OPTISWITCH 6500 C

Technical Datasheet

Capacitance Level Switch for advanced hygienic applications

- Optimised sensor geometry, easy to clean
- Measures products with dielectric constant > 1.5
- Maintenance-free

KROHNE

1.1 Switch for level detection and dry-run protection

The **OPTISWITCH 6500 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. Dry media (sugar or flour) can be also measured. The measurement is precise and not affected by the mounting position. Coating of the sensor or condensate is not detected.

The OPTISWITCH 6500 C is resistant to CIP and SIP agents. Hygienic installation is possible with the comprehensive range of accessories. For further information refer to chapter "Order information".

① LED indication
② PEEK sensor tip
③ Hygienic connection

Highlights

- Process temperature -40 ...+200°C / -40...+392°F (sliding connection)
- Insensitive to build up or foam
- Measures alternating media
- LED switching point indication through cover
- Hygienic 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

1.2 Options and variants

Sliding connection / extension

The OPTISWITCH 6500 C is in two longer versions (100 mm and 250 mm / 3.9" and 9.8") available.
The device is installed with a special packing gland adapter which allows a flexible insertion length.
The devices can be used on high-temperature applications up to +200°C / +392°F; the stem is then working as a cooling neck.
Alternatively, the device can be installed with this option on tanks and pipes with insulation or on level applications with a lower switching point level.

Teach-In function

A Teach-In is necessary when the dielectric constant (ε_r) is < 2 or a medium is hard to detect as present or not, e.g. when yogurt stick to the sensor tip. Teach-In can be done directly with the product by using the teach terminals in the housing.

LED indication

The information that the switching point is triggered, is been indicated by a blue light which shines through the housing cover.

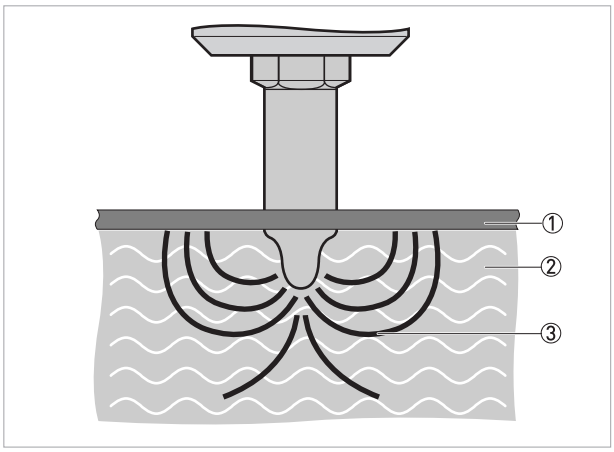
Configuration tool

The configuration tool connects the OPTISWITCH 6500 C with a computer. With a corresponding software, it is possible to fine tune the switching point, change the hysteresis or adjust damping and polarity.

1.3 Measuring principle

A high frequency signal sweep is radiated from the sensor tip into the tank / pipe. The medium will act as a virtual capacitor, which together with a coil in the sensor head, will form a circuit creating the switching point signal. This virtual capacity will depend of the dielectric value of the medium and it is well defined for most media.

The measurement is precise and unaffected by the mounting position.



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

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	Electromagnetic wave, 100..180 MHz
Application range	Level detection, dry-run protection and media separation of liquids and solids.

Design

Construction	The measurement system consists of a measuring sensor and the electronic unit which is available in a compact version. The switching point is signalled by a blue LED indication through the housing cover.
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¨
Reference conditions acc. to EN 60770	
Temperature	+20°C ±5°C / +68°F ±41°F
Pressure	1013 mbar abs. ±20 mbara / 14.69 psi abs. ±0.29 psia
Humidity (IEC 68-2-38)	60% ±15%

Operating conditions

Temperature	
Ambient temperature (T_{amb})	Standard length: -40…+85°C / -40…+185°F
Process temperature	Standard and 3A/DN38 connection: -40…+115°C / -40...+239°F
	Sliding connection: -40…+200°C/ -40..+392°F (refer to separate diagram)
	Cleaning: < 1 hour, T_{amb} < +60°C / +140°F: -40...+140°C / -40...+284°F
Pressure	
Ambient pressure	Atmospheric
Process pressure (tested with water at +20°C / +68°F)	Standard G 1/2 hygienic < 10 bar / 145 psi 3A DN 38 < 40 bar / 580 psi
	Sliding connection: max. 16 bar / 232 psi
Other conditions	
Protection category (acc. to EN 60529)	IP67 equivalent to NEMA 4X

Installation conditions

Installation	In any position. For detailed information refer to chapter "Installation".
Dimensions and weights	For detailed information refer to chapter "Dimensions and weights".

Materials

Sensor housing	Stainless steel 1.4301 / 304
Process connection	Stainless steel 1.4404 / 316L
Sensor insulation	Virgin PEEK, FDA conform
Electrical connection	Plug M12: nickel-plated brass
Surface roughness of wetted part	Ra < 0.8 µm (Ra < 0.4 µm in option)

Process connections

Standard	Hygienic G ½; 3A DN38
Other	For prcocess conenctions options, please refer to the chapter "Order code".

Electrical connections

Power supply	12…36 VDC, 35 mA max.
Power consumption	1.7 W
Power-up time	< 2 s
Reaction time	Max. 0.1 s (100 ms)
Damping	0...10 s
Cable entry	M12 (4 pin Polycarbonate) or M12 (4 pin stainless steel)

Output

Output (active)	Max. 50 mA, short-circuit and high-temperature protected
Output type	PNP, NPN or Digital output (Push-pull)
Output polarity	See drawing in chapter "Electrical connection".
Active "Low"	NPN and digital output; (-VDC + 2.5 V) ± 0.5 V; R_{load} = 1 kilohm
Active "High"	PNP and digital output; (VDC - 2.5 V) ± 0.5 V; R_{load} = 1 kilohm
Factory settings	Output PNP, Measure, DC Value > 1.5, Damping 0.1 s_r > 1.5; damping: 0.1 s
Off Leak Current	+/-100 µA Max

Approvals and certifications

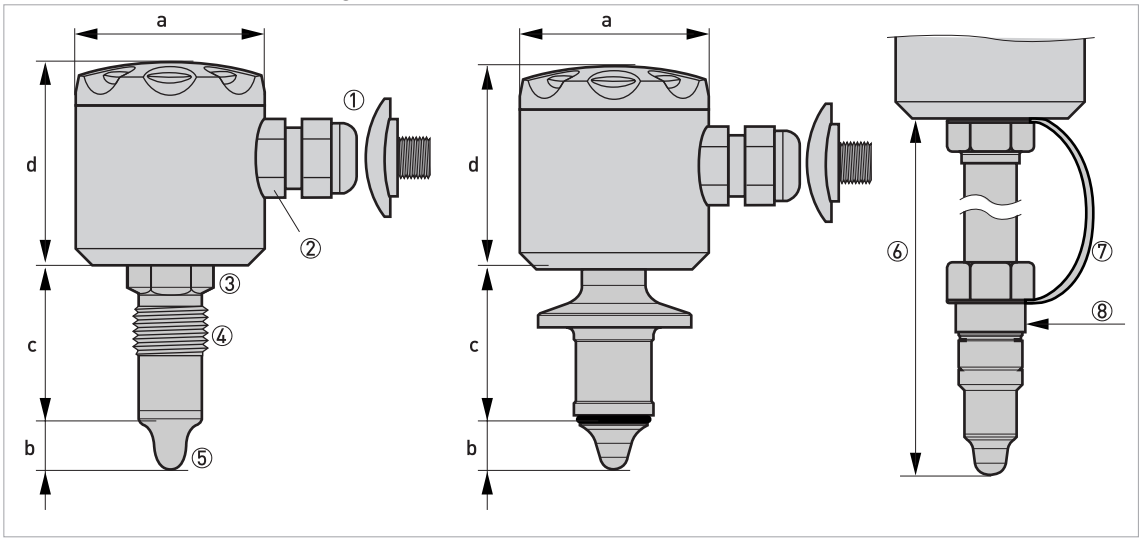
CE	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE marking.
Other standards and approvals	
Electromagnetic compatibility (EMC)	EN 61326-1 (2006)
Vibration resistance	IEC 68-2-6, GL test 2 (standard and DN38 connection)
Hygiene	3A for G ½ and DN38. Material conform to FDA, EC 1935/2004, EC 2023/2006 and EC 10/2011

Explosion protection	**ATEX II 1 G Ex ia IIC T4/T5** Maximum values (for barrier selection): U_i: 30 V DC ; I_i: 100 mA; P_i: 0.75 W Internal capacitance, Ci: 43 nF Internal inductance Li: 10 µH Temperature class: T1...T4: -40°C < T_{amb} < +85°C T1...T5: -40°C < T_{amb} < +74°C ①
	ATEX II 1 D Ex ta IIIC T100 °C Da Voltage supply range 30 V DC max. Temperature class T100 °C: -40°C < T_{amb} < +85°C Protection class of cable accessory IP67
	ATEX II 3 G Ex nA II T4/T5 Voltage supply range 30 V DC max. Temperature class T1...T4: -40°C< T_{amb} < +85°C T1...T5: -40°C< T_{amb} < +74°C

① Recommended barrier: PROFSI3-b25100-ALG-LS

2.2 Dimensions and weights

G ½ hygienic connection, DN38 hygienic connection and G ½ hygienic sliding connection (from left to right)



① M12×1 plug
② M16×1.5 cable gland
③ WS 22
④ G ½
⑤ PEEK tip
⑥ Sliding connection length (refer to ordering data)
⑦ Safety chain
⑧ G ½ hygienic sliding nipple

	Dimensions		Approx. weight	
	[mm]	[inches]	[kg]	[lb]
G ½ hygienic connection				
a	Ø55	Ø2.17	0.4	0.9
b	15	0.71		
c	44	1.73		
d	58	2.28		
3A DN38 hygienic connection				
a	Ø55	Ø2.17	0.4	0.9
b	31.5	1.20		
c	50.5	0.70		
d	58	2.28		

The weight for devices with sliding connection depends on the ordered length of the sliding connection (max. 0.5 kg / 1.1 lb).

3.1 Intended use

The OPTISWITCH 6500 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 media 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 General notes on installation

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

3.3 Installation requirements

- Use only the original KROHNE sleeves or adapters. For more data, refer to *Order code for process connections options* on page 17. If other systems are used, no guarantee can be given for proper functionality or leak-tightness.
- The connection thread must have direct electrical contact with the threaded sleeve and the metal tank or pipe.
- Do not use Teflon or paper gaskets between switch and hygienic adapter. The PEEK sensor together with the stainless steel adapter will perform a hygienic tightening. Assumed that the requirements have been followed.
- The tightening torque for the sleeve should be 20...25 N·m / 14.75...18.44 lb_f·ft (for sliding connection 25...30 N·m / 18.44...22.13 lb_f·ft).
- If the tank or pipe is electrically non-conductive (e.g. plastic), the metal face of a screw-in sleeve with a diameter of at least 28 mm / 1.1¨ will suffice as reference ground.

3.4 Process connection

The hygienic ½¨ process sleeve is easy to weld into tanks or pipes. On a welding adapter there is an arrow or a 3A logo. This must be placed upwards when welding the adapter into a tank (horizontal position). This assures that the electrical connection will be pointing downwards. This form of assembly allows installation in conformity with standards of hygiene (to 3A, FDA EHEDG, Regulation (EC) No 1935:2004, Regulation (EC) No 2023:2006).

Various hygienic adapter sleeves are available for fitting to other process connections. For more information please refer to chapter "Order code".

The sensor can be installed in any desired position.

3.5 Installation of sliding connection

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

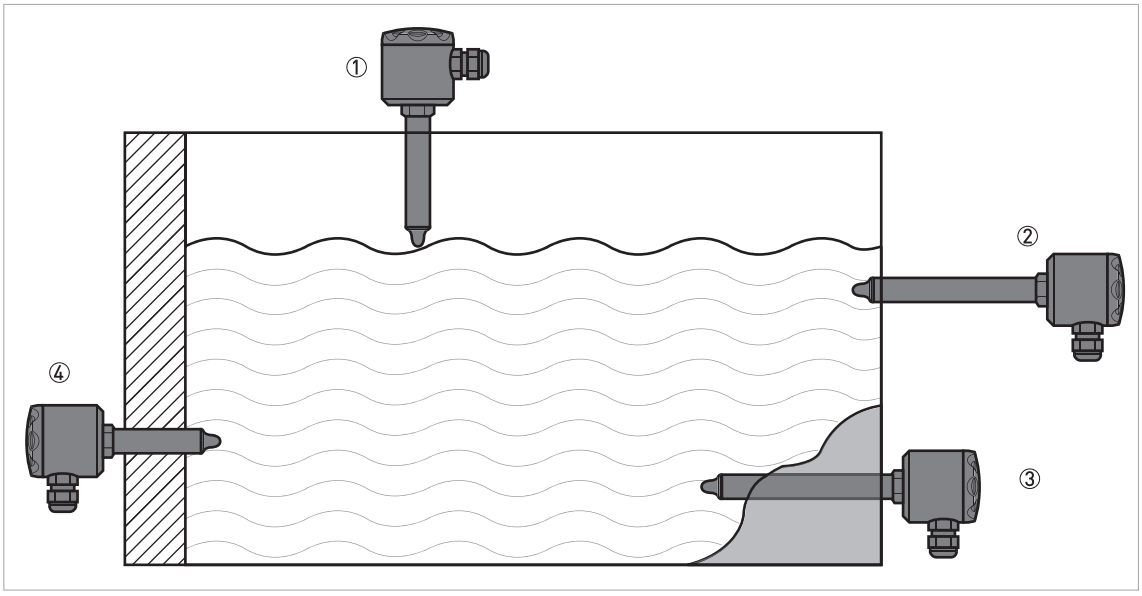


Figure 3-1: Possible applications for sliding connection

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

The OPTISWITCH 6500 C with sliding connection can be mounted with a static pressure up to 16 bar / 232 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.

The operating conditions for the sliding connection in different media temperatures and specified ambient temperatures can be found in the following drawing.

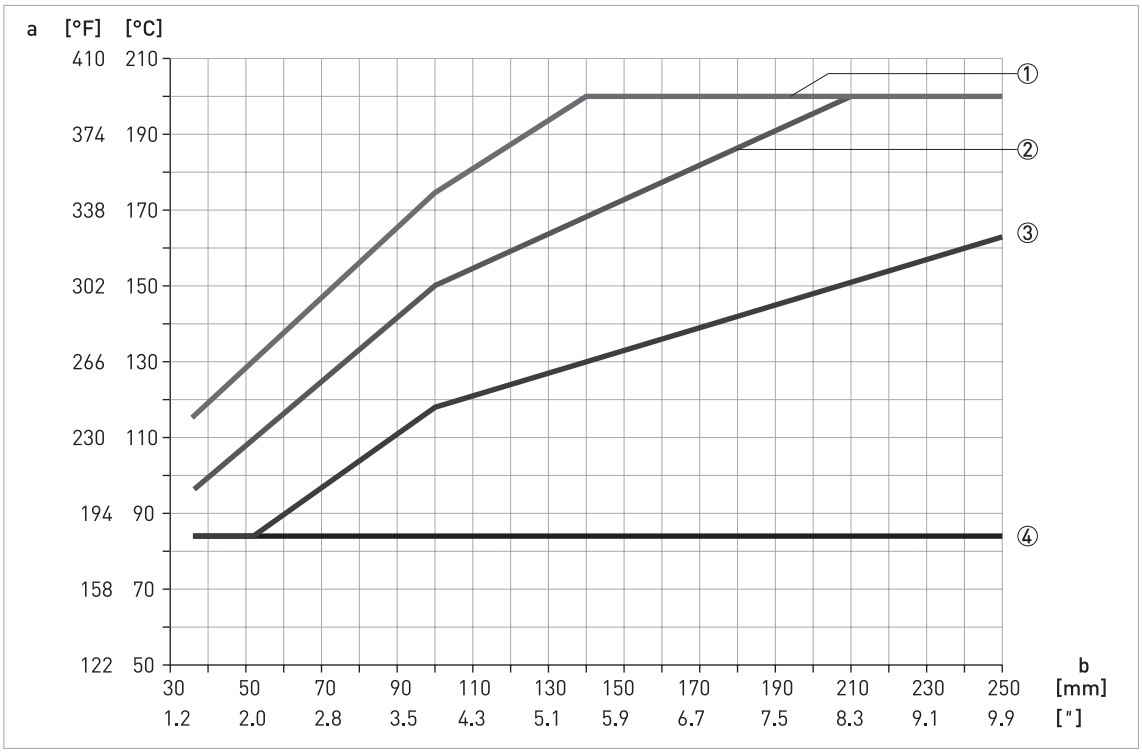


Figure 3-2: Media temperature against external length of sliding connection

a = operating temperature in [°C] or [°F]
b = external length of sliding connection in [mm] or [¨]

① T_{amb} = max. +40°C / +104°F
② T_{amb} = max. +60°C / +140°F
③ T_{amb} = max. +75°C / +167°F
④ T_{amb} = max. +85°C / +185°F

Example, how to read the drawing:

A 250 mm / 9.9¨ sliding connection is mounted in a tank with a total insertion length of 150 mm / 5.9¨. Hence the external length of the sliding connection will be:
250 - 150 = 100 mm or 9.9 - 5.9 = 4¨.

The media temperature will be max. +175°C / +347°F.

Read the x-axis at 100 mm / 4¨ and the y-axis at +160°C / +320°F and find that the ambient temperature must be kept below +40°C / +104°F. In case the radiated heat from the tank will cause a higher ambient temperature at the housing efficient insulation of the tank must be established.

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!

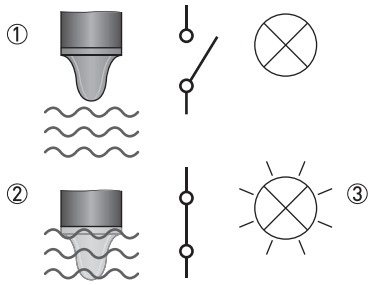
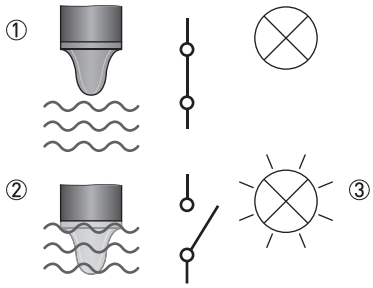
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

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.

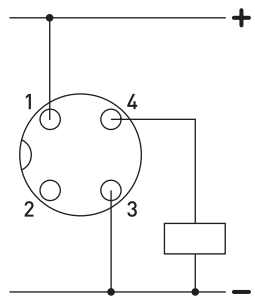
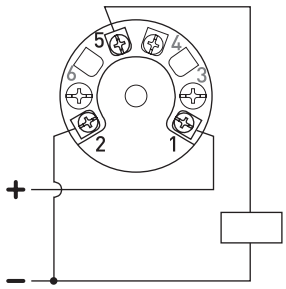
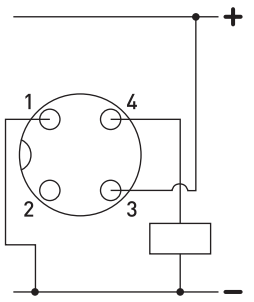
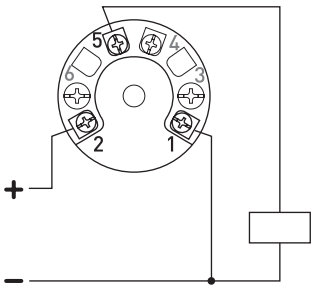
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Electrical connection diagrams

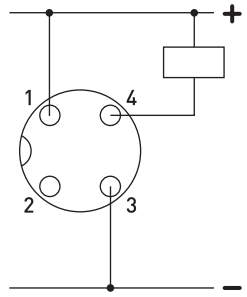
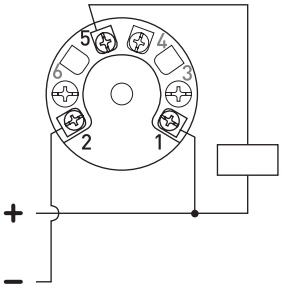
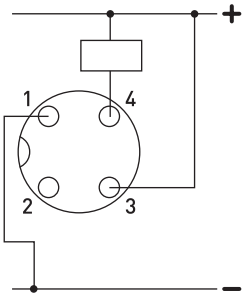
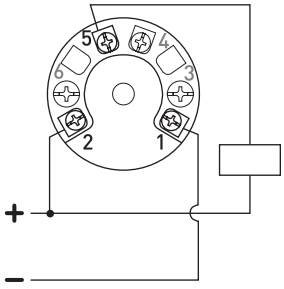
Description of normally open (NO) and normally closed (NC)

Normally open	Normally closed
	
① 0 mA ② 50 mA ③ LED	① 50 mA ② 0 mA ③ LED

PNP

Normally open		Normally closed	
M12	M16	M12	M16
			

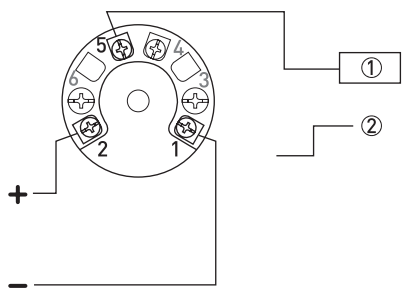
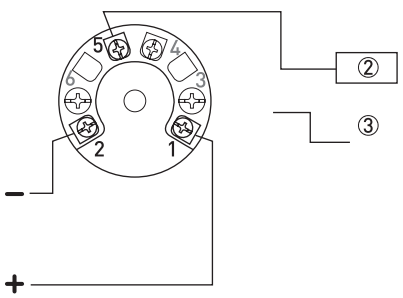
NPN

Normally open		Normally closed	
M12	M16	M12	M16
			

M12 plug

1: brown; 2: white; 3: blue; 4: black

Digital output

Normally open	Normally closed
M16	M16
	
① PLC ② active high	① PLC ② active low

5.1 Device order code

VGP9	4	1	OPTISWITCH 6500 C, with IP67 (equivalent to NEMA 4X), stainless steel housing – materials agree with FDA / Regulation (EC) No 1935:2004 / Regulation (EC) No 2023:2006. The use of VGP7 process connections is required for 3A / EHEDG approved switches.							
			Process connection							
			For hygienic use in combination with VGP7 process connections							
			1	G ½ – standard sensor length 15 mm / 0.59¨ (for use with hygienic process connections Max +115°C / 239°F)						
			4	DN38 hygienic connection incl. EPDM O-ring, 3A certified – insertion length of 18 mm / 0.7¨ Max. +115°C / 239°F						
			For non-hygienic use							
			2	G ½ – with rigid extended sensor 100 mm / 3.9¨ (sliding connection)						
			3	G ½ – with rigid extended sensor 250 mm / 9.8¨ (sliding connection)						
				Electrical connection						
				1	M16 – polyamid cable gland included					
				2	M16 – brass cable gland included					
				3	M12 – 4-pin connector plug in nickel plated brass					
				4	M12 – 4 pin connector plug in stainless steel					
					Approvals					
					0	Without				
					4	ATEX II 1D Ex tD A20 IP67 100°C ①				
						Output configuration				
						0	Standard			
						1	Customer settings – based on data from an installed device. "% of triggering, damping, hysteresis, output mode" to be specified separately.			
							Other Approvals			
							0	None		
							A	Food contact (FDA rules, EC 1935/2004, EC 2023/2006 and EU 10/2011)		
							B	Food contact (FDA rules, EC 1935/2004, EC 2023/2006 and EU 10/2011) + 3-A® + EHEDG – only with process connection. code 1 (G1/2 A) and in combination with hygienic adapters		
							C	Food contact (FDA rules, EC 1935/2004, EC 2023/2006 and EU 10/2011) + EHED G– only with process connection code 2 and 3		
								Surface finish		
								0	Standard 0.8 µm surface roughness	
								1	0.8 µm surface roughness – electro-polished	
								2	0.4 µm surface roughness	
VGP9	4	1							0	Order code

① Available only as LS 6500

Order code for configuration tool (incl. interface unit + USB cable + CD with driver + alligator clips + M12 connection cable)

XGP9	0	0	0	0	1	0	Order code

5.2 Order code for process connections options

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	HWN 220	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	—
KPH-32CB	HGA 200	Hygienic adapter for G 1 process connection	40	580	—
KPH1-3236	HSM 251	DN51 adapter SMS 1145 ①	25	363	—
KPH3-3213	HTC 240	1½¨ Tri-Clamp® DN25/40 DIN 32676, 25/38 mm ISO 2852 ①	40	580	3-A® / EHEDG
KPH3-3216	HTC 250	2¨ Tri-Clamp® DN50 DIN 32676, 51 mm ISO 2852 ①	40	580	3-A® / EHEDG
KPH3-3221	HMT 225	DN25 conical nozzle DIN 11851 ①	40	580	3-A® / EHEDG
KPH3-3224	HMT 240	DN40 conical nozzle DIN 11851 ①	40	580	3-A® / EHEDG
KPH3-3225	HMT 250	DN50 conical nozzle DIN 11851 ①	10	145	3-A® / EHEDG
KPH3-3254	—	DN40 conical nozzle DIN 11851 Type A ①	10	145	3-A® / EHEDG
KPH3-3255	—	DN50 conical nozzle DIN 11851 Type A ①	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 ①	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	—
KPH1-32A1	—	E&H FTL – process connection code EE2, Rd 52	40	580	—
KPH1-32BA	—	E&H FTL – process connection code GQ2 (G ¾), Ø23.7 mm	40	580	—
KPH1-32BC	—	Vegaswing – process connection codes GB/GBV (G ¾), Ø21.3 mm	40	580	—
KPH1-32CD	—	Vegaswing – process connection codes GA/GAV (G 1), Ø21.3 mm	40	580	—
KPI1-A2D	—	G 1½ Cable holder for use with OPTISWITCH 6600 solids	10	145	—

① To order union nuts and gaskets, refer to "Accessories" in the section that follows

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

5.3 Order code for accessories

Code	Description	New hygienic connection code	Old hygienic connection code	Approval options
KPX4-310	Clamp-ring AISI 304 for 1½¨ Tri-Clamp® DN40 DIN 32676, 38 mm ISO 2852	KPH1-3213	HTC 240	—
KPX3-7232	EPDM gasket for 1½¨ Tri-Clamp® DN25/40 DIN 32676 25/38 mm ISO 2852	KPH1-3213	HTC 240	FDA
KPX4-610	Clamp-ring AISI 304 for 2¨ Tri-Clamp® DN50 DIN 32676, 51 mm ISO 2852	KPH1–3216	HTC 250	—
KPX3-7262	EPDM gasket for 2¨ Tri-Clamp®, DN50 DIN 32676, 51 mm ISO 2852	KPH1–3216	HTC 250	FDA
KPX4-630	Union nut AISI 304 for DN51 adapter SMS 1145	KPH1-3236	HSM 251	—
KPX3-8160	NBR gasket for DN51 adapter SMS 1145	KPH1–3236	HSM 251	—
KPX4-140	Union nut AISI 304 for DN25 conical nozzle DIN 11851	KPH1–3221	HMT 225	—
KPX3-9110	NBR gasket for DN25 conical nozzle DIN 11851	KPH1–3221	HMT 225	—
KPX4-440	Union nut AISI 304 for DN40 conical nozzle DIN 11851	KPH1–3224	HMT 240	—
KPX3-9140	NBR gasket for DN40 conical nozzle DIN 11851	KPH1–3224	HMT 240	—
KPX2-A22	EPDM gasket for DN40 conical nozzle DIN 11864-1 from A	—	—	—
KPX2-A32	FKM gasket for DN40 conical nozzle DIN 11864-1 from A	—	—	—
KPX4-540	Union nut AISI 304 for DN50 conical nozzle DIN 11851	KPH1–3225	HMT 250	—
KPX3-9150	NBR gasket for DN50 conical nozzle DIN 11851	KPH1–3225	HMT 250	—
KPX2-B32	FKM gasket for DN50 conical nozzle DIN 11864-1 from A	—	—	—
KPX2-123	EPDM O-ring 3A DN38	within order code OPTISWITCH 6500	—	3-A® /FDA
KPX2-323	EPDM O-ring for DN40/50 VARIVENT® Type N	KPH1–324E	HVF 250	3-A® /FDA

KROHNE – Process instrumentation and measurement solutions

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

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

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