OPTISENS IND 1000 Handbook

Inductive conductivity sensor

The documentation is only complete when used in combination with the relevant documentation for the signal converter.

KROHNE

IMPRINT

1.1 Intended use

CAUTION!
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

INFORMATION!
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The intended use of OPTISENS IND 1000 conductivity sensor is the measurement of conductive liquids. The sensor is suitable for connection to the MAC 100 signal converter.

1.2 Safety instructions from the manufacturer

1.2.1 Copyright and data protection

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1.2.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.2.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.2.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.

1.2.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

DANGER!
This warning refers to the immediate danger when working with electricity.

DANGER!
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

DANGER!
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

DANGER!
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.

WARNING!
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.

CAUTION!
Disregarding these instructions can result in damage to the device or to parts of the operator's plant.

INFORMATION!
These instructions contain important information for the handling of the device.

LEGAL NOTICE!
This note contains information on statutory directives and standards.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➲ RESULT
This symbol refers to all important consequences of the previous actions.

1.3 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

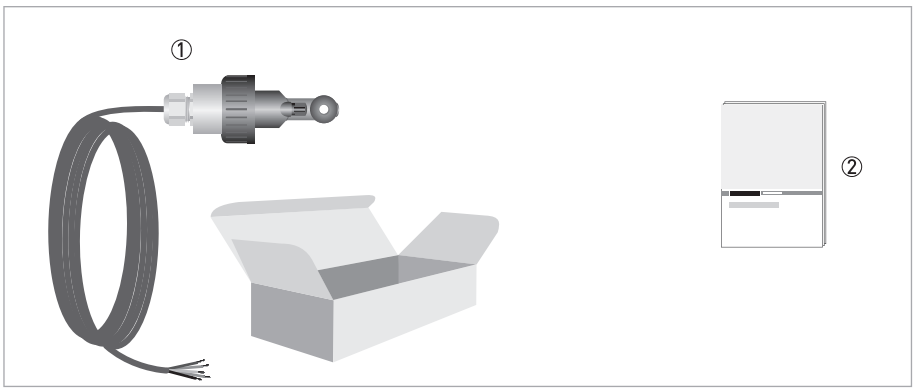

Figure 2-1: Standard scope of delivery

① Ordered sensor with fixed cable 10 m / 33 ft
② Documentation

Optional accessories

- SENSOFIT FLOW 1000 flow-through assembly (T-piece)

2.2 Device description

2.2.1 Sensor types

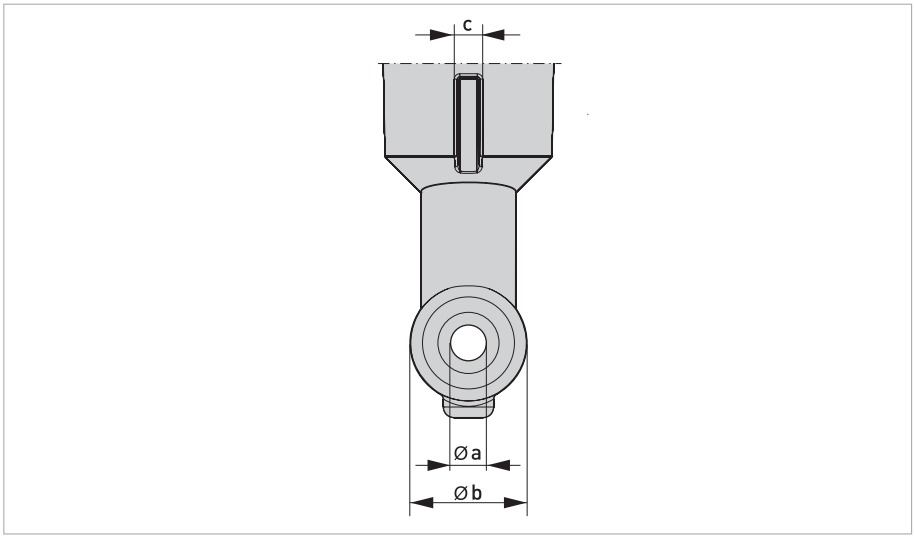

Figure 2-2: Sensor rear view with guide slot

	Dimension [mm]	Dimension [inch]
a	6.7	0.26
b	22	0.87
c	4	0.16

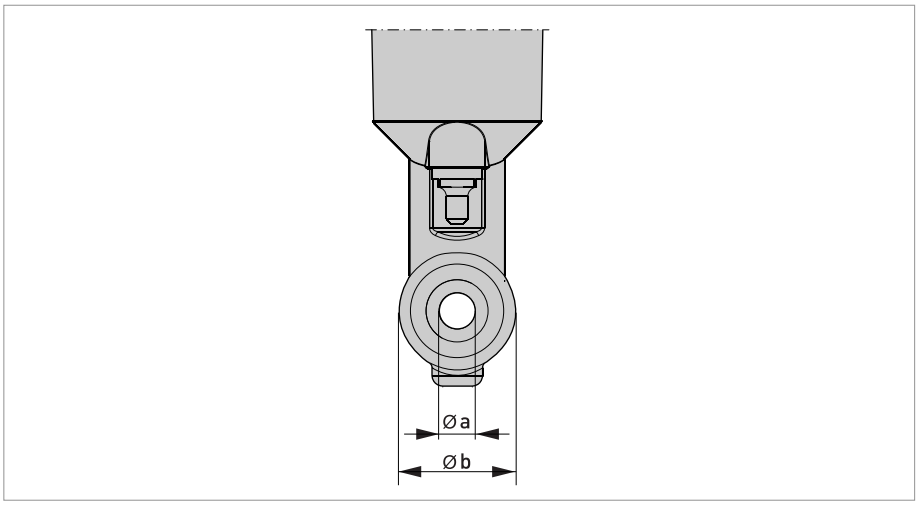

Figure 2-3: Sensor front view with exposed temperature sensor (standard sensor)

	Dimension [mm]	Dimension [inch]
a	6.7	0.26
b	22	0.87

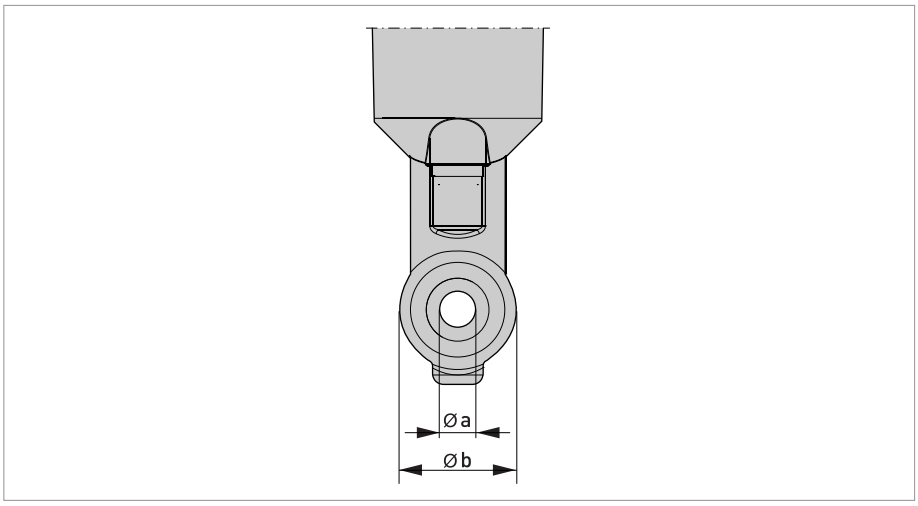

Figure 2-4: Sensor front view with internal temperature sensor

	Dimension [mm]	Dimension [inch]
a	6.7	0.26
b	22	0.87

The OPTISENS IND 1000 sensor features a compact and extremely rugged design as well as a wide measuring range. The meaurement coils are completely enclosed and there is no direct contact of the measurement coils to the medium. This feature makes it corrosion resistant and suitable for measurement mediums with a high dirt load.
The body is either out of PP or PVDF. The sensor features an exposed or internal Pt1000 temperature sensor which reading is used for the temperature compensation of the conductivity. Combined with a signal converter, an extremely reliable and cost-effective measuring systems can be created. Inductive measurement systems are very well suited for conductivity measurements in severely contaminated and aggressive media in all industries.

Thanks to its compact design, the sensor can be installed in pipelines with relatively small diameters. The immersion depth from screw fitting to sensor tip is just 81 mm and such suitable for DN50 pipes. The measurement field requires a minimum of 20 mm free space around the sensor coils to not have an impact onto the cell factor.

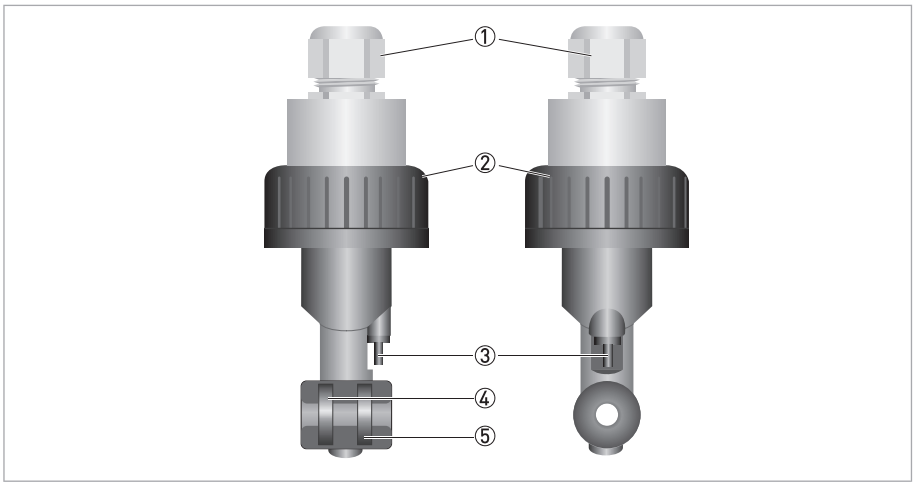

Figure 2-5: Sensor overview

① Cable gland
② Union nut PVC (optional stainless steel)
③ Exposed temperature sensor Pt1000
④ Primary coil
⑤ Secondary coil

2.3 Nameplate

Figure 2-6: Example of a nameplate

① Device name
② Manufacturer
③ Matrix code of the serial number
④ Cell factor
⑤ Serial number
⑥ Articel number
⑦ Order code

3.1 General notes on installation

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Storage and Transport

- Store the conductivity measuring system in its original packaging in a dry and dust-free location. Keep it away from dirt.
- The original packaging serves the protection of the equipment. Therefore always use it for transport or return to the manufacturer.

3.3 Installation procedure

Most new inductive sensors get installed not needing a further calibration and adjustment of the cell factor. However, it is good practice to calibrate a sensor at time of installation into its final measuring location. The cell factor might vary ±15%. Follow the installation order:

1. Unpack the sensor.
2. Connect the sensor to the signal converter.
3. Program the cell factor of the inductive sensor used (PP version c=6.25, PVDF version c=4.65)
4. Adjust the cell factor against a known value after the following step or calibrate the sensor in a standard solution (e.g. 25 mS/cm). Make sure the coils are minimum 20 mm away from any surface and fully immersed in the solution.
5. Install the sensor into its final measuring location.

The required steps are explained in the following sections.

3.4 Pre-installation requirements

CAUTION!

- *Unpack the sensor carefully!*
- *Make sure that the sensor is clean.*

INFORMATION!

- *Nothing shall block the measurement hole within the sensor.*
- *Consider a large enough distance from metal or plastic pipe walls!*

The sensor can be installed into the SENSOFIT FLOW 1000 assembly which is available in DN32, DN40 and DN50.

If installed into small diameter pipes like DN32 and DN40 the minimal free diameter of 20 mm around the sensor coils can not be kept. In these cases the cell factor has to be adjusted. The best method is to do an inline calibration against a reference measurement. In case this is not possible try to achive similar dimensions and materials in a calibration beaker. In case both is not possible you can adjust the cell factor by multiplying it by a factor. Every sensor coil is different or might vary in its characteristics. A multiplier can only be given as an approximate indication. Within a SENSOFIT FLOW 1000 with DN32 you do have ~8mm and with DN 40 ~14mm free space around the sensor available, both being less then 20mm. Mentioned multipliers are approximates only. Therefore the recommendation is to install in a pipe equal or bigger then DN50.

Multipliers for cell factor correction depending on pipe dimensions

SENSOFIT FLOW 1000	Free space around the sensor coil	Approximate multiplier for cell factor correction
DN32	~8 mm	~1.09 (non conductive pipe) ~0.97 (conductive pipe).
DN40	~14 mm	~1.05 (non conductive pipe) ~0.98 (conductive pipe).
DN50	~21 mm	~1.00

3.5 Safety instructions

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

DANGER!
All work on the electrical connections may only be carried out with the power disconnected.

DANGER!
Observe the national regulations for electrical installations!

WARNING!
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order.

3.5.1 Connecting the sensor cable to the signal converter MAC 100

DANGER!
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

When ordering the single channel version, only the interface "Pos.A" is populated. In the version with dual channels the interfaces "Pos.A" and "Pos.B" are populated.

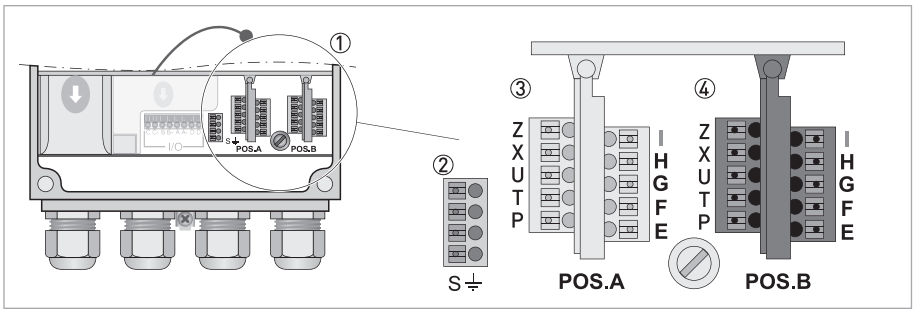

Figure 3-1: Terminal compartment overview

① Sensor connection terminals
② Terminal block S (protective earth)
③ Terminal block A : terminal for sensor

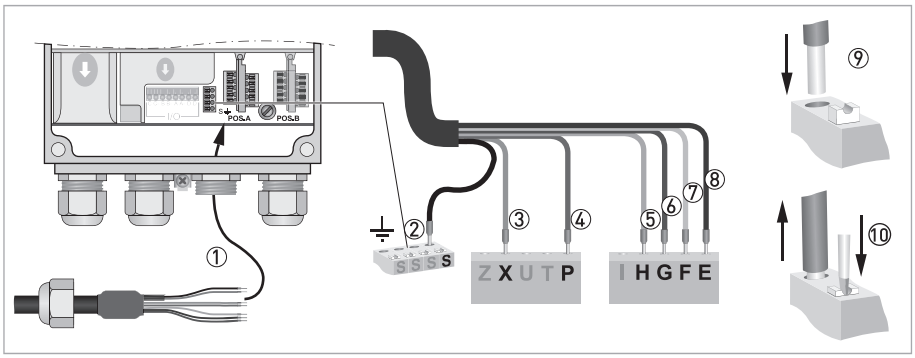

Figure 3-2: Connection of the sensor cable

The following instructions describe the connection of the sensor cable

Connecting the sensor cable to the signal converter

- Thread the sensor cable through the middle right cable gland (1).
- Push the wire (9) into the terminal block Pos A as described in the chart.
- To remove a cable, press down the white clip (10) on the corresponding terminal and pull the cable out.

Wire	Terminal block A or B
Shield (2)	S
Yellow - Pt1000 (3)	X
Green - Pt1000 (4)	P
Shield from pink (5)	H
Pink (6)	G
White (7)	F
Brown (8)	E

3.6 Calibrating the sensor

It is good practice to calibrate an inductive sensor before installation. For further information refer to *Calibrating measurement* on page 26. Then continue with the installation procedure.

3.7 Installing the sensor

3.7.1 General installation instructions

WARNING!
Ensure that the pipe is without pressure before installing or removing a sensor!

INFORMATION!
Be sure that the tube is completely filled with water, otherwise the measuring reading is wrong.

INFORMATION!
During installation you should fix a shut-off valve in front of and behind the instrument so that the sensor can be taken out of the bypass in case of check.

INFORMATION!
To achieve reliable measuring results, note the following items:

- *Always install the sensor in the designated flow through assembly or ensure that the pipe diameter is large enough.*
- *The sensor must always have full contact with the measuring medium.*

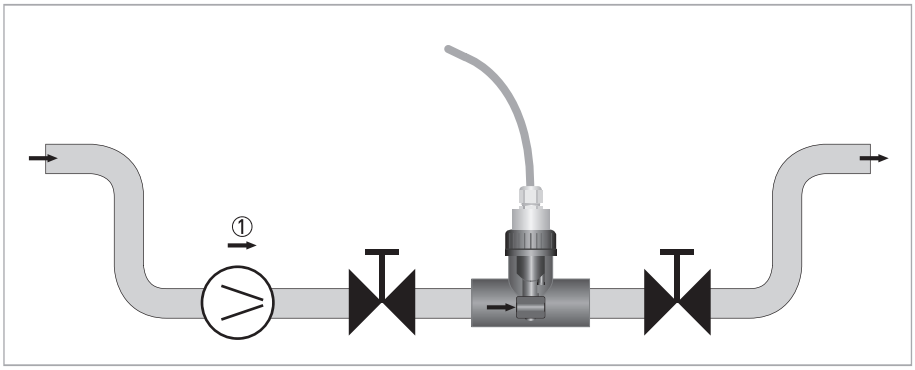

Figure 3-3: Installation requirements

① Flow direction

3.7.2 Mounting to a flow through assembly

WARNING!
Ensure that the pipe is without pressure before installing or removing a sensor!

INFORMATION!
The flow through assembly is an optional accessory and not part of the standard scope of delivery. It has to be installed vertically to the flow direction.

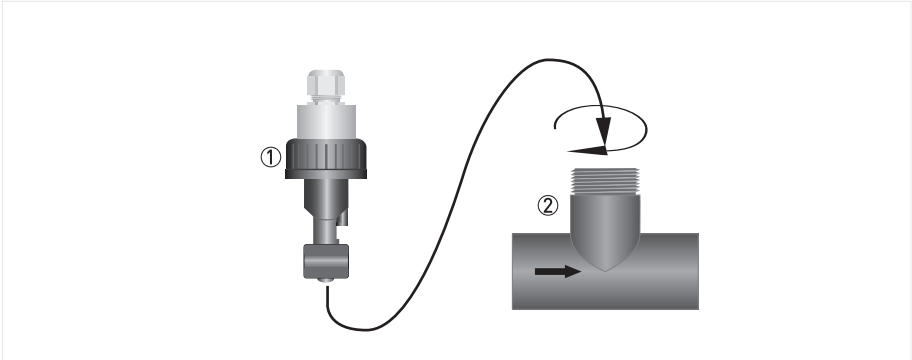

Figure 3-4: Mounting to a flow-through assembly

① Sensor
② Flow-through assembly (T-piece)

- Screw the sensor ① into the flow through assembly ② and tighten the sensor by hand.

3.7.3 Mounting sensor with immersion assembly

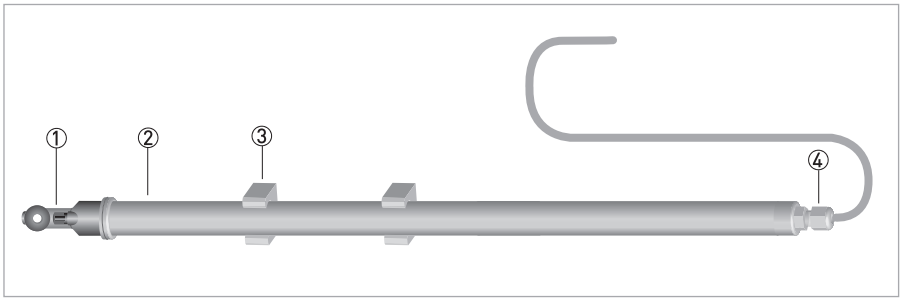

Figure 3-5: Sensor in immersion version

① Sensor with attached cable
② Immersion assembly
③ Clamps onto immersion assembly
④ Cap with cable gland

The Sensor is also available as immersion version with 1000 or 2000 mm length. The sensor is already installed and sealed inside the assembly. The assembly is equipped with retaining clamps.

3.8 Examples of a typical measuring point

The following examples each show the signal converter, a sensor with integrated temperature sensor, and the flow-through or immersion assembly.

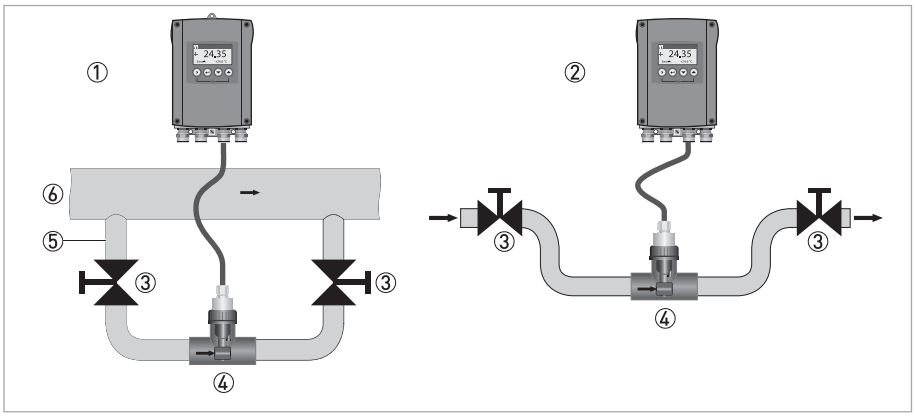

Figure 3-6: Bypass installation with signal converter

① Bypass measurement
② Outlet measurement
③ Shut-off valve
④ Flow-through assembly (T-piece) with sensor
⑤ Bypass pipe
⑥ Main pipe

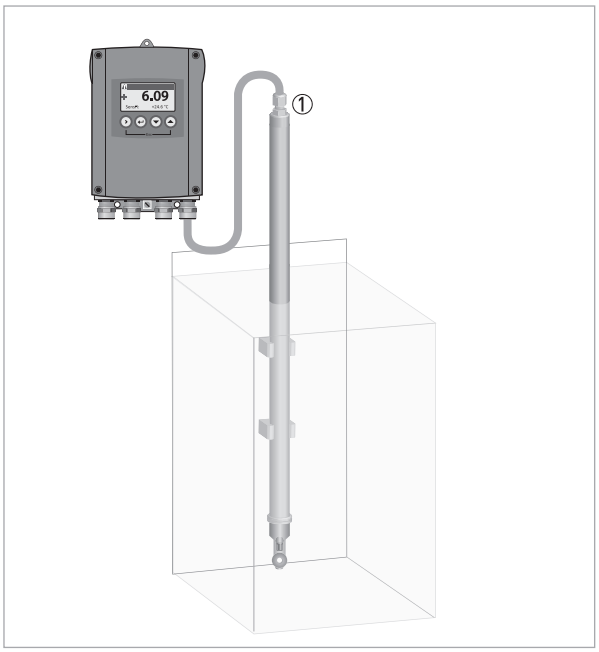

Figure 3-7: Installation with signal converter

① Single channel version

4.1 Menu mode structure

INFORMATION!
The following table just presents an overview. When programming the device, always consult the function tables additionally as they contain further information!
Only the sensor relevant menus are shown in the following tables. For detailed information about the general setting refer to the MAC 100 signal converter manual.

Measurnig mode	Main menu		Submenu		Parameter	
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ↵	**A quick setup**	> ↵	A6 analog outputs	A6.1 measurement	> ↵ For further informatio n see function tables.
					A6.2 spec. conductivity	
					A6.3 range	
					A6.4 time constant	
		B test		B1 sim. process input A	B1.1 temperature	
					B1.2 spec. conductivity	
					B1.3 spec. resistance	
				B4 actual values	B4.2 process input A	
					B4.2.1 temperature	
					B4.2.2 spec. conductivity	
					B4.2.3 Meg. Ohm	
					B4.2.5 pH	
					B4.2.8 generator volt.	
					B4.2.9 CPU temp.	
					B4.2.10 range	
					B4.2.11 electrode volt.	
				B6 information	B6.2 process input A	
		C setup		C1 process input A	C1.1 parameter	
					C1.2 cell constant	
					C1.14 time constant	
					C1.15 temperature	
					C1.23 cell calibration	
		↓↑		↓↑		↓↑

4.2 Function tables

To enter the menu from the measurement display point press > for more than 2.5 seconds, then release the button. You are in the main menu level. Press up and down until the relevant menu point is highlighted. Enter the menu point by pressing >

4.2.1 Menu A, quick setup

INFORMATION!
Note that the appearance of some sub-menus depends on the hardware setting and the used sensor(s). Also only the sensor relevant menus and submenus are shown here in detail. For all other menu functions refer to the MAC 100 signal converter manual.

A 6.1 measurement:

Value used for driving the current output C. Choose between:

- spec. conductivity
- temperature
- concentration % (function is choosable, but not implemented)

A 6.2 spec. conductivity

Unit for the current output range. Choose between:

- µS/cm
- mS/cm
- free unit

4.2.2 Menu B, test

INFORMATION!
Note that the appearance of some sub-menus depends on the hardware setting and the used sensor(s). Also only the sensor relevant menus and sub-menus are shown here in detail. For all other menu functions refer to the MAC 100 signal converter manual.

The procedure to start the simulation process is the same for all functions:

- Choose the function with the help of ↓ or ↑ and press ↵.

➲ You see the two options "set value" (opens the editor to enter the simulation value) and "break" (exits the menu without simulation).

- Choose the desired option with the help of ↑ or ↓ and press ↵.

➲ If you chose "set value", the device asks "start simulation" and offers the options "no" (exits the menu without simulation) or "yes" (starts the simulation finally).

- Choose the desired option with the help of ↑ or ↓ and press ↵.

➲ If you chose "yes", the simulation starts.

B1,sim.process inp.A
B2,sim.process inp.B

Level	Designation / function	Settings / descriptions
B1.1	temperature	In this menu the temperature can be simulated.
B1.2	spec. conductivitiy	In this menu the conductivity can be simulated.
B1.3	spec. resistance	In this menu the resistance can be simulated.

B4, actual values

Level	Designation / function	Settings / descriptions
This menu groups several functions which allow to display the corresponding actual reading. The shown measurements are depending on the device configuration.		
B4.2	process input A	In this menu the measurements from process input A can be read.
B4.3	process input B	In this menu the measurements from process input B can be read.
		For 2 channel version only.

B6, information

Level	Designation / function	Settings / descriptions
This menu groups several other menus which contain device specific information. The build-up of the display is the same for all menus:		
B6.1	C number	Identifies the types of electronics, is also located on the converter nameplate.
B6.2	process input A	Gives information about the electronical part of process input A.
B6.3	process input B	Gives information about the electronical part of process input B.
		For 2 channel version only.
B6.4	SW.REV.MS	Gives information about the main software of the electronics.
B6.5	SW.REV.VIS	Gives information about the user interface of the device.
B6.6	Electronic Revision ER	Reference identification number, electronic revision and production date of the device; includes all hardware and software changes.

4.2.3 Menu C, setup

INFORMATION!
The signal converter MAC 100 has a dual process input, A and B. Each process input has an own submenu in this main menu. Process input A is always present, i.e. there is always a board in the interface "Pos.A" in the connection area. The interface of process input B only has a board with the dual channel signal converter. Be aware that the definition which kind of measurement a process input can do is defined when ordering the device. The configuration cannot be changed later.

INFORMATION!
Note that the appearance of some submenus depends on the hardware setting and the used sensor(s).

C1, process input A
C2, process input B

Level	Designation / function	Settings / descriptions
Process input A and B can be either a sensor 1 or a sensor 2. Further information about the type of sensor 1 or 2 please refer to the signal converter manual "Sensor input combinations". Process input A is always present, process Input B can be present. Note: The exchange of a sensors 1 with a sensor 2, or vice versa, can only be done by the manufacturer! Depending on the sensor which is connected to a slot A or B the menu changes.		
C1.1	parameter (cond. ind.)	This menu item is for selecting the probe which is connected to process input A/B. The entries of this selection depends on the chosen device configuration. The device configuration is customer specific and set during production.
C1.2	cell constant	Enter cell constant.
C1.14	time constant	Enter time constant.
C1.15	temperature	Menu for temperature measurement. Available for sensor 1 and sensor 2.
C1.15.1	probe	Options: • manual: used if no internal or external temperature sensor is connected to the signal converter • Pt1000: used if an external Pt1000 temperature sensor is connected to the signal converter
C1.15.2	manual	Only available if C1.15.1 is set to "manual".
C1.15.3	correction	Offset correction for temperature measurement. Not available if C1.15.1 is set to "manual". If you have chosen “Pt 1000” enter the temperature correction.
C1.15.4	limitation	Measuring ranges for temperature measurement.
C1.15.5	temp. comp.	Menu for activating the temperature compensation parameters for the measurement.
		Options: • Linear: linear temperature compensation. • Off: temperature compensation is disabled.
C1.15.6	temp. coefficient	If you have chosen “linear” enter the temperature coefficient.
C1.15.7	ref. temperature	If you have chosen “linear” enter the reference temperature.
C1.23	cell calibration	For detailed information refer to Calibration refer to *Calibrating measurement* on page 26
C1.23.1	temp. comp.	Menu for temperature measurement.
		Options: • off: temperature measurement is disabled. • manual: temperature value has to be entered manually. • automatic: temperature measurement is performed as configured
C1.23.2	temperature	Menu for setup of manual temperature (manual temperature measurement).
C1.23.3	temp. coefficient	Menu for setup of temperature coefficient (manual temperature measurement).
C1.23.4	spec. conductivity	Enter the conductivity of the calibration fluid.
		Menu for preparation of measurement: • Put probe into calibration fluid • Wait until measurement is stable. • Press enter to proceed. Wait until concentration is measured.
C1.23.5	cell constant	Enter cell constant.
		Check slope, press enter, decide whether to store or to discard calibration parameter.

CAUTION!
If you choose for measurement the temperature compensation "linear" than choose between "automatic" or "manual" for the temperature compensation during calibration. If you choose for measurement the temperature compensation "off" than choose also "off" for the temperature compensation during calibration.

4.3 Calibration

4.3.1 Temperature compensation

There are three basic options for temperature compensation within the submenu probe in the cell calibration menu:

- **automatic:** the signal converter will automatically compensate temperature influences using the information of a Pt1000 temperature sensor.
- **manual:** the signal converter will compensate temperature influences using a manually entered value; this option only makes sense if the temperature of the measured medium is quite constant.
- **off:** temperature compensation is disabled.

INFORMATION!
If you choose no compensation, the measured conductivity will most likely deviate from the actual conductivity. The reason is that the conductivity of a specific medium varies depending on the temperature of the medium.

The menu for temperature within the menu process input (A or B) offers the following options:

- **Pt1000**: choose this option if there is an external Pt1000 temperature sensor connected to the signal converter.
- **manual**: choose this option if there is no internal or external temperature sensor connected to the signal converter.

After starting-up the signal converter, the measuring screen appears. This is the standard screen which is displayed automatically in the normal operating mode. If you are in this mode and you want to choose the temperature compensation, you have to perform the following step:

Step 1: choosing the temperature compensation for the measurement

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press ▼ or ▲ until the main menu **setup** is highlighted.

MAIN MENU

A quick setup
B test
> C setup
D service

- Press **>** to enter the chosen menu.

You are on the first submenu level. In the upper line of the display "setup" and "c1" appears, beneath the submenu **process input A** is highlighted.

- Press ▼ or ▲ to select **process input A**.
- Press **>** to enter the chosen menu.

You are on the second submenu level. In the upper line of the display "process input A" and "c1.1"appears beneath the submenu **parameter** is highlighted.

- Press ▼ or ▲to select **temperature**
- Press **>** to enter the chosen menu.

You are on the third submenu level. In the upper line of the display "temperature" and "C1.15.1" appears, beneath the submenu **probe** is highlighted

- Press ▼ or ▲to select **temp. comp.**
- Press **>** to enter the chosen menu.

- Now you can set up the temperature compensation. Press ▼ or ▲to select **off** or **linear**. Press ↵ to confirm the entered value.

4.3.2 Calibrating the temperature measurement

This section is only required if the measured temperature is not correct.

The temperature is commonly measured with the integrated temperature probe and therefore step 2a does apply in most cases. In rare cases of a process being very stable in temperature manual compensation is used and step 2b applies.

Step 2: correcting the temperature measurement

Step 2a: **probe Pt1000**

Read the currently measured temperature of the Pt1000 temperature sensor from the measurement screen and write it down.
Measure the temperature with a reference thermometer and check if it deviates from the temperature measured by the Pt1000.

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **setup** is highlighted.
- Press ▼ or ▲ until the main menu **setup** is highlighted.

MAIN MENU

A quick setup
B test
> C setup
D service

- Press **>** to enter the chosen menu.

You are on the first submenu level. In the upper line of the display "setup" and "c1" appears, beneath the submenu **process input A** is highlighted. Choose process input A or B where ever pH is configurated.

- Press ▼ or ▲ to select **process input A**.
- Press **>** to enter the chosen menu .

You are on the second submenu level. Press ▼ or ▲ until the submenu **temperature** is highlighted.

- Press **>** to enter the chosen menu.

You are on the third submenu level. Press ▲ or ▼ until the submenu **correction** is highlighted.

- Press **>** to enter the chosen menu.
- Press ▼ or ▲ and ▶ to change the reading.
- Press ↵ to confirm the value

- If necessary, enter the temperature correction in Kelvin so that the signal converter shows the same temperature as the reference thermometer. Press ↵ to confirm the entered value. The temperature sensor has been adjusted.

Step 2b: **probe manual**
Measure the temperature of the measuring medium. • Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **setup** is highlighted. • Press ▼ or ▲ until the main menu **setup** is highlighted.

MAIN MENU
A quick setup B test **> C setup** D service
• Press **>** to enter the chosen menu.

You are on the first submenu level. In the upper line of the display "setup" and "c1" appears, beneath the submenu **process input A** is highlighted.
• Press ▼ or ▲ to select **process input A**.
• Press **>** to enter the chosen menu **process input A**.

You are on the second submenu level. Press ▲ or ▼ until the submenu **temperature** is highlighted.
• Press **>** to enter the chosen menu. The submenu **probe** is highlighted.

• Press ▼ or ▲ until the submenu **manual** is highlighted. • Press ↵ to enter the chosen menu

- Enter the measured temperature. Press ↵ to confirm the entered value. The manually measured temperature will now be used for temperature compensation.

4.3.3 Calibrating measurement

Verification and in case of need calibration is necessary in regular intervals or good practice when installing a new sensor. A sensor should be recalibrated if the verification within a standard solution shows a too high difference in actual reading.

When calibrating a conductivity measurement, keep in mind that the measuring system as a whole is calibrated, and not only the electrode.

To avoid alarms on the distrubted control system (DLC) when temporarily removing the sensor (i.e. for maintenance), the converter has a hold function. This function "freezes" all outputs (i.e. the display and the current outputs) of the last measured value.

INFORMATION!
As an indication that the manual hold function is active, the "warning sign" in the upper left corner of the display appears. Meanwhile the status messages show "checks in progress". For more details about how to select the manual hold function refer to the signal converter manual.

After starting-up the signal converter, the measuring screen appears. This is the standard screen which is displayed automatically in the normal operating mode. If you are in this mode and you want to initiate a calibration, you have to activate the manual hold function in the first step.

Step 1: activating the manual hold function

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press ▼ or ▲ until the main menu **quick setup** is highlighted.

	MAIN MENU		
	> A quick setup B test C setup D service		
	• Press **>** to enter the chosen menu.		
		You are on the first submenu level. In the upper line of the display "quick setup" and A1" appears, beneath the submenu **language** is highlighted.	
		• Press ▼ or ▲ until the submenu **manual hold** is highlighted. • Press **>** to enter the chosen menu.	
			You are on the second submenu level. In the upper line of the display "manual hold" appears, beneath the option **off** is highlighted
			• Press ▼ or ▲ to choose the option on
			• Press ↵ to confirm the entered value.

- You have activated the manual hold function. To go to the next step and prepare the calibration procedure. You have to return to the measuring mode.
- Press ↵ until you reach the measuring mode again

Step 2: preparing the calibration procedure

- If you re-calibrate an existing sensor, remove the sensor from its respective assembly (for further information refer to *Mounting to a flow through assembly* on page 17 or refer to *Calibrating measurement* on page 26).
- If you calibrate a sensor, make sure that the sensor is correctly connected to the converter.
- Check the sensor for damages or dirt deposits.
- During the calibration procedure, you will have to dip the sensor into a standard solution. Provide a suitable vessel.

After activating the manual hold function and the preparative measures, you can get access to the calibration procedure from the measuring mode via the main menu **setup** (step 3).

Step 3: accessing the calibration menu via the main menu **setup**

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press ▼ or ▲ until the main menu **setup** is highlighted.

	MAIN MENU		
	A quick setup B test **> C setup** D service		
	• Press **>** to enter the chosen menu.		
		You are on the first submenu level. In the upper line of the display "setup" and "c1" appears, beneath the submenu **process input A** is highlighted.	
		• Press ▼ or ▲ to select **process input A** is highlighted.	
		• Press **>** to enter the chosen menu.	
			You are on the second submenu level. In the upper line of the display "process input A" and "C1.1" appears, beneath the submenu **parameter** is highlighted.
			• Press ▼ or ▲ until the submenu **cell calibration** is highlighted.
			• Press **>** to enter the chosen menu.

- You can start the calibration procedure now as described in "Step 4".

Put sensor into the calibration solution!

Step 4: calibration procedure

- After choosing the submenu **cell calibration** (step 3) in the previous step, continue by pressing **>**.

➲ The signal converter demands to choose the kind of temperature compensation for the calibration. You have the options "off", "automatic" and "manual" (for detailed information refer to *Temperature compensation* on page 23). Please select the same kind of temperature compensation for the calibration as for the measurement. Recommended and most common setting for this type of measurement with integrated temperature sensor is "automatic".

- If you chose "automatic", just press ↵. If you chose "manual", first enter the temperature of the measured medium using ▼ or ▲ and then press ↵.

➲ On the screen the message **spec.conductivity** appears.

- Enter the specific conductivity in mS/cm (or µS/cm if chosen as unit). Using ▼ or ▲ to change the single digits and **>** to move right.

➲ Ones the value of the used standard (calibration solution) is displayed correctly press ↵.

- The signal converter performs directly a cell factor calibration which takes 25 seconds.

➲ On the screen the message cell constant appears

- The newly calculated cell constant is shown. Press ↵ to confirm

➲ The signal converter now asks store cal. value?

- Choose **yes** to store the calibration values. Choose **no** to discard the results.
- Press ↵ to confirm.

➲ You have completed the calibration.

- If you want to return to the measuring mode, press ↵ several times until you reach this mode.

➲ You might get asked "Save configuration?" and choose either **yes** or **no**.

- Press ↵ to confirm.

➲ You are back in the meaurement mode.

INFORMATION!

The "stored value" is a calculated value based on the actual measurement. The signal converter calculates this value depending on the compensation methods (temperature compensation) chosen for the calibration. Do not change the compensation method in the time between the measurement of the "stored value" and the input of the reference value. Otherwise this could result in a wrong calibration.

4.3.4 Calibration log

INFORMATION!
In order to show the history of the calibrations, the converter has a calibration logbook function. Up to 64 entries of the calibration history are stored including date and time.

Accessing the calibtration log

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press ▼ or ▲ until the main menu **test** is highlighted.

MAIN MENU
A quick setup
> B test
C setup
D service

Press **>** to enter the chosen menu.

You are on the first submenu level. In the upper line of the display "test" and "B1" appears, beneath the submenu **sim.process input A** is highlighted.

Press ▲ or ▼ until the submenu **logbooks** is highlighted.

Press **>** to enter the chosen menu.

You are on the second submenu level. In the upper line of the display "logbooks" and "B5.1" appears, beneath the submenu **status log** is highlighted.

Press ▼ or ▲ until the submenu **calibration log** is highlighted.

Press **>** to enter the chosen menu.

- You are on the data level and you see the calibration history. With the help of ▼ or ▲ you can scroll through the different entries.
- If you want to return to the measuring mode press ↵ several times until you reach this mode.

4.4 Troubleshooting

Problem	Possible cause	Remedy
Signal converter shows: application error sensor in electronic A/B.	Sensor in air or not in solution with correct conductivity range.	Put the sensor into a solution with a minimum conductivity of: cell factor * 100 µS/cm. This is for the sensor in PP > 625 µS/cm.

5.1 Maintenance

5.1.1 Cleaning

- Clean the sensor surface with water and brush.
- Slight dirt residues or dust: Rinse the sensor with water and clean it with a cloth or tissue.
- Oily and greasy coatings: Remove with a warm soap solution and rinse with water.
- Hardness deposits or metal hydroxide deposits: Remove with 10% citric acid or diluted hydrochloric acid and rinse with water.

5.2 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

5.3 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

5.4 Returning the device to the manufacturer

5.4.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

CAUTION!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

CAUTION!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

5.4.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:
Department:		Name:
Tel. no.:		Fax no. and/or Email address:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:		radioactive
		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.		
Date:		Signature:
Stamp:		

5.5 Disposal

CAUTION!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

6.1 Measuring principle

6.1.1 Inductive conductivity measurement

The inductive measurement method enables largely maintenance-free acquisition of specific conductivity, even in the toughest media conditions. In the principle of inductive measurement, the sensor consists of a sender-recipient-coil.
When a magnetic field is generated by an electrical coil and a second electrical coil is placed next to it, a certain amount of electric energy will be transferred to it. In an inductive conductivity sensor, the process media flows directly through the middle of both coils. The amount of energy transferred from the primary to the secondary coil is directly proportional to the electrical resistance of the solution.

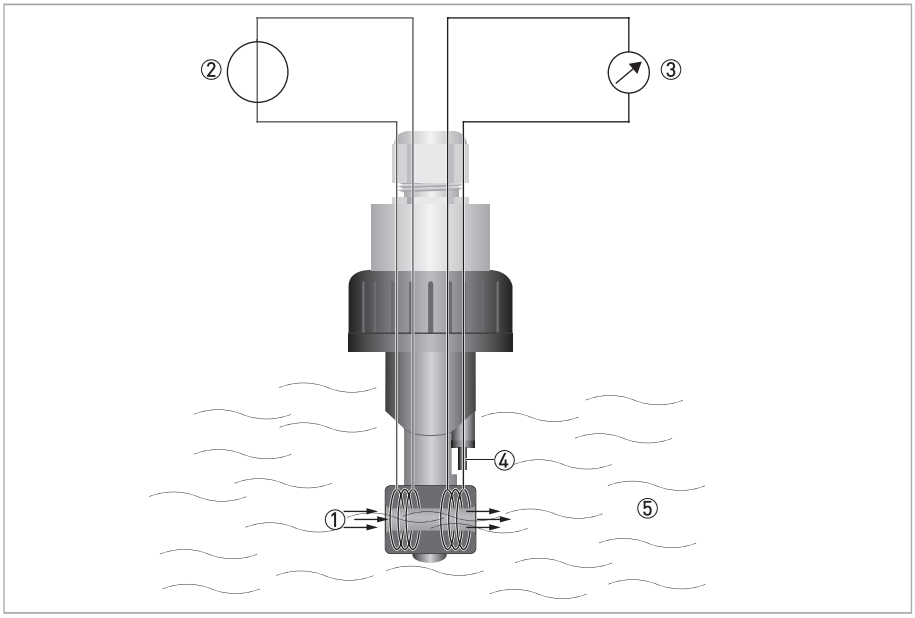

Figure 6-1: Inductive measurement

① Flow direction
② Sinusoidal AC voltage supply
③ Induced voltage measurement
④ Exposed temperature sensor Pt1000
⑤ Measuring medium

6.2 Technical data

INFORMATION!

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	Inductive conductivity - toroidal
Measuring range	0.625…2000 mS/cm (if c=6.25)
Lowest detection limit	Cell factor x 100 µS/cm

Design

Construction	PP or PVDF - body material
Cell constant	c= 6.25 1/cm (PP), c= 4.65 1/cm (PVDF)
Process connection pipe installation	G1½ (PVC or stainless steel)
Process connection open channel installation	Immersion assembly (only PP version)
Temperature sensor	Pt1000
	PP version: exposed or sealed Pt1000
	PVDF version: only sealed Pt1000

Measuring accuracy

Conductivity accuracy	≤ 1% (measuring range)
Temperature accuracy	≤ 0.5% (measuring range)

Operating conditions

Temperature range	PP version: -10…+60°C / +14…+140°F Max. 15 min. at 100°C
	PVDF version: -10…+100°C / +14…+212°F Max. 15 min. at 110°C
	PVC process connection: -10…+60°C / +14…+140°F
Max. operating pressure	PP version: min. -0.1 bar at -10°C...+80°C / min. -1.45 psi at +14°F...+176°F 10 bar at +20°C / 145 psi at +68°F 6 bar at +50°C / 87 psi at 122°F 0 bar at +60°C / 0 psi at 140°F
	PVDF version: min. -0.1 bar at -10°C...100°C / min. -1.45 psi at 14°F...212°F 10 bar at +20°C / 145 psi at +68°F 6 bar at +60°C / 87 psi at 140°F 4 bar at +80°C / 58 psi at 176°F 0 bar at +100°C / 0 psi at 212°F

Installation conditions

Process connection	Pipe installation with G1½ PVC or stainless steel union nut
	Immersion version

Electrical connection

Cable	Attached cable
Cable options	Core end sleeves
Cable length	10 m / 33 ft 9.2 m / 30 ft. (1 meter immersion version) 8.2 / 26 ft. (2 meter immersion version)

6.3 Dimensions

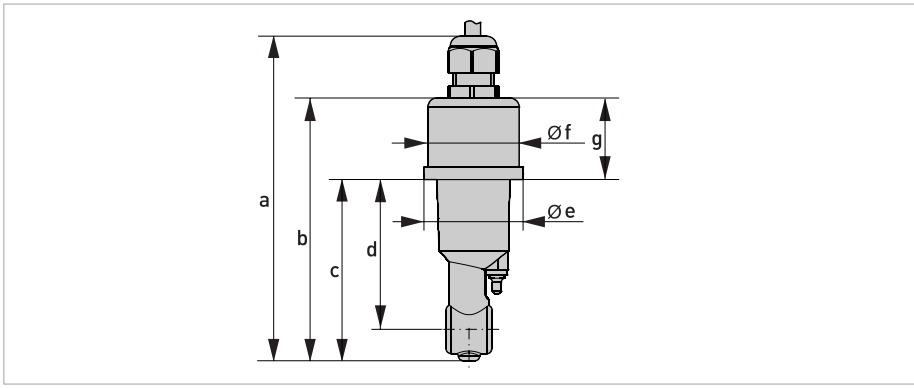

Figure 6-2: Sensor

	Dimensions [mm]	Dimensions [inch]
a	145	5.7
b	118	4.65
c	81	3.2
d	67	2.64
e	44.5	1.75
f	41	1.6
g	36.5	1.44

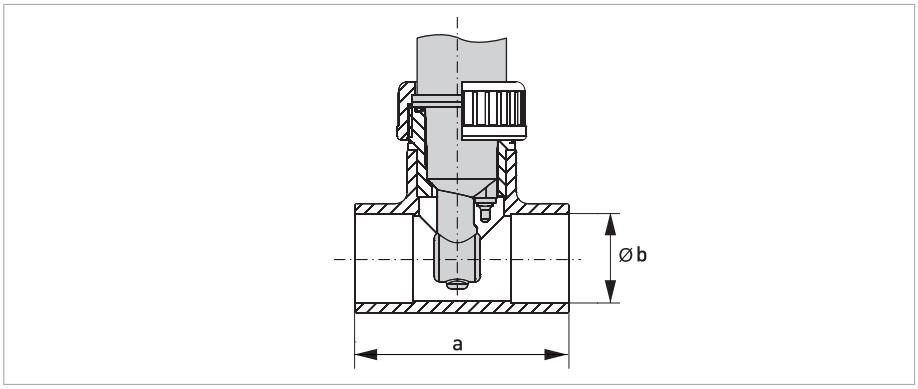

Figure 6-3: Flow-through assembly (T-piece)

DN	a [mm / inch]	øb [mm / inch]	Material	Max. Temp.
32	88 / 3.46	40 / 1.57	PP	+60°C / +140°F
40	102 / 4.02	50 / 1.97		
50	124 / 4.88	63 / 2.48		

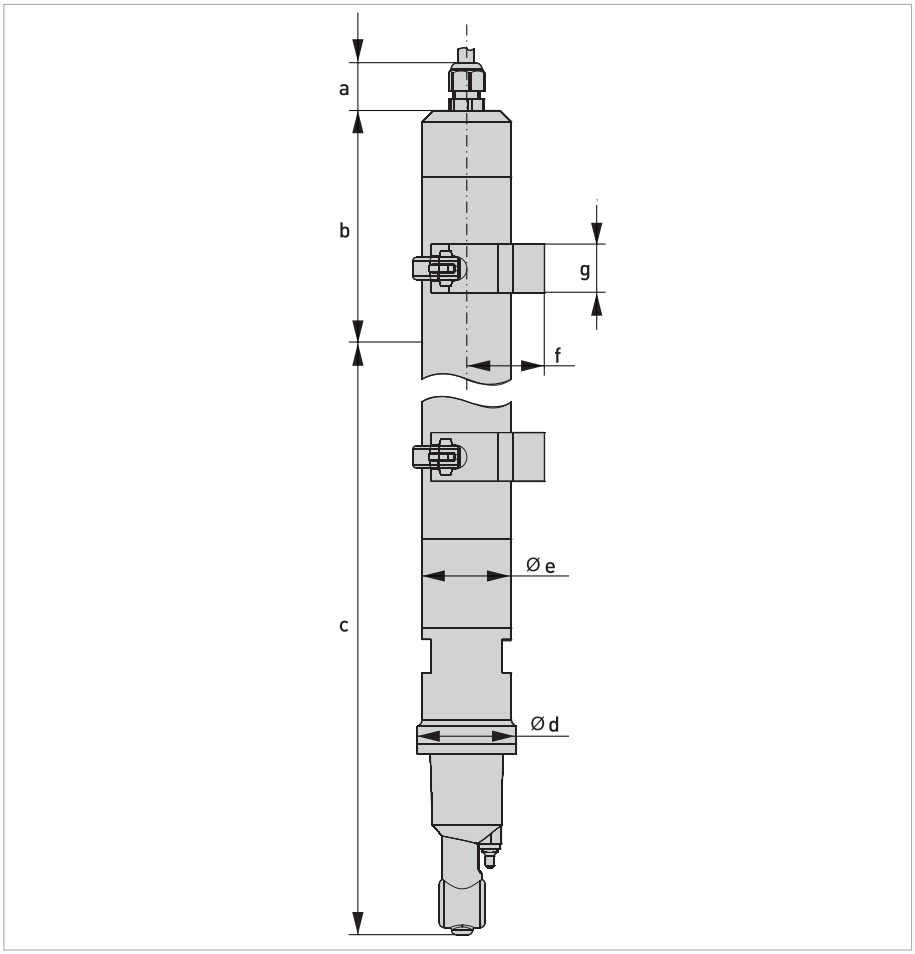

Figure 6-4: Immersions assembly

	Dimensions [mm]	Dimensions [inch]
a	21	0.83
b	120 +/- 10	4.72 +/- 0.4
c	1000 / 2000	39.37 / 78.74
d	44.5	1.75
e	40	1.57
f	40	1.57
g	22	0.87

KROHNE – Process instrumentation and measurement solutions

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- Level
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