2.3.1 Configure limit value monitoring with OUT2

SEL2 **TEMP**	Select and set.
OU2	Select and set switching function. **Hno** = Hysteresis function / normally open **Hnc** = Hysteresis function / normally closed **Fno** = Window function / normally open **Fnc** = Window function / normally closed
SP2	Select and set value where output switches.
rP2	Select and set value where output switches back.

8.2.3.2 Configure analog value for temperature

SEL2 **TEMP**	Select and set.
OU2	Select and set function. **I** = Temperature-proportional current signal (4...20 mA)
ASP	Select and set value where the **minimum value** is provided.
AEP	Select and set value where the **maximum value** is provided.

8.2.4 User settings (optional)

8.2.4.1 Define standard measuring unit for flow rate

Uni	Select and define measuring unit. **Lmin** = Flow rate in standard litre / minute **nm3h** = Flow rate in standard cubic metre / hour **nmS** = Flow velocity in standard metre / second. The setting has only an effect on the flow rate value. Set the display unit before setting the values for the parameters **SPx, rPx, ASP** and **AEP.** By this, rounding errors are avoided during the internal conversion to other units and the desired values are exactly obtained.

8.2.4.2 Configure standard display

SELd	Select and define standard measuring unit. **FLOW** = Display shows current flow rate value in standard measuring unit **TOTL** = Display shows current counter reading in Nm^3 or 1000 Nm^3 **TEMP** = Display shows current media temperature in °C
diS	Select and define updating rate and orientation of the display. **d1** = Measured value updating every 50 ms **d2** = Measured value updating every 200 ms **d3** = Measured value updating every 600 ms **rd1**, **rd2**, **rd3** = Display as d1, d2, d3; rotated by 180 ° **OFF** = The display is switched off in the working mode, on pressing the button, the process value appears for 15 s.

8.2.4.3 Set measured value damping

dAP	Select and set damping constant in seconds (t-value 63%).

8.2.4.4 Set error behaviour of outputs

FOU1 Select and define value

On = Output 1 is switched **ON** in the case of a fault.

OFF = Output 1 is switched **OFF** in the case of a fault.

> For both values – **ON** and **OFF** – the counter does not continue to add in the case of an error.

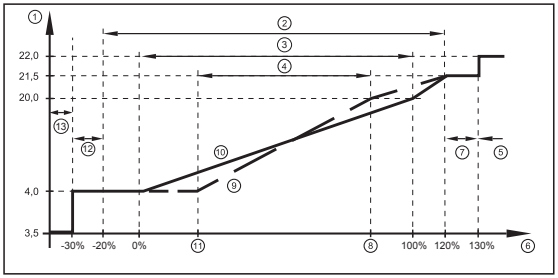
OU = Output 1 operates irrespective of the error case as defined with the parameters

FOU2 Select and define value

On = Output 2 is switched **ON**, in the case of a fault, the analog signal goes to the upper limit value (22 mA).

OFF = Output 2 is switched **OFF** in the case of a fault, the analog signal goes to the lower limit value (3.5 mA).

OU = Output 2 operates irrespective of the error case as defined with the parameters. The course of the analog signal corresponds with IEC60947-5-7.



Output characteristic according to analog output according to standard IEC 60947-5-7

1: Output current in mA
2: Working range
3: Measuring range
4: Area between analog starting point and analog end point
5: Error message [Err.] is displayed
6: Measuring range end value
7: Error message [OL] is indicated (= overload)

8.2.4.5 Set standard pressure which the measuring and display values for the flow rate refer to

rEF.P	Select and set desired standard pressure. Setting range: 950...1050 hPa in steps of 1 hPa.

8.2.4.6 Set standard temperature which the measuring and display values for the flow rate refer to

rEF.T	Select and set desired standard temperature. Setting range: 0...25 °C in steps of 1°C.

8.2.4.7 Set low flow cut-off

LFC	Select and set limit value. Setting range: 0.1...0.8 Nm^3/h in steps of 0.1 Nm^3/h.

8.2.5 Service functions

8.2.5.1 Read min / max values for flow

HI **LO** **Set**	or select, press briefly. **HI** = maximum value, **LO** = minimum value Delete memory
HI **LO**	Or select.
Set	Press and hold until **[----]** is displayed.
	Shortly press **Mode / Enter** It is reasonable to delete the memory as soon as the device works under normal operating conditions for the first time.

8.2.5.2 Reset all parameters to factory setting

NOTES

After the reset to factory setting, the value of the memory goes to zero.

rES	Select.
Set	Press and hold until **[----]** is displayed.
	Shortly press **Mode / Enter**. It is reasonable to note the own settings in this table before executing the function.

8.2.6 Impulse setting

ImPS **Impulse setting in 7 setting ranges**

ImPS is only active if **OU1 = ImP** or **OU2 = ImP**

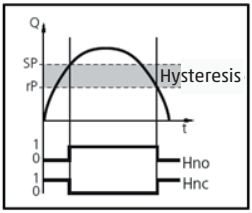
	LED	Display	Step size	Setting range
1	4	0.001 ... 9.999	0,001 Nm³	0,001...9,999 Nm³
2	4	10.00 ... 99.99	0,01 Nm³	10,00...99,99 Nm³
3	4	100.0 ... 999.9	0,1 Nm³	100,0...999,9 Nm³
4	4	1000 ... 9999	1 Nm³	1000...9999 Nm³
5	4 + 6	10.00 ... 99.99	10 Nm³	10 000...99 990 Nm³
6	4 + 6	100.0 ... 999.9	100 Nm³	100 000...999 900 Nm³
7	4 + 6	1000 ... 1000		1 000 000 Nm³

- Set **OU1** to **ImP**
- Press **Mode / Enter** until **ImPS** is displayed.
- Press **Set** and hold.
  > The current numerical value is displayed flashing for 5 s, after that, one of the 4 digits will become active (number is blinking, can be changed).
- Set desired impulse valence:
  - First select the desired setting range (1, 2, 3 ...):
    Hold **Set** key until the setting range has the desired value.
  - Then enter the value from the left (first digit) to the right (fourth digit).
- Shortly press **Mode / Enter** if all 4 digits have been adjusted.

If **Set** is pressed continuously, the display runs through all ranges. After the end value it goes back to the start value. Then release **Set** briefly and restart the setting.

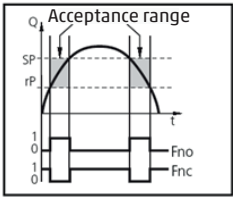
8.2.7 Hysteresis function

The hysteresis keeps the switching condition of the output stable if the throughput varies around the setpoint. If the flow rate increases, the output switches on when the switching point is reached **SPx**. If the flow rate drops again, the output will only switch back when the reset point **rPx** has been reached.
The hysteresis can be adjusted: Firstly, the switching point is defined, then the reset point in the desired distance.



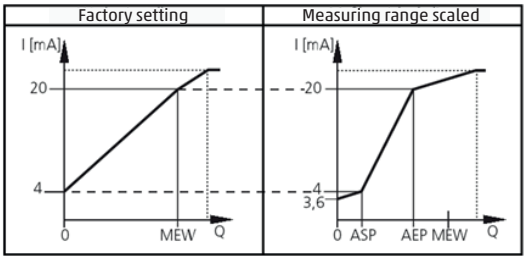
8.2.8 Window function

The window function allows the monitoring of a defined acceptance range. If the flow rate moves between switching point **SPx** and reset point **rPx**, the output is switched through (window function / normally open) or opened (window function / normally closed).
The width of the window is adjustable through the distance from SPx to rPx.
SPx = upper value; **rPx** = lower value.



8.2.9 Scaling of the measuring range

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



MEW = measuring range end value

In the adjusted measuring range, the output signal is between 4...20 mA.

Furthermore, the following signals are issued:

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

9 MAINTENANCE

9.1 Error messages

Display	Description
UL	**Measured value** < -20 % of the measuring range end value (temperature)
OL	**Exceeding of the detection area** (Flow rate > 120 % of the measuring range end value)
SC1	**Flashing:** Short-circuit in output 1*
SC2	**Flashing:** Short-circuit in output 2 *
SC	**Flashing:** Short-circuit in both outputs *
Err	**Flashing:** Error in the sensing element

* The relevant output is deactivated as long as the short-circuit continues.

NOTES

These messages are also displayed with deactivated display.

9.2 Sensor cleaning

A sensor cleaning must be conducted:

- Before every calibration / inspection (minimum once a year)
- Regularly during operation.

The sensor can be removed and cleaned.

9.2.1 Cleaning agent

For sensor cleaning, use tenside-containing (alkaline) agents or water-soluble organic solvents (e.g. ethanol). For cleaning various contaminations, especially greases and oils, isopropanol is recommended.

CAUTION

- The sensor must always be cleaned with the **approved cleaning agents.**
- **Do not use any scrubbing (abrasive) cleaning agents.** These may cause irreparable damage on the sensor.
- **If required, conduct another inspection after completion of the cleaning treatment.**

NOTES

The sensor should be cleaned in an ultrasonic bath within 2 minutes.
As cleaning solution e.g. a solution of 99 % distilled water with 1 % EM 404 from the company EMAG (aluminium and pressure casting cleaner) can be used.
Put the sensor into the mixed solution - the probe must be covered completely.
Switch on the ultrasonic bath for at least 2 minutes.
Afterwards clean the sensor probe with pure, distilled water and let it air-dry.

9.3 Calibration

Due to contaminations (e.g. oil, water, particles), an **annual recalibration of the sensor is recommended**; however, at least every 36 months. This is mandatory for accounting purposes.

calibrationSERVICE und **calibrationSUB**

Safeguard the measuring quality and, with this, the implementation of **ISO 9001 and ISO 50001** through an annual recalibration – as a one-time service or as a cost-efficient subscription and with a free-of-charge immersion sensor, delivered free customer's address – to minimize the downtime.

Further support modules ☞ p. 47

10 TROUBLESHOOTING

10.1 Replacement of defective parts

WARNING

If defects cannot be remedied, the products must be shut down and protected against unintended commissioning. Immediately replace all other damaged parts.
Any damage on the compressed air meter that affects pressure safety, may **only be remedied by authorized personnel**.
After each repair, the technical data of the specifications must be checked by qualified personnel, e.g. pressure test.

For ordering spare parts, please contact our service team, e.g. by telephone under +49 (0) 561. 506 309 -72 or by email to order@postberg.com.

10.2 Replacement of O-ring and sealing ring

- Keep the sealing areas clean from contaminations.
- Remove sticky deposits from time to time.
- In the case of leaks, contact your supplier.

CAUTION

Risk of fluid leakage! The replacement of sealings may only be performed by authorized qualified personnel.

10.3 Returning sensors

If the sensor needs to be repaired, please contact your supplier.
Use the original packaging for the return.

10.4 Disposal

Environmental compatibility was taken into account in the best possible manner for the sensor design. According to the EU Directive 2002/96/EC, the compressed air meter must be disposed off in a **separate collection of electrical and electronic devices** or may be returned to the supplier for disposal. It **must not be disposed of with the unsorted domestic waste. Please observe the local regulations.**

NOTES

NOTES

SUPPORT OPTIONS

installationSERVICE

Installation of new instrument technology in a pressureless system or **without production loss by drilling under pressure**

calibrationSERVICE

Annual **recalibration** of the sensor technology to implement ISO 9001 and ISO 50001

calibrationSUB

Calibration subscription with annual regular recalibration of the sensor technology and a free-of-charge immersion sensor to minimize the downtime

leakageSERVICE

Qualified removal of leakages identified in the **basicCHECK**

projectSERVICE

Professional support in the planning and projecting phase

startSERVICE

Electrical startup with connectivity testing for energy management system

userSERVICE

Introduction of your employees into compressed air controlling and the handling of the purchased products

userSEMINAR

Employee introduction for compressed air efficiency as local inhouse training

controlSERVICE

External compressed air controlling, outsourcing of readout, evaluation and analysis including online permanent preview and coordination workshop

enerGARANT

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Ensure availability.
Increase quality.

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