



## SMARTPAT COND 7200 **Technical Datasheet**

Digital conductivity sensor for the pharmaceutical, food and beverage industries

- 2-wire loop powered sensor with integrated transmitter technology
- Hygienic sensor design for high process reliability
- Equipped with integrated temperature sensor and available with a wide range of process connections

**HART**  
COMMUNICATION PROTOCOL

1 Product features	3
1.1 SMARTPAT conductive conductivity sensor	3
1.2 Design and options	4
1.3 Conductivity measurement	5
2 Technical data	6
2.1 Technical data	6
2.2 Dimensions	8
3 Installation	11
3.1 General notes on installation	11
3.2 Intended use	11
3.3 Pre-installation requirements	12
3.4 Installation procedure	13
4 Electrical connections	14
4.1 Safety instructions	14
4.2 Connecting the cable to the sensor	15
4.3 Connecting the sensor cable	15
4.4 Connection diagram	16
4.5 Installing the sensor	18
4.5.1 General installation instructions	18
4.5.2 Installation recommendation	19
5 Order information	21
5.1 Order code	21
5.2 Accessories and consumables	22
6 Notes	23

## 1.1 SMARTPAT conductive conductivity sensor

SMARTPAT analytical sensors from KROHNE are the first and only sensor line in the market with integrated transmitter technology. The complete circuitry is miniaturised and fits into the sensor head. This technical achievement cuts the price in half compared to all measurement systems.

KROHNE offers a real open standard without transmitter and a direct connection via standardised fieldbus from the sensor to the process control system. The SMARTPAT sensor stores all data and sends these as bidirectional digital signals with 4...20 mA / HART® 7 protocol to the control and asset management systems, handhelds, PC and other peripherals.

The SMARTPAT COND 7200 meets all requirements of the pharmaceutical, food and beverage industries.

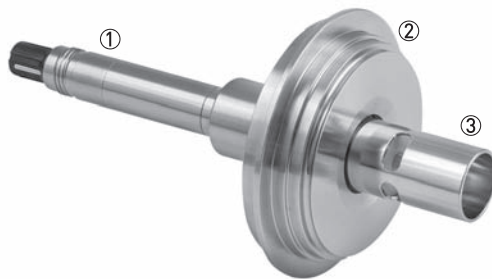


Figure 1-1: SMARTPAT COND 7200

- ① VP2 connector and nickel-plated brass body
- ② M28 x 1.5 thread for process connections Varivent® DN 40...125, TriClamp DN 25/32/40 (1...1.5" / Ø50.5 mm) or TriClamp DN 50 (2" / Ø64 mm) adapter in stainless steel 1.4435 / 316L
- ③ Electrodes: stainless steel 1.4435 / 316L and PEEK (Isolator)

### Highlights

- Direct connection via standardised fieldbus
- Easy handling of offline and online configuration via free of charge PACTware™ FDT/DTM
- Sterilisable sensor design for hygienic requirements
- Hygienic process connection for direct installation in pipelines and tanks
- Available with different low cell constants for water and pure water applications
- Robust sensor material with stainless steel electrodes
- With integrated Pt1000 and standard VP2 connector

### Industries

- Food and beverage
- Pharmaceutical
- Water

### Applications

- Pure water monitoring
- Quality control in water conditioning and preparation
- Water treatment

## 1.2 Design and options



SMARTPAT COND 7200 is available with various hygienic process connection in stainless steel (1.4435 / 316L, Ra <0.8):

- Varivent® DN 40...125
- TriClamp DN 25/32/40 (1...1.5" / Ø50.5 mm)
- TriClamp DN 50 (2" / Ø64 mm)

The electrodes material:

- Stainless steel (1.4435 / 316L, Ra <0.8)

Available cell constant c

- c=0.01 (0.05...10 µS/cm at 25°C / 77°F)
- c=0.1 (1...1000 µS/cm at 25°C / 77°F)

The sensor can be integrated into the process control system via PACTware™ FDT/DTM with the open standard in fieldbus systems - HART®.

SMARTPAT COND 7200 is compatible with all 2-wire loop powered displays.

### 1.3 Conductivity measurement

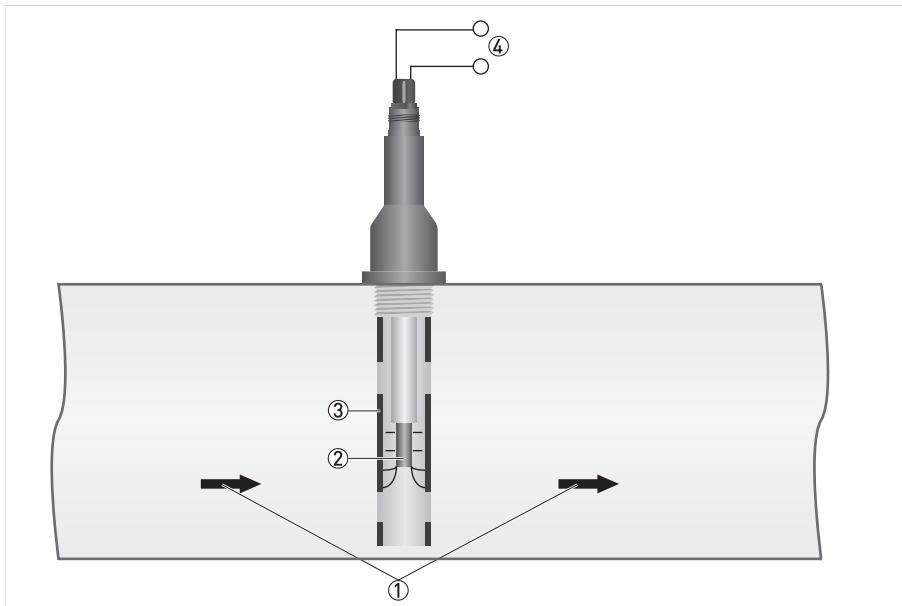


Figure 1-2: Measuring principle for conductivity measurement

- ① Flow direction
- ② Inner electrode
- ③ Outer electrode
- ④ Power supply

The principle of conductivity measurement is defined as the capacity of a solution to conduct an electrical current between two electrodes. In a solution, the current flows by ion transport. The higher the ion concentration, the more current can flow. Using Ohm's law: Resistance = Voltage/Current, the resistance of a liquid can be determined by measuring the current while keeping the voltage constant. Specific conductivity is defined by 1/resistivity. The unit of measurement is Siemens/meter and is normally expressed in  $\mu\text{S}/\text{cm}$ .

An important criterion for the measuring range of conductivity cells is the geometry of the electrodes. There are two rules which are characteristic for conductivity measurement:

1. The larger the distance between the two electrodes, the larger the resistance.
2. The larger the electrode surface, the lower the resistance.

The surface area (A) and the distance (L) must be correctly matched to the desired measuring range. This is called the "cell constant" defined as  $c=L/A$ .

## 2.1 Technical data

- 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	Conductivity measurement - conductive
Measuring range	0.05...10 µS/cm (c=0.01) at 25°C / 77°F 1...1000 µS/cm (c=0.1) at 25°C / 77°F

### Design

Temperature sensor	Pt1000
Connector	VarioPin 2.0 (VP2)

### Operating conditions

Process temperature	0...+135°C / +32...+275°F
Ambient temperature	-10...+85°C / +14...+185°F
Storage temperature	-40...+85°C / -40...+185°F
Process pressure	16 bar at 25°C / 232 psi at 77°F, 9 bar at 60°C / 130 psi at 140°F
Measuring accuracy	±3% of the measured value

### Installation conditions

Ingress protection	IP68
Weight	Sensor insertion length 40 mm / 1.57": approx. 256 g / 0.56 lb
	Sensor insertion length 70 mm / 2.76": approx. 377 g / 0.83 lb
	Varivent® DN 40...125 adapter: approx. 616 g / 1.36 lb
	TriClamp DN 25/32/40 adapter: approx. 134 g / 0.30 lb
Process connection	TriClamp DN 50 adapter: approx. 292 g / 0.64 lb
	<p>Varivent® DN 40...125 (1.4435 / 316L, Ra &lt;0.8 µm)            TriClamp DN 50 (2" / Ø 64 mm) (1.4435 / 316L, Ra &lt;0.8 µm)            TriClamp DN 25/32/40 (1...1.5" / Ø 50.5 mm) (1.4435 / 316L, Ra &lt;0.8 µm)</p> <p>Ø 50.5 mm fit to:            DN 25/32/40 according to DIN 32676            DN 20/25/30 according to ISO 2852            DN 1" and DN 1.5"</p> <p>Ø 64 mm fit to:            DN 50 according to DIN 32676            DN 40 according to ISO 2852            DN 2"</p> <p>Valid standards: ISO 2852, DIN 32676, BS 4825 (ASME BPE)</p>

## Materials

Process connection	Stainless steel (1.4435 / 316L, Ra <0.8 µm)
Electrodes	Stainless steel (1.4435 / 316L, Ra <0.8 µm)
Sensor head	Nickel-plated brass body with VP2 connector
Isolator	PEEK (FDA)
Sealing	FKM / Viton® (FDA)

## Communication

Measuring range	0.05...10 µS/cm (c=0.01) at 25°C / 77°F (for c=0.01 displayed unit is µS/cm for conductivity and MΩm*cm for resistivity) 1...1000 µS/cm (c=0.1) at 25°C / 77°F (for c=0.1 the displayed unit is µS/cm for conductivity and kΩm*cm for resistivity)
Output signal	4...20 mA (passive)
Output resolution	20 µA
Field communication	HART® 7 - FSK 1200 physical layer definition on top of the current loop
Filter adjustable	1...60 seconds

## Electrical connections

Power supply	15...30 VDC loop powered
Output	4...20 mA + HART® protocol
Load	Minimum 0 Ω; maximum $R_L = [(U_{ext.} - 15 \text{ VDC}) / 22 \text{ mA}]$
HART®	HART® protocol via current output
Device revision	1
Physical layer	FSK
Device category	Sensor, galvanically isolated
System requirements	250 Ω loop resistance for HART® communication
Multidrop operation	4 mA In a multidrop communication system, up to 32 devices can be connected. For installation in a multidrop communication system please consider the voltage drop for the 250 Ω loop resistance for HART® communication. The supply voltage has to be adjusted.

## Approvals and certifications

CE	
The device meets the essential requirements of the EU directives. The CE marking indicates the conformity of the product with the Union legislation applying to the product and providing for CE marking.	
For full information of the EU directives and standards and the approved certifications, please refer to the EU declaration on the website of the manufacturer.	
Other approvals and standards	
Shock resistance:	IEC 60068-2-31

## 2.2 Dimensions

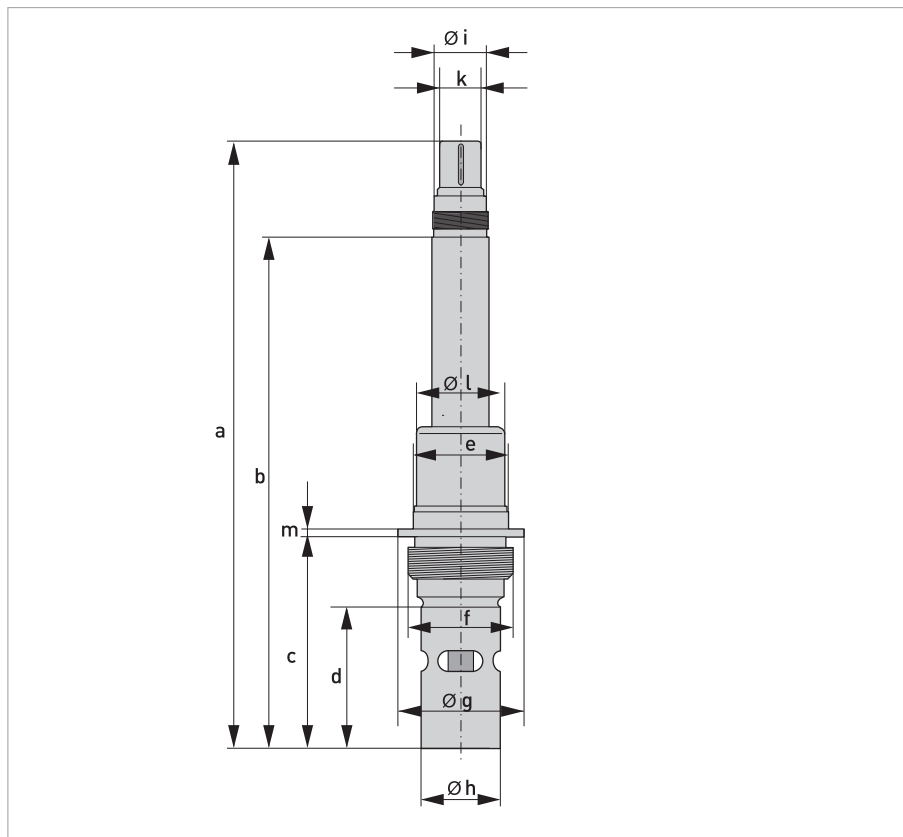


Figure 2-1: SMARTPAT COND 7200

	Dimensions [mm]	Dimensions [inch]
a	170 / 200	6.69 / 7.87
b	143 / 173	5.63 / 6.81
c	60 / 90	2.36 / 3.54
d	40 / 70	1.57 / 2.76
e	WS 27	
f	M28 x 1.5	
g	35.9	1.41
h	22.5	0.88
i	Ø20.5	Ø0.87
k	VarioPin	
l	25	0.98
m	2	0.08



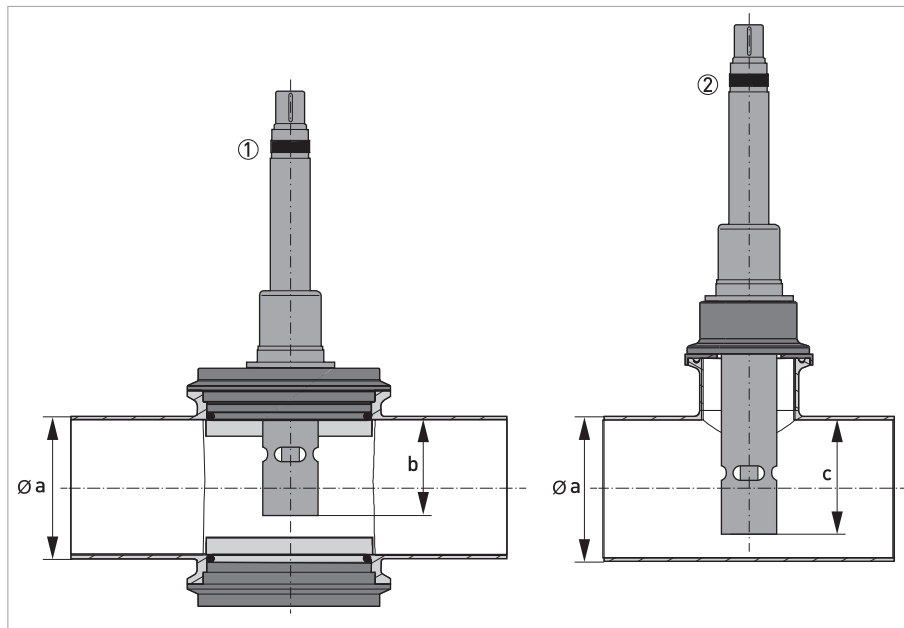


Figure 2-2: Sensor mounted with process connection

- ① Sensor insertion length 40 mm / 1.57"  
 ② Sensor insertion length 70 mm / 2.76"

	Dimensions [mm]	Dimensions [inch]
a	DN 50	2
	DN 65	2 1/2
	DN 80	3
	DN 100	4
	DN 125	5
	DN 150	6
b	39	1.54
c	41	1.61

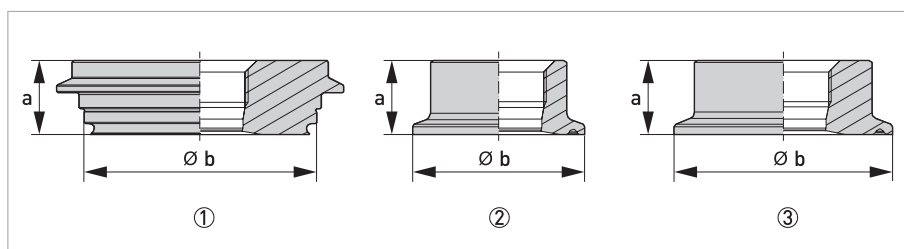


Figure 2-3: Process connection adapter

- ① Varivent® DN 40...125
- ② TriClamp DN 25/32/40 (1...1.5" / Ø50.5 mm)
- ③ TriClamp DN 50 (2" / Ø64 mm)

	Dimensions [mm]		Dimensions [inch]	
	a	b	a	b
Varivent® DN 40...125	21.5	68	0.85	2.68
TriClamp DN 25/32/40		50.5		1.99
TriClamp DN 50		64		2.52

### 3.1 General notes on installation

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

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

*Observe the national regulations for electrical installations!*

*During installation of the device make sure that you use ESD (electrostatic discharge) protection equipment.*

*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.*

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

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

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

### 3.2 Intended use

*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.*

*This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.*

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

The intended use of the sensor SMARTPAT COND 7200 is the measurement of conductivity in conductive liquids.

### 3.3 Pre-installation requirements

- *Do not drop the device! Handle the device with care!*
- *Never touch or scratch the electrodes of the sensor.*
- *Store the sensor in its original packaging in a dry, dust-free location. Keep it away from dirt. If necessary, clean it as described in the manual of the sensor.*
- *Do not make any mechanical modifications to the sensor (electrodes shortened, drilled, bent or scratched). This can result in the loss of proper functionality, as well as the rights under the device warranty.*
- *The sensor must be suitable for the temperature, pressure and medium conditions which are specified (including chemical resistance).*

A sensor specific DTM software for usage with PACTware™ FDT is available. The DTM software is free of charge and available from CD (scope of delivery) or can be downloaded from the KROHNE website (Downloadcenter).

The required steps are explained in the following sections.

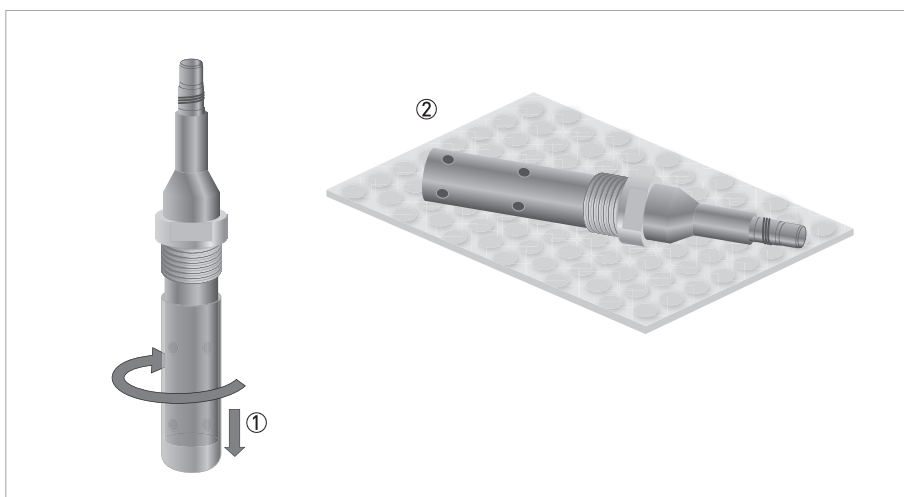


Figure 3-1: Unpacking the sensor

#### Unpacking the sensor

- Remove by gently twisting and pulling the protective cap from the sensor ①.
- Lay the sensor on a soft ESD mat or soft paper tissue ②.
- Leave the protection cap of the VP connector, as long as the sensor is not connected to the cable.

### 3.4 Installation procedure

*During installation of the device make sure that you use ESD (electrostatic discharge) protection equipment.*

- ① Screw the process connection adapter on the sensor.
- ② Connect the sensor to the junction box or directly to the process control system.
- ③ Install the sensor into its final measuring location.
- ④ If necessary re-calibrate the cell constant for your process conditions. (To re-calibrate connect either a HART field communicator or connect the sensor via OPTIBRIDGE / SMART-BRIDGE to a PC.)

## 4.1 Safety instructions

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

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

*Observe the national regulations for electrical installations!*

*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.*

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

## 4.2 Connecting the cable to the sensor

*During installation of the device make sure that you use ESD (electrostatic discharge) protection equipment.*

*Moisture on the sensor connector must be avoided! Moisture may cause a short-circuit and a malfunction of the sensor!*

*If moisture has entered the connector dry it with air (e.g. hot air gun).*

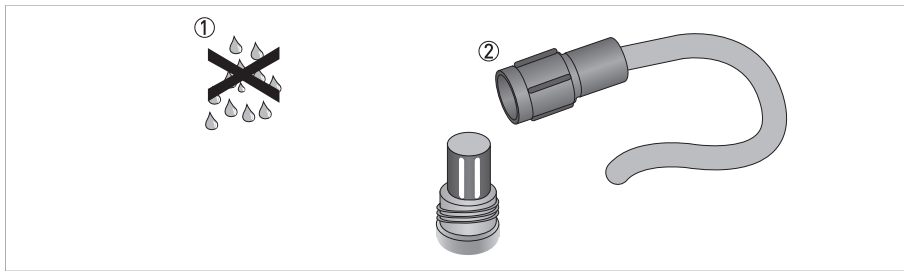


Figure 4-1: Connecting the cable to the sensor

### Connecting the cable to the sensor

- Ensure that both cable and sensor connector are absolutely dry ①.
- Screw the cable connector ② on the sensor connector and tighten it by hand.

## 4.3 Connecting the sensor cable

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

*The cable glands installed by the manufacturer are designed for a cable diameter of 8 mm...13 mm / 0.31"...0.51". If you are using cables with a larger diameter, you must replace the manufacturer's cable glands with suitable ones. The operator is responsible for the correct sealing of cable glands.*

### Cable VP2-S

Transparent-black (inner coax shield)	Ub+
White	Ub-
Shield	S

## 4.4 Connection diagram

### Connection to SJB 200 W-Ex

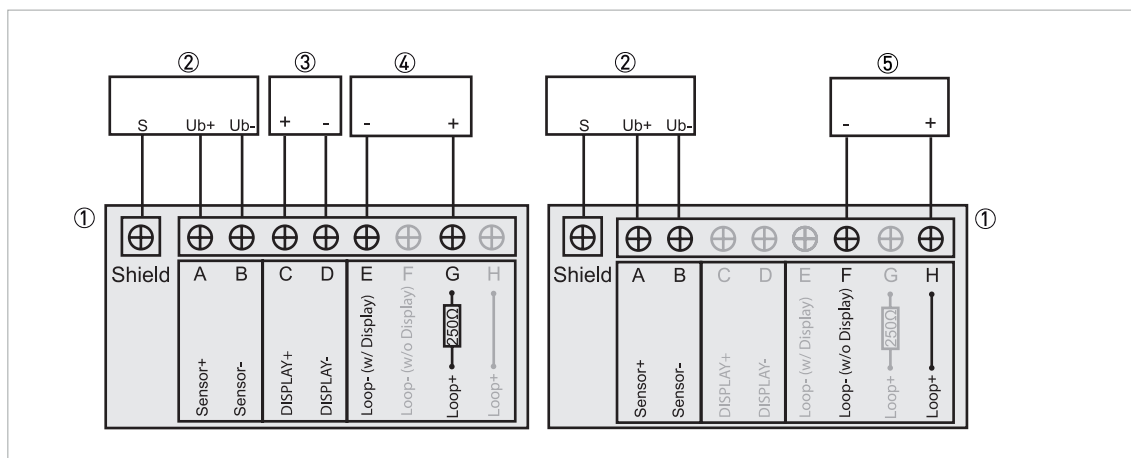


Figure 4-2: Example of a connection with a SJB 200 W-Ex junction box

- ① SJB 200 W-Ex junction box with or without internal resistor used
- ② Sensor with VP2-S cable
- ③ Display or other 4...20 mA loop powered device (e.g. data logger)
- ④ Control system without internal 250  $\Omega$  resistor connected to internal resistor of SJB 200 W-Ex
- ⑤ Control system with internal 250  $\Omega$  resistor connected to SJB 200 W-Ex without using internal resistor

SJB 200 W-Ex with internal resistor		SJB 200 W-Ex without internal resistor	
S	Shield	S	Shield
A	Sensor +	A	Sensor +
B	Sensor -	B	Sensor -
C	Display +	F	Loop - w/o Display
D	Display -	H	Loop +
E	Loop - w/ Display		
G	Loop + [250 $\Omega$ ]		



## HART® interface within SJB 200 W

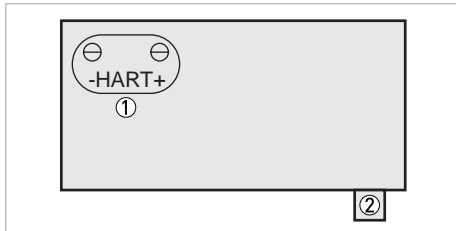


Figure 4-3: Example of a HART® handheld connection

- ① Connection via crocodile clips  
 ② **Only for Ex:** M12 connector for the HART® handheld connecting cable

Connection of SMARTMAC 200 W with a loop powered device via the optional SJB 200 W-Ex junction box to a SMARTPAT Sensor.

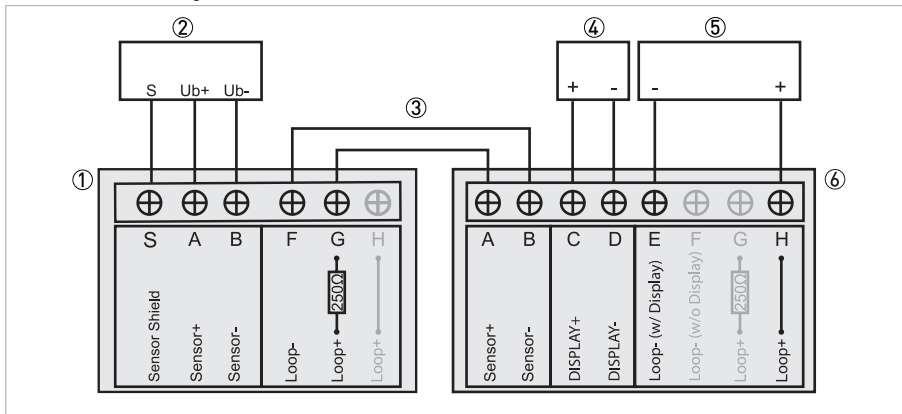


Figure 4-4: Example of connecting the SMARTMAC 200 W to a control system without internal 250 Ω resistor and one additional loop powered device.

- ① SMARTMAC 200 W  
 ② Sensor with VP2-S cable  
 ③ Cable connection between SJB 200 W-Ex and SMARTMAC 200 W  
 ④ Display or other 4...20 mA loop powered device (e.g. data logger)  
 ⑤ Control system without internal 250 Ω resistor  
 ⑥ SJB 200 W-Ex junction box

SMARTMAC 200 W with internal resistor		SJB 200 W-Ex without internal resistor	
S	Shield	A	Sensor +
A	Sensor +	B	Sensor -
B	Sensor -	C	Display +
F	Loop -	D	Display -
G	Loop + [250Ω]	E	Loop - w/ Display
		H	Loop +

The SJB 200 W offers the opportunity to access the sensor via HART® hand held. For further information refer to the manual of the SJB 200 W.

## Connection with sensor and control system

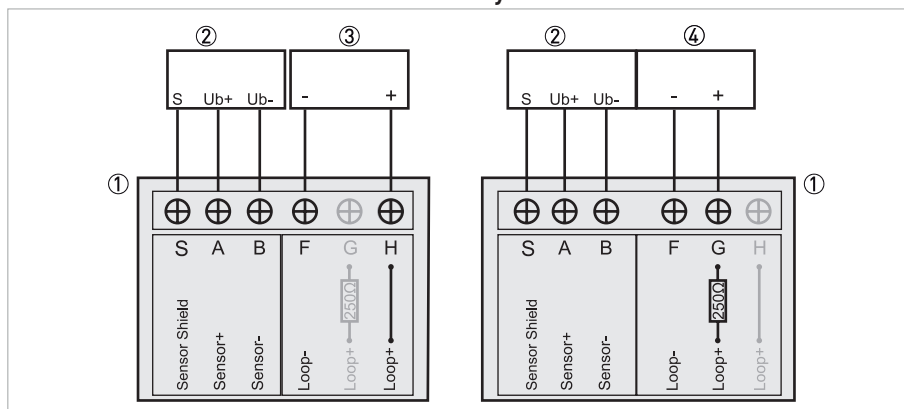


Figure 4-5: SMARTMAC 200 W connection to a control system with internal 250  $\Omega$  resistor (left side). SMARTMAC 200 W connection to a control system without internal 250  $\Omega$  resistor (right side).

- ① SMARTMAC 200 W
- ② Sensor with VP2-S cable
- ③ Control system with internal 250  $\Omega$  resistor
- ④ Control system without internal 250  $\Omega$  resistor

SMARTMAC 200 W without internal resistor		SMARTMAC 200 W with internal resistor	
S	Shield	S	Shield
A	Sensor +	A	Sensor +
B	Sensor -	B	Sensor -
F	Loop -	F	Loop -
H	Loop +	G	Loop + [250 $\Omega$ ]

## 4.5 Installing the sensor

### 4.5.1 General installation instructions

*Ensure that the pipeline is without pressure before installing or removing a sensor!*

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

*To achieve reliable measuring results, the electrodes must always have full contact with the measuring medium.*

*Basically any installation position is possible. However, ensure that sufficient medium flows through and around the electrodes (the conductive electrodes must always be completely surrounded by the medium). Structural measures must be taken to prevent flow interruption or gas bubbles.*

#### 4.5.2 Installation recommendation

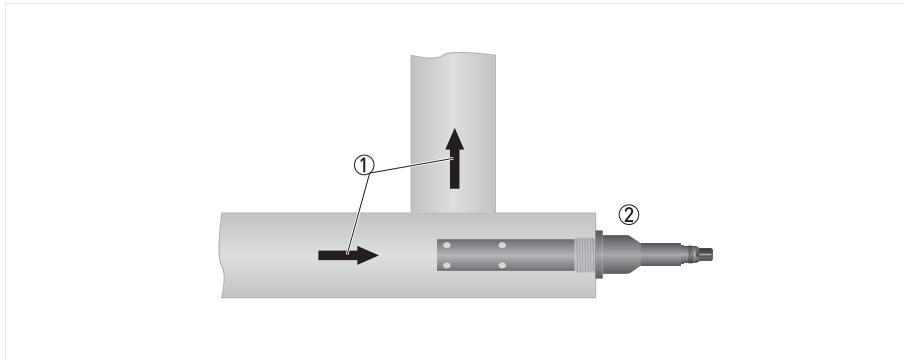


Figure 4-6: Typical installation

- ① Flow direction
- ② Ordered sensor

- Installation against the flow to ensure direct exposure of the electrodes.

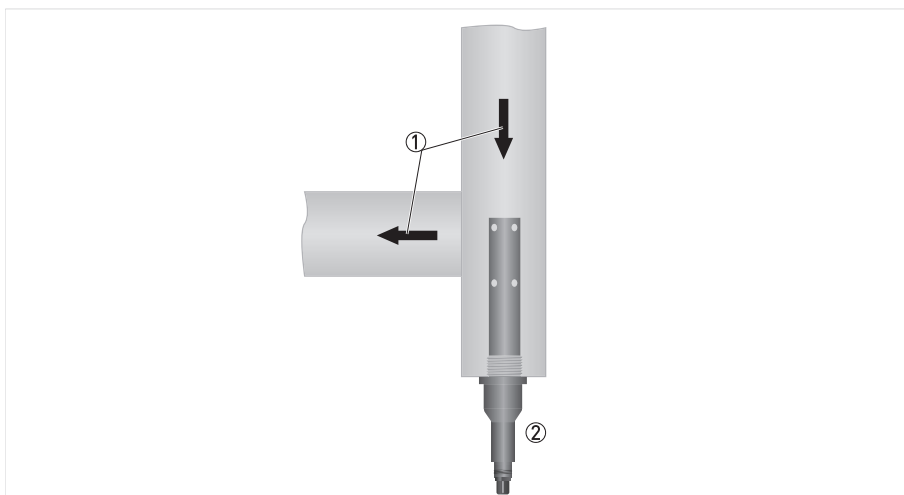


Figure 4-7: Installation for clean water

- ① Flow direction
- ② Ordered sensor

- This installation is only recommended if the pipeline is completely filled and if there are no particles or air bubbles in the pipeline.

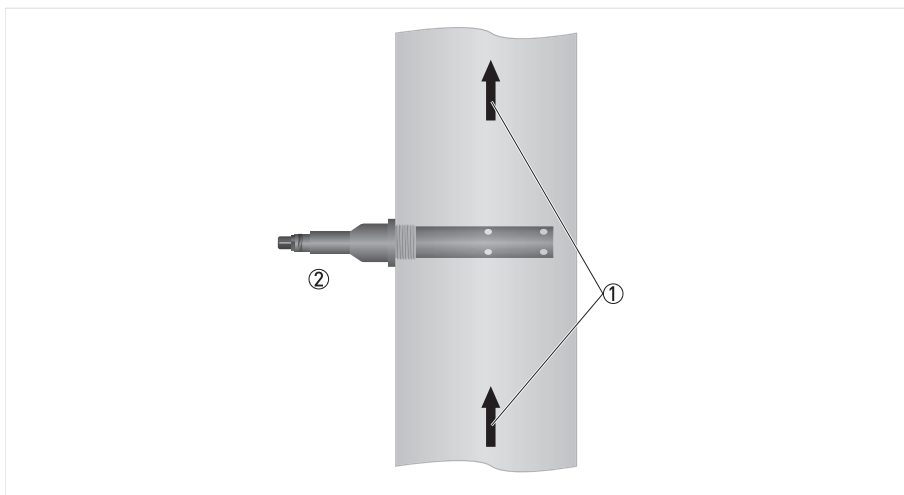


Figure 4-8: Possible installation

- ① Flow direction
- ② Ordered sensor

- This installation is only recommended if the pipeline is completely filled and if there are no particles or air bubbles in the pipeline.
- Consider the diameter of the pipeline, i.e. compare pipeline DN with insertion length of the sensor shaft.

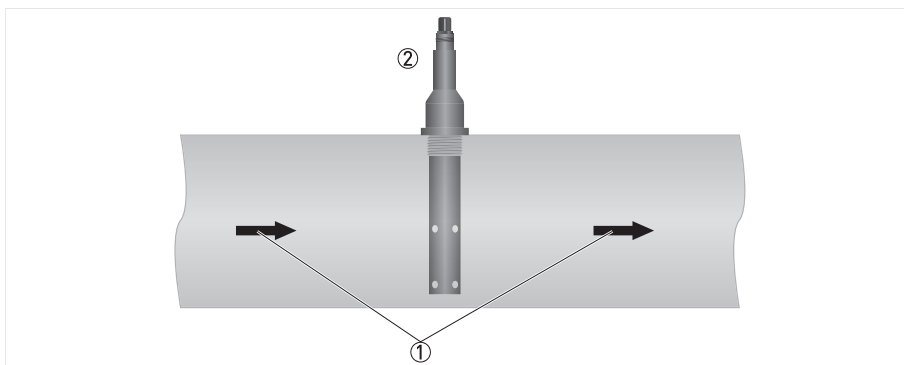


Figure 4-9: Possible installation

- ① Flow direction
- ② Ordered sensor

- This installation is only recommended if the pipeline is completely filled and if there are no particles or air bubbles in the pipeline.
- Consider the diameter of the pipeline, i.e. compare pipeline DN with insertion length of the sensor shaft.

## 5.1 Order code

The characters of the order code highlighted in light grey describe the standard.

VGS C	4	Sensor type											
		4	SMARTPAT COND 7200										
			Measuring range										
			B	0.05...10 µS/cm (c=0.01)									
			C	1...1000 µS/cm (c=0.1)									
			Materials										
			3	Process connections / electrodes: stainless steel (1.4435 / 316L, Ra <0.8 µm), PEEK (Isolator)									
			Process conditions										
			A	0...+135°C, 16 bar at +25°C / +32...+275°F, 232 psi at +77°F									
			Process connection										
			3	Varivent® DN 40...125 (1.4435 / 316L, Ra <0.8 µm)									
			4	TriClamp DN 25/32/40 (1.4435 / 316L, Ra <0.8 µm)									
			5	TriClamp DN 50 (1.4435 / 316L, Ra <0.8 µm)									
			Insertion length										
			B	40 mm / 1.57"									
			C	70 mm / 2.75"									
			Communication										
			1	4...20 mA / HART®									
			Connector type										
			B	VarioPin (VP2), nickel-plated brass									
			Approval										
			0	none									
			Documentation										
			0	none									
			1	English									
			2	German									
			3	French									
			4	Spanish									
			Material certification										
			0	none									
			1	Material certification + copies 3.1 according to EN 10204									
VGS C	4												

## 5.2 Accessories and consumables

Accessories	Order code
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### Cable

Cable VP2-S-3 (3 m / 9.84 ft)	XGA W 080130
Cable VP2-S-5 (5 m / 16.4 ft)	XGA W 080140
Cable VP2-S-10 (10 m / 32.8 ft)	XGA W 080150
Cable VP2-S-15 (15 m / 49.2 ft)	XGA W 080160
Cable VP2-S-20 (20 m / 65.6 ft)	XGA W 080170
Cable VP2-S-30 (30 m / 98.4 ft)	XGA W 080180

### Junction box

SJB 200 W-Ex - Junction box for connecting sensor with process control system, for sensor cable with shield	XGA S 080013
Connecting cable M12 - Cable with M12 cable connector for connecting HART® handheld (e.g. Emerson 475 FIELD COMMUNICATOR) to SJB 200 W-Ex junction box	XGA S 080014

### USB interface cable

OPTIBRIDGE - USB interface cable with stainless steel housing and various adapter cables for SMARTPAT sensors	See technical datasheet OPTIBRIDGE
SMARTBRIDGE - USB interface cable with plastic housing for SMARTPAT sensors	XGA S 080010

### Display

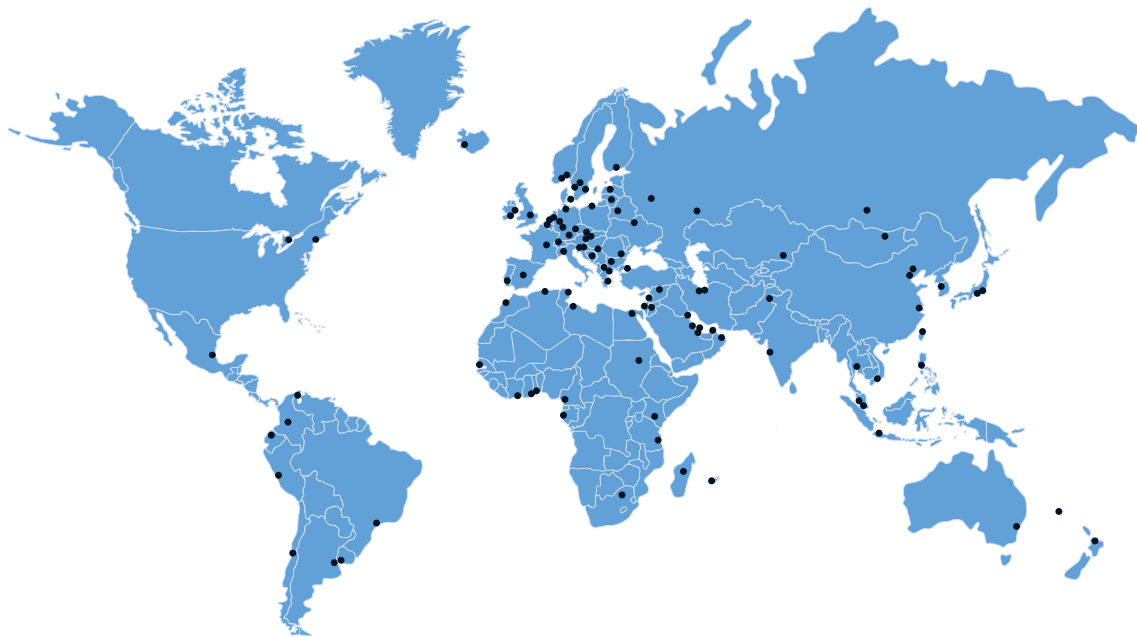
SD 200 W - Indicator for SMARTPAT sensors, wall mount	VGSD 4 1A2A2A200
SD 200 R - Indicator for SMARTPAT sensors, rack mount	VGSD 4 2A3A0A000

Consumables	Order code
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### Standard solution for conductivity calibration

Conductivity standard solution 0.015 mS/cm - 1 x 250 ml (glass bottle)	XGA S 030010
Conductivity standard solution 0.147 mS/cm - 1 x 250 ml (glass bottle)	XGA S 030020





## KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

Head Office KROHNE Messtechnik GmbH  
Ludwig-Krohne-Str. 5  
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Fax: +49 203 301 10389  
[info@krohne.com](mailto:info@krohne.com)

The current list of all KROHNE contacts and addresses can be found at:  
[www.krohne.com](http://www.krohne.com)

**KROHNE**