Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Indumax P CLS50

Highly resistant, inductive conductivity sensor for standard, hazardous and high-temperature applications

Application

CLS50 conductivity sensors are especially suitable for application in the chemical industry and process engineering. The six-decade measuring range and the high chemical resistance of the materials in contact with medium (PFA or PEEK) permit to use this sensor in a number of various applications, e.g.:

- Concentration measurement of acids and bases
- Quality monitoring of chemical products in tanks and pipes
- Phase separation of product/product mixtures

CLS50 sensors are used with the transmitters Liquiline M CM42, Liquisys M CLM223/253 or Mycom S CLM153.

Your benefits

- High durability
  - High chemical resistance thanks to PFA coating
  - PEEK version for high temperatures up to 180 °C (356 °F)
- Low risk of soiling
  - Dirt-repellent PFA surface
  - Large sensor opening
- Easy installation
  - Can be installed in T-pieces ≥ DN 80 with the outgoing diameter reduced to ≥ DN 50
  - Total cable length up to 55 m (180 ft)
- Wide measuring range from 2 µS/cm to 2000 mS/cm
- Integrated, coated Pt 100 temperature sensor, error class A
- Ex approval EEx ia IIC T6/T4

TI182C/07/en/05.07
51517565

Endress+Hauser

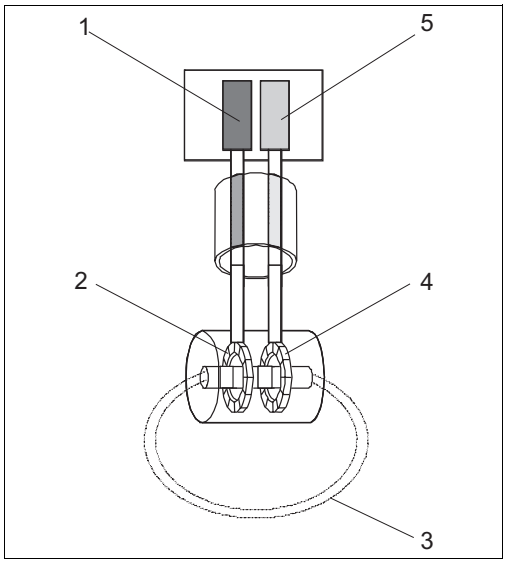
People for Process Automation

Function and system design

Measuring principle

Inductive conductivity measurement

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



Inductive conductivity measurement
1 Generator
2 Primary coil
3 Current flow in the medium
4 Secondary coil
5 Receiver

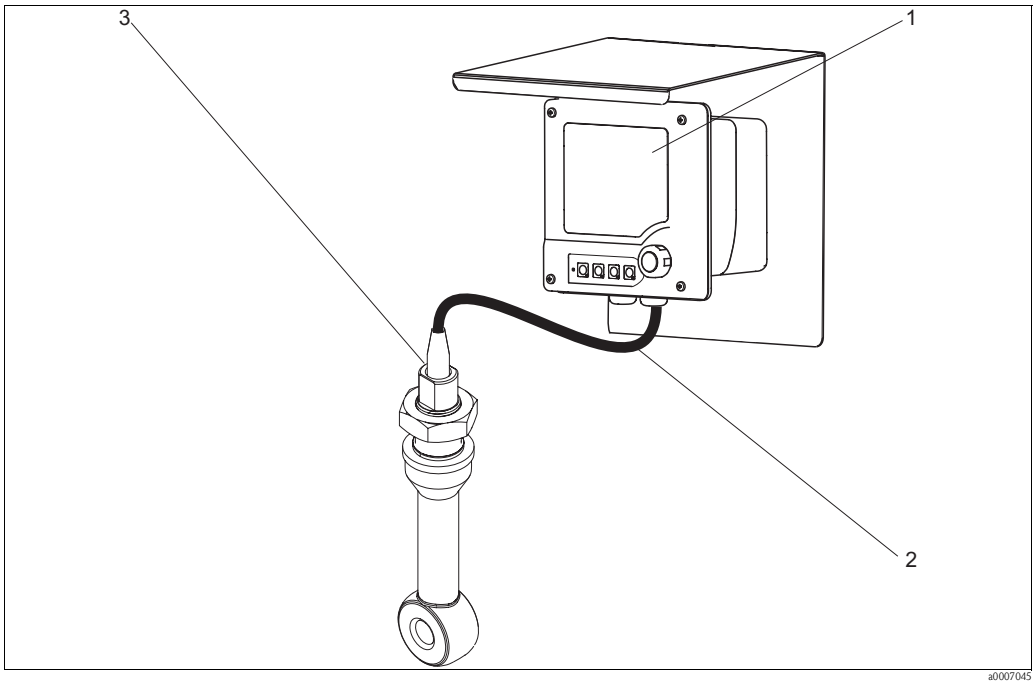
Benefits of inductive conductivity measurement
- No electrodes, therefore no polarization
- Accurate measurement in media or solutions with a high soiling degree and a tendency to deposition
- Complete galvanic separation of measurement and medium

Important properties

- **Wide measuring range**
  The sensor's measuring range comprises six decades, from 2 µS/cm to 2000 mS/cm.
- **Durability**
  The materials in contact with medium (PEEK, PFA) feature a very high chemical resistance. In addition, the PEEK version is suitable for application at high temperatures of up to 180 °C (356 °F).
- **Low risk of soiling**
  Thanks to its large opening, the sensor is not susceptible to soiling. The PFA version requires even less cleaning thanks to its dirt-repellent surface.

Measuring system

A complete measuring system comprises:
- a CLS50 conductivity sensor with fixed cable
- a transmitter, e.g. Liquiline M CM42



Example of a measuring sytem

1 Liquiline M CM42 transmitter
2 Measuring cable
3 Indumax P CLS50

Input

Measured variable

Conductivity
Temperature

Cell constant k

k = 1.98 cm^{-1}

Measuring range

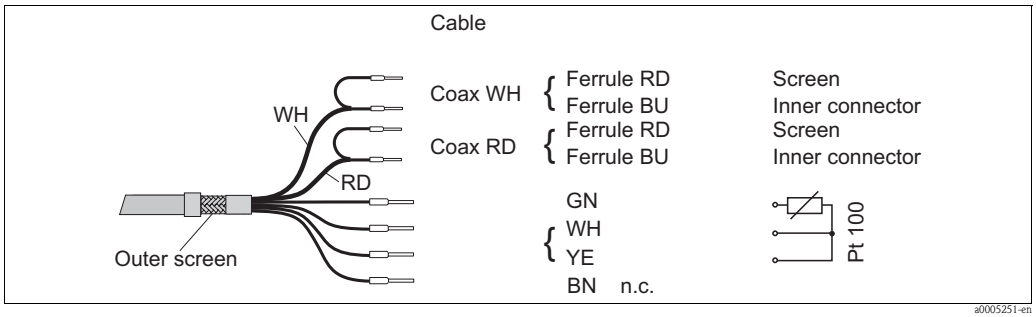
Conductivity:	2 µS/cm to 2000 mS/cm (uncompensated)
Temperatur	–20 to +180 °C (-4 to +356 °F)

Temperature sensor

Pt 100 (class A acc. to IEC 60751)

Cable specification

The sensor is supplied with a fixed cable. The connection to the transmitter can be extended using the CLK5 special measuring cable.



Fixed cable / special measuring cable CLK5

Total cable length: max. 55 m (180 ft)

Note!
Please note that the residual coupling increases when the cable is extended.

Performance characteristics

Temperature response time t_{90}

PEEK version: approx. 7 min
PFA version: approx. 11 min

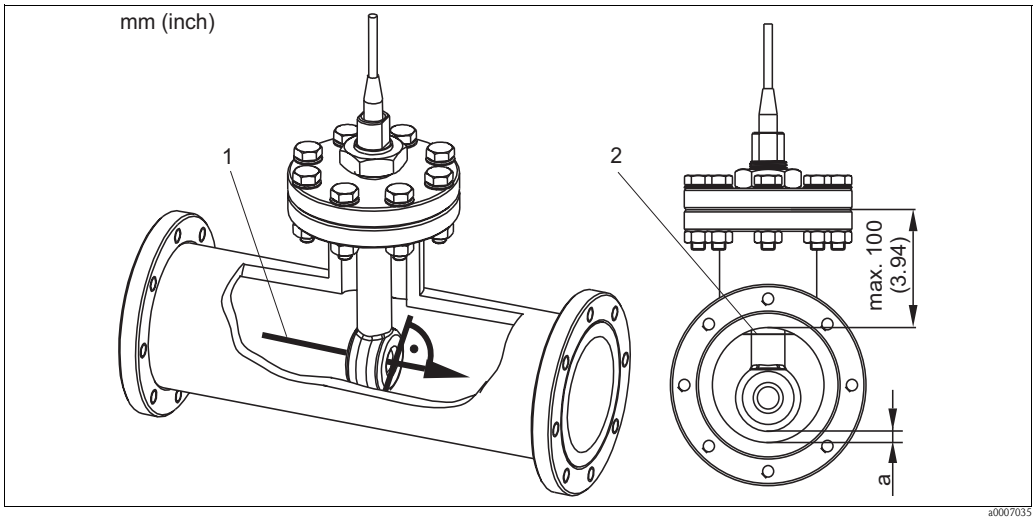
Measured error

-20 to 100 °C (-4 to 212 °F): ±(5 µS/cm + 0.5 % of measured value)
> 100 °C (212°F): ±(10 µS/cm + 0.5 % of measured value)

Installation

Installation position

Install the sensor in such a way that the sensor opening is oriented in the flow direction of the medium (see figure below). The sensor head must be completely immersed in the medium.

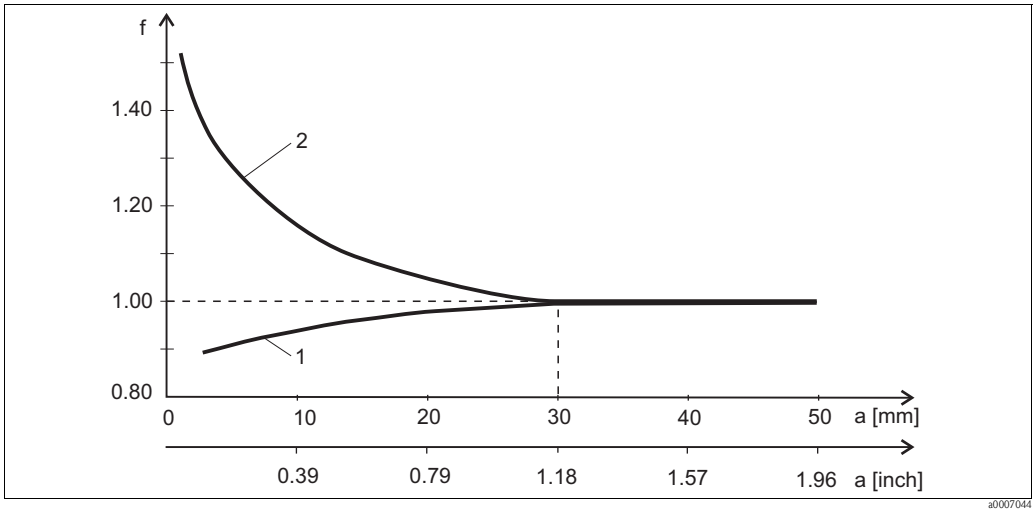


Installation position of the sensor

1 Flow direction of medium
2 Minimum water level in the pipe
a Sensor distance from the pipe wall

Installation factor

In narrow installation conditions, the ion flow in the medium is affected by the pipe walls. This effect is compensated by the so-called installation factor. The installation factor can be entered in the transmitter or the cell constant can be corrected by multiplication with the installation factor to ensure correct measurement. The value of the installation factor depends on the diameter and the conductivity of the pipe as well as the sensor's distance from the wall.
If the distance from the wall is sufficient (a > 30 mm (1.18"), from DN 65), it is not necessary to consider the installation factor (f = 1.00).
If the distance from the wall is smaller, the installation factor increases in case of electrically insulating pipes (f > 1) and decreases in case of electrically conductive pipes (f < 1).
The installation factor can be measured using calibration solutions or it can be approximately determined from the following diagram.



Dependance of installation factor f on the wall distance a

1 Conductive pipe
2 Insulating pipe

Air set

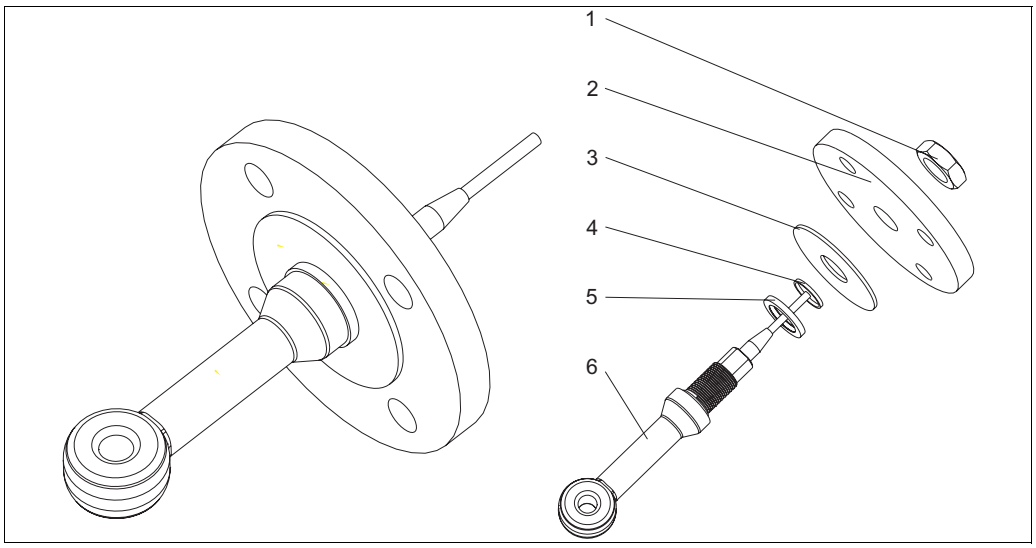
To compensate residual coupling in the cable and between the two sensor coils, you must perform a zero calibration in air ("air set") before installing the sensor.
For further information, refer to the Operating Instructions of your transmitter.

Installation of sensors with flange

The sensor is suitable for installation in T-pieces ≥ DN 80 with the outgoing diameter reduced to ≥ DN 50.

Caution!
- Tighten the sensor nut (see figures below) with a torque of at least 25 Nm.
- To avoid leakages, regularly check the tightness of the sensor nut.

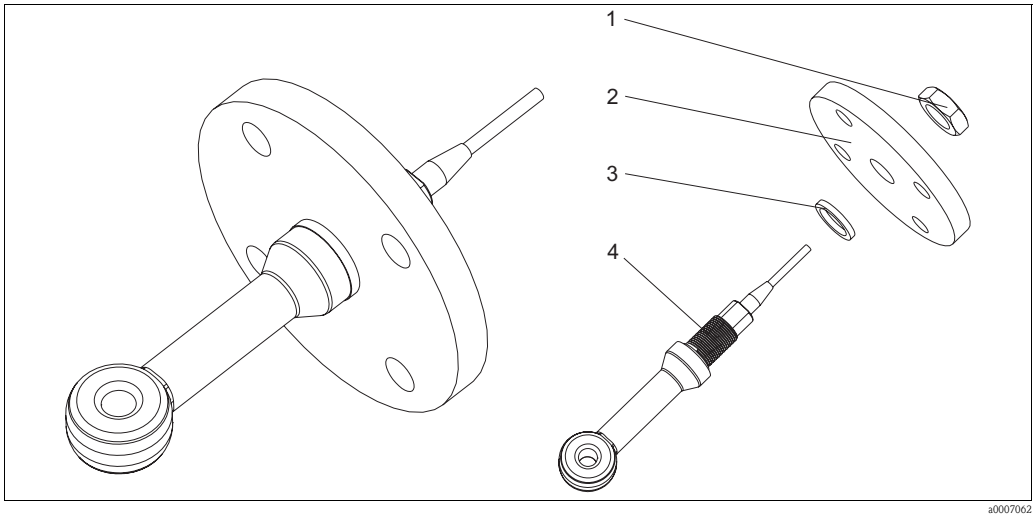
Flange, not in contact with medium



Fixed flange, not in contact with medium (order option "process connection": 5, 6, 7)

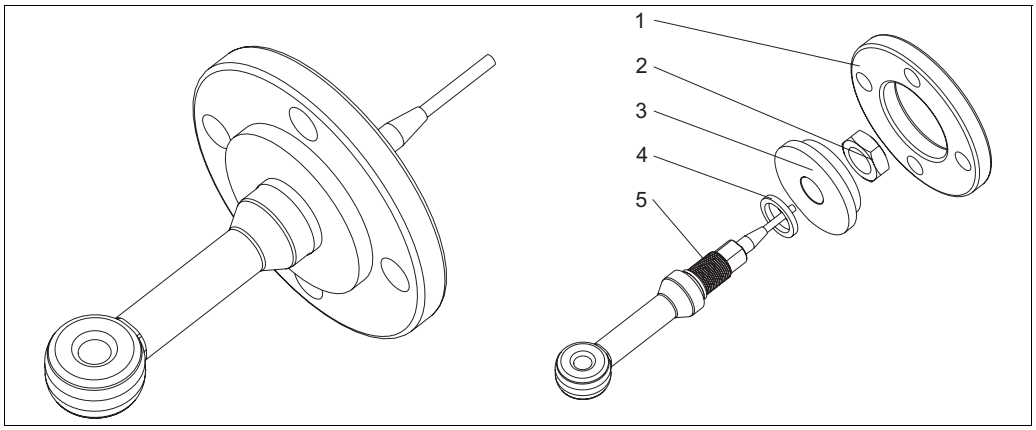
1	*Nut*	*4*	*Distance ring*
2	*Flange*	*5*	*Seal*
3	*Sealing disk (PTFE)*	*6*	*Sensor*

Flange, in contact with medium



Fixed flange, in contact with medium (order option "process connection": 3, 4)

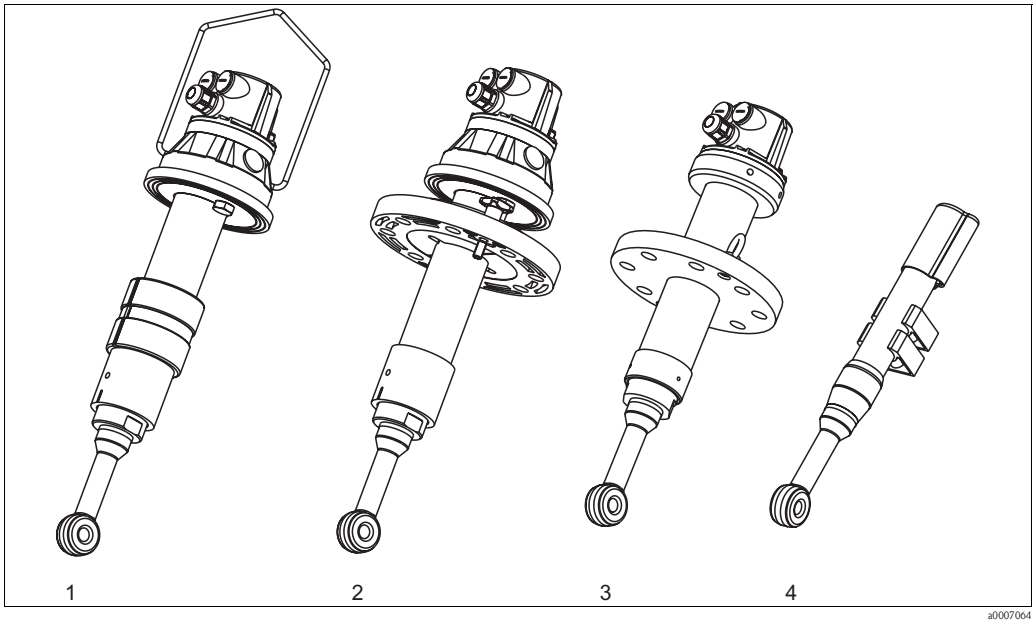
1	*Nut*	*3*	*Seal*
2	*Flange*	*4*	*Sensor*



Lap-joint flange, not in contact with medium (order option "process connection": A, B, C)

1	*Lap-joint flange (PP-GF)*	*4*	*Seal*
2	*Nut*	*5*	*Sensor*
3	*Flange (PVDF)*		

Installation of sensor with assembly



Installation of sensor with assembly

1	*CLA111 with suspension bracket*	*3*	*CLA140 with flange connection*
2	*CLA111 with flange connection*	*4*	*CYA611*

Environment

Ambient temperature	–10 to +70 °C (+14 to +158°F)
Storage temperature	–20 to +80 °C (-4 to +176 °F)
Ingress protection	IP 67 / NEMA 6 (installed sensor combined with original seal)

Process

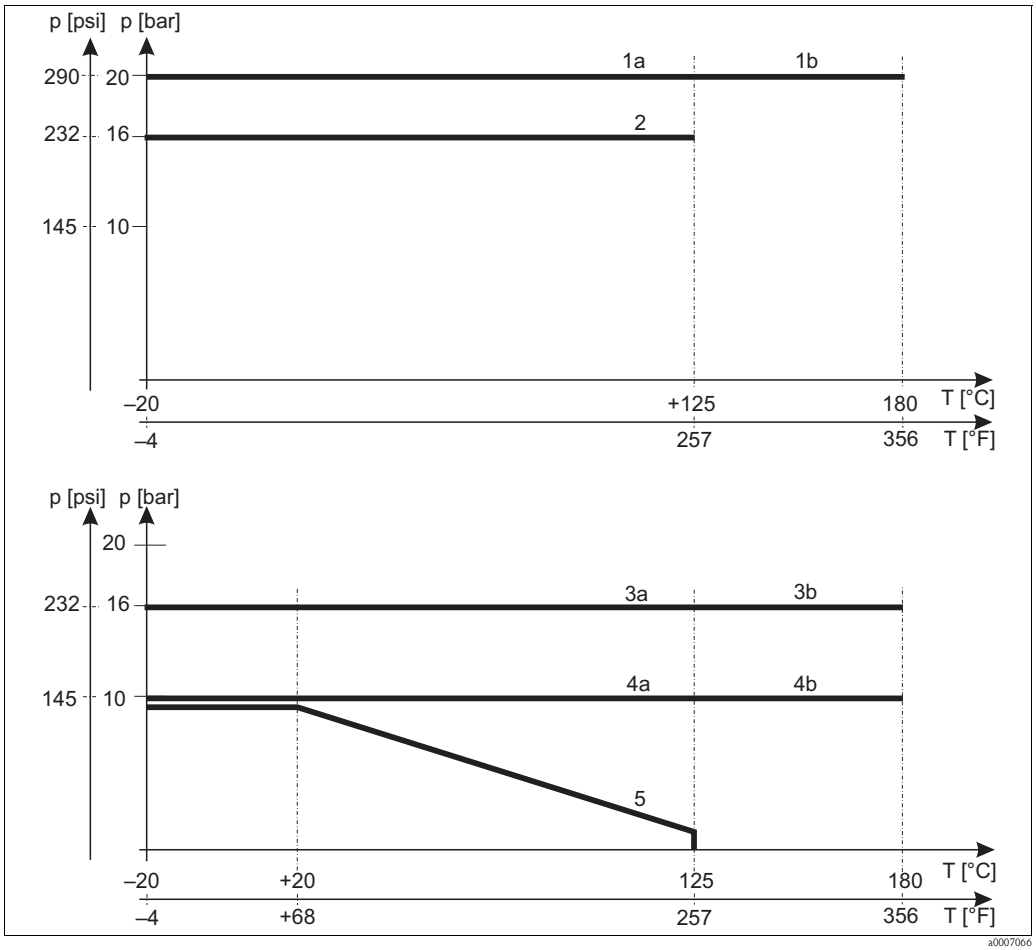
Process temperature

–20 to 180 °C (-4 to 356 °F) depending on sensor version, see pressure-temperature load curves

Process pressure

max. 20 bar (290 psi) depending on sensor version, see pressure-temperature load curves

Pressure-temperature load curves

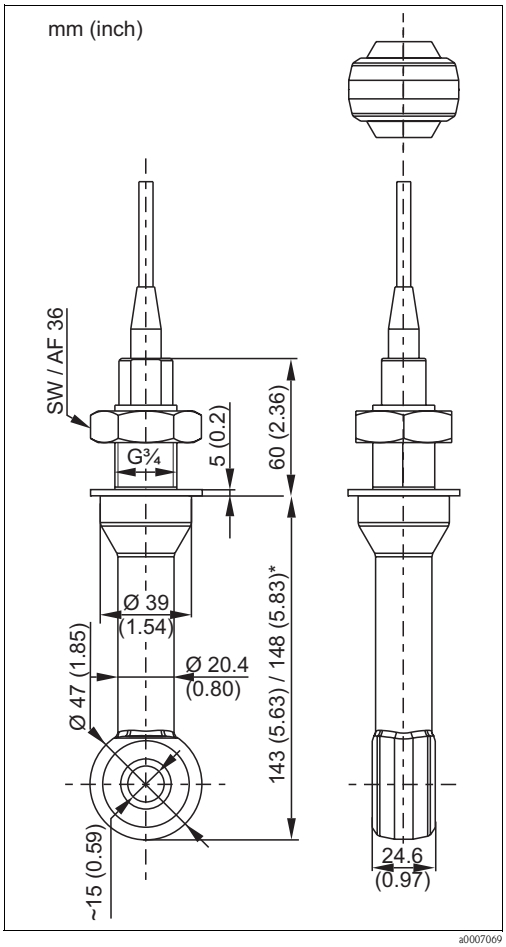


Pressure-temperature load curves (sensor versions, see Ordering information)

1a PEEK sensor up to 125 °C (257 °F), without flange
1b PEEK sensor up to 180 °C (356 °F), without flange
2 PFA sensor up to 125 °C (257 °F), without flange
3a PEEK/PFA sensor up to 125 °C (257 °F), with DN 50/ANSI 2" flange made of stainless steel 1.4404 (AISI 316 L)
3b PEEK sensor up to 180 °C (356 °F), with DN 50/ANSI 2" flange made of stainless steel 1.4404 (AISI 316 L)
4a PEEK/PFA sensor up to 125 °C (257 °F), with JIS flange made of stainless steel 1.4404 (AISI 316 L)
4b PEEK sensor up to 180 °C (356 °F), with JIS flange made of stainless steel 1.4404 (AISI 316 L)
5 PEEK/PFA sensor, with PVDF flange

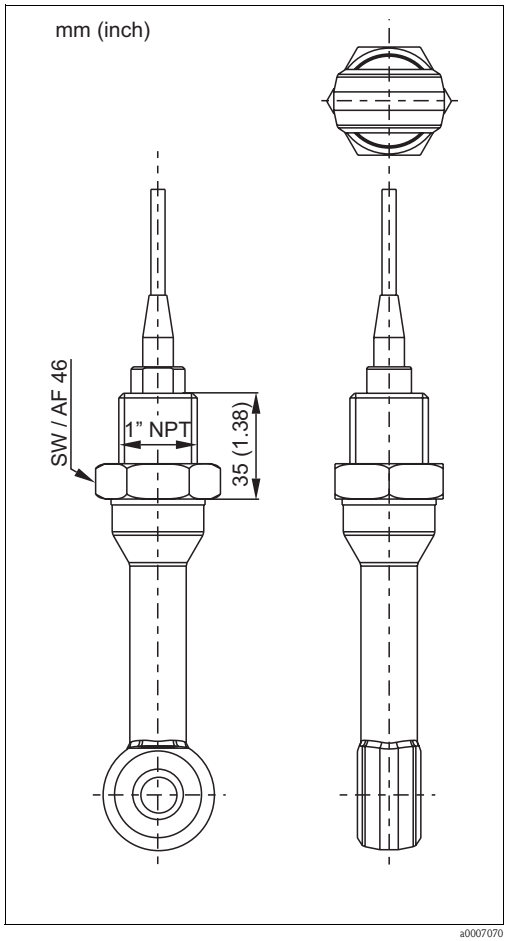
Mechanical construction

Sensor dimensions



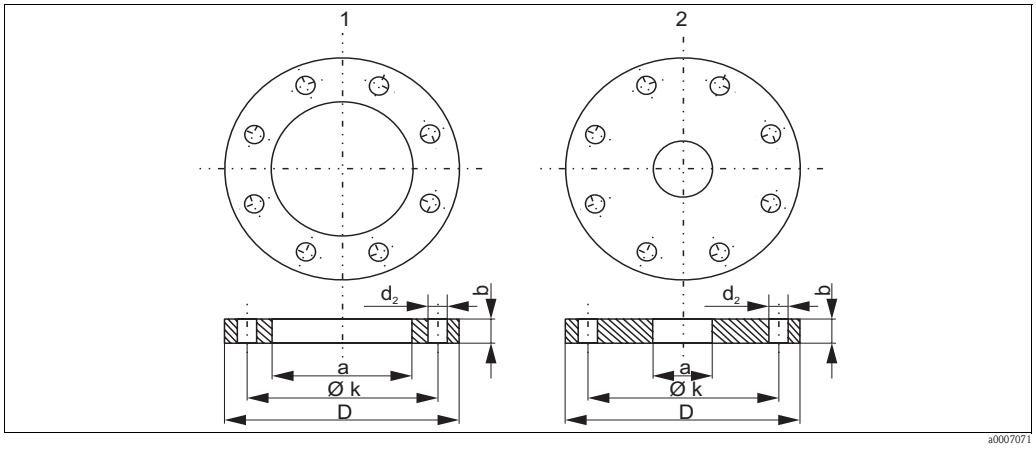
Dimensions of sensor version with G¾ thread

* *Dimensions of PEEK version*



Dimensions of sensor version with NPT 1" thread

Flange dimensions



Flange dimensions

1 Lap-joint flange (PP-GF)
2 Fixed flange (stainless steel)

Lap-joint flange PP-GF	DN 50 PN 10	ANSI 2" 150 lbs	JIS 10K 50A
D	165	165	152
Ø k	125	121	120
d_2	4 x 18	8 x 19	4 x 19
b	18	18	18
a	78	78	78
Screws	M16	M16	M16

Fixed flange SS 316 L	DN 50 PN 16	ANSI 2" 300 lbs	JIS 10K 50A
D	165	165.1	155
Ø k	125	127	120
d_2	4 x 18	8 x 19	4 x 19
b	18	22.2	16
a	27	27	27
Screws	M16	M16	M16

Weight

approx. 1350 g (2.98 lbs)

Material

Sensor:	PEEK, PFA (depending on ordered version)
Sensor seal:	PTFE, Viton (depending on ordered version)
Process connections:	
G ¾:	stainless steel 1.4571 (AISI 316 Ti)
1" NPT:	PEEK
Fixed flange:	stainless steel 1.4404 (AISI 316 L)
Sealing disk:	PTFE
Lap-joint flange:	PP-GF
Flange combined with lap-joint flange:	PVDF

Chemical durability

Medium	Concentration	PEEK	PFA
Sodium hydroxide solution NaOH	0 to 3 %	20 to 80 °C (68 to 176 °F)	20 to 80 °C (68 to 176 °F)
Nitric acid HNO_3	0 to 5 %	20 to 60 °C (68 ... 140 °F)	20 to 60 °C (68 to 140 °F)
	0 to 40 %	20 °C (68 °F)	20 to 60 °C (68 to 140 °F)
Phosphoric acid H_3PO_4	0 to 10 %	20 to 60 °C (68 to 140 °F)	20 to 60 °C (68 to 140 °F)
Sulphuric acid H_2SO_4	0 to 2.5 %	20 to 80 °C (68 to 176 °F)	20 to 100 °C (68 to 212 °F)
	0 to 30 %	20 to 80 °C (68 to 176 °F)	20 to 100 °C (68 to 212 °F)
Hydrochloric acid HCl	0 to 5 %	20 to 100 °C (68 to 212 °F)	20 to 50 °C (68 to 122 °F)
	0 to 10 %	20 to 100 °C (68 to 212 °F)	20 °C (68 °F)

No responsibility is taken for the correctness of this information.

Ordering information

Product structure

	Approval				
	A	Non-hazardous area			
	G	EEx ia IIC T4 / T6, ATEX II 1G			
	L	Non-hazardous area, PWIS free			
	M	ATEX I M2 EEx ia I			
	O	FM IS NI Cl . I, II, III, Div. 1&2, Group A-G			
	S	CSA IS NI Cl . I, II, III, Div. 1&2, Group A-G			
	T	TIIS			
		Process connection			
		A	Lap joint flange DN 50 PN 10, PP-GF		
		B	Lap joint flange ANSI 2" 150 lbs, PP-GF		
		C	Lap joint flange JIS 10 K 50 A, PP-GF		
		1	Thread G ¾, stainless steel 1.4571 (AISI 316 Ti)		
		2	Thread NPT 1", PEEK		
		3	Flange DN 50 PN 16, stainless steel 1.4404 (AISI 316 L)		
		4	Flange ANSI 2" 300 lbs, stainless steel 1.4404 (AISI 316 L)		
		5	Flange DN 50 PN 16, stainless steel 1.4404 (AISI 316 L), PTFE sealing disk		
		6	Flange ANSI 2" 300 lbs, stainless steel 1.4404 (AISI 316 L), PTFE sealing disk		
		7	Flange JIS 10 K 50 A, stainless steel 1.4404 (AISI 316 L), PTFE sealing disk		
			Sensor material ; seal		
			A	PFA ; PTFE	
			B	PEEK ; Viton	
			C	PEEK ; PTFE	
				Cable length and temperature range	
				1	5 m (16 ft) fixed cable, max. 125 °C (257 °F)
				2	10 m (32 ft) fixed cable, max. 125 °C (257 °F)
				3	20 m (65 ft) fixed cable, max. 125 °C (257 °F)
				4	fixed cable of specific length, max. 55 m (180 ft), max. 125 °C (257 °F)
				5	5 m (16 ft) fixed cable, max. 180 °C (356 °F) (PEEK only, version for non-hazardous areas only)
				6	10 m (32 ft) fixed cable, max. 180 °C (356 °F) (PEEK only, version for non-hazardous areas only)
CLS50-					**complete order code**

Accessories

Measuring cables

Extension cable CLK5
- For inductive conductivity sensors, for extension via the VBM junction box, sold by the meter
- Order no.: 50085473

Junction box VBM
- For cable extension
- 10 terminals
- Cable entries: 2 x Pg 13.5 or 2 x NPT ½"
- Material: aluminum
- Ingress protection: IP 65 (≙ NEMA 4X)
- Order numbers:
  – cable entries Pg 13.5: 50003987
  – cable entries NPT ½": 51500177

Transmitters

Liquiline M CM42 (for analog conductivity sensors and digital conductivity sensors with Memosens technology)
- Modular two-wire transmitter for Ex and non-Ex areas
- Hart®, PROFIBUS or FOUNDATION Fieldbus available
- Ordering acc. to product structure, see Technical Information (TI381C/07/en)

Liquisys M CLM223/253 (for analog conductivity sensors)
- Transmitter for conductivity, field or panel-mounted housing,
- Hart® or PROFIBUS available
- Ordering acc. to product structure, see Technical Information (TI193C/07/en)

Mycom S CLM153 (for analog conductivity sensors)
- Transmitter for conductivity, one or two channel version, Ex or Non-Ex,
- Hart® or PROFIBUS available
- Ordering acc. to product structure, see Technical Information (TI234C/07/en)

Assemblies

Dipfit W CLA111
- Immersion assembly for open and closed tanks with flange DN 100;
- Ordering acc. to product structure, see Technical Information TI135C/07/en

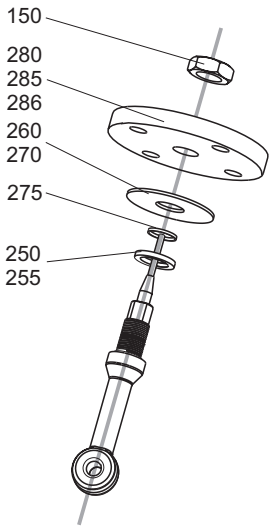
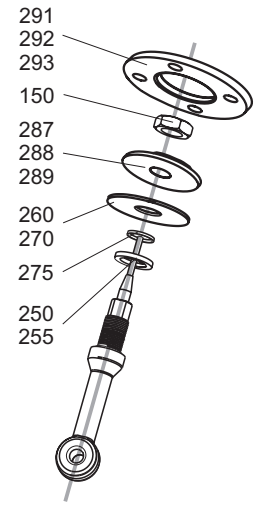
Dipfit P CLA140
- For the inductive sensor CLS50
- Immersion assembly with flange connection for highly demanding processes;
- Ordering acc. to product structure, see Technical Information TI196C/07/en

Immersion assembly Dipfit W CYA611
- For sensor immersion in basins, open channels and tanks, PVC
- Ordering acc. to product structure, see Technical Information TI166C/07/en

Calibration solutions

Precision solutions, traceable to SRM (standard reference material) by NIST, for qualified calibration of conductivity measurement systems according to ISO 9000, with temperature table
- CLY11-B
  149.6 µS/cm (reference temperature 25 °C / 77 °F), 500 ml / 16.9 fl.oz
  Order no. 50081903
- 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
  107.0 mS/cm (reference temperature 25 °C / 77 °F), 500 ml / 16.9 fl.oz
  Order no. 50081906

Service kits

	Pos. no.	Spare part kit	Order no.
	150, 255	Kit PTFE seal ■ Nut (Pos. 150) ■ Seal, 2 pcs. (Pos. 255)	51500482
	150, 250	Kit Viton seal ■ Nut (Pos. 150) ■ Seal, 3 pcs. (Pos. 250)	51500481
	260, 275	Kit PTFE sealing disk DN 50 ■ PTFE disk DN 50 (Pos. 260) ■ Distance ring (Pos. 275)	51500483
	270, 275	Kit PTFE sealing disk ANSI 2" and JIS 10K 50A ■ PTFE disk 2" (Pos. 270) ■ Distance ring (Pos. 275)	51500484
	150, 280	Kit fixed flange DN 50, stainless steel 1.4404 (AISI 316L) ■ Nut (Pos. 150) ■ Flange DN 50 (Pos. 280)	51500525
	150, 285	Kit fixed flange ANSI 2", stainless steel 1.4404 (AISI 316L) ■ Nut (Pos. 150) ■ Flange ANSI 2" (Pos. 285)	51500527
	150, 286	Kit fixed flange JIS, stainless steel 1.4404 (AISI 316 L)Nut ■ (Pos. 150) ■ Flange DN 50 (Pos. 286)	51500934
	150, 288, 292	Kit lap-joint flange ANSI 2", PVDF ■ Nut (Pos. 150) ■ Flange ANSI 2", PVDF (Pos. 288) ■ Lap-joint flange, UP-GF (Pos. 292)	51500937
	150, 287, 291	Kit lap-joint flange DN 50, PVDF ■ Nut (Pos. 150) ■ Flange DN 50, PVDF (Pos. 287) ■ Lap-joint flange, UP-GF (Pos. 291)	51500936
	150, 289, 293	Kit lap-joint flange JIS, PVDF ■ Nut (Pos. 150) ■ Flange JIS, PVDF (Pos. 289) ■ Lap-joint flange, UP-GF (Pos. 293)	51500935

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel.+41 61 715 81 00
Fax+41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser

People for Process Automation

TI182C/07/en/05.07
Printed in Germany / FM+SGML 6.0 / DT

51517565