INTRA-AUTOMATION GmbH

MESS- UND REGELINSTRUMENTE

elektronische Meß- und Regelinstrumente

Itabar-Flow-Sensors for Gases and Liquids

(Fixed Installation)

Series: IBR and IBF

	
IBR Threaded process connection	IBF Flanged process connection

Installation and Operation Manual

09/2016

FLOW

THE EXPERT IN LEVEL AND FLOW

Thanks for choosing an Instrument from Intra-Automation.

Intra-Automation
Installation- and Operation Manual
09/2016

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Itabar-Flow-Sensors for Gases and Liquids
(Fixed Installation)

Series: IBR and IBF

List of Contents:

1. Safety Instructions

In this manual you will find information for your own safety and to prevent any type of damage. The hints are marked with a danger sign described as follows:

DANGER
means, that death, personal injury or high damage to property **will** occur, if there should be taken no precaution.

WARNING
means, that death, personal injury or high damage to property **can** occur, if there should be taken no precaution.

CAUTION
means, that only small personal injuries can occur, if there should be taken no precaution.

CAUTION
means, that damage to property can occur, if there should be taken no precaution.

ATTENTION
highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

NOTE
Is important information about the product itself, the handling of the product or that part of the manual to which special attention is to be drawn to.

Limited liability

We checked the content of the manual in accordance to the hardware. But we can not guarranty that there will be differences between the manual and the hardware. The manual will be checked regularly to correct the manual in the following versions.

2 General Instructions

NOTE

For reasons of clarity the manual does not contain detailed information about all types of products and cannot take into account every conceivable case of installation, operation or maintenance.

If you require further information or should any problems occur which are not sufficiently explained in the manual, you can consult your local Intra-Automation branch to obtain the necessary information.

May we also draw your attention to the fact that the contents of the manual are not part of a previous or existing agreement, approval or legal relationship or an amendment thereof. All obligations of the Intra-Automation GmbH result from the contract of purchase which also contains the full and solely valid warranty agreement. These contractual warranty conditions are neither extended nor restricted by the contents of the manual.

The contents reflect the technical state at the time of going to print. They are subject to technical modifications in the course of further development.

WARNING

Intrinsically safe devices lose their license as soon as they are operated on circuits which do not meet the requirements of the EC test certificate.

The device may be operated with high pressure and corrosive media. Therefore serious injuries and/ or considerable material damage cannot be ruled out in the event of improper handling of the device.

The perfect and safe operation of this equipment is conditional upon proper transport, proper storage, installation and assembly as well as on careful operation and commissioning.

The equipment may only be used for the purposes specified in this instruction manual.

Exclusion of liability

All modifications to the device require the expressed approval of the manufacturer.

Qualified Personnel

Qualified personnel is persons familiar with installation, commissioning and operation of the product and wo have the appropriate qualifications for their activities, such as:

- training or instruction or authorization to operate and maintain devices/ systems according to the standard of safety technology for high pressures and corrosive media.
- training or instruction according to the standards of safety engineering in the care and use of suitable safety equipment.
- training in first aid.

CAUTION

Modules which are sensitive to electrostatic charge may be destroyed by voltages which are far below the human level of perception. These voltages occur already when you touch a component or electrical connections of a module without first discharging yourself electro-statically. The damage incurred by a module as a result of an overvoltage is not usually immediately perceptible but only becomes noticeable after a long time in operation.

Trade mark

Itabar is a trade mark of Intra-Automation GmbH.

3. Measurement principle of Itabar-Flow-Sensors

Once a corpus like our patented flow sensor profile is being brought into parallel flow with the velocity of w, the fluid will partly pond while passing the barrier. The streamline flowing in the middle of the ponding area, the ponding flow line, hits the barrier vertically. The fluid will totally calm down at this very point, called the ponding point. As ponding flows are always laminar – at least until they reach the corpus (Ponding point) – and therefore are always certainly calculable (even if the flow friction is involved), which makes them very usable for measurement procedures. Using the energy equation acc. to Bernoulli, the outcome is:

$$p_{ges} = p_{stat} + \frac{1}{2}\rho w^2$$

With the patented sensor profile of the Itabar-sensor it is possible to measure the total pressure p_{ges} on the front side as well as the static pressure p_{stat} on the backside of the sensor. From the difference the flow velocity can be calculated:

$$w = \sqrt{\frac{2 * p_{dyn}}{\rho}}$$

At known pipe inside diameter the following applies acc. to the continuity equation:

$$V \sim wA$$

From that completed by a proportional coefficient (or correction coefficient “k”) the following equations result:

$$V = k * w * A \text{ or } m = k * \rho * w * A$$

The correction coefficient “k” is only related to the patented Itabar-sensor-profile. The coefficient has been determined by empiric methods for all sensor profiles by Intra-Automation GmbH. (For additional information please download the detailed product catalogue from www.intra-automation.com.)

4. Product description

Congratulations for your choice of an Itabar®-Flow Sensor series IBR (resp. IBF).

When installed properly, the ITABAR®-sensor offers an array of advantages over other measurement systems with respect to it’s accuracy, pressure loss and installation. The following guide is designed to help you with the sensor’s installation and operation.

5. Operating conditions

The Itabar-Flow-Sensor in your hands can be applied to the following operation conditions

	series IBR	**series IBF**
Operational pressure	up to 70 bar @ 70 °C	up to PN400, depending on the mounting flange’s rating
Operational temperature	-50 °C up to +200 °C	up to 400 °C
Nominal pipe sizes:	DN 40 up to DN 1800	DN 40 up to DN 12000

6. Receipt, Transport and Storing

On receipt of the equipment, the outside packing has to be checked for any damage incurred while shipment. If the packing case is damaged, the local carrier should be notified immediately regarding the liability. Remove the envelope containing the packing list. Carefully remove the equipment from the transport box and inspect for damaged or missing parts. Please check the case to be sure that all parts (e.g. accessories) have been unpacked. For transport or storing please only use the original packing case. Conditions for storing:

- Do not pile up the cases at any time!
- For storage, protect the units against heat frost, humidity, dust of chemical vapour/media.
- Storage temperature: 10°C [50 °F] up to 40 °C [104 °F]

The time of storage is unlimited, but pay attention to the agreed guarantee period.

! WARNING !

WARNING

For transport of units with weights higher than 25 kg [55 lbs], only use lifting tools. Please take care of the centre of gravity signed on the packing (without sign if the centre is in the middle of the case). During transport do not enter the area of danger. Wear safety clothes (e.g. shoes) only.

7. Pre-Installation Checks

Before installation, please make sure that all of the following parts are included in the sensor kit:

	series IBR	series IBF
Itabar-Flow-Sensor	☑	☑
Weld socket with cutting ring and pressure nut	☑	
Mounting flange		☑
Gasket for the mounting flange		☑
Bolts & Nuts		☑
Opposite end supports (only for profile types: 21/26/36/66)	☑	☑
Instrument valve assembly (if ordered)	☑	☑

Compare the specification on the TAG-plate with the given specification of your Purchase order. The TAG-plate contains the following details:

fig 1: TAG plate Itabar

- Serial-no.
- Sensor type
- Pipe inside diameter
- TAG-no. (measurement location number) – if provided
- Material of construction
- Measuring range

NOTE

NOTE

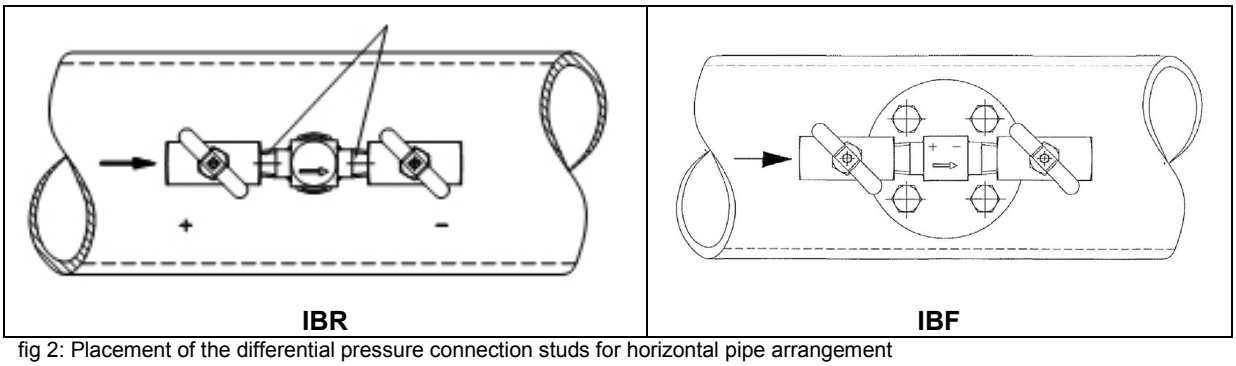
Make sure that the pipe inside diameter indicated on the TAG-plate matches your pipe diameter!

8. General Instructions for Installation

In order to obtain optimal measurement results, follow the instructions concerning the installation of the Itabar-Flow-Sensor as given below.

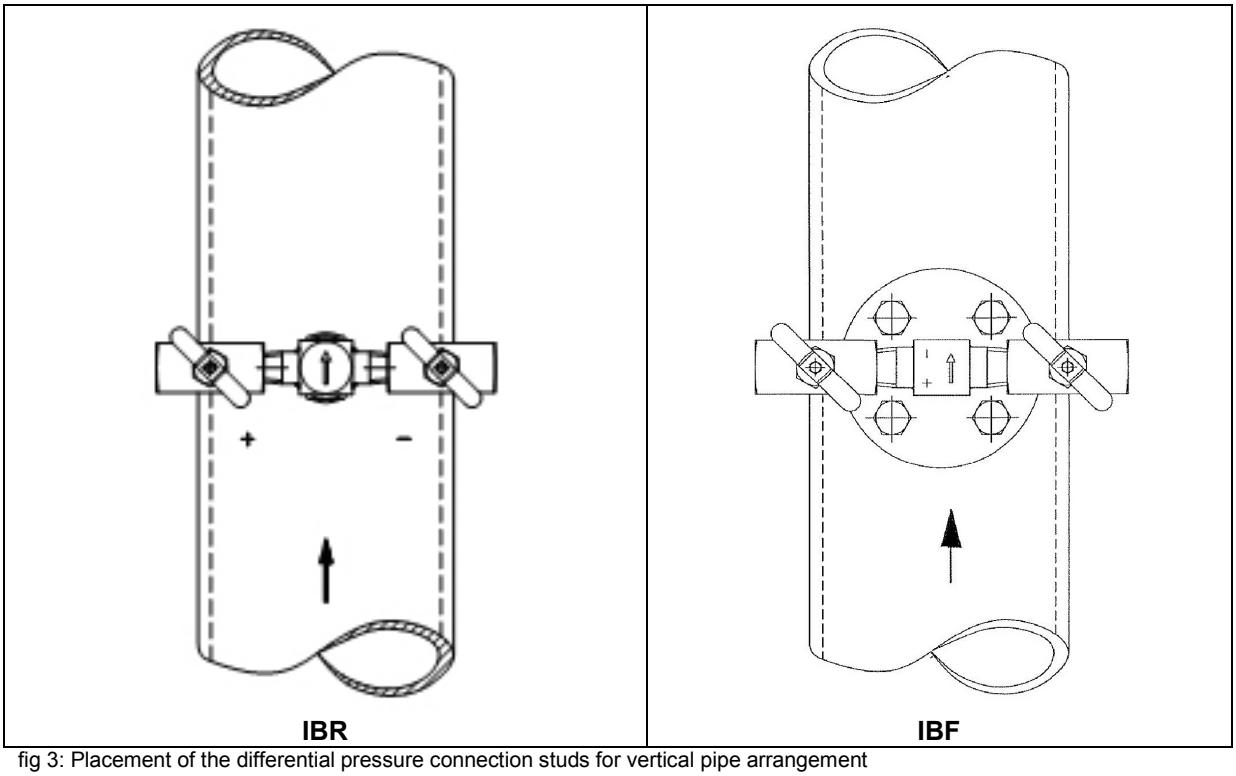
8.1 Specification of the Pipe Arrangement at Place of Installation

For design reasons, the pipe arrangement at the installation has to be known before the sensor is manufactured.
For horizontal pipe arrangements the instrument connections are placed in line with the flow direction (see figure 2).
For vertical pipe arrangements the instrument connections for the measurement of the differential pressure are arranged with an angle of 90° to the flow direction (see figure 3).



IBR IBF

fig 2: Placement of the differential pressure connection studs for horizontal pipe arrangement



IBR IBF

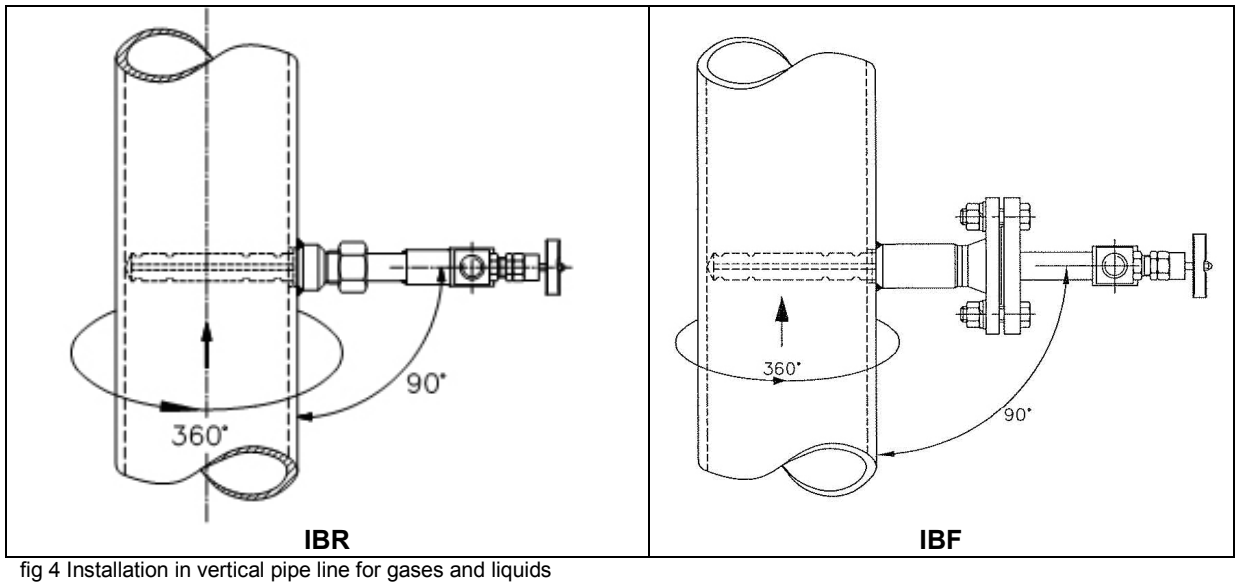
fig 3: Placement of the differential pressure connection studs for vertical pipe arrangement

NOTE

NOTE
In each case, the flow direction is indicated by an arrow on the sensor head.

8.2 Vertical Pipe Arrangement

The Itabar-Sensor for flow measurement of liquids and gases can be installed in vertical pipe runs at any location, however, the instrument connections have to be located in the same horizontal plain (see fig. 4).



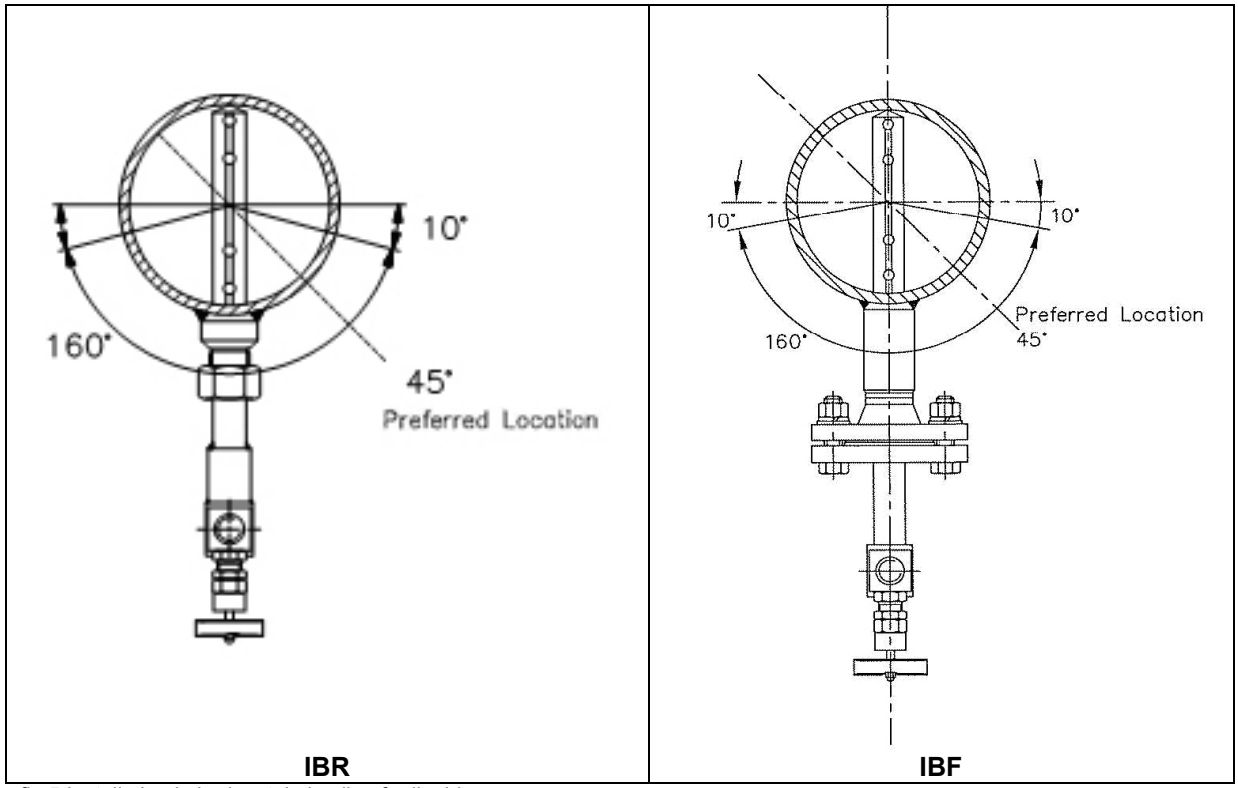
IBR **IBF**

fig 4 Installation in vertical pipe line for gases and liquids

8.3 Horizontal Pipe Arrangement

Liquids:

For flow measurement of liquids, the Itabar-Sensor has to be installed in the lower half of the pipe perimeter; the connections to the instruments have to be located below the pipe axis. This assures gas or air bubbles in the pressure piping will find their way back into the flowing liquid (see fig 5).



IBR **IBF**

fig 5 Installation in horizontal pipe line for liquids

Gases:

For flow measurement of gases, the Itabar-Sensor has to be installed in the upper half of the pipe perimeter; the connections to the instruments have to be located below the pipe axis. This will prevent moisture and condensations from entering the instrument connections and from altering the measurement (see fig 6).

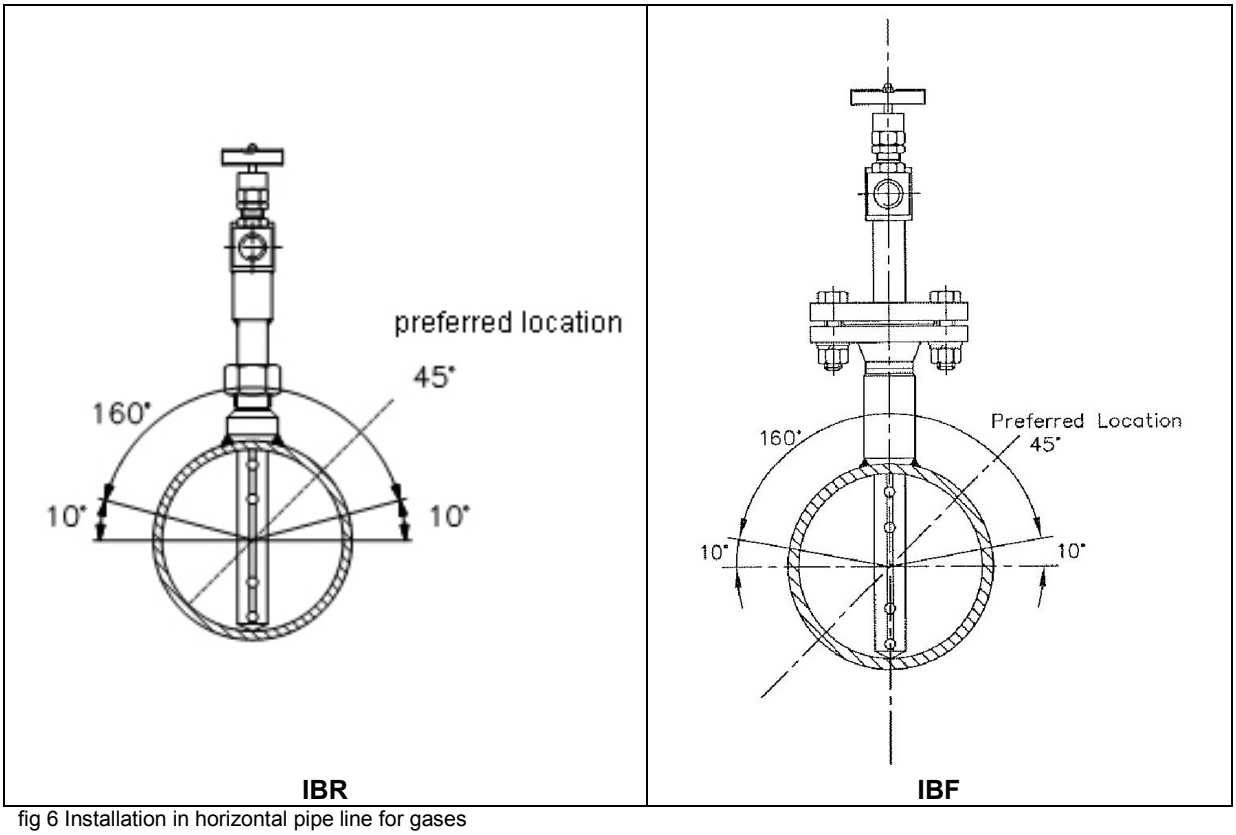


fig 6 Installation in horizontal pipe line for gases

8.4 Misalignment

The Itabar-Sensor operates based on simple physical principles. Its design incorporates no moving parts which are subject to wear. The sensor is not affected by being slightly out of alignment. The influence on the accuracy of the measurement is neglible as long as the limits in the below fig 7 are not exceeded (The pictures show IBR-types, but the values are also valid for IBF.)

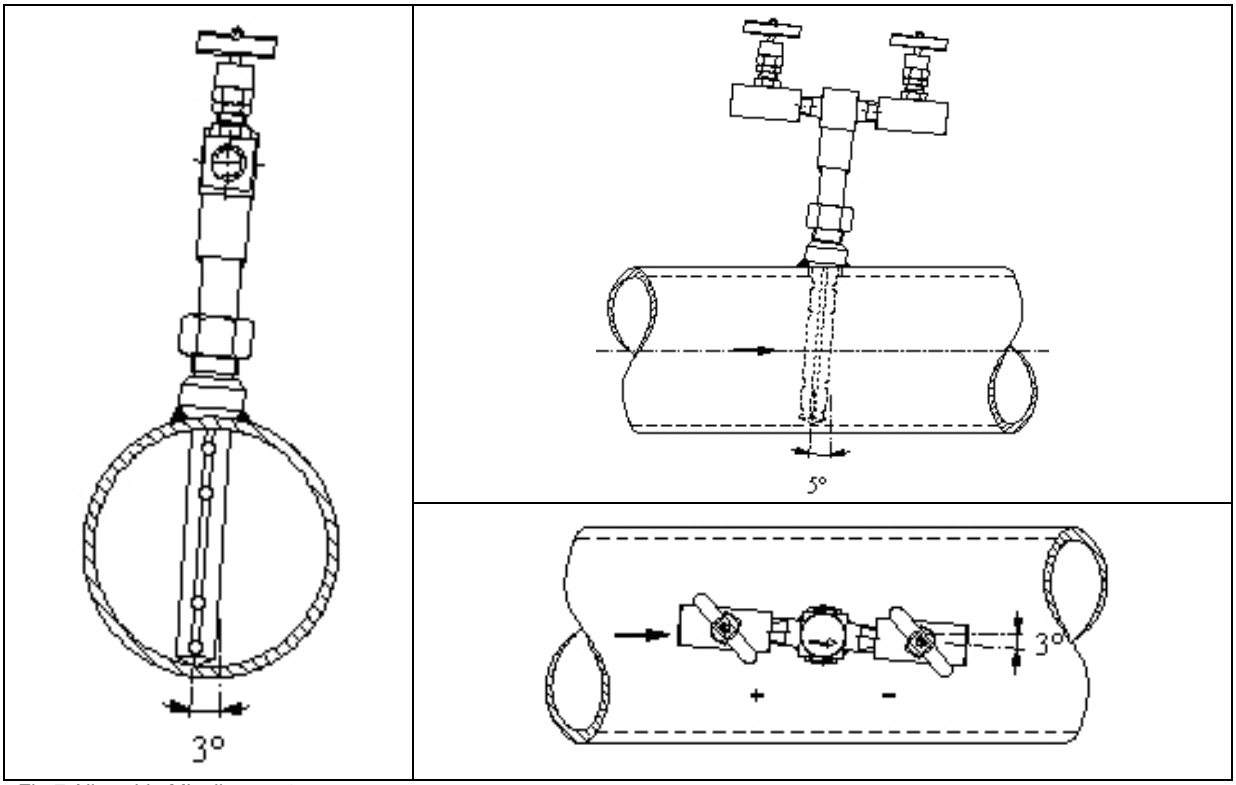


Fig 7 Allowable Misalignments.

8.5 Required undisturbed Pipe Run Lengths (in Multiples of D) to achieve an Accuracy of ± 1 %

The accuracy of the measurements with the Itabar-Sensor depends on the development of a stream profile which should be as undisturbed as possible. Therefore, the selection of the installation location within the pipe run is of considerable importance. The following tried and true hints (see table page 11) regarding the required pipe lengths ahead of and behind the sensor are designed to help you in your selection of the most advantageous location.

NOTE

NOTE

As a general rule, control valves, throttle valves and gate-type valves should be installed behind the sensor.

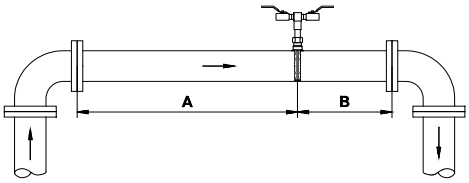
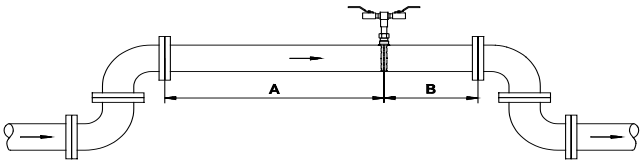
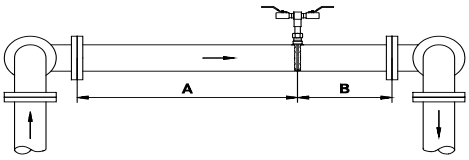
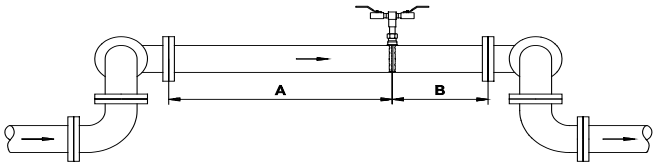
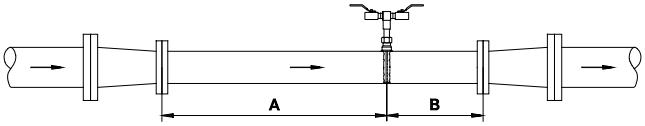
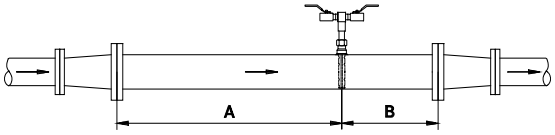
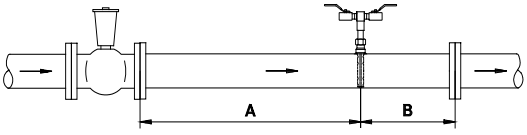
NOTE

NOTE

If the recommended straight pipe lengths are not available, the measuring accuracy can be adjusted to the specific conditions of the measuring section by conducting a comparison measurement.

The measurement guarantees that the differential pressure corresponds to the true flow velocity, thereby assuring the specified accuracy.

For details, please contact us.

D = Pipe diameter	A = Upstream	B= Downstream
	7D	3D
	9D	3D
	17D	4D
	18D	4D
Restriction in the pipe run 	7D	3D
Widening in the pipe run 	7D	3D
Control device 	24D	4D

(The pictures show IBR-types, but the values are also valid for IBF.)

9. Installation of the Itabar-Sensor

WARNING

Please observe the general security notes of this manual! Take good care to always wear adequate safety clothes while installing the sensor!

Table bore diameters (pipe line):

FOR IBF (flanged process connection):

Sensor type:	Mounting stud:	Bore diameter Installation of sensor	Bore diameter opposite end support
...-20	DN25PN16 resp PN 40 or 1“150# resp 300#	18 mm	
	DN25PN100 resp. PN160 or 1“600#	30 mm	
...-21	DN25PN16 resp PN 40 or 1“150# bzw. 300#	18 mm	15 mm
	DN25PN100 resp. PN160 or 1“600#	30 mm	26 mm
...-25	DN32PN16 resp. PN 40	30 mm	
	DN40, DN50, 1 ½“ and 2“	36 mm	
...-26	DN32PN16 resp. PN 40	30 mm	30 mm
	DN40, DN50, 1 ½“ and 2“	36 mm	36 mm
...-35	DN50 resp. 2“	47 mm	
...-36	DN50 resp. 2“	47 mm	44 mm
…-65	For mounting the welding stud, plese measure the inside diameter of the stud and drill this diameter into the pipe line. For mounting the opposite end support (…-66), please act analogical.		
…-66			

FOR IBR (threaded process connection):

Sensor type:		Bore diameter Installation of sensor	Bore diameter opposite end support
...-20		16,5 mm	
…-21			15 mm
…-25		30,5 mm	
…-26			30,5 mm
…-35		42,5 mm	
…-36			44 mm

9.1 Instructions to install IBR (Threaded Process Connection)

9.1.1 Installation of the Itabar-Sensor without end support (IBR-20/25/35)

1. Drill a hole (diameter according to your type of sensor in relation with “Table bore diameters (pipe line)” on page 12 of this manual) into the pipe.
2. Before welding, remove the cutting ring (2) from the weld socket (1) in order to protect it from thermal stresses which are generated by welding process. The pressure nut (3) remains threaded onto the weld socket during installation (compare Fig. 8 (page 13)), to prevent damage of the thread.
3. Tack the weld socket onto the pipe leaving approx. 2mm clearance. Align the socket (e.g. with a bolt or pin) so that it is exactly perpendicular to the pipe axis.
4. Now the final welding can be carried out. Check the alignment of the weld socket again! For permissible deviations, please see chapter 8.4.
5. Now the Itabar-Sensor can be installed into the pipe. Remove the pressure nut (3) form the weld socket (1) and slip it over the sensor tip (4). Slip the cutting ring (2) over the sensor tip also (The smaller half points upwards!). Then insert the sensor tip together with the pressure nut and the cutting ring into the weld socket until the sensor tip touches the opposite pipe wall.
6. Check the seating of the cutting ring and lightly tighten the pressure nut.
7. Align the Itabar-Sensor so that the arrow on the sensor exactly points in the flow direction. Tighten the pressure nut. Check the alignment again! Should the sensor be misaligned, loosen the pressure nut and repeat the last installation step.

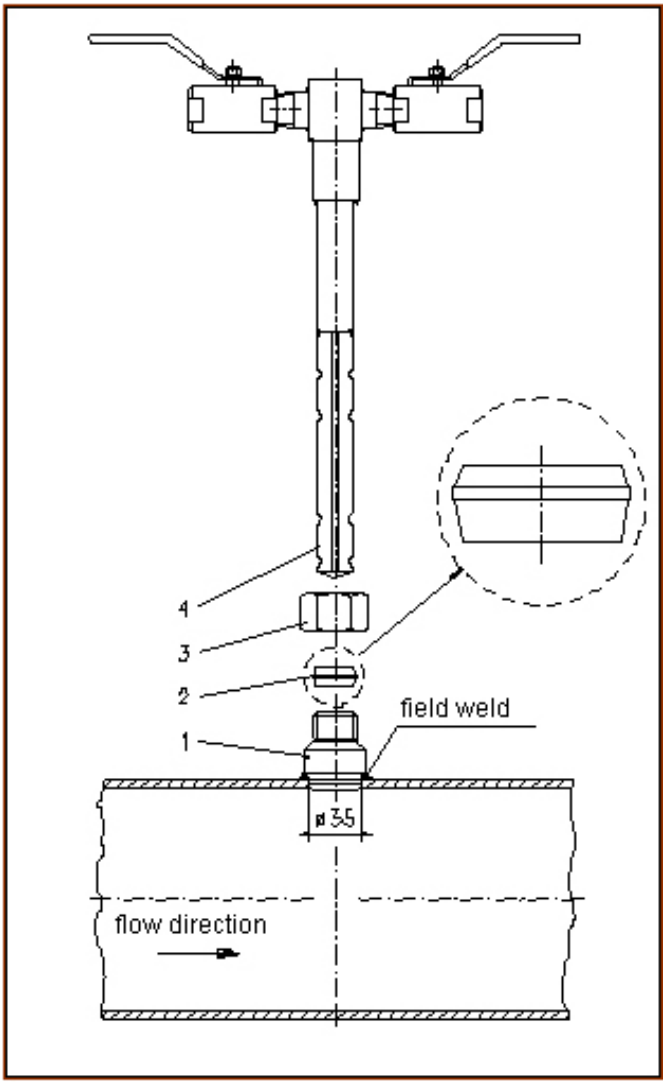


fig 8 Installation of an IBR without end support

9.1.1 Installation of the Itabar-Sensor with end support (IBR-21/26/36)

The design of the Itabar-Sensor types IBR-21/26/36 is almost identical to the types IBR-20/25/35. The only difference is the end support (see fig. 9), which permits higher stream velocities in the pipe. Except for the installation of the sensor end support, the installation steps are identical to those for type Itype IBR-20/25/35.

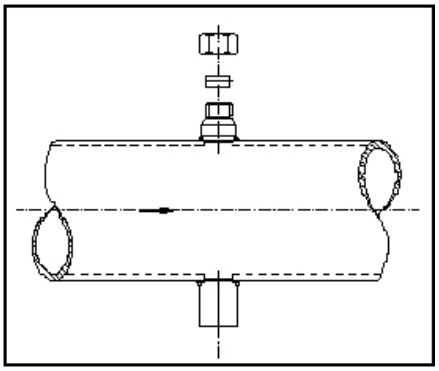


fig 9 mounting parts with end support

Installation of the end support

1. Install the weld socket, cutting ring and pressure nut as already described under chapter 9.1.2, points 1 to 7.
2. Take a cord and tie one end around the existing welding stud. Wrap the other end around toe pipe so that it forms a loop around the pipe. Mark the half-way point of the pipe circumference on the pipe.
3. Now drill a second hole (diameter: see table on page 12 of this manual) into the pipe.
4. Tack the sensor end support onto the pipe leaving approximately 2 mm clearance.
5. Insert the sensor into the pipe and check the alignment of the sensor end support. If necessary, correct the alignment.
6. Now the finish weld can be performed.
7. Perfom the installation of the sensor into the pipe according to the instructions given in chapter 9.1.2, points 5 to 7.

9.2 Instructions to install IBF (Flanged Process Connection)

It is particularly important to make sure that the distance from the gasket surface to the pipe agrees with the H-dimension you gave in your order (Fig. 10).

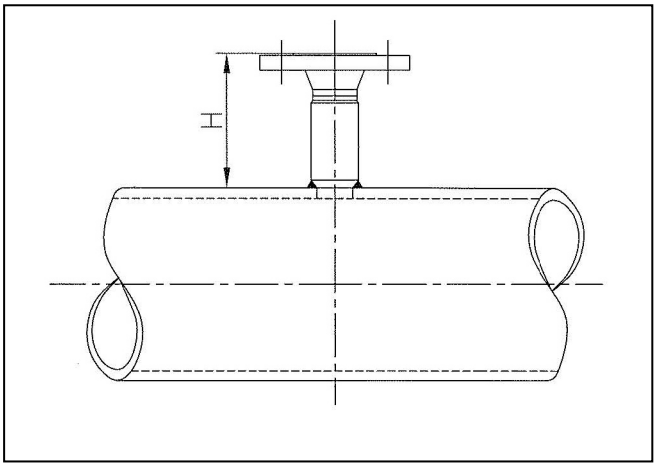


fig 10 H-dimension for IBF

Itabar®-Sensors of the type IBF come with the following standard H-dimensions:

IBF-20	80 mm
IBF-25/26	127 mm
IBF-35/36	150 mm
IBF-65/66	146 mm

(Tolerances: +1,0…-0,5 mm)

9.2.1 Installation of the Itabar-Sensor without end support (IBF-20/25/35/65)

1. Drill a hole into the pipe line (diameter: see table on page 12 of this manual).

2. Tack the mounting stud onto the pipe leaving a clearance of 1-2 mm. The bolt holes of the flange must be at 45° angles to the pipe axis (see Fig. 11).

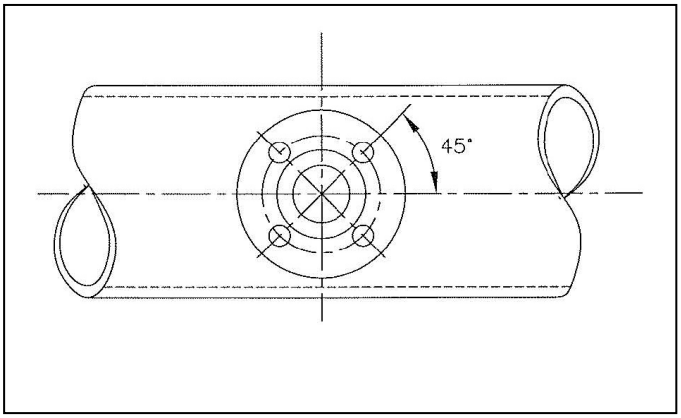


Fig. 11

3. Observe the H-dimension while welding of the mounting stud (see Fig. 9a).

4. Check the alignment of the mounting stud again. Then the finish weld can be done.

5. Now the Itabar®-Sensor can be installed into the pipe. Place the included gasket on the gasket surface of the flange.

DANGER!
From faulty installation, leakages may occur. Only use undamaged gaskets, which are suitable for your application (regarding pressure, temperature, fluid).

Insert the sensor into the welded stud and make sure that the arrow on the sensor head points in the flow direction. Tighten the bolts and nuts.

NOTE
On flanges with eight bolt holes, the welding stud has to be welded in a way that the bolt holes form an angle of 22,5° to the pipe axis (see fig 12).

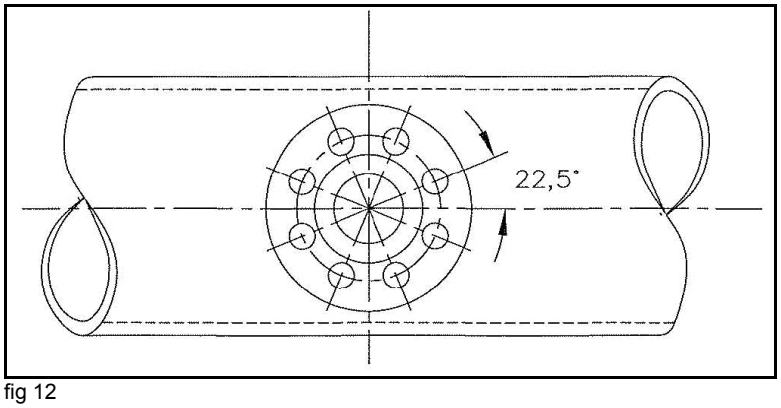


fig 12

9.2.2 Installation of the Itabar-Sensor with end support (IBF-21/26/36/66)

The design of the ITABAR sensor types IBF-21/26/36/66 is almost identical to the types IBF-20/25/35/65. The only difference is the sensor end support which allows higher stream velocities in the pipe.
Except for installation of the sensor end support, the installation steps are identical to those for types IBF-20/25/35/65.

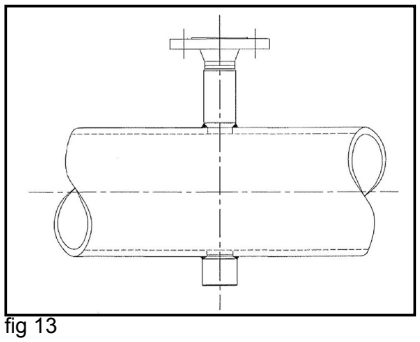


fig 13

Installation of the end support

8. Install the mounting stud as already described under chapter 9.2.1, points 1 to 5.
9. Take a cord and tie one end around the existing welding stud. Wrap the other end around toe pipe so that it forms a loop around the pipe. Mark the half-way point of the pipe circumference on the pipe.
10. Now drill a second hole (diameter: see table on page 12 of this manual) into the pipe.
11. Tack the sensor end support onto the pipe leaving approximately 2 mm clearance.
12. Insert the sensor into the pipe and check the alignment of the sensor end support. If necessary, correct the alignment.
13. Now the finish weld can be performed.
14. Perform the installation of the sensor into the pipe according to the instructions given in chapter 9.2.1.

NOTE
On long sensors, an installation aid can be screwed into the ½" tread of the sensor end (e.g. threaded pipe). This will ease the insertion for the sensor into the opening of the sensor end support and align the sensor.

10. Installation of the Accessories and the Differential Pressure Transmitter

10.1 Accessories

The instrument valves for the differential pressure lines are pre- installed by the manufacturer, if it is part of the order.
When installing multi- directional valve block, make sure that all bolts are tightened uniformly and opposite bolts are tightened in sequence.

DANGER!
From faulty installation, leakages may occur. Only use undamaged gaskets, which are suitable for your application (regarding pressure, temperature, fluid).

10.2 Differential Pressure (Δp) Transmitter

For liquid measurements, the differential pressure transmitter should always be installed below the Itabar-Sensor in order to avoid the occurrence of air bubbles in the instrument connections (see Fig. 14).
When measuring dry gases and air, the differential pressure transmitter should always be installed above the Itabar-sensor in order to avoid measurement degradation due to condensation and presence of solid particles (see Fig. 15).

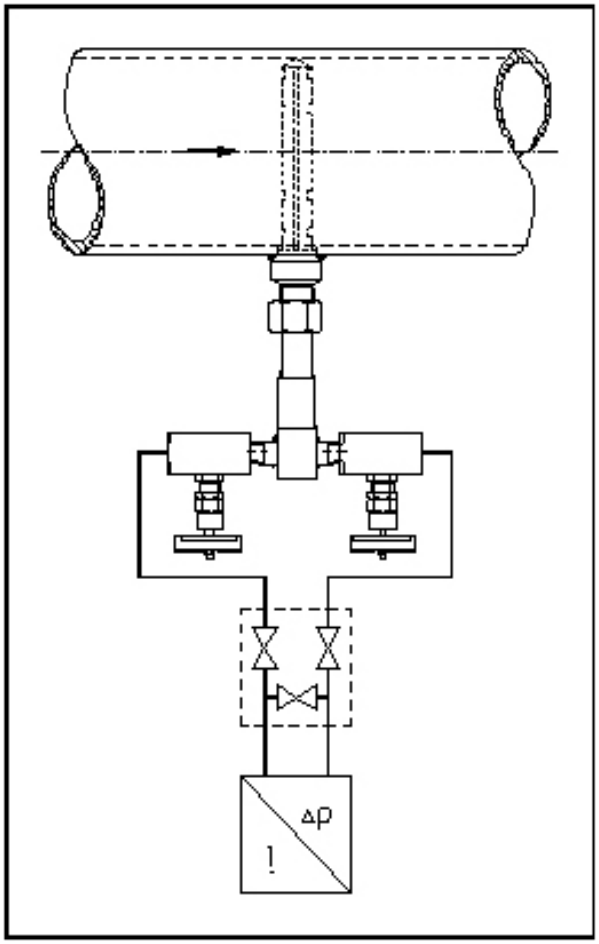


fig 14 Arrangement for liquid flow measurement

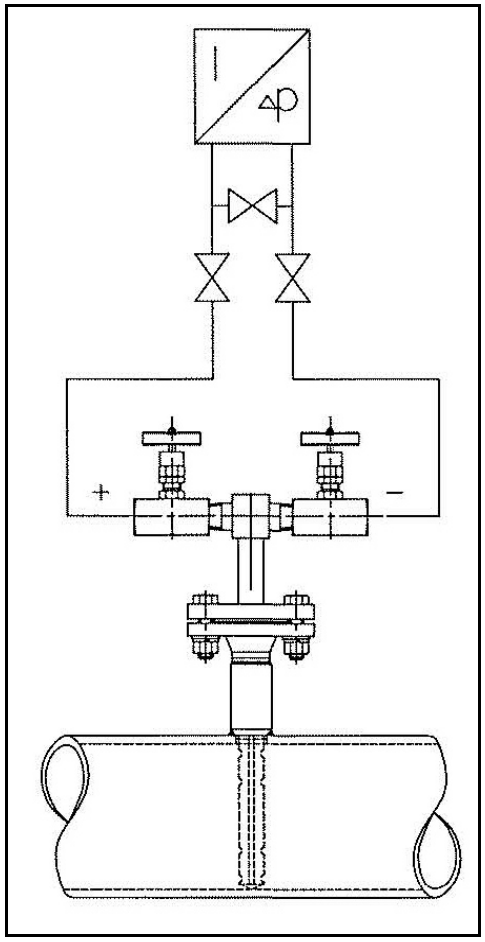


fig 15 Arrangement for dry gas and air flow measurement

10.3 Itabar-Sensor with flange plate

By using the flange plate version, you can mount the differential pressure transmitter directly onto the flow sensor. Using this version, you do not have to install pressure lines and screwed connections. In combination with a multi-directional valve manifold this version is the best solution.

When installing multi-directional valve manifolds, make sure that all bolts are tightened uniformly and opposite bolts are tightened in sequence.

11. Start-Up

Make sure that

- all installation openings are closed (sensor and end support [IBR/IBF-21/26/36/66]),
- all installed parts are securely bolted together
- and all instrument valves are closed.

Now the pipe can be cleared for the appropriate medium.
IBR: Check all connections for tightness, especially the threaded connections around the cutting ring.
IBF: Check all connections for tightness, especially the flanges.
Then open the instrument valves to the Δp-transmitter.

NOTE
When measuring liquids, the differential pressure lines and the transmitter absolutely must be vented. Open the venting screws on the backside of the transmitter and keep them open until all air has escaped from the transmitter and the connection lines.

ATTENTION!
Do not overheat the differential pressure transmitter!

12. Preventive maintenance of the Itabar-Sensors

Itabar-Sensors are insensitive to dirt and soil build-up and therefore nearly maintenance-free.
However, if cleaning is required:

- remove the sensor
- purge completely
- hand-clean with a soft wire brush

13. Trouble-Shooting

If, after the start-up of the Itabar-Sensor, any measuring errors will occur, they may possibly be corrected quite easily:

Error:	***Correction:***
No differential pressure indication	Check whether all instrument valves to the Δp-transmitter are opened. Check the alignment of the sensor with the pipe. The arrow on the sensor must point exactly in the flow direction (downstream).
Only for IBR-series:	
Weld socket leaks	Check whether the cutting ring has been installed correctly (smaller half points upwards!) and whether it was damaged during tightening. If necessary, replace the cutting ring.

NOTE:
With highly corrosive media it is possible (if the sensor material has been specifically selected for such operating conditions) that a connection between the plus and minus sides has been formed. This can only be checked after removal of the sensor from the pipe. Close the holes in the sensor rod and blow through both minus and plus connections of the sensor (e.G. with pressurized air). If air emerges from the opposite connection, the sensor is defective. In this case, please notify the manufacturer.

Besides the products covered by this brochure, Intra-Automation GmbH also manufactures other high-quality and high precision instruments for industrial measurement tasks. For more information, please contact us (contact details on the backside of this brochure).

Flow measurement

Itabar®-Flow Sensor

IntraSonic IS210 Ultrasonic Flow Meter

Level measurement

ITA-mag. Level Gauge

MAGLINK Level Indicator

Other Measurement Tasks:

DigiFlow Flow and Level Computers

IntraCon Digital Controllers

IntraDigit Digital Indicators / Meters

INTRA-AUTOMATION

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