TI01080C/07/EN/06.21
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2021-06-30

Technical Information
Smartec CLD18

Compact inductive conductivity measurement for the food and beverage industry



Application

Compact measuring system for inductive conductivity measurement in liquids with medium to high conductivity. The structure is made from highly durable, food-safe polyetheretherketone (PEEK). The excellent chemical resistance properties of the sensor mean it can also be used in applications outside the food industry. The measuring system is perfectly suited for:

- Phase separation of product/water mixtures in the beverage industry
- Control of cleaning-in-place facilities (CIP), concentration control, separation in the cleaning return line
- Industrial water monitoring
- Rinsing processes in pickling plants

Your benefits

- Hygienic sensor design in accordance with EHEDG and 3-A requirements, no risk of recontamination
- Stainless steel or plastic transmitter housing, IP 69, can be cleaned with high-pressure steam
- High level of repeatability, 0.5 % of reading, always guarantees same separation or monitoring
- Optionally available with IO-Link

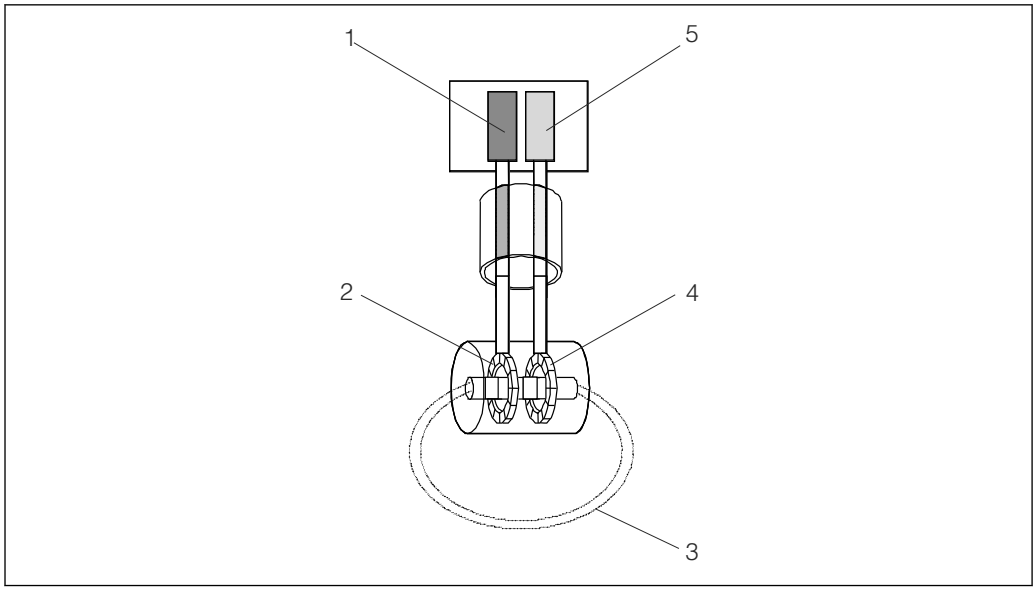
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Function and system design

Measuring principle

Inductive conductivity measurement

An oscillator (1) generates an alternating magnetic field in the primary coil (2), which induces a current flow (3) in the medium. The strength of the current depends on the conductivity and thus on the ion concentration in the medium. The current flow in the medium, in turn, generates a magnetic field in the secondary coil (4). The resulting induced current is measured by the receiver (5) and used to determine the conductivity.



1 Inductive conductivity measurement

1 Oscillator
2 Primary coil
3 Current flow in the medium
4 Secondary coil
5 Receiver

Advantages of inductive conductivity measurement:
- No electrodes and therefore no polarization effects
- Accurate measurement in media with a high degree of pollution and a tendency to form buildup
- Complete galvanic isolation of the measurement and the medium

Input

Measured variables

Conductivity

Temperature

Measuring range

Conductivity:	Recommended range: 200 µS/cm to 1000 mS/cm (uncompensated)
Temperature:	−10 to 130 °C (14 to 266 °F)

Binary input

The binary input is used in the SIO [1] (without IO-Link communication) for measuring range switching.

Voltage range	0 V to 30 V
High voltage min.	Analog: 12.0 V IO-Link: 13.0 V
Low voltage max.	Analog: 9.0 V IO-Link: 8.0 V
Current consumption at 24 V	Analog: 30.0 mA IO-Link: 5.0 mA
Undefined voltage range	Analog: 9.0 to 12.0 V IO-Link: 8.0 to 13.0 V

Output

Output signal

Conductivity:	Analog: 0 / 4 to 20 mA, galvanically isolated IO-Link: 0 / 4 to 20 mA
Temperature:	Analog: 0 / 4 to 20 mA, galvanically isolated

Load

Max. 500 Ω

Characteristic

Linear

Signal resolution

Resolution:	> 13 bit
Accuracy:	± 20 µA

Alarm output (only CLD18-A/B/C/D)

The alarm output is implemented as an "open collector".

Max. current	200 mA
Max. voltage	30 V DC
Error or device without supply voltage	Alarm output blocked (0 mA)
No error	Alarm output open (up to 200 mA)

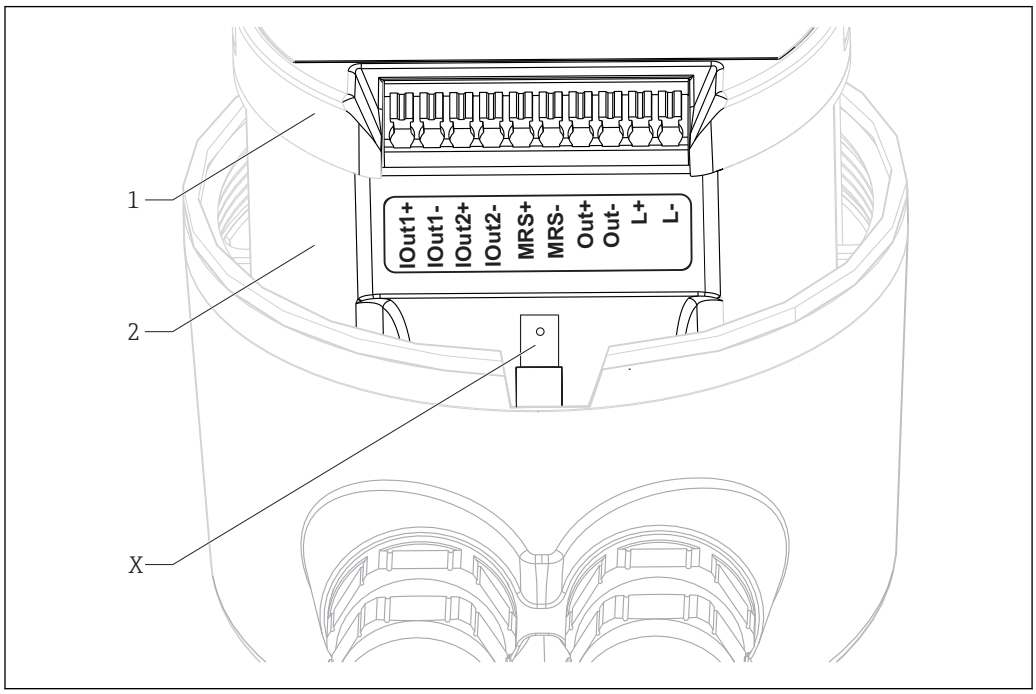
Protocol-specific data (only CLD18-E)

IO-Link specification	Version 1.1.3
Device ID	0x020101 (131329)
Manufacturer ID	0x0011 (17)
IO-Link Smart Sensor Profile 2nd Edition	Identification, diagnosis, DMSS (digital measuring and switching sensors)
SIO mode	Yes
Velocity	COM2 (38.4 kBd)
Minimum cycle time	10 ms
Process data width:	80 bit
IO-Link data storage	Yes
Block configuration	Yes

1) SIO = standard input output

Power supply

Terminal assignment (only CLD18-A/B/C/D)



2 *Terminal assignment*

IOut1	*Current output conductivity (active)*
IOut2	*Current output temperature (active)*
Out	*Alarm output (open-collector)*
MRS	*Binary input (measuring range switch)*
L+/L-	*Power supply*
X	*Grounding pin (flat male tab 4.8 mm)*
1	*Cover on electronics box*
2	*Electronics box*

Supply voltage

Analog: 24 V DC ± 20 %, protected against reverse polarity

IO-Link: 18 to 30 V DC (SELV, PELV, Class 2), protected against reverse polarity

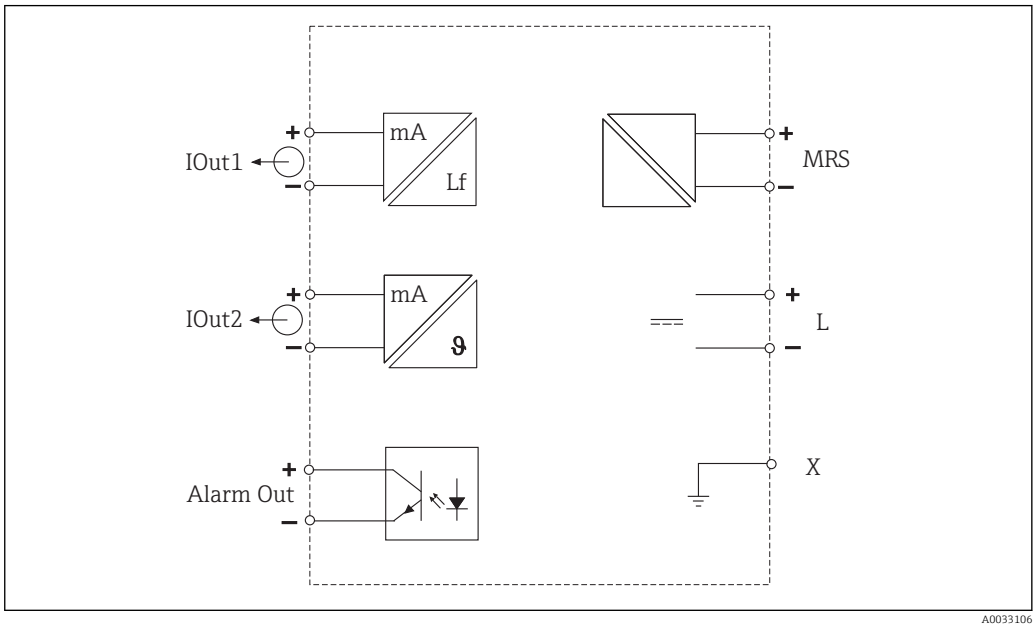
Power consumption

Analog: 3 W

IO-Link: 1 W

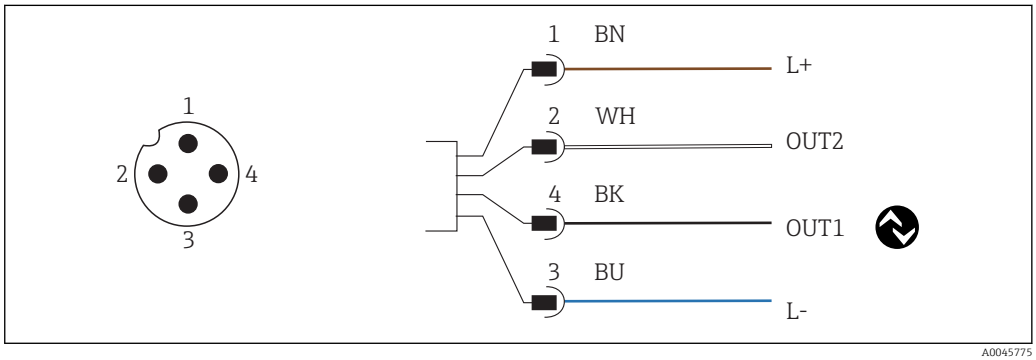
Electrical connection

CLD18-A/B/C/D (without IO-Link)



3 Electrical connection

CLD18-E (with IO-Link)



4 Connection via M12 connector (A-coded)

1 L+
2 OUT2, current output 0/4 to 20 mA
3 L-
4 OUT1, IO-Link communication / SIO input for measuring range switching

Cable specification

Analog: 0.5 mm² recommended, max. 1.0 mm²

IO-Link: 0.34 mm² recommended, maximum cable length 20 m

Overvoltage protection

Overvoltage category I

Performance characteristics

Response time

Conductivity:	t_{95} < 1.5 s
Temperature:	t_{90} < 20 s

Measured error

Conductivity:	± (2.0 % of measured value + 20 µS/cm)
Temperature:	± 1.5 K
Signal outputs	± 50 µA

Repeatability	Conductivity:	max. 0.5 % of measured value ± 5 µS/cm ± 2 digits
Cell constant	11.0 cm^{-1}	
Temperature compensation	Range	−10 to 130 °C (14 to 266 °F)
	Types of compensation	▪ None ▪ Linear with user-configurable temperature coefficient
Reference temperature	25 °C (77 °F)	

Installation

Mounting instructions

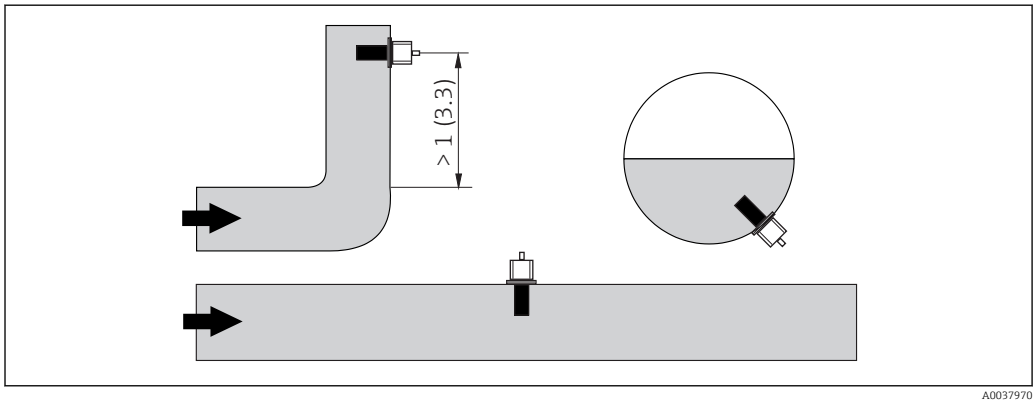
Hygienic requirements

- Easily cleanable installation of equipment according to the criteria of the EHEDG must be free of dead legs.
- If a dead leg is unavoidable, it shall be kept as short as possible. Under no circumstances shall the length of a dead leg L exceed the pipe's inner diameter D minus the equipment's enveloping diameter d. The condition L ≤ D − d applies.
- Furthermore, the dead leg must be self-draining, so neither product nor process fluids are retained therein.
- Within tank installations, the cleaning device must be located so that it directly flushes the dead leg.
- For further reference, see the recommendations concerning hygienic seals and installations in EHEDG Doc. 10 and the Position Paper: "Easy cleanable Pipe couplings and Process connections".

For 3-A-compliant installation, please observe the following:
- After the device has been mounted, hygienic integrity must be guaranteed.
- The leakage hole must be located at the lowest point on the device.
- 3-A-compliant process connections must be used.

Orientations

The sensor must be completely immersed in the medium. Avoid air bubbles in the area of the sensor.



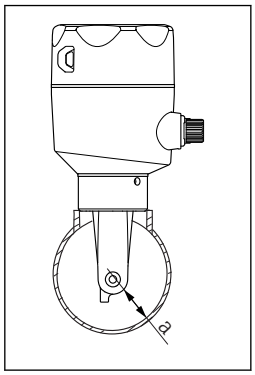
5 Orientation of conductivity sensors. Engineering unit: m (ft)

Changes in the flow direction (after pipe bends) can cause turbulence in the medium.

1. Install the sensor at a distance of at least 1 m (3.3 ft) downstream from a pipe bend.
2. When installing, align the sensor in such a way that the medium flows through the flow opening of the sensor in the direction of medium flow. The sensor head must be completely immersed in the medium.

Installation factor

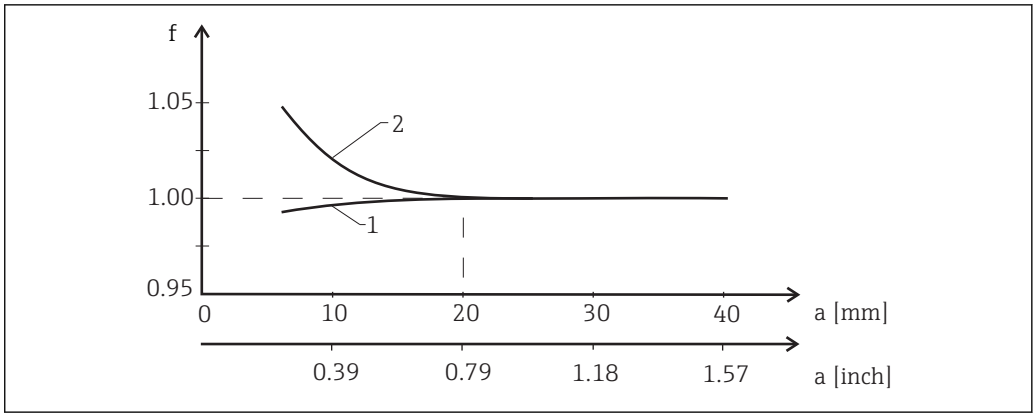
In confined installation conditions, the walls affect the ionic current in the liquid. This effect is offset by what is referred to as the installation factor. The installation factor can be entered in the transmitter for the measurement or the cell constant is corrected by multiplying by the installation factor.
The value of the installation factor depends on the diameter and the conductivity of the pipe nozzle as well as the distance a between the sensor and the wall.
The installation factor can be disregarded (f = 1.00) if the distance to the wall is sufficient (a > 20 mm, from DN 60).
If the distance to the wall is shorter, the installation factor increases for electrically insulating pipes (f > 1) and decreases for electrically conductive pipes (f < 1).
It can be measured using calibration solutions, or a close approximation can be determined from the following diagram.



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6 CLD18 installation

a Wall distance



A0020517

7 Relationship between installation factor f and wall distance a

1 Electrically conductive pipe wall
2 Electrically insulating pipe wall

▶ Install the measuring system in such a way that the housing is not exposed to direct sunlight.

Environment

Ambient temperature	Stainless steel process connection: PVC process connection:	−20 to 60 °C (−4 to 140 °F) −10 to 60 °C (14 to 60 °F)
Storage temperature	Stainless steel process connection: PVC process connection:	−25 to 80 °C (−13 to 176 °F) −10 to 60 °C (14 to 140 °F)
Humidity	≤ 100 %, condensating	
Climate class	Climate class 4K4H as per EN 60721-3-4	
Degree of protection	IP 69 as per EN 40050:1993 Degree of protection NEMA TYPE 6P as per NEMA 250-2008	
Shock resistance	Complies with IEC 61298-3, certified up to 50 g	
Vibration resistance	Complies with IEC 61298-3, certified up to 5 g	

Electromagnetic compatibility

Analog:

Interference emission as per EN 61000-6-3:2007 + A1:2011 and EN 55011:2009 + A1:2010

Interference immunity as per EN 61326-1:2013

IO-Link:

Interference emission according to EN 61326-1:2013, Class A

Interference immunity according to EN 61326-1:2013, Class A and IEC 61131-9:2013 (at least: Annex G1)

Pollution degree

Pollution level 2

Altitude

<2000 m (6500 ft)

Process

Process temperature

Stainless steel process connection:
−10 to 110 °C (14 to 230 °F)
Max.130 °C (266 °F) up to 60 minutes

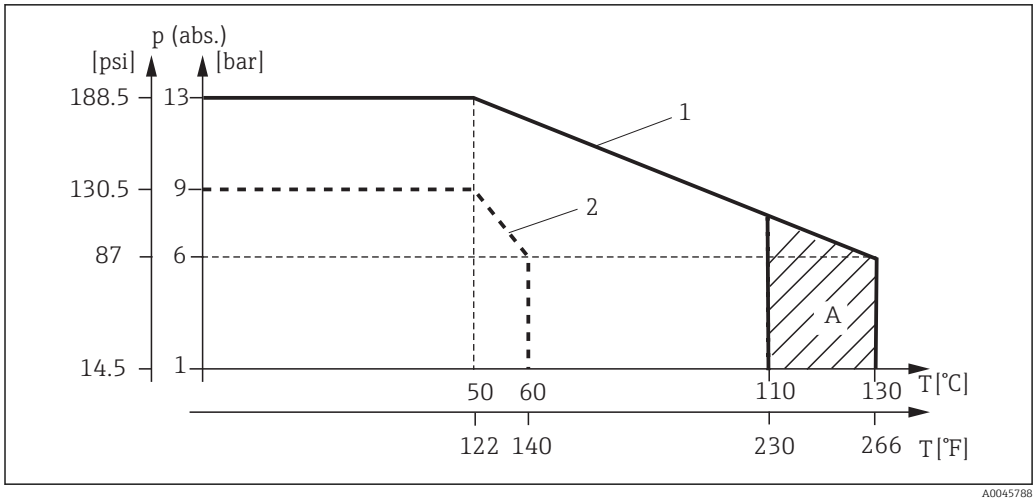
PVC process connection:
−10 to 60 °C (14 to 140 °F)

Absolute process pressure

Stainless steel process connection:
13 bar (188.5 psi), abs to up to 50 °C (122 °F)
7.75 bar (112 psi), abs at 110 °C (230 °F)
6.0 bar (87 psi), abs at 130 °C (266 °F) max. 60 minutes
1 to 6 bar (14.5 to 87 psi), abs in CRN environment tested with 50 bar (725 psi)

PVC process connection:
9 bar (130.5 psi), abs to up to 50 °C (122 °F)
6.0 bar (87 psi), abs at 60 °C (140 °F)
1 to 6 bar (14.5 to 87 psi), abs in CRN environment tested with 50 bar (725 psi)

Pressure-temperature ratings



8 Pressure/temperature ratings

1 Stainless steel process connection
2 PVC process connection
A Process temperature increased briefly (max. 60 minutes)

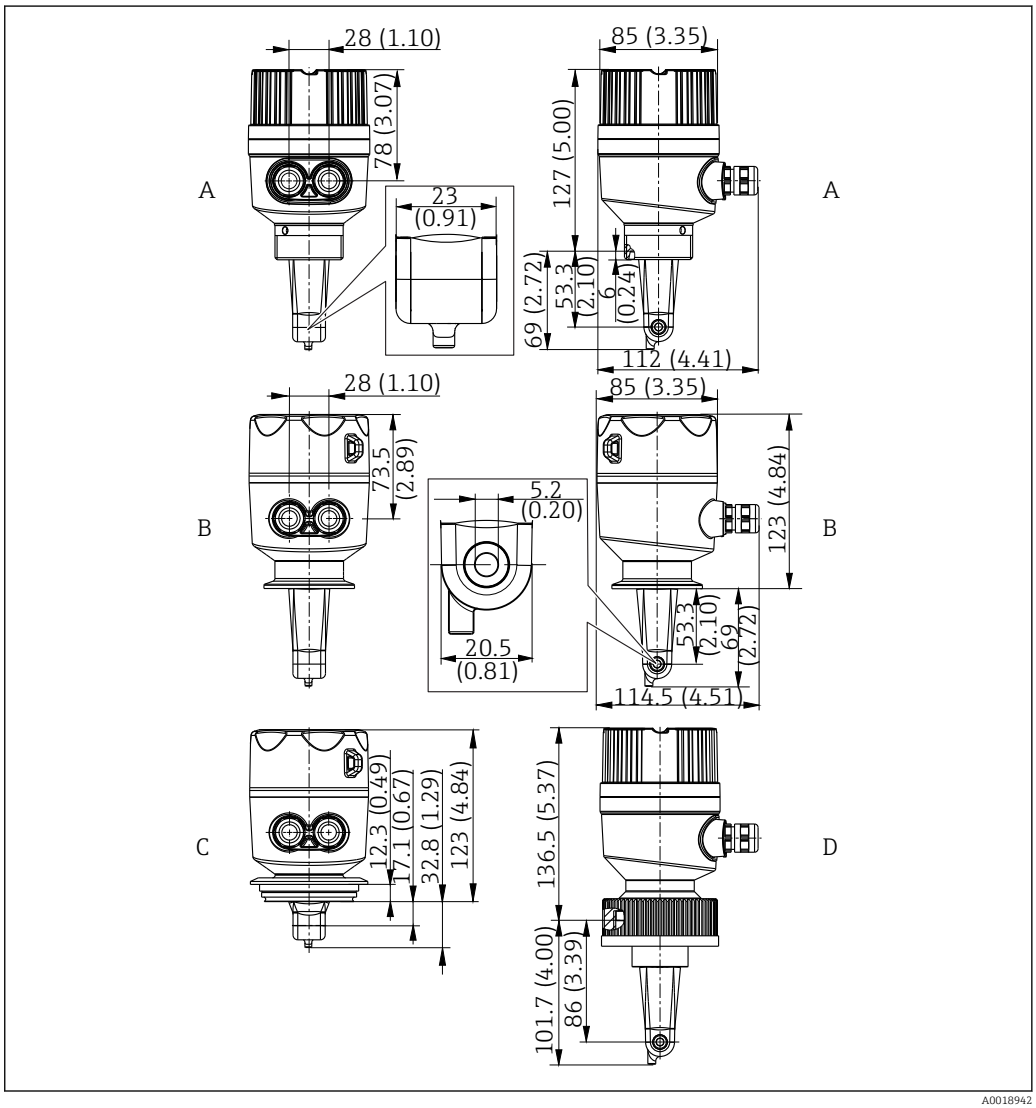
Flow velocity

max. 10 m/s (32.8 ft/s) for low-viscosity media in pipe DN 50

Mechanical construction

Design and dimensions

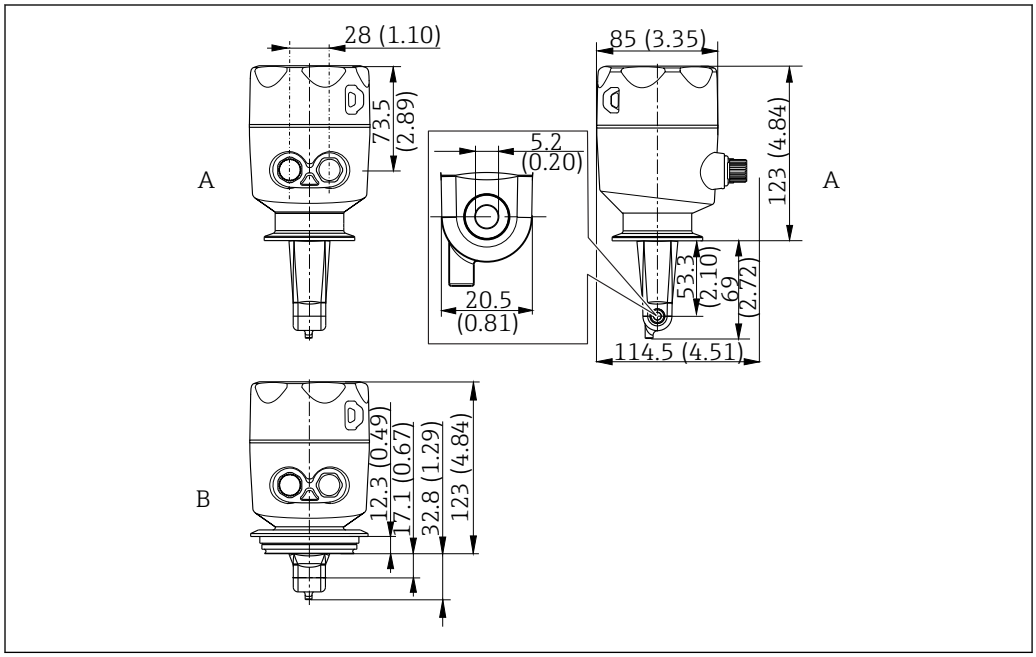
CLD18-A/B/C/D (without IO-Link)



9 Dimensions and versions (examples). Engineering unit: mm (in)

A Plastic housing with thread G 1½
B Stainless steel housing with ISO 2852 clamp 2"
C Stainless steel housing with Varivent DN 40 to 125
D Plastic housing with coupling nut 2¼" PVC

CLD18-E (with IO-Link)



10 Dimensions and versions (examples). Engineering unit: mm (in)

A Stainless steel housing with ISO 2852 clamp 2"
B Stainless steel housing with Varivent DN 40 to 125

Weight

Stainless steel housing:	max. 1.870 kg (4.12 lbs)
Plastic housing:	max. 1.070 kg (2.36 lbs)

Materials

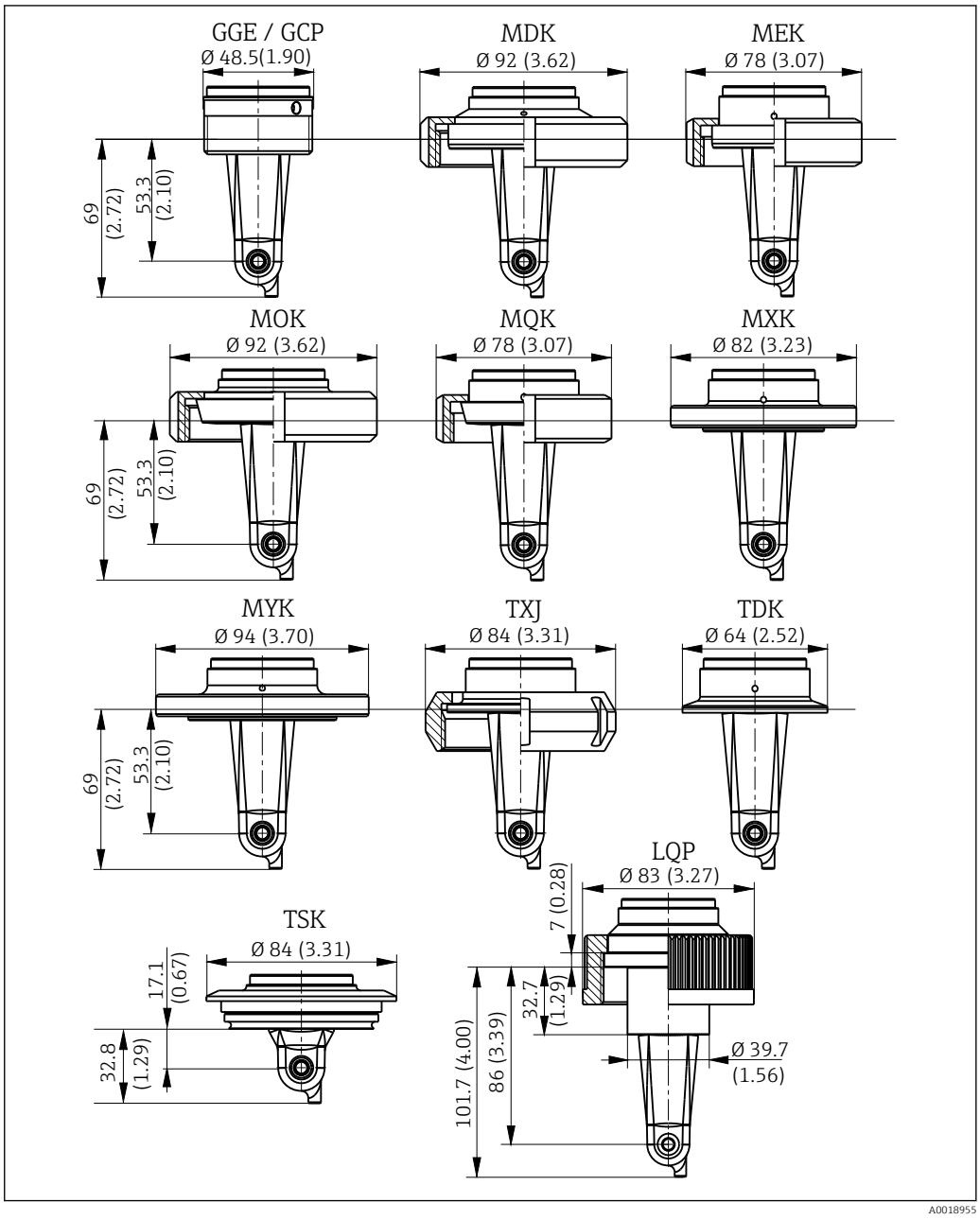
In contact with medium

Sensor:	PEEK (polyetheretherketone)
Process connection:	Stainless steel 1.4435 (AISI 316 L), PVC-U
Seal:	EPDM

Not in contact with medium

Stainless steel housing:	Stainless steel 1.4308 (ASTM CF-8, AISI 304)
Plastic housing:	PBT GF20, PBT GF10
Seals:	EPDM
Window:	PC
Cable glands:	PA, TPE

Process connections



11 Process connections, dimensions in mm (inch)

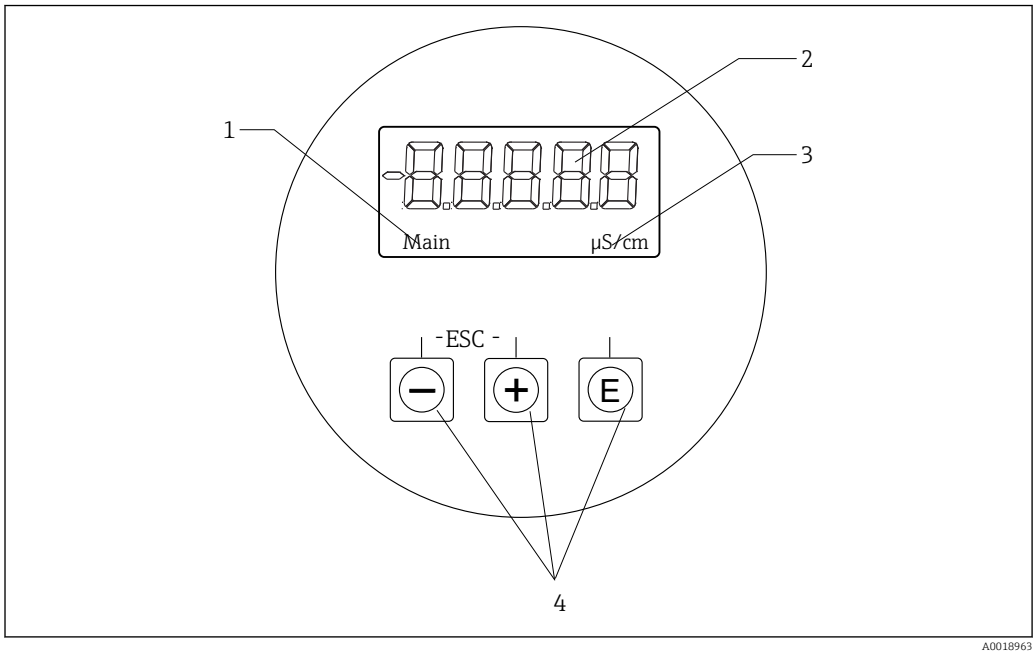
GGE	*Thread G1½*
GCP	*Thread G1½ PVC*
MDK	*Aseptic DIN 11864-1-A DN 50*
MEK	*Aseptic DIN 11864-1-A DN 40*
MOK	*Dairy fitting DIN 11851 DN 50*
MQK	*Dairy fitting DIN 11851 DN 40*
MXK	*Dairy fitting DIN 11853 -2 DN 40*
MYK	*Dairy fitting DIN 11853 -2 DN 50*
TXJ	*SMS 2"*
TDK	*Tri-Clamp ISO 2852 2"*
TSK	*Varivent N DN 40 to 125*
LQP	*Coupling nut 2¼" PVC*

Temperature sensor Pt1000

Operability

Local operation

Local operation can be locked and unlocked via IO-Link.



12 *Local display and buttons*

1 *Parameter*
2 *Measured value*
3 *Unit*
4 *Operating keys*

In the event of an error the device automatically alternates between displaying the error and the measured value.
The operating language is English.

System integration

IO-Link

In order to integrate field devices into a digital communication system, the IO-Link system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transfer rate. This data is available in the IODD (IO Device Description) which is provided to the IO-Link master via generic modules when the communication system is commissioned.

Download via endress.com

1. endress.com/download
2. Select **Device Driver** from the search options shown.
3. For **Type** select "IO Device Description (IODD)".
4. Select the **Product Code** or enter it as text.
   ↳ A list of search results is displayed.
5. Download the appropriate version.

Download via ioddfinder

1. ioddfinder.io-link.com
2. For **Manufacturer** select "Endress+Hauser".
3. Enter the **Product Name**.
   ↳ A list of search results is displayed.
4. Download the appropriate version.

Certificates and approvals

Current certificates and approvals for the product are available via the Product Configurator at www.endress.com.

1. Select the product using the filters and search field.
2. Open the product page.

The **Configuration** button opens the Product Configurator.

Ordering information

Product page

www.endress.com/CLD18

Product Configurator

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
   ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
   ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.

For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

Scope of delivery

The scope of delivery comprises:
- Smartec CLD18 measuring system in the version ordered
- Analog: Operating Instructions BA01149C
- IO-Link: Operating Instructions BA02097C

Accessories

The following are the most important accessories available at the time this documentation was issued.

▶ For accessories not listed here, please contact your Service or Sales Center.

Standard solutions

Conductivity calibration solutions CLY11
Precision solutions referenced to SRM (Standard Reference Material) by NIST for qualified calibration of conductivity measuring systems in accordance with ISO 9000:
- CLY11-C, 1.406 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081904
- CLY11-D, 12.64 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081905
- CLY11-E, 107.00 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081906

For further information on "Calibration solutions", see the Technical Information → 2



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