OPTISWITCH 6700 C

Technical Datasheet

Level switch for hygienic and industrial applications

- Two adjustable contact outputs
- Problem solver for adhesions
- IO link interface

1.1 Level switch for hygienic and industrial applications

The **OPTISWITCH 6700 C** is a level switch for level detection and dry-run protection for liquids and solids. Through its small and optimal sensor shape, the device is easy to clean and the risk of clogging of sticky products is minimised.

The device measures liquids such as water and beer and even viscous and sticky products such as honey or toothpaste. Solids (sugar or flour) can be also measured. The measurement is precise and not affected by the mounting position. Coating of the sensor or condensate are not detected.

The OPTISWITCH 6700 C is resistant to CIP and SIP agents. Hygienic installation is possible with the comprehensive range of accessories. For further information refer to *Process connections options* on page 6.

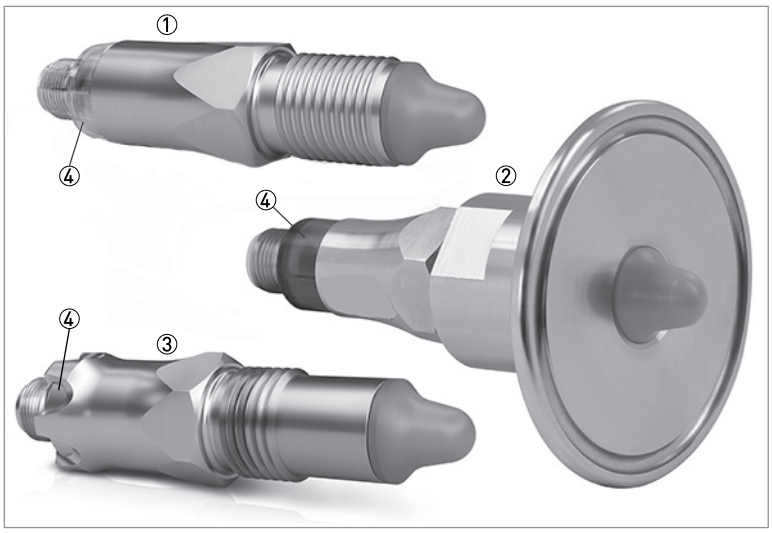


Figure 1-1: Different versions and LED indication

① Level switch for industrial applications
② Level switch with clamp adapter
③ Level switch for hygienic applications
④ LED indication of the switch points

Highlights

- Process temperature -40...+115°C / -40...+239°F
- Possibility for analogue output
- Adaptive trigger
- Insensitive to build up or foam
- Measures alternating media
- LED's for indication of the two switch points
- Switch entirely made of stainless steel
- Excellent for media separation
- No blockage of the pipeline

Industries

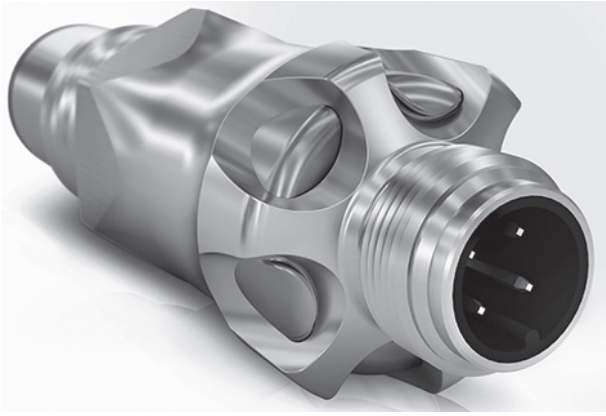
- Food & Beverage
- Pharmaceuticals
- Cosmetics

Typical applications

- Level detection of mustard
- Dry-run protection of cream
- Level detection of ketchup
- Media differentiation
- Evaluation of cleaning processes
- Moisture determination

1.2 Options and variants

LED indication

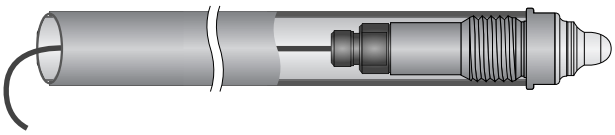


The condition of the two switch points can be indicated by 360° multicolour LED's (5 colours).

Indication is possible over a transparent polycarbonate collar or over a collar protected metal crown LED (King crown).

Alternatively an option without LED indication is also available.

Pipe assembly



The construction with the reverse-threaded G3/4 connection can be mounted in a pipe.

Electrical connection is made over the standard M12 connector.
The pipe and the cable is not scope of our supply.

1.3 Process connections options

For full information on hygienic adapters refer to the "Hygienic Accessories Data-Sheet" which is available on our website.

Code	Old code	Description	Max. pressure		Approval options
			[barg]	[psig]	
KPW3-321	HWN 200	Weld-in sleeve (outside Ø30 mm)	100	1450	3-A® / EHEDG
KPW3-322	HWN 210	Collared weld-in sleeve	40	580	3-A® / EHEDG
KPW2-327	-	Weld-in sleeve with shoulder – for DN65...150 pipes	40	580	—
KPW2-326	HWN 220	Weld-in sleeve with shoulder – for DN25...50 pipes	40	580	—
KPW2-324	HWN 250	Spherical weld-in sleeve – for angled sensor mounting	40	580	—
KPH1-3236	HSM 251	DN51 adapter SMS 1145	25	363	—
KPH3-3213	HTC 240	1 1/2" Tri-Clamp® DN25/40 DIN 32676, 25/38 mm ISO 2852	40	580	3-A® / EHEDG
KPH3-3216	HTC 250	2" Tri-Clamp® DN50 DIN 32676, 51 mm ISO 2852	40	580	3-A® / EHEDG
KPH3-3221	HMT 225	DN25 conical nozzle DIN 11851	40	580	3-A® / EHEDG
KPH3-3224	HMT 240	DN40 conical nozzle DIN 11851	40	580	3-A® / EHEDG
KPH3-3225	HMT 250	DN50 conical nozzle DIN 11851	10	145	3-A® / EHEDG
KPH3-3254	—	DN40 conical nozzle DIN 11851 Type A	10	145	3-A® / EHEDG
KPH3-3255	—	DN50 conical nozzle DIN 11851 Type A	40	580	3-A® / EHEDG
KPH3-324E	HVF 250	DN40/50 Varivent® Type N	10	145	3-A® / EHEDG
KPW2-621	—	3-A® DN38 weld in tank part	40	580	3-A® / EHEDG
KPW2-626	—	3-A® DN38 weld in pipe extrusion	40	580	3-A® / EHEDG
KPX5-32	HST 200	Allen screw blanking plug	100	1450	—

Table 1-1: Hygienic connections

All hygienic process connections agree with FDA regulations, Regulation (EC) No 1935:2004 and Regulation (EC) No 2023:2006.

Code	Old code	Description	Max. pressure		Approval options
			[barg]	[psig]	
KPW1-721	NWN 200	Weld-in sleeve (outside Ø30 mm) for thick wall tank	100	1450	—

Table 1-2: Non-hygienic connections

1.4 Measuring principle

An electrode integrated into the sensor tip forms a virtual capacitor with the environment.

The medium determines the capacity value depending on its dielectric constant (DC values). The virtual capacitor and a coil built into the sensor form a resonant circuit.

Depending on the resonance frequency measured and the programmable trigger type, the switch signal is activated.

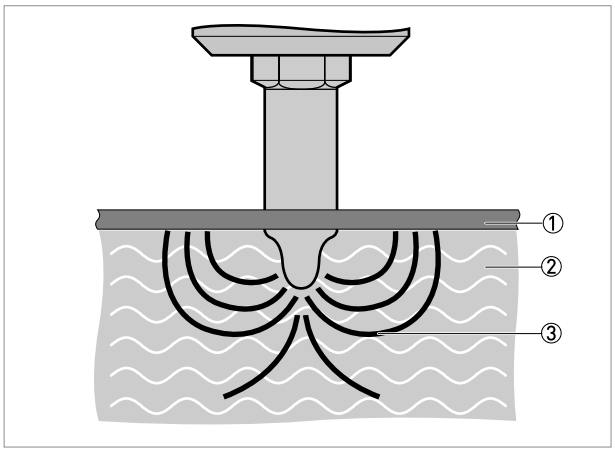


Figure 1-2: Measuring principle

① Tank wall / pipe wall
② Medium
③ Line of electric flux

1.5 Trigger modes

The two outputs of the OPTISWITCH 6700 C can be configured independently. One of the three trigger modes can be selected for each switch:

- Adaptive trigger mode
- Window trigger mode
- Analogue output 4...20 mA

The **adaptive trigger** is a plug-and-play solution. With the adaptive trigger, manual sensor configuration is not required, since the trigger will automatically configure the output signal to react to a new medium.
The adaptive trigger is very useful for applications with sticky media or for applications where the medium is changed frequently.

The **window trigger** is used to cause a sensor switch to react within a specific range, for example, in order to isolate a specific medium. The switching window can be configured within a range from 0...100%. The window trigger is recommended for detecting and separating different layers, for example oil from water or foam from beer.

The **analogue signal** (4...20 mA) represents the complete range of the sensor from 0...100%. The analogue signal can be used to evaluate different media in the same application.

For the information how to adjust the three different mode refer to the handbook.

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	Frequency sweep
Application range	Level detection, dry-run protection and media separation of liquids and solids.
Trigger modes	Adaptive trigger, window trigger and analogue signal (4...20 mA)
Factory settings – Adaptive trigger	
Switching logic	Normally open (N/O) for the 2 switch outputs
Advanced setup	Disabled
Set point high	100%
Steady detection	Active
Damping	0 ms
Trigger distance	3.0%
Startup Level	0.0%
Factory settings – Window trigger	
Switching logic	Normally open (N/O) for the 2 switch outputs
Switch window, min.	0%
Switch window, max.	75.3%
Switch window, hysteresis	2.4 %
Damping	0.1 s

Design

Construction	The measurement system consists of a measuring sensor and the electronic unit which is available in a compact version. The two switch points are signalled by a LED (green / yellow / cyan / blue) at the neck of the M12 connector.
Options	Teach-In function for applications where the medium is hard to detect.
Accessories	Comprehensive range of adapters and process connections for hygienic installation. Please refer to the specific data sheet "Accessories".

Measuring accuracy

Repeatability	±1 mm / ±0.04¨
Hysteresis	±1 mm / ±0.04¨
Media characteristics	Dielectric constant > 1.5
Step response time	< 150 ms

Operating conditions

Temperature	
Ambient temperature (T_{amb})	-40...+85°C / -40...+185°F
	-40...+60°C / -40...+140°F with 4...20 mA output signal
Storage temperature	-40°C...+85°C / -40 ...+185°F
Process temperature	G1/2 A ISO 228-1, G1/2 A DIN 3852-E, 1/2-14 NPT: -40...+115°C / -40...+239°F
	G1/2 A hygienic: -40...+115°C / -40...+239°F
	Reverse-threaded G3/4 ISO 228-1: -40...+85°C / -40...+185°F
	G1/2 A hygienic, length 82 mm: -40...+115°C / -40...+239°F
	G1/2 A hygienic sliding connection, length 250 mm: -40...+150°C / -40...+302°F
	Temporary +135°C / +275°F < 1 hour, T_{amb} < +50°C / +122°F
Pressure	
Ambient pressure	Atmospheric
Process pressure	Inclusive industrial process connection: max. 100 bar / 1450 psi
	G1/2 A hygienic connection: max. 10 bar / 145 psi
	Sliding connection: max. 5 bar / 72.5 psi
Derating effect on O-ring	For further information refer to *Pressure / temperature de-rating of internal O-ring* on page 13.
Other conditions	
Ingress protection (according to IEC 60529)	IP67 (with appropriate cable)
	IP69K (with appropriate cable)
Ambient conditions	
Humidity	< 98 % RH, condensing
Vibration (EN 61373:2010)	Category 2 (bogie-mounted)
	Functional test: 5.4 m/s², 5...250 Hz, 10 min. per axis
	Life-time: 30.6 m/s², 5...250 Hz, 5 h per axis
Shock (EN 61373:2010)	Category 2 (bogie-mounted) 300 m/s², 18 ms, 3 impulses per axis and direction

Installation conditions

Installation	In any position (top, bottom, side). For further information refer to *Installation* on page 14.
Dimensions and weights	For further information refer to *Dimensions and weight* on page 12.

Materials

Sensor housing	Stainless steel 1.4404 / 316L
Process connection	Stainless steel 1.4404 / 316L
Sensor insulation	Virgin PEEK, FDA / Regulation (EC) No 1935:2004 / Regulation (EC) No 2023:2006
Sealing-/ O-ring (internal)	NBR, FKM/Viton, EPDM, Silicone
Electrical connection	Stainless steel or polycarbonate
Surface roughness of wetted part	Ra ≤ 0.8 µm; Ra ≤ 0.4 µm as option

Process connections

Variants	G1/2 A ISO 228-1 or G1/2 A DIN 3852-E; G1/2 A hygienic; reverse-threaded G3/4 ISO 228-1; G1/2 A hygienic 82 mm; G1/2 A hygienic sliding connection; 1/2-14 NPT

Electrical connections

Voltage supply	8...35 VDC
Current consumption (without load)	25 mA typical, 53 mA max.
Power-up time	< 1.5 s
Reaction time	0.1 s typical (0.15 +/- 0.05 s)
Damping	0.1...10 s (adjustable); default: 0.1 s
Cable entry	M12 4-pin

Output signal

Output type	PNP, NPN, digital (push-pull) and 4...20 mA
Switching logic	Normally open (NO), normally closed (NC), active high and active low
Voltage drop	PNP: (+Vs -1.4 V) ± 0.5 V, R_{load} ≥ 10 kΩ
	NPN: (-Vs +0.6 V) ± 0.3 V, R_{load} ≥ 10 kΩ
Current rating	100 mA max.
Off leak current	< 100 µA max.
Short circuit protection	Yes
Interface	IO-Link 1.1

IO-Link interface

IO-Link version	1.1
IO-Link port type	Class A
Baud rate	38.4 kbaud (COM2)
Cycle time	≥ 6.4 ms
SIO-mode	Yes

Approvals and certificates

Declaration of conformity	The device fulfils the statutory requirements of the relevant directives and regulations. The manufacturer certifies successful testing of the product by applying the conformity mark on the device.
	For more information on the directives, regulations, standards and certifications, please refer to the declaration of conformity which can be downloaded from the manufacturer's website.
Compliance and approvals	
Electromagnetic compatibility (EMC)	EN 61326-1, EN 50121-3-2:2016
Hygiene (pending)	3A (74-07), EHEDG EL class 1, FDA (21CFR 177.2415)

Table 2-1: Technical data

2.2 Dimensions and weight

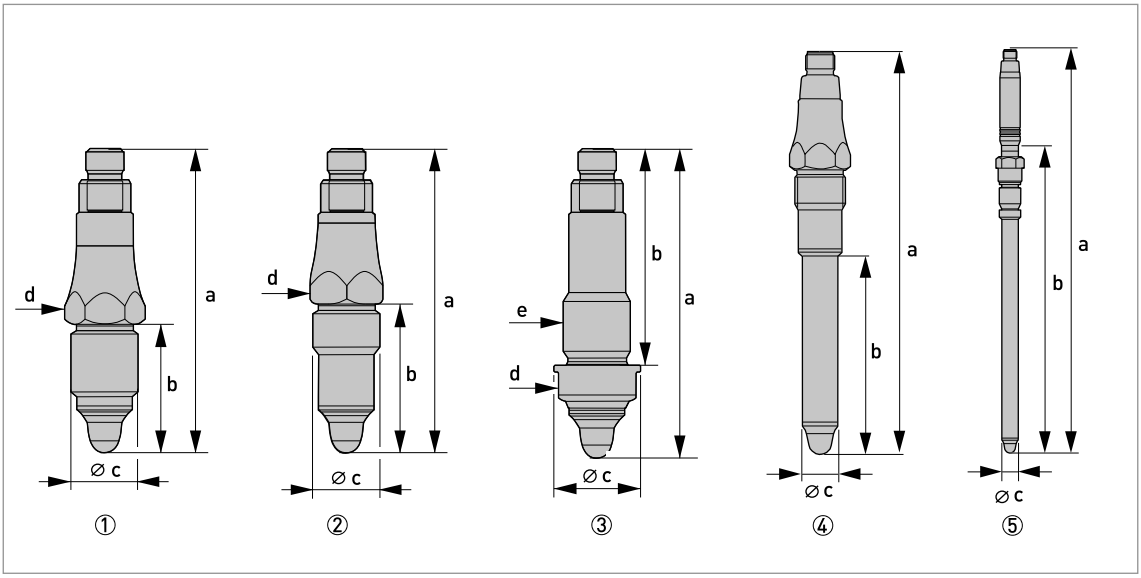


Figure 2-1: Dimensions of all variants

① G1/2 A ISO 228-1, G1/2 A DIN 3852-E and 1/2-14 NPT
② G1/2 A hygienic
③ Reverse-threaded G3/4 ISO 228-1
④ G1/2 A hygienic, length 82 mm
⑤ G1/2 A hygienic sliding connection, length 250 mm

	Dimensions		Approx. weight without adapter	
	[mm]	[inch]	[kg]	[lb]
G1/2 A ISO 228-1 or G1/2 A DIN 3852-E ①				
a	97	3.82	0.1	0.22
b	41	1.61		
c	G1/2 A			
d	WS22 (ISO) or WS27 (DIN)	WS0.87 (ISO) or WS0.87 (DIN)		
G1/2 A hygienic ②				
a	97	3.82	0.1	0.22
b	48	1.89		
c	G1/2 A			
d	WS22	WS0.87		
Reverse-threaded G3/4 ISO 228-1 ③				
a	97	3.82	0.1	0.22
b	68	2.68		
c	Ø32	Ø1.05		
d	WS24	WS0.94		
e	G3/4			

G1/2 A hygienic, length 82 mm ④				
a	167	6.57	0.12	0.27
b	117	4.61		
c	14.6	0.55		
G1/2 A hygienic sliding connection, length 250 mm ⑤				
a	360	14.17	0.25	0.55
b	264	10.39		
c	14.6	0.55		
1/2-14 NPT ①				
a	100	3.94	0.21	0.46
b	41	1.61		
c	1/2-14 NPT			

Table 2-2: Dimensions and weight in mm / inch and kg / lb

2.3 Pressure / temperature de-rating of internal O-ring

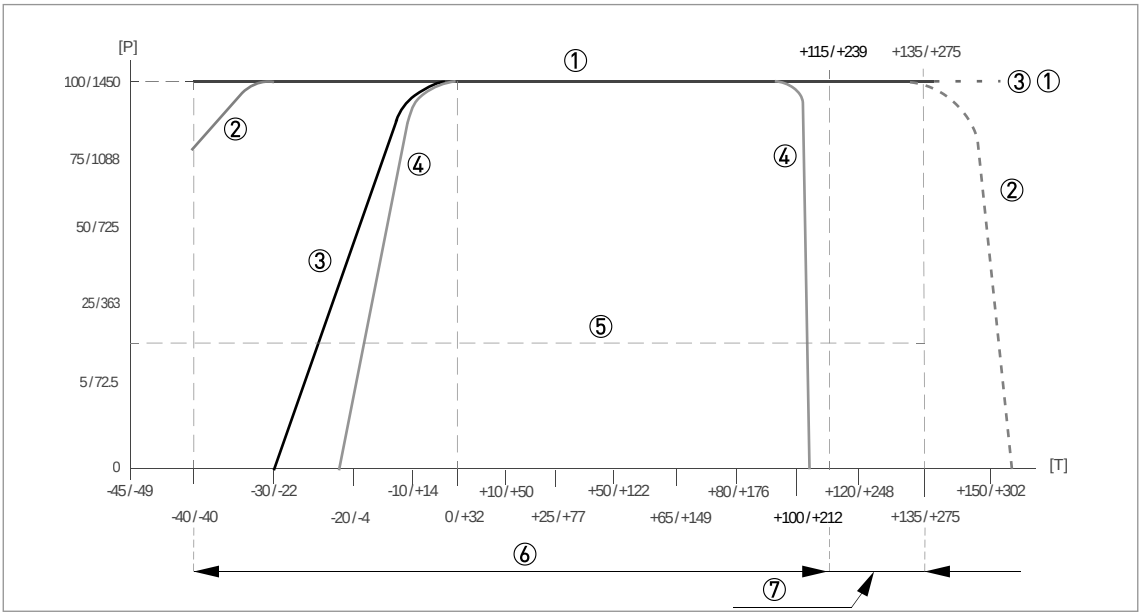


Figure 2-2: Pressure / temperature de-rating of internal O-ring

[P]: Process pressure in bar / psi
[T]: Process temperature in °C / °F

① Silicone
② EPDM
③ FKM (Viton®)
④ NBR
⑤ G1/2 A hygienic, max. 10 bar / 145 psi
⑥ Working range
⑦ 135°C / 274°F, max. 1 h

3.1 Intended use

The OPTISWITCH 6700 C is a level switch for level detection and dry-run protection for liquids and solids. The device measures liquids such as water and beer and well as viscous and sticky products such as honey or toothpaste. Even dry medias can be measured such as sugar or flour.

The measurement is precise and not affected by the mounting position.

Coating of the sensor or condensate is not detected.

3.2 Installation

3.2.1 Level switch for industrial applications

For following process connections:

- G1/2 A ISO 228-1
- 1/2-14 NPT

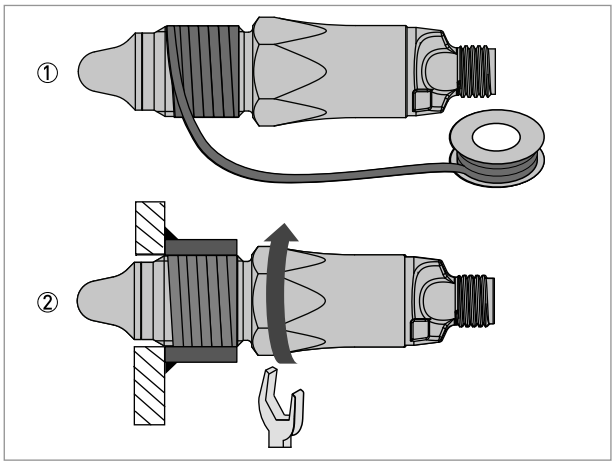


Figure 3-1: Mounting of sensor

① Standard sensor
② Screw-in sensor

- Seal thread on sensor with Teflon tape (PTFE).
- For screw-in sensor:
  tightening torque G1/2 A: 30 Nm max.; tightening torque NPT: 20 Nm max.

For following process connections:

- G1/2 A ISO 228-1 with industrial weld-in adapter for universal use, Ø30 x 26 (KPW1-721)
- G1/2 A DIN 3852-E

For these process connections, do not seal with Teflon tape (PTFE) or elastomer.

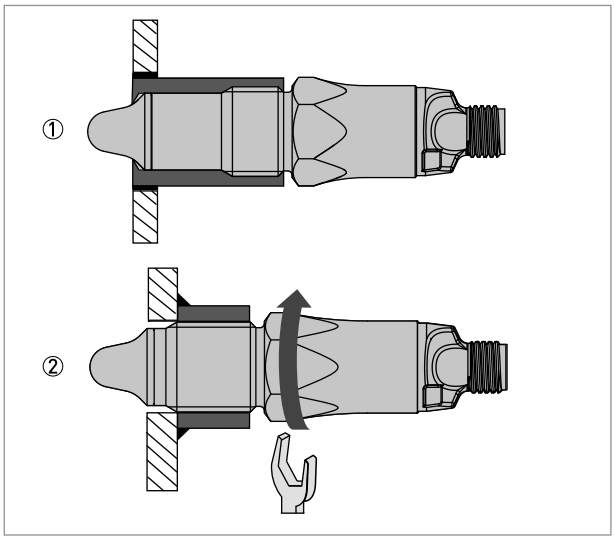


Figure 3-2: Mounting of sensor

① Sensor with adapter or weld-in adapter
② Screw-in sensor

- Adapter or weld-in adapter are mounted free of dead space.
- For screw-in sensor: tightening torque: 15...20 Nm

3.2.2 Level switch for hygienic applications

For following process connections:

- G1/2 A hygienic with weld-in adapter or alternative hygienic adapter

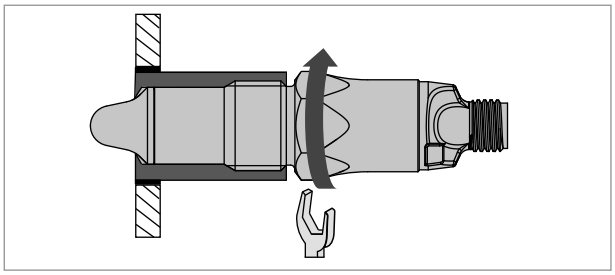


Figure 3-3: Mounting of sensor

- Weld-in sleeve or adapter are hygienically mounted and are internally flush.
- Weld seams are smoothed out to Ra < 0.8 µm.
- Leakage hole points downwards.
- For screw-in sensor: tightening torque: 15...20 Nm

3.3 Process connection

The hygienic 1/2" adapter is easy to weld into tanks or pipes. This kind of assembly allows installation in conformity with standards of hygiene (according to 3A, EHEDG, FDA, Regulation (EC) No 1935:2004, Regulation (EC) No 2023:2006).

Various hygienic adapter are available for fitting to other process connections.

The sensor can be installed in any desired position.

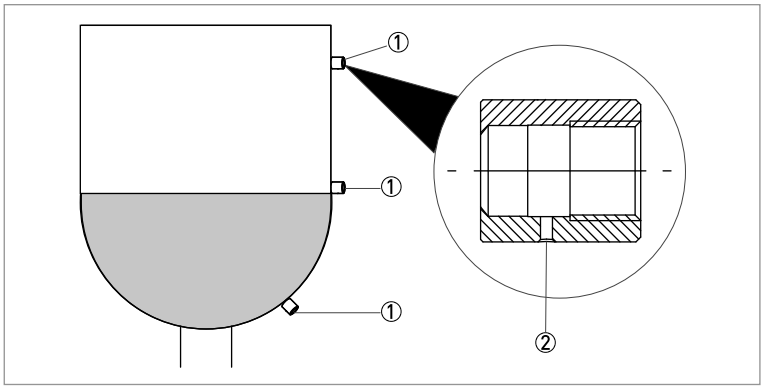


Figure 3-4: Example of mounting with weld-in adapter

① Weld-in adapter
② Leakage hole

3.4 Installation of sliding connection

The following drawing shows how the sliding connection can be used for at least 4 applications:

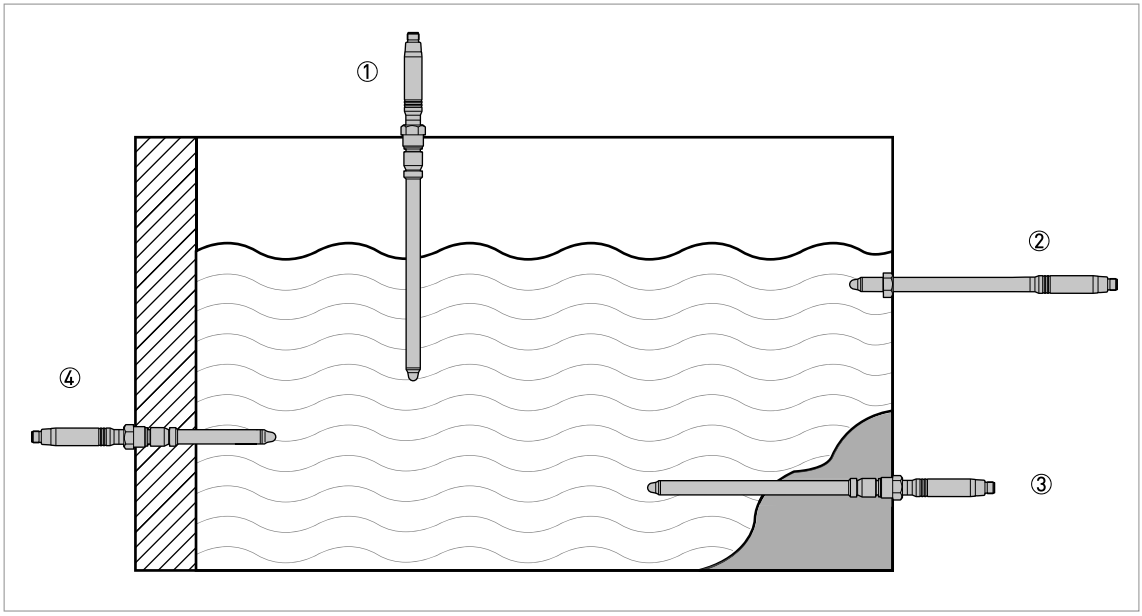


Figure 3-5: Possible applications for sliding connection

① Mounted at the top of a tank to adjust to a certain level.
② Serving as a cooling neck in high media temperature applications.
③ Adjusted to place the sensor tip deeper inside the tank (for lumpy or sticky media).
④ To reach in through insulation material.

The switch with sliding connection can be mounted with a static pressure up to 5 bar / 72.5 psi. To prevent personnel injuries, it is essential that the safety chain is mounted correctly and undamaged.

It is essential that the max. ambient temperature for the electronics is never exceeded.

Process conection	Continuous		Temporary (t < 1 h)	
	Process temperature @Tamb < 50°C / 122°F	Process pressure	Process temperature max. @Tamb < 50°C / 122°F	Process pressure @ process temperature max.
G1/2 A ISO 228-1 BSC	-40...+115°C / -40...+239°F	-1...100 bar / -14.5...1450 psi	+135°C / +275°F	-1...100 bar / -14.5...1450 psi
G1/2 A hygienic	-40...+115°C / -40...+239°F	-1...10 bar / -14.5...145 psi	+135°C / +275°F	-1...5 bar / -14.5...72.5 psi
G1/2 A DIN 3852-E	-40...+115°C / -40...+239°F	-1...100 bar / -14.5...1450 psi	+135°C / +275°F	-1...100 bar / -14.5...1450 psi
1/2-14 NPT	-40...+115°C / -40...+239°F	-1...100 bar / -14.5...1450 psi	+135°C / +275°F	-1...100 bar / -14.5...1450 psi
G3/4 ISO 228-1 for reverse assembly (in-shell thread)	-40...+85°C / -40...+185°F	-1...100 bar / -14.5...1450 psi	-	-
G1/2 A hygienic, length 82 mm	-40...+115°C / -40...+239°F	-1...100 bar / -14.5...1450 psi	+135°C / +275°F	-1...100 bar / -14.5...1450 psi
G1/2 A hygienic sliding connection, length 250 mm	-40...+150°C / -40...+302°F	-1...5 bar / -14.5...72.5 psi	-	-

Table 3-1: Operating conditions for different process connections of the sliding connection

For further information regarding operating conditions of the different types of internal O-rings refer to Pressure / temperature de-rating of internal O-ring on page 13.

4.1 Safety instructions

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

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. Check for the correct supply voltage printed on the nameplate.

4.2 Electrical connection diagrams

Programmable output, IO-Link, PNP

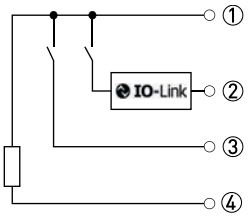
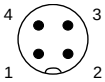
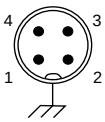
Equivalent circuit	Electrical connection	Function		Pin assignment
		①	+Vs	1
		②	SW1 (IO-Link)	4
		③	SW2	2
		④	GND (0 V)	3
		①	+Vs	1
		②	SW1 (IO-Link)	4
		③	SW2	2
		④	GND (0 V)	3
			Frame Ground	Plug thread

Table 4-1: Programmable output, IO-Link, PNP

Programmable output, IO-Link, NPN

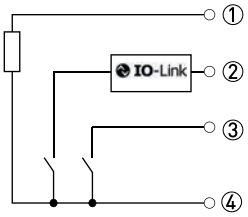
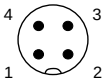
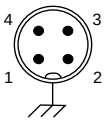
Equivalent circuit	Electrical connection	Function		Pin assignment
		①	+Vs	1
		②	SW1 (IO-Link)	4
		③	SW2	2
		④	GND (0 V)	3
		①	+Vs	1
		②	SW1 (IO-Link)	4
		③	SW2	2
		④	GND (0 V)	3
			Frame Ground	Plug thread

Table 4-2: Programmable output, IO-Link, NPN

Programmable output, IO-Link, digital (push-pull)

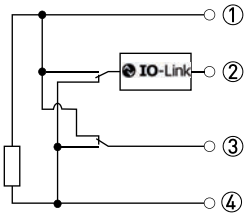
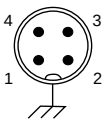
Equivalent circuit	Electrical connection		Function	Pin assignment
		①	+Vs	1
		②	SW1 (IO-Link)	4
		③	SW2	2
		④	GND (0 V)	3
		①	+Vs	1
		②	SW1 (IO-Link)	4
		③	SW2	2
		④	GND (0 V)	3
			Frame Ground	Plug thread

Table 4-3: Programmable output, IO-Link, digital (push-pull)

Programmable output, IO-Link, PNP + analogue 4...20 mA

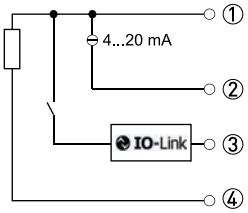
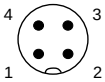
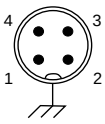
Equivalent circuit	Electrical connection		Function	Pin assignment
		①	+Vs	1
		②	Iout	2
		③	SW1 (IO-Link)	4
		④	GND (0 V)	3
		①	+Vs	1
		②	Iout	2
		③	SW1 (IO-Link)	4
		④	GND (0 V)	3
			Frame Ground	Plug thread

Table 4-4: Programmable output, IO-Link, PNP + analogue 4...20 mA

Programmable output, IO-Link, NPN + analogue 4...20 mA

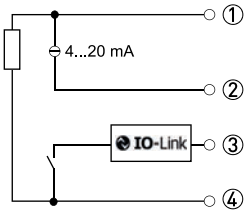
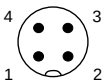
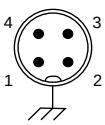
Equivalent circuit	Electrical connection		Function	Pin assignment
		①	+Vs	1
		②	Iout	2
		③	SW1 (IO-Link)	4
		④	GND (0 V)	3
		①	+Vs	1
		②	Iout	2
		③	SW1 (IO-Link)	4
		④	GND (0 V)	3
			Frame Ground	Plug thread

Table 4-5: Programmable output, IO-Link, NPN + analogue 4...20 mA

Programmable output, IO-Link + analogue 4...20 mA, digital (push-pull)

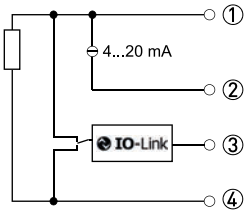
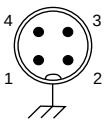
Equivalent circuit	Electrical connection	Function		Pin assignment
		①	+Vs	1
		②	Iout	2
		③	SW1 (IO-Link)	4
		④	GND (0 V)	3
		①	+Vs	1
		②	Iout	2
		③	SW1 (IO-Link)	4
		④	GND (0 V)	3
			Frame Ground	Plug thread

Table 4-6: Programmable output, IO-Link + analogue 4...20 mA, digital (push-pull)

KROHNE – Products, Solutions and Services

- Process instrumentation for flow, level, temperature, pressure measurement and process analytics
- Flow metering, monitoring, wireless and remote metering solutions
- Engineering, commissioning, calibration, maintenance and training services

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 203 301 0
Fax: +49 203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com