

Table of contents

| | Page |
|----------------------------------|------|
| Safety notes / Technical support | 2 |
| <hr/> | |
| Introduction | 3 |
| <hr/> | |
| Technical data | 4 |
| Electrical data | 4 |
| Dimensions | 6 |
| Mechanical data | 9 |
| <hr/> | |
| Options/ Accessories | 11 |
| <hr/> | |
| Operating conditions | 12 |
| <hr/> | |
| Approvals | 14 |
| <hr/> | |
| Installation | 15 |
| Mechanical installation | 15 |
| Electrical installation | 20 |
| <hr/> | |
| Operation | 24 |
| Operating elements / LED's | 24 |
| Operation with potentiometer | 25 |
| Factory calibration | 26 |
| Recalibration | 27 |
| Advanced calibration | 28 |
| Operation with IO-Link | 33 |
| IO-Link data / registers | 34 |
| Setting of signal outputs | 36 |
| Calibration possibilities | 37 |
| Factory calibration | 38 |
| Recalibration | 39 |
| Advanced calibration | 40 |
| WHG Proof Test | 46 |
| <hr/> | |
| Troubleshooting | 47 |
| <hr/> | |
| Transport and Storage | 48 |
| <hr/> | |
| Maintenance | 49 |
| <hr/> | |
| Disposal | 50 |

Subject to technical change.

We assume no liability for typing errors.

Different variations than specified are possible.
 Please contact our technical consultants.

Safety notes / Technical support

Notes

- Installation, maintenance and commissioning may be accomplished only by qualified technical personnel.
- The product must be used only in the manner outlined in this instruction manual.

Special attention must be paid to warnings and notes as follows:

WARNING



Relates to a caution symbol on the product: A failure to observe the necessary precautions can result in death, serious injury and/or considerable material damage.

WARNING



Relates to a caution symbol on the product: Risk of electric shock

WARNING



A failure to observe the necessary precautions can result in death, serious injury and/or considerable material damage.

This symbol is used, when there is no corresponding caution symbol on the product.

CAUTION

A failure to observe the necessary precautions can result in considerable material damage.

Safety symbols

| In manual and on product | Description |
|--------------------------|--|
| | CAUTION: refer to accompanying documents (manual) for details. |
| | Earth (ground) Terminal |
| | Protective Conductor Terminal |

Technical support

Please contact your local supplier (for address see www.uwt.de). Otherwise you can contact:

UWT GmbH
 Westendstr. 5
 D-87488 Betzigau
 Germany

Tel.: 0049 (0)831 57123-0
 Fax: 0049 (0)831 76879
info@uwtgroup.com
www.uwtgroup.com

Introduction

Measurement principle

The Capanivo series CN 7000 detects the capacitance around its probe. Due to the active shield technology it has an increased insensitivity to material buildup on the probe.

Applications

The Capanivo series CN 7000 is a capacitance switch for:

- Level detection of liquids, solids (powder and granules), slurries and foam.
- Interface detection (for example, oil / water or foam / liquid)

It works in all types of vessels, pipes and silos within a wide range of applications like:

- Food, brewery, dairy, beverage and pharmaceuticals
- Chemical and petrochemical
- Water and waste water
- Machine building industry

It can also be used for leakage detection in double walled vessels, tanks and silos or in moldings and collecting ponds.

Features

Process

- Measurement independent from influence of the vessel wall
- Factory provided precalibration allows measurement of most applications without sensitivity setting on site
- Active shield electrode for compensation of material buildup
- Potted construction protects from shock, vibration, humidity, condensation
- Dielectric constant of 1.5 or more
- Process temperature up to 125°C
- Approvals CE, FM, FMc, WHG

Electronics

- IO-Link, IEC 61131-9 SDCI standard
- PNP, NPN or Push-Pull output (configurable)
- Terminal or M12 plug
- Sensitivity setting by IO-Link or by potentiometer (configurable)

Mechanics

- Corrosion resistant construction with enclosure made of thermoplastic polyester, wetted parts made of PPS, PVDF, PEEK and 316L stainless steel
- Compact probe length
- Pipe extension (max. 4m), optional sliding sleeve allows to change the switch point easily during operation of the device
- Various process connections: threaded (including G½" hygienic), flanged (screwed) or Tri-clamp

Technical data

Electrical data

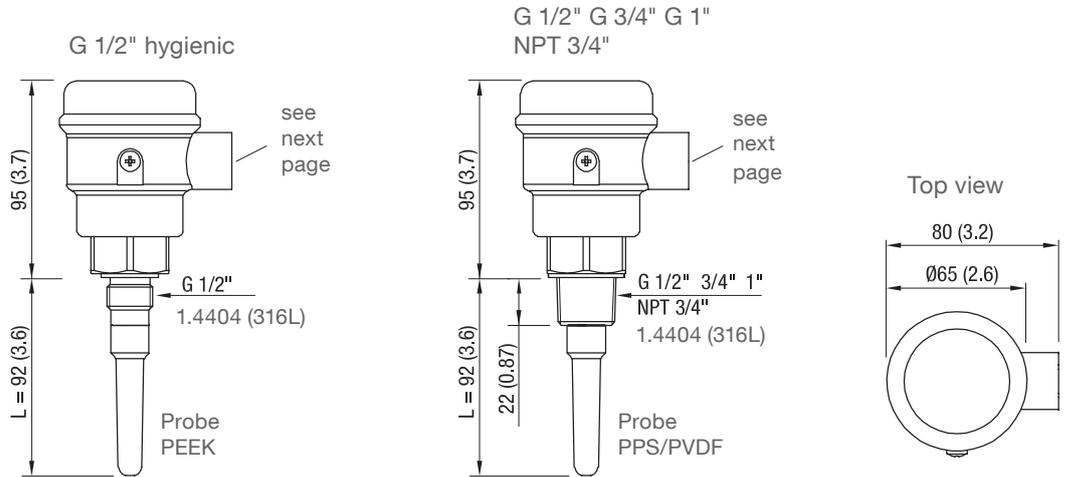
| | |
|--|--|
| Power supply | 10 - 30 V DC incl. 10% of EN 61010-1 Operation with IO-Link requires min. 18V Current consumption: <55mA |
| Signal outputs Electrical ratings | Out 1 and Out 2: Max. current: One output active: 200 mA Both outputs active: 100 mA each (short-circuit proof) Voltage drop: <2V |
| Out 1 Configuration | SIO mode*: Factory setting PNP (FSL) Other than factory setting can be configured via IO-Link as follows: PNP (FSH) or NPN (FSH or FSL) or Push/pull (FSH or FSL) COM-mode IO-Link communication *Note: If there is no IO-Link communication, the device operates in the SIO mode |
| Out 2 Configuration | Factory setting PNP (FSH) Note: Out 2 PNP is opposite to Out 1 PNP (antivalent) Other than factory setting can be configured via IO-Link as follows: PNP (FSL) or NPN (FSH or FSL) or Push/pull (FSH or FSL) |
| Diagnostics | Self diagnostics present |
| Safety operation (FSL,FSH) | Configurable via IO-Link |
| Signal delay | Configurable via IO-Link. Factory setting Probe uncovered -> covered ca. 0.5 sec Probe covered -> uncovered ca. 0.5 sec |
| Indicating light | Build in LEDs: Power (green), Signal output (yellow), Sensor status / Diagnostics (white) |
| Sensitivity | Factory setting Adjustable by potentiometer alternative Programmable by IO-Link |
| Electrical connection | With enclosure Ø65mm (2.56"): Terminal block, terminals (0.14 - 1.5 mm ² (AWG 28-16) With enclosure Ø65mm (2.56") and Ø35mm: (1.38") M12x1 according to IEC 61076-2-101, male, 4-pole, coding A-standard |
| Cable entry | With enclosure Ø65mm (2.56"): M20 x 1.5 screwed cable gland Clamping range (diameter) of factory provided cable glands: 6..12 mm (0.24 .. 0.47") or NPT 1/2" conduit |
| Overvoltage category | II |
| Protection class | III |

Technical data

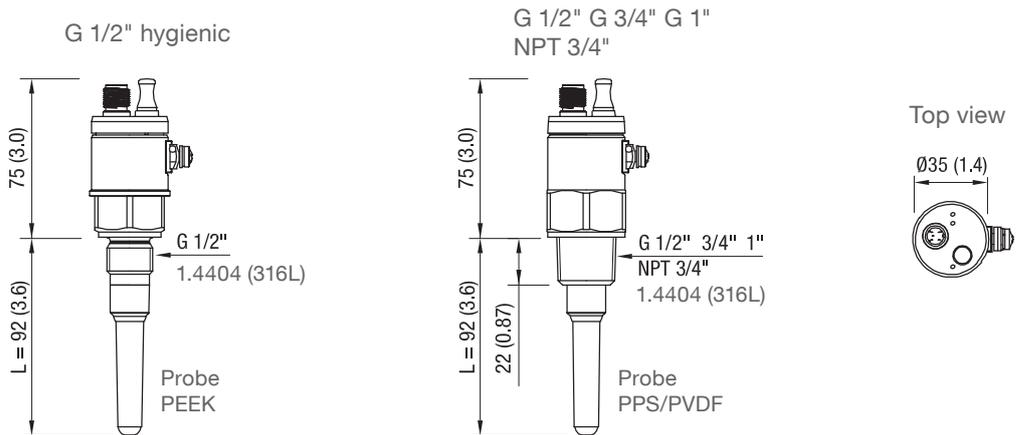
Dimensions All dimensions in mm (inch)

CN 7120 - Short extension length Stainless steel process connection

Enclosure Ø65mm (2.56")

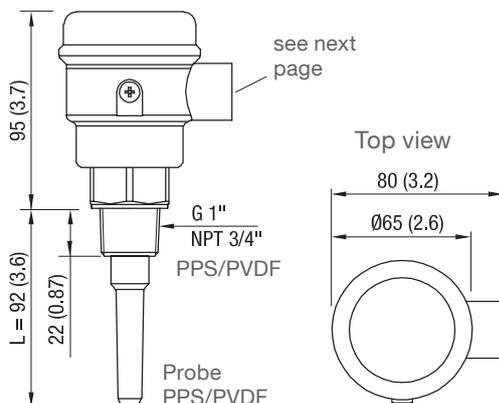


Enclosure Ø35mm (1.38")

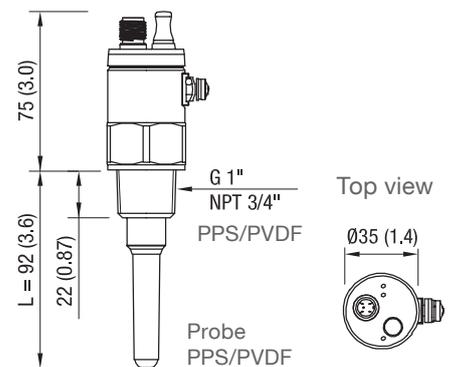


CN 7121 - Short extension length Plastic process connection

Enclosure Ø65mm (2.56")

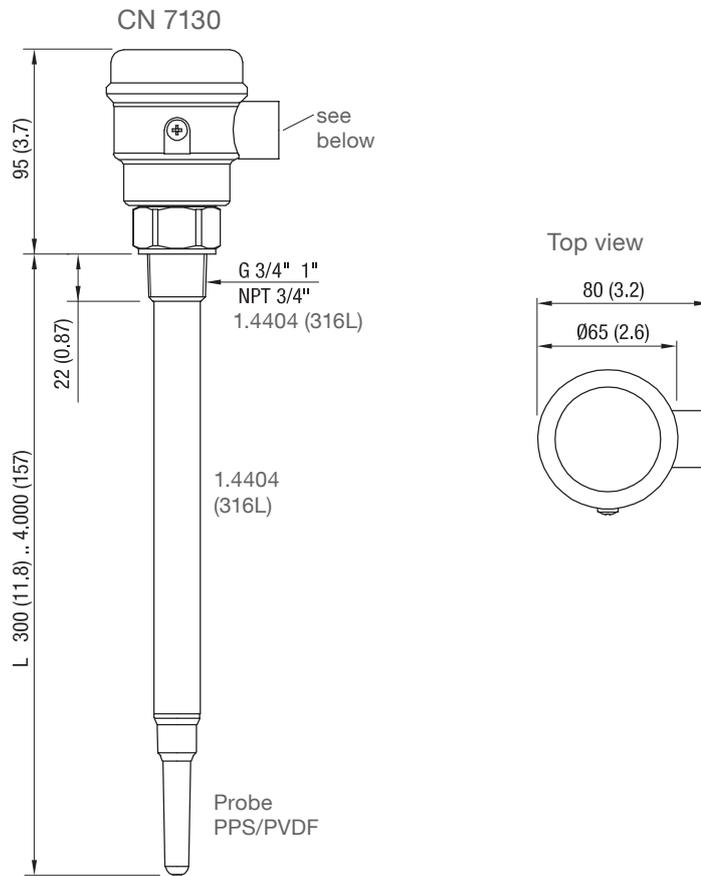


Enclosure Ø35mm (1.38")



Technical data

CN 7130 - Pipe extension

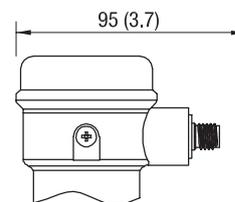
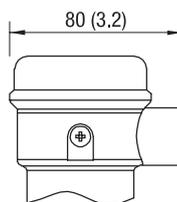
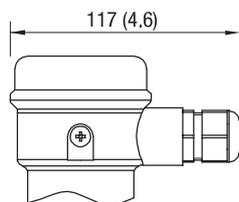


Enclosure Ø65mm (2.56") Possible wiring

M20x1,5
 cable gland

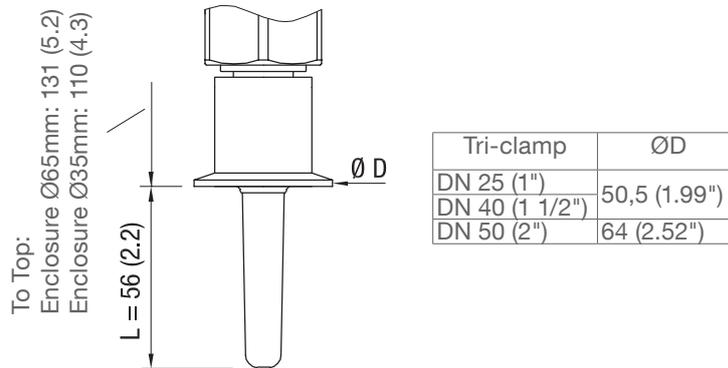
1/2" NPT
 conduit

M12
 plug

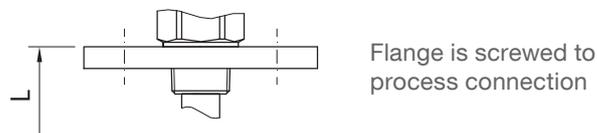


Technical data

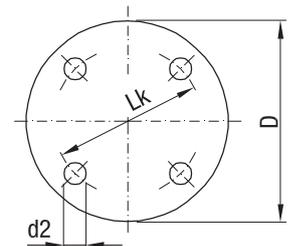
Tri-clamp



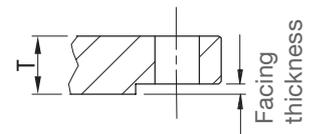
Flange



| | Code | Type | Number of holes | d2 mm (Inch) | Lk mm (Inch) | D mm (Inch) | T thickness mm (Inch) |
|------------------------------------|------|--------------------|-----------------|-----------------|-----------------|----------------|-----------------------------|
| ASME B16.5, raised face | R | 1" 150 lbs | 4 | 15,9 (0.63) | 79,3 (3.12) | 108,0 (4.25) | 14,3 (0.56) |
| | S | 1" 300 lbs | 4 | 19,1 (0.75) | 88,9 (3.5) | 123,8 (4.87) | 17,5 (0.69) |
| | T | 1½" 150 lbs | 4 | 15,9 (0.63) | 98,6 (3.88) | 127,0 (5.0) | 17,5 (0.69) |
| | U | 1½" 300 lbs | 4 | 22,2 (0.87) | 114,3 (4.5) | 155,6 (6.13) | 20,6 (0.81) |
| | V | 2" 150 lbs | 4 | 19,1 (0.75) | 120,7 (4.75) | 152,4 (6.01) | 19,1 (0.75) |
| | W | 2" 300 lbs | 8 | 19,1 (0.75) | 127,0 (5.0) | 165,1 (6.5) | 22,2 (0.87) |
| EN 1092-1 type A, flat faced | N | DN25 PN16/40 | 4 | 14,0 (0.55) | 85,0 (3.35) | 115,0 (4.53) | 18,0 (0.71) |
| | P | DN40 PN16/40 | 4 | 18,0 (0.71) | 110,0 (4.33) | 150,0 (5.91) | 18,0 (0.71) |
| | Q | DN50 PN16/25/40 | 4 | 18,0 (0.71) | 125,0 (4.92) | 165,0 (6.5) | 18,0 (0.71) |



Raised face



| Type | Facing thickness |
|--------------|------------------|
| ASME 150 lbs | 2 mm (0.08") |
| ASME 300 lbs | |

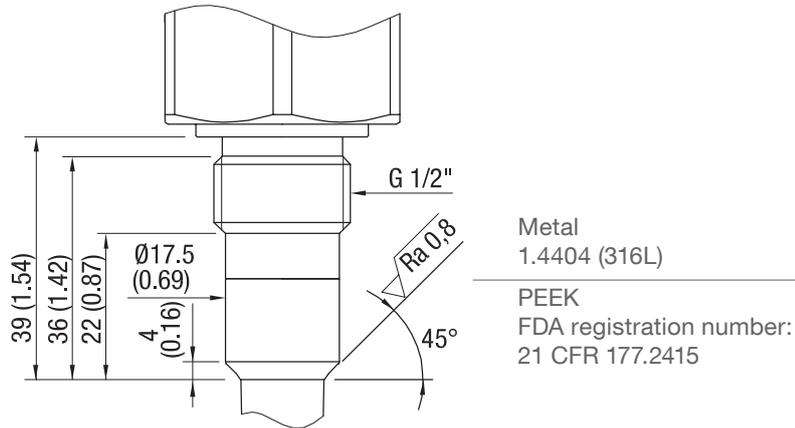
Technical data

CN 7120 - G 1/2" hygienic process connection / EHEDG approval

EHEDG versions

EHEDG approval is available with CN7120 with process connection G 1/2" hygienic

CN 7120 process connection

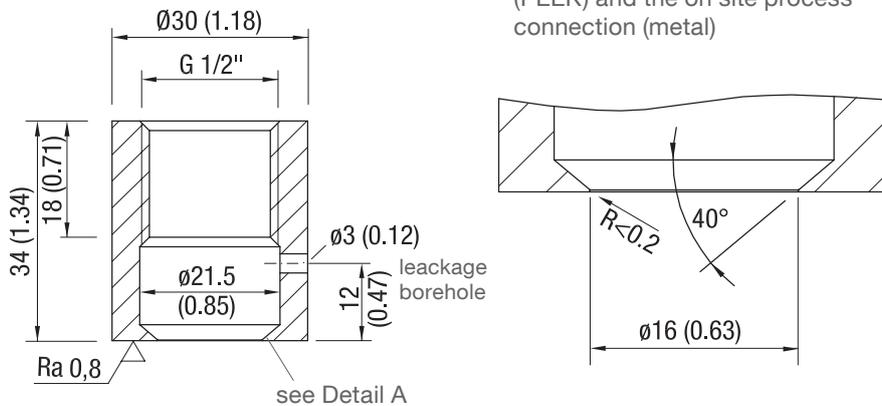


Flush welding socket: Design

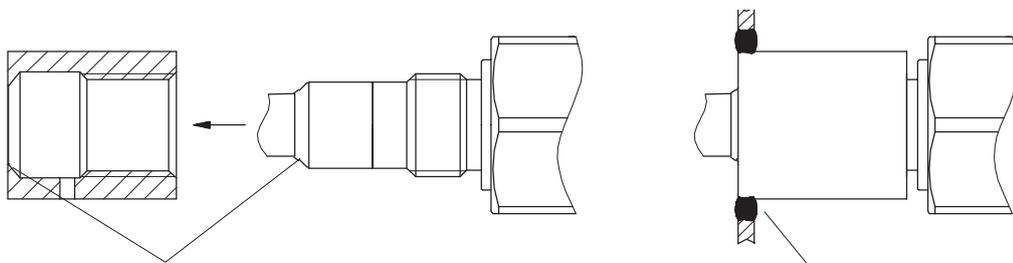
The flush welding socket must meet the following design:

Metal type according to hygienic and further external requirements.

Detail A:
 Sealing area between CN 7120 (PEEK) and the on site process connection (metal)



Flush welding socket: Installation



Metal-peek sealing

- The support must be plane and without any gap. No teflon tape (or similar) is allowed to be in between.
- Fixing torque 30 Nm

The quality of the welding with the container wall must be according to the respective regulations (e.g. gaps, transitions, surface finish).

Technical data

Mechanical data

Process connection and extension

CN 7120 - Stainless steel process connection, version G 1/2" Hygienic:

| | |
|--------------------------------|------------------------------------|
| Material process connection: | 1.4404 (316L) |
| Material probe: | PEEK ^(1,2) |
| Seal process connection-probe: | FKM (optional FFKM) ⁽²⁾ |
| Thread ⁽³⁾ : | G 1/2" Hygienic |
| Wetted sensor surface: | Ra ≤ 0.8 µm (31 µin) |
| Hygienic design: | EHEDG |

CN 7120 - Stainless steel process connection:

| | |
|---------------------------------|---|
| Material process connection: | 1.4404 (316L) |
| Material probe: | PPS (glass fibre reinforced) ^(1,2) Optional PVDF ^(1,2) |
| Seal process connection-probe: | FKM (optional FFKM) ⁽²⁾ |
| Thread ⁽³⁾ : | G 1/2", G 3/4", G 1", NPT 3/4" Adapters for G 1 1/2", NPT 1 1/4", NPT 1 1/2" |
| Tri-clamp | DN25 (1"), DN40 (1 1/2"), DN50 (2") DIN 32676 Type A (DIN 11851) and DIN 32676 Type C (ASME BPE 2009) |
| Flange (screwed) ⁽⁴⁾ | DN 25, 40, 50; ASME 1", 1 1/2", 2" |

CN 7121 -Plastic process connection:

| | |
|--------------------------------|---|
| Material process connection: | PPS (glass fibre reinforced) ^(1,2) Optional PVDF ^(1,2) |
| Material probe: | PPS (glass fibre reinforced) ^(1,2) Optional PVDF ^(1,2) |
| Seal process connection-probe: | FKM (optional FFKM) ⁽²⁾ |
| Thread ⁽³⁾ : | G 1", NPT 3/4" |

CN 7130 - Pipe extension:

| | |
|---------------------------------|---|
| Material process connection: | 1.4404 (316L) |
| Material pipe extension: | 1.4404 (316L) |
| Material probe: | PPS (glass fibre reinforced) ^(1,2) Optional PVDF ^(1,2) |
| Seal pipe-probe: | FKM (optional FFKM) ⁽²⁾ |
| Thread ⁽³⁾ : | G 3/4", G 1", NPT 3/4" Adapters for G 1 1/2", NPT 1 1/4", NPT 1 1/2" |
| Flange (screwed) ⁽⁴⁾ | DN 25, 40, 50; ASME 1", 1 1/2", 2" |

⁽¹⁾ Discolouration is possible due to influence of UV and temperature. This has no negative effect to the material properties.

⁽²⁾ Food grade, FDA registration number:
 Seals 21 CFR 177.2600
 PVDF 21 CFR 177.1550
 PPS 21 CFR 175.300
 PEEK 21 CFR 177.2415

⁽³⁾ Thread types: G = DIN ISO 228-1 NPT = ASME B 1.20.1

⁽⁴⁾ Flange pressure rating: DN25 PN16/40, DN40 PN16/40, DN50 PN16/25/40
 ASME 150lbs, ASME 300lbs

Technical data

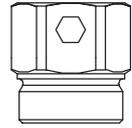
| | | |
|---|---|--|
| Extension length "L" | CN 7120 Stainless steel process conn.: | 92 mm (3.6") |
| | CN 7121 Plastic process connection: | 92 mm (3.6") |
| | CN 7130 Pipe extension: | 300 .. 4000mm (11.8 .. 157") |
| Tolerance length "L" | CN 7120 Stainless steel process conn.: | ±5 mm (±0.2") |
| | CN 7121 Plastic process connection: | ±5 mm (±0.2") |
| | CN 7130 Pipe extension: | ±10 mm (±0.4") |
| Material Enclosure Ø65mm (2.56") | Material Housing: | Thermoplastic polyester (PBT/PC) |
| | Material Lid: | Transparent thermoplastic polycarbonate (PC) |
| | Material Seal between housing and lid: | VMQ (vinyl-methyl-silicone) |
| | Material Nameplate: | polyester film |
| Material Enclosure Ø35mm (1.38) | Material Housing: | 1.4404 (316L) |
| | Material Lid with M12 plug: | Transparent thermoplastic polycarbonate (PC) |
| | Material Seal between housing and lid: | VMQ (vinyl-methyl-silicone) |
| | Material Nameplate: | polyester film |
| Ingress protection | Type 4X / IP68 | |
| Sound level | n.a. (no sound is produced) | |
| Overall weight (ca.) | CN 7120 Stainless steel process conn.: | 0.35 kg (0.77 lbs) |
| | CN 7121 Plastic process connection: | 0.25 kg (0.55 lbs) |
| | CN 7130 Pipe extension: | 0.6 kg (1.32 lbs) + 0.85 kg/m (1.87 lbs per 39.3") |
| | All weights with threaded process connection. | |

Options / Accessories

Options

Sliding sleeve
 CN 7130

G 1 1/4" / G 1 1/2" / NPT 1 1/4" / NPT 1 1/2"
 Material: 1.4404 (316L)
 Sealing material to the extension pipe: FKM
 Max. process pressure: -1 to 10 bar (146 psi)

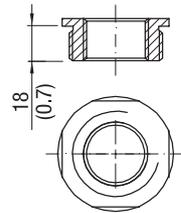


Accessories

Adapter for process connection

Adapter from G 1" thread to G 1 1/2"
 Adapter from NPT 3/4" thread to NPT 1 1/4" / NPT 1 1/2"

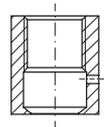
Material: 1.4305 (303) or 1.4404 (316L)
 Max. process pressure: -1 to 25 bar (363 psi)



Flush welding socket

For version with EHEDG certificate
 Fitting to CN 7120 with process connection G 1/2" hygienic

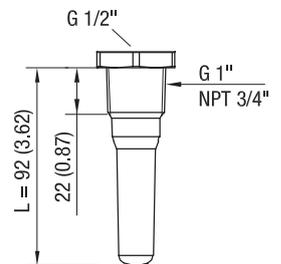
Details see page 8



Shortening kit For CN 7150 extension cable

Sensguard

Outer thread (process connection):
 G1" DIN ISO 228-1 or NPT 3/4" ASME B 1.20.1
 Internal thread:
 G 1/2" (requires CN 7120 with process connection G 1/2" to fit in).
 Material: PPS
 Max. process pressure: -1 to 10 bar (146 psi)



Complementary products (from outside companies)

M12 mating plug 4 pole, for version with M12 plug

Operating conditions

Functional

Dielectric constant Min. 1.5
 Factory setting = 2.0
 For dielectric constant of applicable materials: see external dielectric constant tables

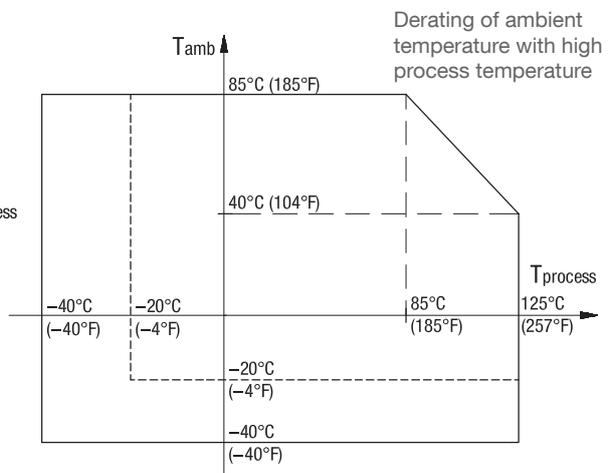
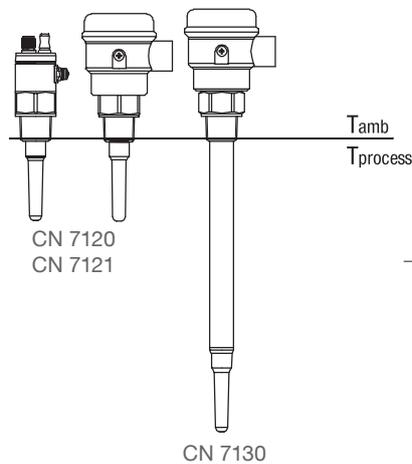
Switching point Depending on setting of potentiometer and dielectric constant value of measured material.

Repeatability 2 mm (0.08"), for water based liquids

Environment

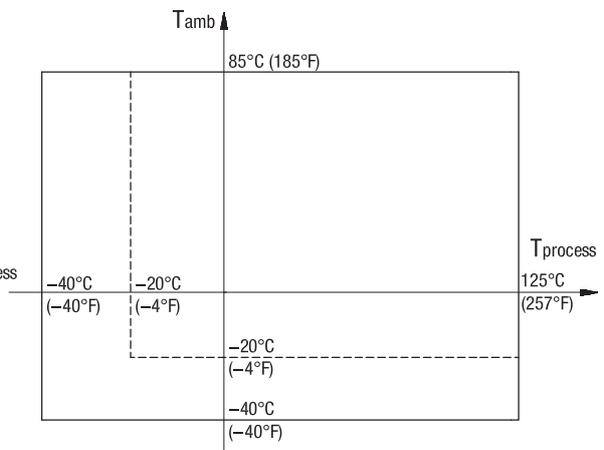
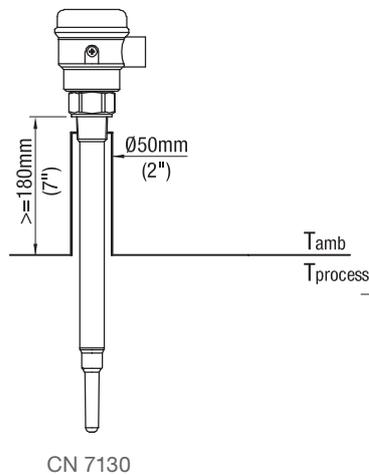
Ambient and process temperature

Mounting with short socket



Ambient- and process temperature limited to -20°C (-4°F) with option FFKM seal O-ring

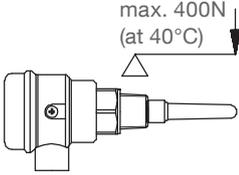
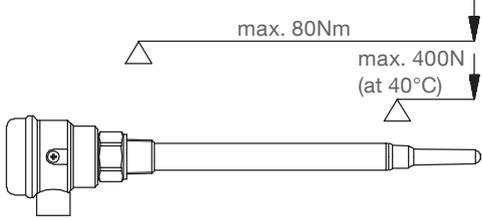
Mounting with long socket



Ambient- and process temperature limited to -20°C (-4°F) with option FFKM seal O-ring

Operating conditions

| | |
|---------------------------------|--|
| Max. temperature for CIP | 135°C (275°F), duration 60min 150°C (302°F), duration 30min (only for CN 7120 with process connection G 1/2" hygienic) Ambient temperature limited to 50°C (122°F), unit de-energized. |
|---------------------------------|--|

| | | |
|---|---|--|
| Max. permitted mechanical torque | CN 7120 / CN 7121 | CN 7130 |
| |  |  |

| | | |
|--|---|------------------------|
| Max. process pressure | CN 7120 Stainless steel process connection: | -1 to 25 bar (363 psi) |
| | CN 7121 Plastic process connection: | -1 to 10 bar (146 psi) |
| | CN 7130 Pipe extension: | -1 to 25 bar (363 psi) |
| | CN 7130 Pipe extension with sliding sleeve: | -1 to 10 bar (146 psi) |
| Observe possible pressure limitation from the used flange type ! | | |

| | |
|------------------|---|
| Vibration | 1.5 (m/s ²) ² /Hz according to EN 60068-2-64 |
|------------------|---|

| | |
|-------------------------|---|
| Pollution degree | 4 |
|-------------------------|---|

| | |
|--------------------------|------------------------------------|
| Relative Humidity | 0 - 100%, suitable for outdoor use |
|--------------------------|------------------------------------|

| | |
|-----------------|-------------------------|
| Altitude | max. 3.000 m (9.843 ft) |
|-----------------|-------------------------|

| | |
|--------------------|-----------------------------|
| Ventilation | Ventilation is not required |
|--------------------|-----------------------------|

| | |
|----------------------------------|---|
| Expected product lifetime | Following parameters have a negative influence on the expected product lifetime: High ambient- and process temperature, corrosive environment, high vibration, high flow rate of abrasive bulk material passing the probe. |
|----------------------------------|---|

Approvals

| | |
|--|---|
| General Purpose * (Ordinary Locations) | CE UKCA FM / CSA TR-CU |
| Overfill and leakage protection *, ** | WHG VLAREM |
| EMC | EN 61326 |
| RoHS conform | According to directive 2011/65/EU |
| Food grade material | Wetted parts with FDA registration. Details see "Mechanical data". |
| Pressure Equipment Directive (2014/68/EU) | The units are not subject to this directive, because they are classified as „pressure-keeping equipment“ and do not have a pressurized housing (see Art.1, clause 2.1.4). The units are designed and manufactured in accordance to the Pressure Equipment Directive. The unit is NOT intended for use as an “equipment part with safety function (Art.1, clause 2.1.3). If the units should be used as „equipment part with safety function" please contact the manufacturer. |

* Depending on selected version

** Relevant information for use in applications with WHG/VLAREM: see documentation "Technical Description"

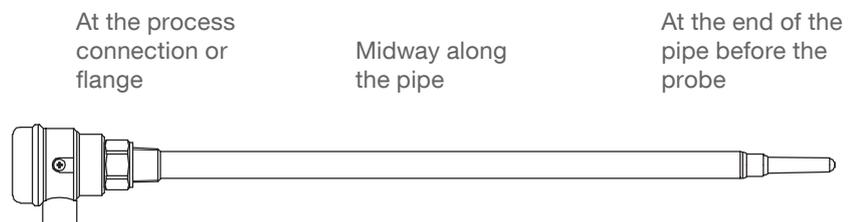
Mechanical installation

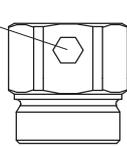
! General Safety Instructions

| | |
|---|--|
| Process pressure | Improper installation may result in loss of process pressure. Observe possible pressure limitation from the used flange type or in case of use of the sliding sleeve (CN 7130). |
| Chemical resistance against the medium | Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing. |
| Fastening of the threaded process connection | Mounting torque for the thread may not exceed 40 Nm (metal thread)/ 20 Nm (plastic thread). Use a open-end wrench. Do not fasten by turning the housing, for this will destroy the unit. |
| EHEDG approval/ Food grade material | The materials are available for the use under normal and predictable applications (according to directive 1935/2004 Art.3). Other conditions can influence the safety. |

! General Mounting instructions

Handling precautions To prevent damage of the pipe extension, all CN 7130 units with a pipe longer than 2 m (6.5 ft), must be supported at these three points when lifting from a horizontal position

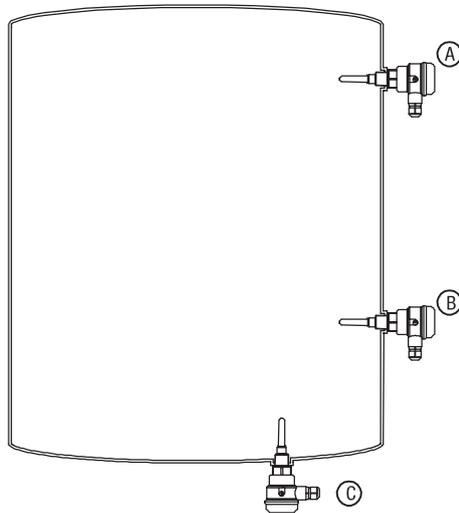


| | | |
|---|--|---|
| Sliding sleeve | Tighten both straining screws with 15 Nm to obtain resistance against pressure |  |
| Direction of the cable glands (enclosure Ø65mm [2.56"]) | When the unit is mounted from the side, ensure, that the cable glands face downwards and are closed to avoid water penetration into the housing. The enclosure can be rotated against the process connection after mounting. | |
| Sealing | Ensure proper seal of the process connection thread in case of process pressure. | |
| Hygienic process connection | Observe that the correct "On site process connection" is present, see page 8. | |

Mechanical installation - Liquid applications

Liquid applications - Mounting instructions

CN 7120 /
 CN 7121



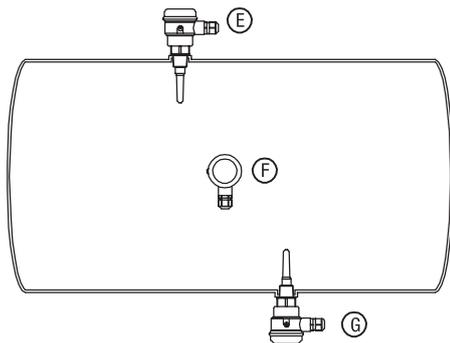
CAUTION

Observe:

- General distances of the probe (see page 17)
- Distance to material flow (filling)
- Max. permitted mechanical load (see page 13)

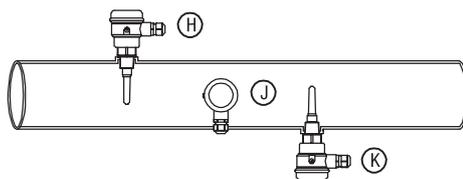
Vertical vessel

- A** Full detector horizontal
- B** Demand or empty detector horizontal
- C** Empty detector oblique from the bottom
- D** Empty detector in outlet pipe



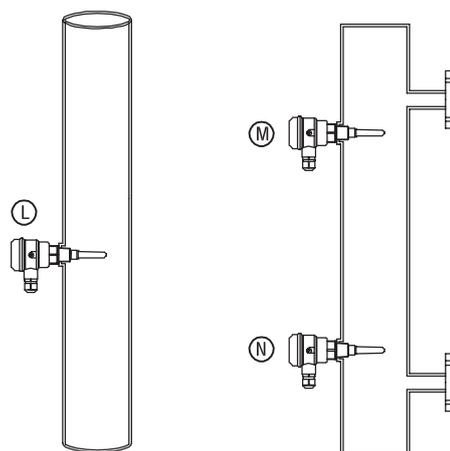
Horizontal vessel

- E** Full detector vertical
- F** Demand or empty detector horizontal
- G** Empty detector vertical from the bottom



Horizontal pipe

- H** Full detector vertical
- J** Demand or empty detector horizontal
- K** Empty detector vertical from the bottom



Vertical pipe

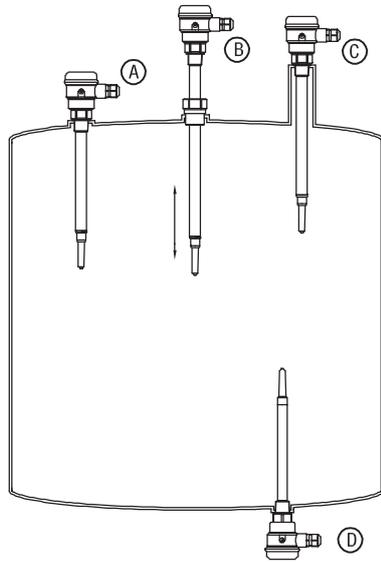
- L** Full, demand or empty detector horizontal

Bypass

- M** Full detector horizontal
- N** Demand or empty detector horizontal

Mechanical installation - Liquid applications

CN 7130



CAUTION

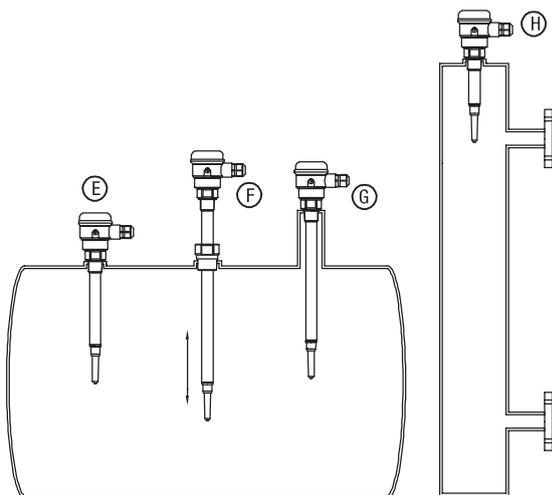
Observe:

- General distances of the probe (see page 17)
- Distance to material flow (filling)
- Max. permitted mechanical load (see page 13)

Vertical vessel

Full, demand or empty detector:

- A** Vertical
- B** Vertical with sliding sleeve
- C** Vertical with long mounting socket
- D** Vertical from bottom



Horizontal vessel

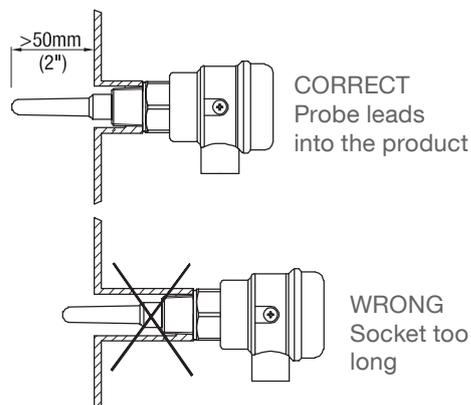
- E** Full, demand or empty detector vertical
- F** Vertical with sliding sleeve
- G** Vertical with long mounting socket

Bypass

- H** Full, demand or empty detector vertical

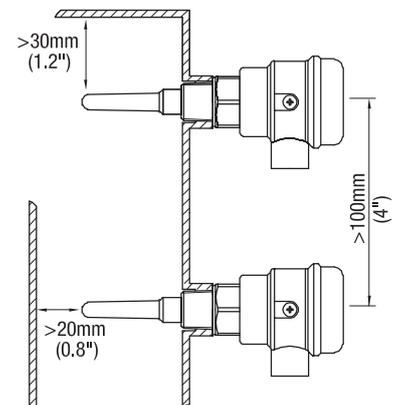
Distances of the probe

Observe socket length



Observe min. distance

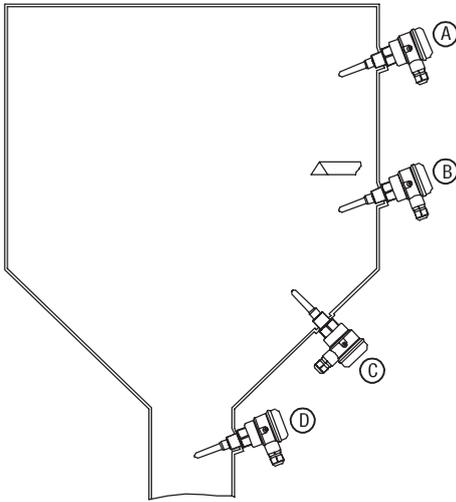
- between two probes
- to metal vessel wall



Mechanical installation - Solid applications

Solid applications - Mounting instructions

CN 7120 /
 CN 7121



CAUTION

Observe:

- General distances of the probe (see page 19)
- Distance to material flow (filling)
- Max. permitted mechanical load (see page 13)
- Wearing due to abrasive bulk material

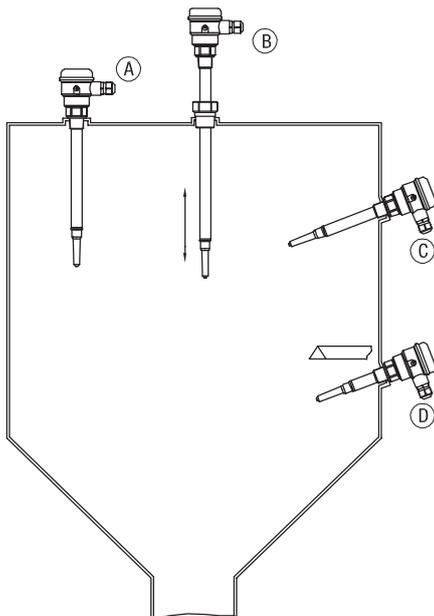
A Full detector horizontal or oblique.
 Slight incline mounting helps remaining material to fall off more easily.

B Demand or empty detector horizontal or oblique.
 Slight incline mounting helps remaining material to fall off more easily. Protective angle recommended depending on load and abrasion of the material

C Empty detector oblique from the bottom

D Empty detector in the silo outlet

CN 7130



CAUTION

Observe:

- General distances of the probe (see page 19)
- Distance to material flow (filling)
- Max. permitted mechanical load (see page 13)
- Wearing due to abrasive bulk material

A Full detector vertical

B Full detector with sliding sleeve

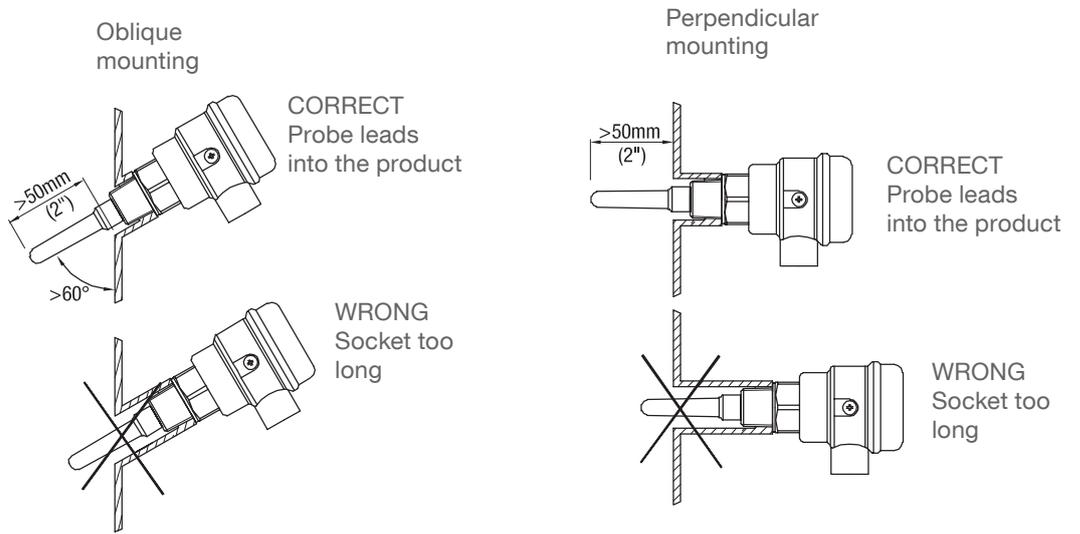
C Full detector horizontal or oblique. Slight incline mounting helps remaining material to fall off more easily

D Demand or empty detector horizontal or oblique.
 Slight incline mounting helps remaining material to fall off more easily. Protective angle recommended depending on load and abrasion of the material

Mechanical installation - Solid applications

Distances of the probe

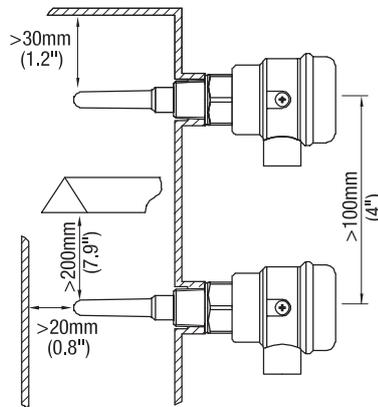
Observe socket length



Observe mounting angle to ensure, that the active tip of the probe has enough distance to the metal silo wall

Observe min. distance

- between two probe
- to metal vessel wall
- to protective angle



Electrical installation

! General Safety Instructions

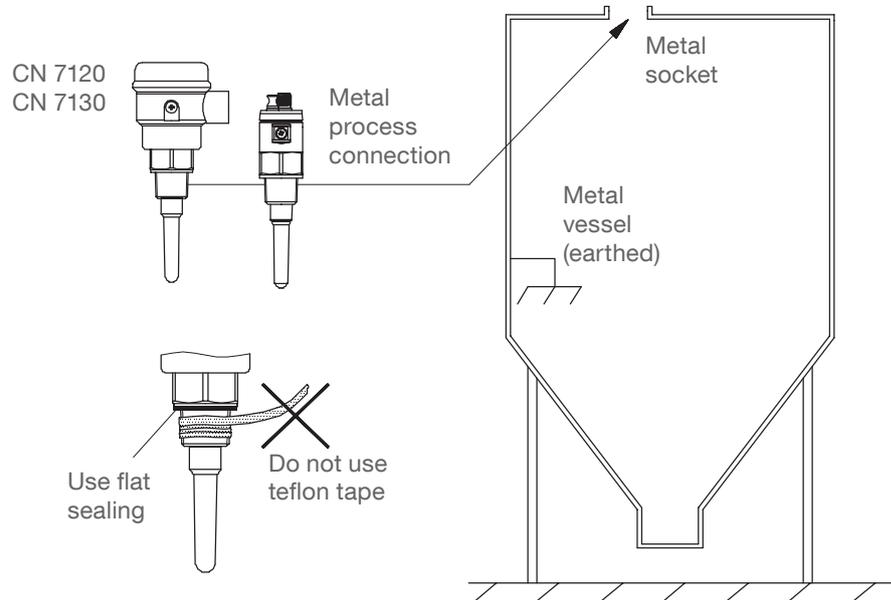
| | |
|--|--|
| Handling | In the case of inexpert handling or handling malpractice the electric safety of the device cannot be guaranteed. |
| Installation regulations | The local regulations or VDE 0100 (Regulations of German Electro technical Engineers) must be observed. |
| Power supply switch | A power-supply-disconnecting switch must be provided and marked near the device. |
| Wiring diagram | The electrical connections have to be made according to the wiring diagram. |
| Supply voltage | <p>Compare the supply voltage applied with the specifications given on the name plate before switching the device on.</p> <p>The unit must be supplied from a SELV source providing electrical isolation between the input and output, in order to meet the applicable safety requirements of IEC 61010-1.</p> <p>Observe reduced supply voltage ratings in wet locations. A wet location is a location where water or other conductive liquid may be present and is likely to increase the risk of electric shock.</p> |
| Cable gland and Field wiring cables | <p>With use of terminal block and cable gland: The screwed cable gland must have following specifications:</p> <ul style="list-style-type: none"> • Ingress protection IP68 • Temperature range from -40°C to 10 K above max. ambient temperature • UL or VDE certified (depending on the country where the unit is installed) • Pull relief <p>Make sure that the screwed cable gland safely seals the cable and that it is tight (danger of water intrusion).</p> <p>The field wiring cables must have following specifications:</p> <ul style="list-style-type: none"> • The diameter has to match to the clamping range of the used cable gland. • The cross section has to match with the clamping range of the connection terminals and consider the max. current. • The temperature rating must be at least 10 K above max. ambient temperature. <p>Cut the field wiring cables to appropriate length to fit properly into the housing.</p> |
| M12 mating plug and Field wiring cables | <p>With use of M12 plug: The mating plug must have following specifications</p> <ul style="list-style-type: none"> • M12x1 according to IEC 61076-2-101, female, 4-pole, coding A-standard • Ingress protection IP68 • Temperature range from -40°C to 10 K above max. ambient temperature <p>The field wiring cables must have following specifications:</p> <ul style="list-style-type: none"> • The diameter and cross section has to match to the specification of the mating plug. • The temperature rating must be at least 10 K above max. ambient temperature. • Install the field wiring cables according to the instructions of the mating plug |
| Signal output contact protection | Provide protection for signal output to protect the device against spikes with inductive loads (e.g. when connecting external relays). |
| Protection against static charging | The unit must be earthed in any case to avoid static charging of the unit, especially on applications with pneumatic conveying. Functional earthing is satisfactory to protect against static charging, see page 21. |

Electrical installation

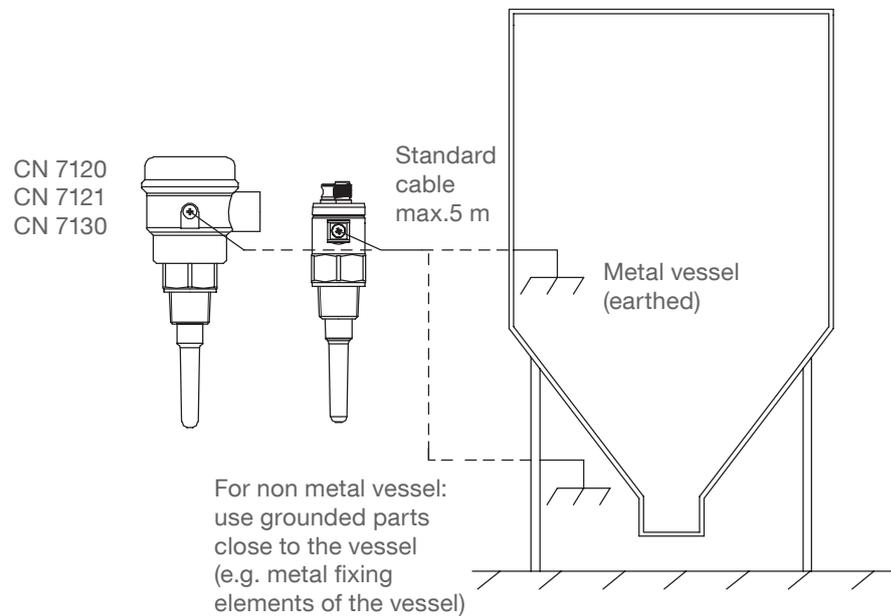
Functional earthing

The unit must have connection to earth for proper functioning. This can be done by one of the following possibilities:

Earthing through metal process connection



Earthing through external equipotential bonding terminal



Electrical installation

| | | |
|---------------------------|------------------------------|--|
| Electrical ratings | Power supply (L+, L-): | 10 .. 30 V DC incl. 10% of EN 61010-1 Operation with IO-Link requires min. 18V <55mA |
| | Signal outputs (Out1, Out2): | One output active: max. 200 mA Both outputs active: max. 100 mA each |

Output type

PNP*

NPN

Push-Pull

*factory setting

Change to NPN or Push-Pull can be done in IO-Link registers.

External fuse in L+:
max. 0,5A, fast or slow, HBC, 250V

Terminal 3 see "Cable shield" below

| | | Pin assignment | |
|--------------|--|----------------|----------------|
| | | M12 plug | Terminal block |
| | | | |
| L+ | | 1 | 1 |
| Out 1 | | 4 | 4 |
| Out 2 | | 2 | 5 |
| L- | | 3 | 2 |

Cable shield

It is recommended to use a shielded cable for stable measurement.

With M12 plug: With use of common M12 cables, the cable shield is connected with the M12 cap nut. Since the M12 thread on CN7 is made of plastics, the cable shield on the M12 cap nut is not connected with CN7 and must be connected on the other side to ground.

With Terminal block: The cable shield can be connected either to terminal 3 or on the other side to earth. Do not connect both sides of the shield to earth. Note: terminal 3 is internal connected to the external equipotential bonding terminal on the enclosure.

Output logic

| Output logic (factory setting) | | | | | Fault | |
|-----------------------------------|---------|-----------|---------|-----------|---------|-----------|
| | PNP/NPN | Push-Pull | PNP/NPN | Push-Pull | PNP/NPN | Push-Pull |
| White LED | ● | ☀ | ☀ | ☀ | 2Hz | ⊗ |
| Yellow LED | ● | ☀ | ☀ | ☀ | ● | ● |
| Output type | PNP/NPN | Push-Pull | PNP/NPN | Push-Pull | PNP/NPN | Push-Pull |
| Out 1 | FSL | | | | | |
| Out 2 | FSH | | | | | |

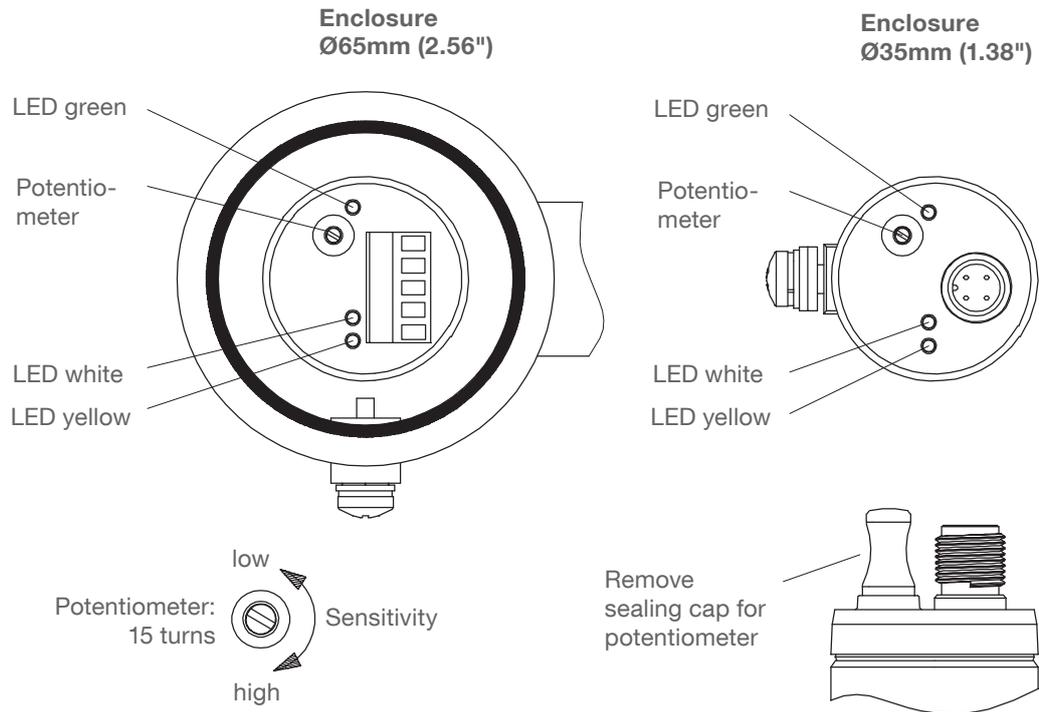
FSL = Fail safe low
 FSH = Fail safe high

Factory setting of output logic: Out 1 is set to FSL, Out 2 is set to FSH.
 Output logic can be changed in IO-Link registers

Operation

Operation - Operating elements / LED's

Operating elements



LEDs

| | | | |
|----------------------|---|--|---|
| Green | ON | | Power on |
| | OFF | | Power off |
| Yellow | ON | | Out 1 activated |
| | OFF | | Out 1 idle |
| | Blinks for a few times, then stops blinking | | The number of blinks indicates the position of the potentiometer after it was turned (see page 32) |
| White | ON | | Unit indicates covered Capacitance on probe > setted switchpoint |
| | OFF | | Unit indicates uncovered Capacitance on probe < setted switchpoint |
| | Blinks fast (twice per second) | | Diagnostics has indicated a failure |
| Yellow+ White | Both LEDs blink 5 times, then stop blinking | | Blinking happens when the potentiometer is turned. The potentiometer is not valid. Calibration by IO-Link is setted. See page 37. |

Operation with potentiometer

Operation with potentiometer - Factory calibration

Switchpoint factory calibration - General applications

Application Factory calibration is applicable for general applications.

| Typical general application | On site calibration |
|---|---------------------|
| <ul style="list-style-type: none"> • Low viscosity liquids • Water based liquids • High conductivity liquids without buildup • Dry solids | Not required |

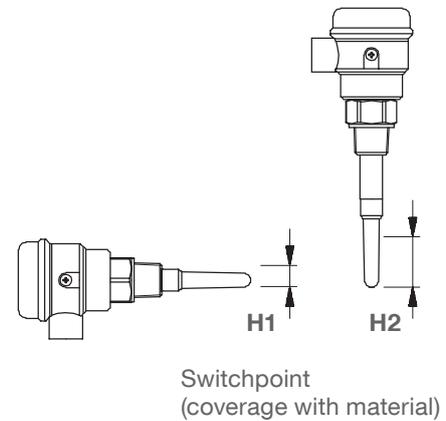
Switchpoint with factory calibration The unit is factory calibrated to measure dielectric constant of material ≥ 2.0 . With factory calibration the probe must be covered with a certain height of material in order to switch from uncovered to covered (switchpoint), as follows:

| Dielectric constant of measured material | Probe horizontal H1 | Probe vertical H2 |
|--|---------------------------------------|-----------------------------|
| < 2.0 | not possible with factory calibration | |
| 2.0 | 5mm (0.2") | 20mm (0.8") |
| 2.0 ... 3.0 | 0mm (0.0") | 15mm (0.6") |
| 3.0 ... 5 | -5mm (-0.2")* | 8mm (0.3") |
| 5 ... 10 | -8mm (-0.3")* | 5mm (0.2") |
| >10 ... 40 | -10mm (-0.4")* | 3mm (0.1") |

* Switchpoint is below the probe (material not touching the probe).

The stated values are valid under following conditions:

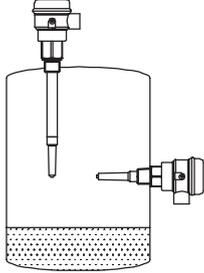
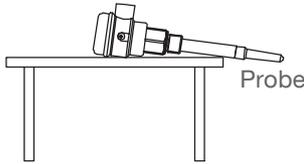
- The distance of the probe to a metal wall is not smaller than stated on page 17 and 19.
- The Sensguard (see page 11) is not used.
- Conductive material is not present.



Note The active shield technology in combination with the length of the probe, resulting in adequate distance between internal measurement electrode and ground electrode, reduces the influence of various measured capacitance due to the mounting situation and of moderate material buildup. As a result, no on site calibration is required for general applications.

Operation with potentiometer - Recalibration

Switchpoint setting - In case of recalibration or if factory calibration is not applicable

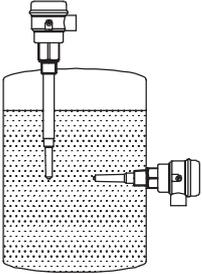
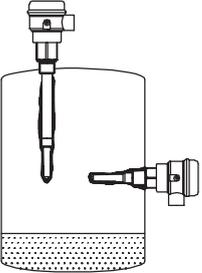
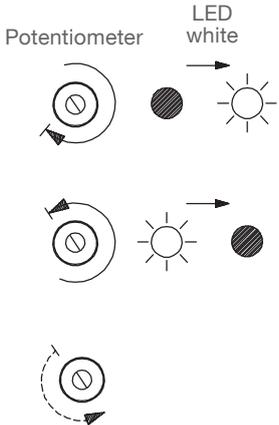
| <p>1. Ensure that the probe is uncovered</p> | <p>The unit will calibrate to an uncovered probe.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Setting with mounted sensor:</p> <p>Ensure material level is well below the probe</p> </div> <div style="text-align: center;">  <p>Setting on the bench:</p> <p>Take care not to touch the probe and keep the probe at least 200mm (7.87") away from any material (for example table)</p> </div> </div> | | | | | | | | | | |
|---|--|---------------------------------|-----------------|----------|---|--------|---|--------|---|----|---|
| <p>2. Set switchpoint with potentiometer</p> | <p>Note: 1 second after stopping to turn the potentiometer, the yellow LED blinks for a few times, then stops blinking. This allows to identify the position of the potentiometer which enables more easy service in case external technicians are contacted. Details see page 32.</p> <p>If LED white is OFF, turn clockwise until LED white is ON.</p> <p>Turn counter clockwise until LED white just stops glowing.</p> <p>Turn further counter clockwise:</p> <table border="1" data-bbox="603 1357 987 1583"> <thead> <tr> <th>Dielectric constant of material</th> <th>Number of turns</th> </tr> </thead> <tbody> <tr> <td>1.6 .. 2</td> <td>1</td> </tr> <tr> <td>2 .. 3</td> <td>2</td> </tr> <tr> <td>3 .. 4</td> <td>3</td> </tr> <tr> <td>>4</td> <td>4</td> </tr> </tbody> </table> <p>The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used. Depending on the application and the required switchpoint the number of turns can be varied.</p> <div style="text-align: right; margin-top: 20px;"> </div> | Dielectric constant of material | Number of turns | 1.6 .. 2 | 1 | 2 .. 3 | 2 | 3 .. 4 | 3 | >4 | 4 |
| Dielectric constant of material | Number of turns | | | | | | | | | | |
| 1.6 .. 2 | 1 | | | | | | | | | | |
| 2 .. 3 | 2 | | | | | | | | | | |
| 3 .. 4 | 3 | | | | | | | | | | |
| >4 | 4 | | | | | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | | | | | |

Operation with potentiometer Advanced calibration

Operation with potentiometer - Advanced calibration

Switchpoint setting - Demanding Applications

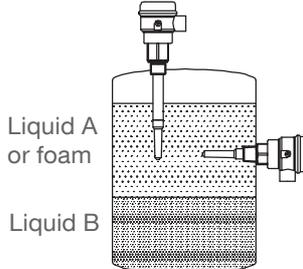
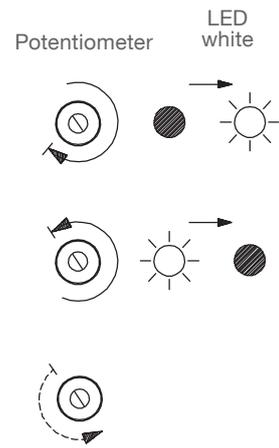
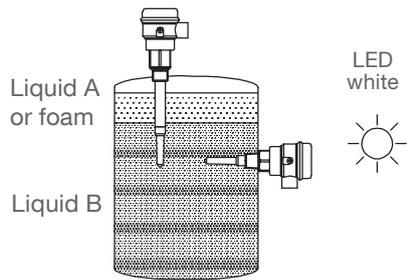
| Typical demanding application | On site calibration |
|---|--|
| Material with heavy buildup (non conductive): <ul style="list-style-type: none"> • High viscosity liquids • Hygroscopic/ wet solids | Probe covered and then uncovered, retaining max. possible material buildup |
| <ul style="list-style-type: none"> • Heavy buildup (conductive) | Consult manufacturer |

| <p>1. Ensure material level is well above the probe</p> |  | | | | | | | | | | |
|--|--|---------------------------------|-----------------|----------|---|--------|---|--------|---|----|---|
| <p>2. Ensure material level is well below the probe</p> | <p>It is important that as much material buildup as possible is retaining on the probe.</p>  | | | | | | | | | | |
| <p>3. Set switchpoints with potentiometer</p> | <p>Note: 1 second after stopping to turn the potentiometer, the yellow LED blinks for a few times, then stops blinking. This allows to identify the position of the potentiometer which enables more easy service in case external technicians are contacted. Details see page 32.</p> <p>If LED white is OFF, turn clockwise until LED white is ON.</p> <p>Turn counter clockwise until LED white just stops glowing.</p> <p>Turn further counter clockwise:</p> <table border="1" data-bbox="603 1615 987 1839"> <thead> <tr> <th>Dielectric constant of material</th> <th>Number of turns</th> </tr> </thead> <tbody> <tr> <td>1.6 .. 2</td> <td>1</td> </tr> <tr> <td>2 .. 3</td> <td>2</td> </tr> <tr> <td>3 .. 4</td> <td>3</td> </tr> <tr> <td>>4</td> <td>4</td> </tr> </tbody> </table> <p>The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used. Depending on the application and the required switchpoint the number of turns can be varied.</p>  | Dielectric constant of material | Number of turns | 1.6 .. 2 | 1 | 2 .. 3 | 2 | 3 .. 4 | 3 | >4 | 4 |
| Dielectric constant of material | Number of turns | | | | | | | | | | |
| 1.6 .. 2 | 1 | | | | | | | | | | |
| 2 .. 3 | 2 | | | | | | | | | | |
| 3 .. 4 | 3 | | | | | | | | | | |
| >4 | 4 | | | | | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | | | | | |

Operation with potentiometer - Advanced calibration

Switchpoint setting - Interface detection

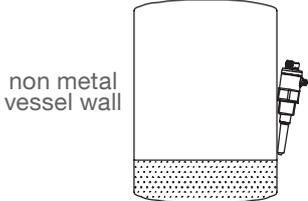
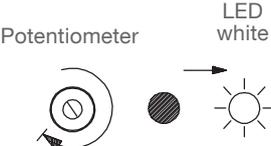
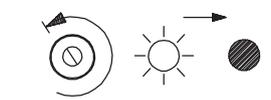
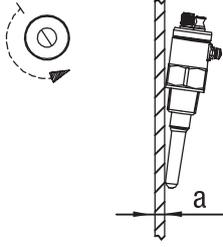
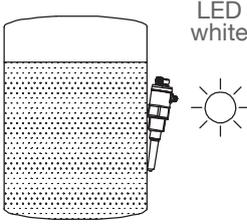
| Typical interface application | On site calibration |
|--|-----------------------------------|
| <ul style="list-style-type: none"> • Ignoring liquid A/ detecting liquid B • Ignoring foam/ detecting liquid | Immerse probe in liquid A or foam |

| <p>1. Immerse probe in liquid A or in foam which should NOT be detected</p> | <p>Ensure that liquid A or foam (which should NOT be detected) is covering the probe.</p> <p>Liquid A or foam must have a lower dielectric constant than liquid B, which should be detected.</p>  | | | | | | |
|--|--|---|-----------------|-----------|---|--------|---------------|
| <p>2. Set switchpoints with potentiometer</p> | <p>Note: 1 second after stopping to turn the potentiometer, the yellow LED blinks for a few times, then stops blinking. This allows to identify the position of the potentiometer which enables more easy service in case external technicians are contacted. Details see page 32.</p> <p>If LED white is OFF, turn clockwise until LED white is ON.</p> <p>Turn counter clockwise until LED white just stops glowing.</p> <p>Turn further counter clockwise:</p> <table border="1" data-bbox="507 1265 890 1417"> <thead> <tr> <th>Dielectric constant of liquid A or foam</th> <th>Number of turns</th> </tr> </thead> <tbody> <tr> <td>≤ 10</td> <td>1</td> </tr> <tr> <td>> 10</td> <td>$\frac{1}{2}$</td> </tr> </tbody> </table> <p>The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used.</p> <p>Depending on the application and the required switchpoint the number of turns can be varied.</p> <p>The sensitivity is now setted thus that liquid A or foam is NOT detected.</p>  | Dielectric constant of liquid A or foam | Number of turns | ≤ 10 | 1 | > 10 | $\frac{1}{2}$ |
| Dielectric constant of liquid A or foam | Number of turns | | | | | | |
| ≤ 10 | 1 | | | | | | |
| > 10 | $\frac{1}{2}$ | | | | | | |
| <p>3. Immerse probe in liquid B which should be detected</p> | <p>Ensure that liquid B (which should be detected) is covering the probe.</p> <p>LED white should glow.</p>  | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | |

Operation with potentiometer - Advanced calibration

Switchpoint setting - Measurement through non metal vessel wall

| Typical application | On site calibration |
|---|----------------------|
| • Measuring through non metal vessel wall | Material below probe |

| <p>1. Ensure material level is well below the probe</p> | <p>The unit will calibrate to an uncovered probe.</p>  | | | | | | | | | |
|--|--|---------------------------------|--------------------------------|-----------------|----------|---------------------------|---------------|--------|---------------------------|---------------|
| <p>2. Set switchpoints with potentiometer</p> | <p>Note: 1 second after stopping to turn the potentiometer, the yellow LED blinks for a few times, then stops blinking. This allows to identify the position of the potentiometer which enables more easy service in case external technicians are contacted. Details see page 32.</p> <p>If LED white is OFF, turn clockwise until LED white is ON.</p>  <p>Turn counter clockwise until LED white just stops glowing.</p>  <p>Turn further counter clockwise:</p> <table border="1" data-bbox="603 1332 1056 1512"> <thead> <tr> <th>Dielectric constant of material</th> <th>Distance a (material to probe)</th> <th>Number of turns</th> </tr> </thead> <tbody> <tr> <td>≥ 3</td> <td>$\leq 10\text{mm (0.4")}$</td> <td>$\frac{1}{4}$</td> </tr> <tr> <td>> 40</td> <td>$\leq 20\text{mm (0.8")}$</td> <td>$\frac{1}{2}$</td> </tr> </tbody> </table> <p>Depending on the application and the required switchpoint the number of turns can be varied</p>  | Dielectric constant of material | Distance a (material to probe) | Number of turns | ≥ 3 | $\leq 10\text{mm (0.4")}$ | $\frac{1}{4}$ | > 40 | $\leq 20\text{mm (0.8")}$ | $\frac{1}{2}$ |
| Dielectric constant of material | Distance a (material to probe) | Number of turns | | | | | | | | |
| ≥ 3 | $\leq 10\text{mm (0.4")}$ | $\frac{1}{4}$ | | | | | | | | |
| > 40 | $\leq 20\text{mm (0.8")}$ | $\frac{1}{2}$ | | | | | | | | |
| <p>3. Ensure material level is well above the probe</p> | <p>LED white should glow.</p>  | | | | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | | | | |

Operation with potentiometer - Advanced possibilities

Advanced possibilities

The unit allows following usefull advanced possibilities, which are related to the position of the potentiometer

Indicating the actual position of the potentiometer 1 second after stopping to turn the potentiometer, the yellow LED blinks for a few times, then stops blinking. This allows to identify the actual position of the potentiometer which enables more easy service in case external technicians are contacted.
 Note: The signal output (IO-Link /PNP / NPN / Push-Pull) does not follow the blinking.
 See Table below.

Relation of potentiometer position to sensitivity The position of the potentiometer is clearly related to the dielectric constant and therefore to the sensitivity of the unit.
 See Table below.

| Required min. dielectric constant of material to be detected (1) | Position of the potentiometer = No. of potentiometer turns, see (2) below | Number of blinking of yellow LED, see (3) below |
|--|---|---|
| not applicable | 0 ... 2 | 0 |
| 1 (Probe in air) | 3 | 1 |
| 1.5 | 4 | 2 |
| 2 | 5 | 3 |
| 3 | 6 | 4 |
| 4 | 7 | 5 |
| 6 | 8 | 6 |
| 8 | 9 | 7 |
| 11 | 10 | 7 |
| 15 | 11 | 8 |
| 25 | 12 | 8 |
| 40 | 13 | 9 |
| 60 | 14 | 9 |
| 90 | 15 | 9 |

- (1) The stated values are valid under following conditions:
- The distance of the probe to a metal wall is not smaller than stated on page 17 and 19.
 - The probe is mounted inside the vessel (no measurement from outside through the vessel wall).
 - The Sensguard (see page 14) is not used.
 - Conductive material is not present.

(2) To set the position of the potentiometer to a certain sensitivity, do following steps:



a) Turn potentiometer clockwise for min. 15 turns, thus stop position (= max. sensitive position) is safely reached.



b) Turn potentiometer counter clockwise according to the number of turns stated in the table above.

(3) Yellow LED starts blinking 1 second after stopping to turn the potentiometer.

Operation with IO-Link

Operation with IO-Link

IO-Link Data

| | |
|-------------------------|-------------------------------------|
| Communication interface | IO-Link, IEC 61131-9, SDCI standard |
| IODD version | 1.1 |
| IO-Link Profiles | Smart Sensor |
| Required IO-Link master | as per DIN EN 61131-9 |
| Speed | COM2 (38,4 kBaud) |
| Min. process cycle time | 128 ms |
| Process data width | 16 bit |
| IO-Link data storage | yes |
| Block parameter | no |
| SIO-Mode | yes |

IO-Link Registers

Process data (PDE - Process data Exchange)

| Bit 0 (LSB) to Bit 13 (MSB) | Bit 14 | Bit 15 |
|--|-----------------|-----------------|
| Actual measured value: 0 ... 10000 (equates to 0.00% - 100.00%) | Status Out 1 | Status Out 2 |

Data Type: UInteger
 Status Out 1 and Out 2:
 1 = contact closed 
 0 = contact open 

Pin assignment:
 see page 22

! In application with overfill approval (WHG, VLAREM) the use of IO-Link is applicable for setting parameters only.
 The "Process data Exchange" is not allowed, instead the signal output (PNP, NPN) must be used.

| Item | ISDU (dec) | Access | Length (byte) | Data type | Value Range | Default value |
|------|------------|--------|---------------|-----------|-------------|---------------|
|------|------------|--------|---------------|-----------|-------------|---------------|

System commands

| | | | | | | |
|---------------------|----|-----|---|--------|---|---|
| System Command | 2 | W | 1 | UInt8 | 130 = Factory reset 160 = Reset switchpoints to default values 161 = Switchpoint setting by potentiometer | |
| Device Access Locks | 12 | R/W | 2 | Record | Bit 1 = Data Storage | 0 |

System Command 130 sets all stated registers to "Default value", except register 127, which is set to "1 = IO-Link"
 System Command 160 sets registers 96, 97, 112, 113 to "Default values". Register 127 is set to "1 = IO-Link"
 System Command 161 sets register 127 to "0 = Potentiometer"

IO-Link specific device data

| | | | | | | |
|--------------------------|----|-----|----|--------|---|-------------------------|
| Vendor Name | 16 | R | 64 | String | | UWT GmbH |
| Vendor Text | 17 | R | 64 | String | | Level Control |
| Product Name | 18 | R | 64 | String | Order code | |
| Product ID | 19 | R | 64 | String | Device version | |
| Product Text | 20 | R | 64 | String | | Capacitive level sensor |
| Serial number | 21 | R | 64 | String | | |
| Firmware Revision | 23 | R | 64 | String | | |
| Application-specific Tag | 24 | R/W | 32 | String | | *** |
| Status / Diagnosis | 36 | R | 1 | UInt8 | 0 = Device is operating properly 3 = Functional-check 4 = Failure | 0 |

Operation with IO-Link

| Item | ISDU (dec) | Access | Length (byte) | Data type | Value Range | Default value |
|------|------------|--------|---------------|-----------|-------------|---------------|
|------|------------|--------|---------------|-----------|-------------|---------------|

UWT specific device data

Setting of signal output:

| | | | | | | |
|-----------------------------------|----|-----|---|--------|--|---------|
| Out 1 and Out 2: Output type | 64 | R/W | 1 | UInt8 | 0 = Push-Pull 1 = NPN 2 = PNP | PNP |
| Out 1: Output logic | 65 | R/W | 1 | UInt8 | 0 = FSH 1 = FSL | FSL |
| Out 1: Delay uncovered to covered | 66 | R/W | 2 | UInt16 | 5 ... 600 (equates to 0.5 - 60 sec) | 0.5 sec |
| Out 1: Delay covered to uncovered | 67 | R/W | 2 | UInt16 | 5 ... 600 (equates to 0.5 - 60 sec) | 0.5 sec |
| Out 2: Output logic | 80 | R/W | 1 | UInt8 | 0 = FSH 1 = FSL With Push-Pull Out 2 will be set antivalent to Out 1 | FSH |
| Out 2: Delay uncovered to covered | 81 | R/W | 2 | UInt16 | 5 ... 600 (equates to 0.5 - 60 sec) | 0.5 sec |
| Out 2: Delay covered to uncovered | 82 | R/W | 2 | UInt16 | 5 ... 600 (equates to 0.5 - 60 sec) | 0.5 sec |

Switchpoint setting of sensor:

| | | | | | | |
|---|-----|-----|---|--------|--|----------|
| Out 1: Switchpoint: covered to uncovered * | 96 | R/W | 2 | UInt16 | 0 ... 10000 (equates to 0.00% - 100.00%) | 3.00% ** |
| Out 1: Switchpoint: uncovered to covered * | 97 | R/W | 2 | UInt16 | 0 ... 10000 (equates to 0.00% - 100.00%) | 4.00% ** |
| Out 2: Switchpoint: covered to uncovered * | 112 | R/W | 2 | UInt16 | 0 ... 10000 (equates to 0.00% - 100.00%) | 3.00% ** |
| Out 2: Switchpoint: uncovered to covered * | 113 | R/W | 2 | UInt16 | 0 ... 10000 (equates to 0.00% - 100.00%) | 4.00% ** |
| Actual switchpoint setting is done by: | 127 | R | 1 | UInt8 | 0 = Potentiometer 1 = IO-Link | 0 |

* If register is written, register 127 is set to "1 = IO-Link".

** Factory setted values for switchpoints can slightly deviate from the stated values, since factory calibration is done by use of potentiometer. This does not influence the proper function of the unit.

Diagnostics:

| | | | | | | |
|--------------------------------|-----|-----|---|--------|---|--------|
| Operating hours | 128 | R | 4 | UInt32 | 0 ... 2 ³² | 0 |
| Temperature electronic* actual | 131 | R | 1 | Int8 | -128 ... +127 °C | |
| Temperature electronic* min. | 132 | R | 1 | Int8 | -128 ... +127 °C | 127°C |
| Temperature electronic* max. | 133 | R | 1 | Int8 | -128 ... +127 °C | -128°C |
| Functional-check | 134 | R/W | 1 | UInt8 | 0 = No functional-check 1 = Simulate uncovered probe 2 = Simulate covered probe | 0 |

* Ambient temperature of the electronic inside the enclosure (outside process)

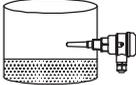
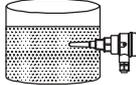
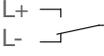
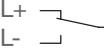
ISDU = Indexed Service Data Unit
 R/W = read/write

FSL = Fail safe Low = output contact open with uncovered sensor
 FSH = Fail safe High = output contact open with covered sensor

Operation with IO-Link - Setting of signal outputs

Setting of signal outputs (output logic)

Out 1 and Out 2 can be set individually by the related registers.

| Output logic Out 1 and Out 2 |  | |  | |
|---------------------------------|---|---|---|---|
| | PNP/NPN | Push-Pull | PNP/NPN | Push-Pull |
| White LED* | ● | | ☀ | |
| Yellow LED* | ● | | ☀ | |
| Output type | PNP/NPN | Push-Pull | PNP/NPN | Push-Pull |
| FSL** Fail safe low |  |  |  |  |
| FSH** Fail safe high |  |  |  |  |

*In case Out 1 and Out 2 are programmed to have different switchpoints and/or different output logic, the white and yellow LED follows Out 1.

** Factory setting: Out 1 = FSL, Out 2 = FSH

Pin assignment of Out 1 and Out 2: see page 22.

Operation with IO-Link - Calibration possibilities

Calibration possibilities (Switchpoint setting)

The switchpoint (sensitivity) is factory setted as stated on the next page.
 If required, the switchpoint can be changed either with the potentiometer or with IO-Link.

Switchpoint setting by potentiometer (default)

Procedures see page 25ff.

The switchpoint in IO-Link registers of Out 1 and Out 2 are automatically setted due to the position of the potentiometer. The switchpoints "covered to uncovered" and "uncovered to covered" of each Out 1 and Out 2 are the same.

In case the switchpoints were setted before with IO-Link:

- The potentiometer is not valid (register "Switchpoint setting by: 1=IO-Link").
 If the potentiometer is turned, both yellow and white LEDs blink 5 times, then stop blinking to indicate that the potentiometer is not valid.
- The setting can be set back to potentiometer:
 By System Command 161 =Switchpoint setting by potentiometer
 or
 By turning the potentiometer to CW (or CCW) stop position and then, within 30 seconds, to CCW (or CW) stop position
- By setting back to potentiometer the switchpoint registers will be overwritten according to the actual position of the potentiometer. Usually a new calibration by potentiometer is required.

Switchpoint setting by IO-Link

Following sets the potentiometer to be not valid:

- System Command 130, 160.
 - Write any number in one or more of the IO-Link registers "Switchpoint setting of sensor" for Out 1 and Out 2.
- Calibration procedures to find the Switchpoints with IO-Link: see following pages.

Situation when using a spare unit with transfer of the register values

In case that a preset unit will be replaced by a spare unit, and the register values of the present unit are readout and transfered to the spare unit, the switchpoint values will be transfered as well. It is not relevant whether the switchpoints were setted by potentiometer or by IO-Link. By writing the switchpoints values with IO-Link to the spare unit, the register "Switchpoint setting by: 1 = IO-Link" is set and the potentiometer is not valid.

Operation with IO-Link - Factory calibration

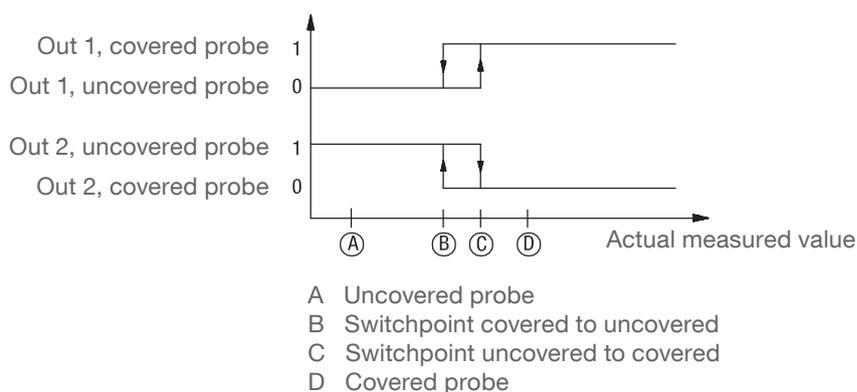
Switchpoint setting - Level detection of general applications

Application Factory calibration is applicable for general applications.

| Typical general application | On site calibration |
|---|---------------------|
| <ul style="list-style-type: none"> • Low viscosity liquids • Water based liquids • High conductivity liquids without buildup • Dry solids | Not required |

Sensor behaviour:

Material covers the probe: Out1 and Out2 detect this material

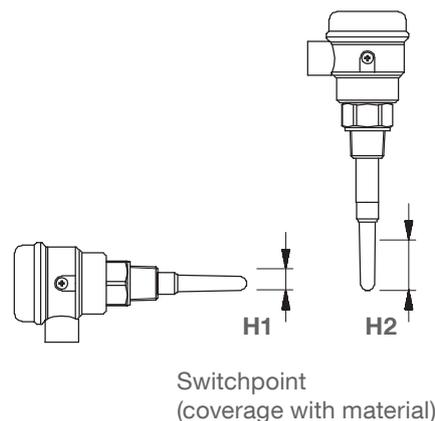


The diagram shows:
 Out 1 set to FSL
 Out 2 set to FSH
 1 = contact closed
 0 = contact open
 Pin assignment with PNP, NPN, Push-Pull: see page 22

Switchpoint with factory calibration

The unit is factory calibrated to measure dielectric constant of material ≥ 2.0 . The switchpoints are set in the IO-Link registers as stated on page 35, "Switchpoint setting of sensor". With factory calibration the probe must be covered with a certain height of material in order to switch from uncovered to covered (switchpoint), as follows:

| Dielectric constant of measured material | Probe horizontal H1 | Probe vertical H2 |
|--|---------------------------------------|-------------------|
| < 2.0 | not possible with factory calibration | |
| 2.0 | 5mm (0.2") | 20mm (0.8") |
| 2.0 ... 3.0 | 0mm (0.0") | 15mm (0.6") |
| 3.0 ... 5 | -5mm (-0.2")* | 8mm (0.3") |
| 5 ... 10 | -8mm (-0.3")* | 5mm (0.2") |
| >10 ... 40 | -10mm (-0.4")* | 3mm (0.1") |



* Switchpoint is below the probe (material not touching the probe).

The stated values are valid under following conditions:

- The distance of the probe to a metal wall is not smaller than stated on page 17 and 19.
- The Sensguard (see page 11) is not used.
- Conductive material is not present.

Note

The active shield technology in combination with the length of the probe, resulting in adequate distance between internal measurement electrode and ground electrode, reduces the influence of various measured capacitance due to the mounting situation and of moderate material buildup. As a result, no on site calibration is required for general applications.

Operation with IO-Link - Recalibration

Switchpoint setting - Level detection of general applications

**Set switchpoints
B, C**

In case recalibration is required or factory calibration is not applicable, set the switchpoints (B, C) as stated in the table below.
 See diagram on top of previous page for explanation of sensor behaviour and B,C.

| Dielectric constant of material | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered |
|---------------------------------|--|--|
| <2 | B=3.00% | C=4.00% |
| 2 ... 4 | B=5.20% | C=7.00% |
| >4 | B=7.50% | C=10.00% |

The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used.

Operation with IO-Link

Advanced calibration

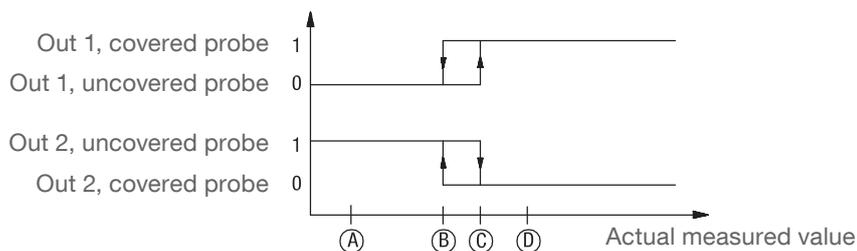
Operation with IO-Link - Advanced calibration

Switchpoint setting - Level detection of demanding applications

| Typical demanding application | On site calibration |
|--|---|
| Material with heavy buildup (non conductive): • High viscosity liquids • Hygroscopic/ wet solids | Probe covered and then uncovered, retaining max. possible material buildup |
| • Heavy buildup (conductive) | Consult manufacturer |

Sensor behaviour:

Material covers the probe: Out1 and Out2 detect this material



The diagram shows:
 Out 1 set to FSL
 Out 2 set to FSH
 1 = contact closed

0 = contact open

Pin assignment with PNP, NPN, Push-Pull: see page 22

- A Uncovered probe
- B Switchpoint covered to uncovered
- C Switchpoint uncovered to covered
- D Covered probe

| <p>1. Ensure material level is well above the probe</p> <p>2. Ensure material level is well below the probe</p> | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>1.</p> </div> <div style="text-align: center;"> <p>2.</p> </div> </div> <p style="text-align: right;">It is important that as much material buildup as possible is retaining on the probe</p> | | | | | | | | | | | | | | | |
|---|---|---|------------------------------------|------------------------------------|----------|------------------|--------------|--------|------------------|--------------|--------|------------------|--------------|----|------------------|--------------|
| <p>3. Set switchpoints</p> | <ul style="list-style-type: none"> • Read the "Actual measured value" (process data), which is "A Uncovered probe". • Set the switchpoints (B, C) by increasing "A Uncovered probe" as stated in the table below. See diagram on top of this page for explanation of A,B,C. <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Dielectric constant of material A or foam</th> <th>B Switchpoint covered to uncovered</th> <th>C Switchpoint uncovered to covered</th> </tr> </thead> <tbody> <tr> <td>1,6 .. 2</td> <td>$B=0.75 \cdot C$</td> <td>$C=A+1.80\%$</td> </tr> <tr> <td>2 .. 3</td> <td>$B=0.75 \cdot C$</td> <td>$C=A+5.00\%$</td> </tr> <tr> <td>3 .. 4</td> <td>$B=0.75 \cdot C$</td> <td>$C=A+7.60\%$</td> </tr> <tr> <td>>4</td> <td>$B=0.75 \cdot C$</td> <td>$C=A+9.00\%$</td> </tr> </tbody> </table> <p>The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used. Depending on the application and the required switchpoint the values B and C can be varied.</p> | Dielectric constant of material A or foam | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered | 1,6 .. 2 | $B=0.75 \cdot C$ | $C=A+1.80\%$ | 2 .. 3 | $B=0.75 \cdot C$ | $C=A+5.00\%$ | 3 .. 4 | $B=0.75 \cdot C$ | $C=A+7.60\%$ | >4 | $B=0.75 \cdot C$ | $C=A+9.00\%$ |
| Dielectric constant of material A or foam | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered | | | | | | | | | | | | | | |
| 1,6 .. 2 | $B=0.75 \cdot C$ | $C=A+1.80\%$ | | | | | | | | | | | | | | |
| 2 .. 3 | $B=0.75 \cdot C$ | $C=A+5.00\%$ | | | | | | | | | | | | | | |
| 3 .. 4 | $B=0.75 \cdot C$ | $C=A+7.60\%$ | | | | | | | | | | | | | | |
| >4 | $B=0.75 \cdot C$ | $C=A+9.00\%$ | | | | | | | | | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | | | | | | | | | | |

Operation with IO-Link - Advanced calibration

Switchpoint setting - Interface detection

Sensor behaviour:

Material 1 (Liquid A or foam) covers the probe: Out 1 and Out 2 do not detect this material.

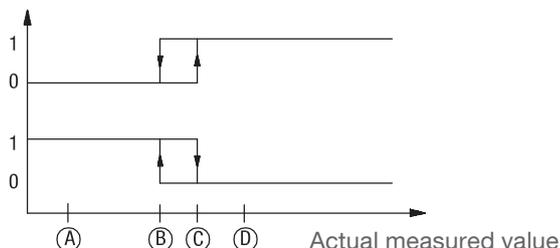
Material 2 (Liquid B) with higher dielectric constant than material 1 covers the probe: Out 1 and Out 2 detect this material

Out 1, covered probe (Liquid B)

Out 1, uncovered probe*

Out 2, uncovered probe*

Out 2, covered probe (Liquid B)



The diagram shows:

Out 1 set to FSL

Out 2 set to FSH

1 = contact closed

0 = contact open

Pin assignment with PNP, NPN, Push-Pull: see page 22

- A Uncovered probe*
- B Switchpoint covered to uncovered
- C Switchpoint uncovered to covered
- D Covered probe (Liquid B)

* For interface measurement "Uncovered probe" relates to a probe covered by Liquid A or foam

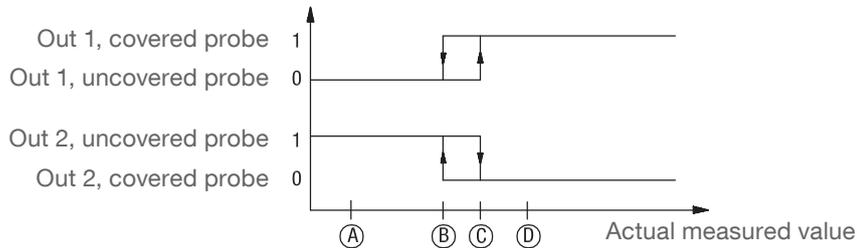
| <p>1. Immerse probe in liquid A or in foam which should NOT be detected</p> | <p>Ensure that liquid A or foam (which should NOT be detected) is covering the probe.</p> <p>Liquid A or foam must have a lower dielectric constant than liquid B, which should be detected.</p> <div data-bbox="1053 974 1364 1254" style="text-align: right;"> </div> | | | | | | | | | |
|--|---|---|------------------------------------|------------------------------------|------|------------------|--------------|------|------------------|--------------|
| <p>2. Set switchpoints</p> | <ul style="list-style-type: none"> • Read the "Actual measured value" (process data), which is "A Uncovered probe". • Set the switchpoints (B, C) by increasing "A Uncovered probe" as stated in the table below. See diagram on top of this page for explanation of A,B,C. <table border="1" data-bbox="502 1384 1375 1534" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Dielectric constant of material A or foam</th> <th>B Switchpoint covered to uncovered</th> <th>C Switchpoint uncovered to covered</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">≤ 10</td> <td style="text-align: center;">$B=0.75 \cdot C$</td> <td style="text-align: center;">$C=A+2.00\%$</td> </tr> <tr> <td style="text-align: center;">> 10</td> <td style="text-align: center;">$B=0.75 \cdot C$</td> <td style="text-align: center;">$C=A+4.00\%$</td> </tr> </tbody> </table> <p>The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used.</p> <p>Depending on the application and the required switchpoint the values B and C can be varied.</p> <p>The sensitivity is now setted thus that liquid A or foam is NOT detected.</p> | Dielectric constant of material A or foam | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered | ≤ 10 | $B=0.75 \cdot C$ | $C=A+2.00\%$ | > 10 | $B=0.75 \cdot C$ | $C=A+4.00\%$ |
| Dielectric constant of material A or foam | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered | | | | | | | | |
| ≤ 10 | $B=0.75 \cdot C$ | $C=A+2.00\%$ | | | | | | | | |
| > 10 | $B=0.75 \cdot C$ | $C=A+4.00\%$ | | | | | | | | |
| <p>3. Immerse probe in liquid B which should be detected</p> | <p>Ensure that liquid B (which should be detected) is covering the probe.</p> <p>LED white should glow.</p> <div data-bbox="973 1758 1380 2049" style="text-align: right;"> </div> | | | | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | | | | |

Operation with IO-Link - Advanced calibration

Switchpoint setting - Level detection through non metal vessel wall

Sensor behaviour:

Material covers the probe: Out1 and Out2 detect this material

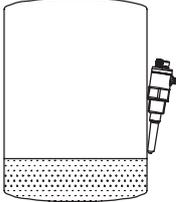
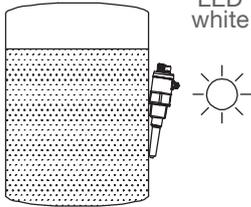


- A Uncovered probe
- B Switchpoint covered to uncovered
- C Switchpoint uncovered to covered
- D Covered probe

The diagram shows:
 Out 1 set to FSL
 Out 2 set to FSH
 1 = contact closed

0 = contact open

Pin assignment with PNP, NPN, Push-Pull: see page 22

| <p>1. Ensure that the probe is uncovered</p> | <p>The unit will calibrate to an uncovered probe.</p>  <p style="text-align: center;">non metal vessel wall</p> | | | | | | | | | | | | |
|--|--|------------------------------------|------------------------------------|------------------------------------|------------------------------------|----------|---------------------------|------------------|--------------|--------|---------------------------|------------------|--------------|
| <p>2. Set switchpoints</p> | <ul style="list-style-type: none"> • Read the "Actual measured value" (process data), which is "A Uncovered probe". • Set the switchpoints (B, C) by increasing "A Uncovered probe" as stated in the table below. See diagram on top of this page for explanation of A,B,C. <table border="1" data-bbox="598 1283 1323 1476"> <thead> <tr> <th>Dielectric constant of material</th> <th>Distance "a" (material to probe)</th> <th>B Switchpoint covered to uncovered</th> <th>C Switchpoint uncovered to covered</th> </tr> </thead> <tbody> <tr> <td>≥ 3</td> <td>$\leq 10\text{mm (0.4")}$</td> <td>$B=0.75 \cdot C$</td> <td>$C=A+0.50\%$</td> </tr> <tr> <td>> 40</td> <td>$\leq 20\text{mm (0.8")}$</td> <td>$B=0.75 \cdot C$</td> <td>$C=A+1.00\%$</td> </tr> </tbody> </table>  <p>Depending on the application and the required switchpoint the values B and C can be varied.</p> | Dielectric constant of material | Distance "a" (material to probe) | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered | ≥ 3 | $\leq 10\text{mm (0.4")}$ | $B=0.75 \cdot C$ | $C=A+0.50\%$ | > 40 | $\leq 20\text{mm (0.8")}$ | $B=0.75 \cdot C$ | $C=A+1.00\%$ |
| Dielectric constant of material | Distance "a" (material to probe) | B Switchpoint covered to uncovered | C Switchpoint uncovered to covered | | | | | | | | | | |
| ≥ 3 | $\leq 10\text{mm (0.4")}$ | $B=0.75 \cdot C$ | $C=A+0.50\%$ | | | | | | | | | | |
| > 40 | $\leq 20\text{mm (0.8")}$ | $B=0.75 \cdot C$ | $C=A+1.00\%$ | | | | | | | | | | |
| <p>3. Ensure material level is well above the probe</p> | <p>LED white should glow.</p>  <p style="text-align: right;">LED white</p> | | | | | | | | | | | | |
| <p>Switchpoint setting is finished</p> | | | | | | | | | | | | | |

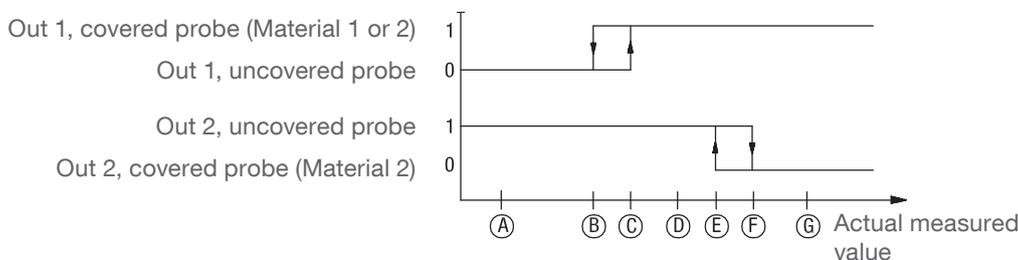
Operation with IO-Link - Advanced calibration

Switchpoint setting - Level detection of two different materials

Sensor behaviour:

Material 1 covers the probe: Out 1 detects this material, Out 2 does not detect this material

Material 2 with higher dielectric constant than material 1 covers the probe: Out 1 and Out 2 detect this material



- A Uncovered probe
- B Out 1: Switchpoint covered to uncovered
- C Out 1: Switchpoint uncovered to covered
- D Covered probe (Material 1)
- E Out 2: Switchpoint covered to uncovered
- F Out 2: Switchpoint uncovered to covered
- G Covered probe (Material 2)

The diagram shows:

Out 1 set to FSL
 Out 2 set to FSH
 1 = contact closed

0 = contact open

Pin assignment with PNP, NPN, Push-Pull: see page 22

Note: the white and yellow LED follows Out1

Set switchpoints B, C, E, F

Set the switchpoints (B, C, E, F) as stated in the table below. See diagram on top of this page for explanation of B, C, E, F.

| Dielectric constant of material 1 | B (Out 1) Switchpoint covered to uncovered | C (Out 1) Switchpoint uncovered to covered |
|-----------------------------------|--|--|
| <2 | B=3.00% | C=4.00% |
| 2 ... 4 | B=5.20% | C=7.00% |
| >4 | B=7.50% | C=10.00% |

| Dielectric constant of material 2 | E (Out 2) Switchpoint covered to uncovered | F (Out 2) Switchpoint uncovered to covered |
|-----------------------------------|--|--|
| <2 | E=3.00% | F=4.00% |
| 2 ... 4 | E=5.20% | F=7.00% |
| >4 | E=7.50% | F=10.00% |

The stated values assume, that the distance of the probe to a metal wall is not smaller than stated on page 17 and 19 and that the Sensguard (see page 11) is not used. Depending on the application and the required switchpoint the values B,C,E,F can be varied.

Operation with IO-Link - Advanced possibilities

Advanced possibilities

Relation of "Actual measured value" to dielectric constant The "Actual measure value" (process data) is clearly related to the dielectric constant and therefore to the sensitivity of the unit.
 See Table below.

| Required min. dielectric constant of material to be detected (1) | Actual measured value |
|--|-----------------------|
| 1 (Probe in air) | 0.0% |
| 1.5 | 2.6% |
| 2 | 4.2% |
| 3 | 7.1% |
| 4 | 10% |
| 6 | 14% |
| 8 | 18% |
| 11 | 22% |
| 15 | 27% |
| 25 | 36% |
| 40 | 45% |
| 60 | 53% |
| 90 | 61% |

(1) The stated values are valid under following conditions:

- The distance of the probe to a metal wall is not smaller than stated on page 17 and 19.
- The Sensguard (see page 11) is not used.
- The probe is mounted inside the vessel (no measurement from outside through the vessel wall).
- Conductive material is not present.

Operation - WHG Proof Test

The implementation of the WHG proof test is done in accordance with the documentation "Technical Description" for WHG, Annex 8, Proof Test, by following possibilities:

- Filling the vessel**
- Filling the vessel until the switchpoint is reached and monitoring the correct reaction of the system

-
- Simulation of the level**
- Suitable simulation of the level or of the physical measurement effect

This can be done for example by dismounting the sensor and immersion into the original medium.

Troubleshooting

| LEDs | | | Behaviour | Cause | Action |
|--------------------------|---|---|--|---|---|
| Green Power supply | Yellow Signal output | White Probe covered/ uncovered | | | |
| OFF | OFF | OFF | | <p>Proper power not applied to device</p> <p>Connector came loose.</p> <p>Defective component in device.</p> | <p>Check supply voltage</p> <p>Refasten connector</p> <p>Contact distributor</p> |
| ON | ON or OFF | ON | Probe is uncovered but LED white states covered | Sensitivity is set too high Either sensitivity setting not properly done or too much material buildup. | Reduce sensitivity (see page 25ff for potentiometer or 37ff for IO-Link). If applicable clean probe from buildup. |
| ON | ON or OFF | OFF | Probe is covered but LED white states uncovered | Sensitivity is set too low. Either sensitivity setting not properly done or too low dielectric constant from material. | Increase sensitivity: By potentiometer (see page 25ff) or by IO-Link (see page 37ff). Dielectric constant of material must be 1.5 or more. |
| ON | blinks for a few times, then stops blinking | ON or OFF | Blinking happens after the potentiometer was turned | This is a normal operation. The blinking indicates the position of the potentiometer after it was turned (see page 32). | No action required |
| ON | Both LEDs blink 5 times, then stop blinking | | Blinking happens when the potentiometer is turned | Calibration by potentiometer is not valid. Calibration by IO-Link is setted. | The calibration can be set back to potentiometer: By turning the potentiometer to CW (or CCW) stop position and then within 30 seconds to CCW (or CW) stop position. or With IO-Link by System Command 161 (see page 34) |
| ON | OFF | Blinks fast (twice per second) | Signal output = idle | Diagnostics has indicated a failure | Contact distributor |
| ON | ON or OFF | ON or OFF | Signal output Out1 does not follow yellow LED | Defective component in device | Contact distributor |
| ON | ON or OFF | ON or OFF | No respond (change of white and yellow LED) when potentiometer is turned and probe is uncovered. | Defective component in device | Contact distributor |

Transport and Storage

Transport

Observe the instructions as stated on the transport packaging, otherwise the products may get damaged.

Transport temperature: -40 .. +80°C (-40 .. +176°F)

Transport humidity: 20 .. 85%

Transport incoming inspections must be carried out to check for possible transport damage.

Storage

Products must be stored at a dry and clean place. They must be protected from influence of corrosive environment, vibration and exposure to direct sunlight.

Storage temperature: -40 .. +80°C (-40 .. +176°F)

Storage humidity: 20 .. 85%

Maintenance

| | |
|-----------------------------------|--|
| Opening the lid (cover) |  Before opening the lid for maintenance reasons observe following items: <ul style="list-style-type: none"> • No dirt or rain can enter into the housing. |
| Frequent check of the unit |  To ensure durable safety with electrical safety, following items must be checked frequently depending on the application: <ul style="list-style-type: none"> • Mechanical damage or corrosion of any components (housing side and process side) and of the field wiring cables. • Tight sealing of the process connection, cable glands and enclosure lid. • Properly connected external PE cable (if present). |
| Cleaning |  If cleaning is required by the application, following must be observed: <ul style="list-style-type: none"> • Cleaning agent must comply with the materials of the unit (chemical resistance). • Mainly the lid sealing, cable gland and the surface of the unit must be considered. <p>The cleaning process must be done in a way, that:</p> <ul style="list-style-type: none"> • The cleaning agent cannot enter into the unit through the lid sealing or cable gland. • No mechanical damage of the lid sealing, cable gland or other parts can happen. <p>Units with EHEDG certification, which are used in the respective EHEDG applications, must be cleaned according to the respective regulations.</p> |
| Max. temperature for CIP |  <ul style="list-style-type: none"> • 135°C (275°F), duration 60min • 150°C (302°F), duration 30min (only for CN 7120 with process connection G 1/2" hygienic) • Ambient temperature limited to 50°C (122°F), unit de-energized. |
| Function test |  A frequent function test may be required depending on the application. <ul style="list-style-type: none"> • Observe all relevant safety precautions related with a safe work depending on the application (e.g. dangerous material, electric safety, process pressure). <p>This test does not proof if the unit is sensitive enough to measure the material of the application.</p> <p>Function test is done by touching the probe with appropriate means (e.g. grounded metal plate or hand) and monitor if a correct change of the signal output from uncovered to covered happens.</p> |
| Production date | The production date can be traced by the serial number on the typeplate. Please contact the manufacturer or your local distributor. |
| Spare parts | All available spare parts are stated in the selection list |

Disposal

The product consists of materials which can be recycled, details of the used materials see chapter "Technical data - mechanical data". Recycling must be done by a specialised recycling company.