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

Technical Information

Condumax CLS21 and CLS21D

Conductivity sensors, analog or digital with Memosens technology
Cell constant k = 1 cm^{-1}

Application

Measurements in media of medium and high conductivities:
- Medium separation in medium conductivities (milk/water)
- Medium separation in high conductivities (alkaline solution/water)
- Drinking water treatment
- Wastewater treatment

The cell constant of the sensor is k = 1 cm^{-1}. The measuring range reaches from 10 µS/cm to 20 mS/cm.

Sensors with a temperature sensor are used together with conductivity transmitters equipped with automatic temperature compensation:
- Liquiline CM42
- Mycom CLM153
- Liquisys CLM223/253

For measurement of resistivity, MΩ · cm measuring ranges are available in the menus of these transmitters.

Your benefits

- Various designs guarantee optimum adaptation to the process conditions and methods of installation
- Installation in pipes or flow chambers
- Compact design
- Available with plug-in head or fixed cable
- High chemical, thermal and mechanical stability
- IP 65 (with four-pole plug-in head) / IP 67 (with fixed cable) / IP 68 (with Memosens plug-in head)
- Quality certificate with statement of the individual cell constant

Further benefits offered by Memosens technology
- Maximum process safety through contactless inductive signal transmission
- Data safety through digital data transmission
- Easy handling thanks to storage of sensor-specific data in the sensor
- Predictive maintenance possible thanks to registration of sensor load data in the sensor

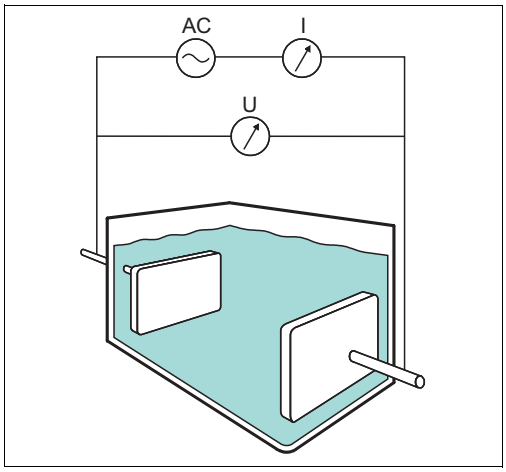
TI085C/07/EN/04.10
71109189

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Conductive measurement of conductivity



Conductive measurement of conductivity

AC Power supply
I Current meter
U Voltage meter

The conductivity of liquids is measured with the following measurement setup: Two electrodes are immersed in the medium. An AC voltage is applied to these electrodes which generates a current in the medium.
The electric resistance or its reciprocal value, the conductance G, is calculated according to Ohm's law. The specific conductivity κ is determined using the cell constant k that is dependent on the sensor geometry.

General properties

- **Electrodes**
  The sensor has two coaxial electrodes made of graphite for a large measuring range.
  The graphite guarantees high chemical stability and low polarization effects.
- **Temperature compensation**
  A temperature sensor is integrated to measure the medium temperature.
- **Durability**
  – The sensor is pressure-proof up to 16 bar at 20 °C (232 psi at 68 °F).
  – It can be applied with temperatures of up to 135 °C at 2.5 bar (275 °F at 36.3 psi).

Important properties of CLS21D

Maximum process safety
The inductive and non-contacting measured value transmission of Memosens guarantees maximum process safety and offers the following benefits:

- All problems caused by moisture are eliminated.
  – The plug-in connection is free from corrosion.
  – Measured value distortion from moisture is not possible.
  – The plug-in system can even be connected under water.
- The transmitter is galvanically decoupled from the medium.
- EMC safety is guaranteed by screening measures for the digital measured value transmission.

Data safety through digital data transfer
The Memosens technology digitalizes the measured values in the sensor and transfers them to the transmitter contactlessly and free from interference potential. The result:

- An automatic error message is generated if the sensor fails or the connection between sensor and transmitter is interrupted.
- The availability of the measuring point is dramatically increased by immediate error detection.

Easy handling
Sensors with Memosens technology have integrated electronics that allow for saving calibration data and further information such as total hours of operation and operating hours under extreme measuring conditions. When the sensor is connected, the calibration data are automatically transferred to the transmitter and used to calculate the current measured value. Storing the calibration data in the sensor allows for calibration and adjustment away from the measuring point. The result:

- Sensors can be calibrated unter optimum external conditions in the measuring lab. Wind and weather do neither affect the calibration quality nor the operator.
- The measuring point availability is dramatically increased by the quick and easy replacement of precalibrated sensors.
- Maintenance intervals can be defined based on all stored sensor load and calibration data and predictive maintenance is possible.
- The sensor history can be documented on external data carriers and evaluation programs at any time. Thus, the current application of the sensors can be made to depend on their previous history.

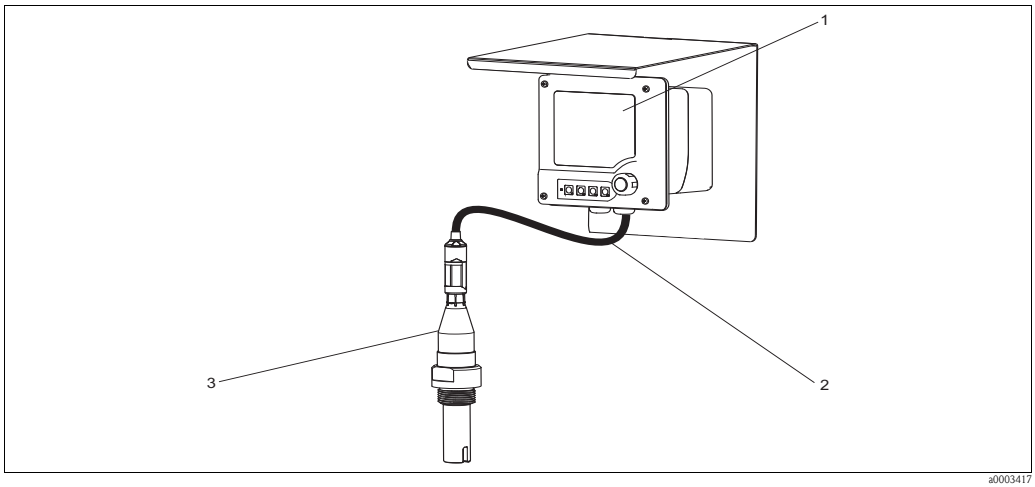
Communication with the transmitter
Always connect digital sensors to a transmitter with Memosens technology. Data transmission to a transmitter for analog sensors is not possible.

Data storage of CLS21D

Digital sensors are able to store the following system data in the sensor:
- Manufacturing data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Cell constant
  - Change in cell constant
  - Number of calibrations
  - Serial number of the transmitter used for the last calibration
- Application data
  - Temperature application range
  - Conductivity application range
  - Date of first commissioning
  - Maximum temperature value
  - Operating hours at high temperatures

Measuring system

A complete measuring system comprises:
- a CLS21 or CLS21D conductivity sensor
- a transmitter, e.g. Liquiline CM42
- a measuring cable, e.g. CYK71 or CYK10 Memosens data cable



Measuring system example

1 Liquiline CM42 transmitter
2 CYK10 Memosens data cable
3 Condumax CLS21D sensor

Input

Measured values

Conductivity
Temperature

Cell constant k

k = 1 cm^{-1} nominal

Measuring ranges

Conductivity measurement (referred to water at 25 °C / 77°F)
10 µS/cm to 20 mS/cm

in the following temperature range:
CLS21: -20 to 135 °C (-4 to 275 °F)
CLS21D: -20 to 100 °C (-4 to 212 °F) (spec. measuring accuracy up to 100 °C (212 °F))

Temperature measurement
CLS21: - 20 to 135 °C (-4 to 275 °F)
CLS21D: - 20 to 100 °C (-4 to 212 °F) (spec. measuring accuracy up to 100 °C (212 °F))

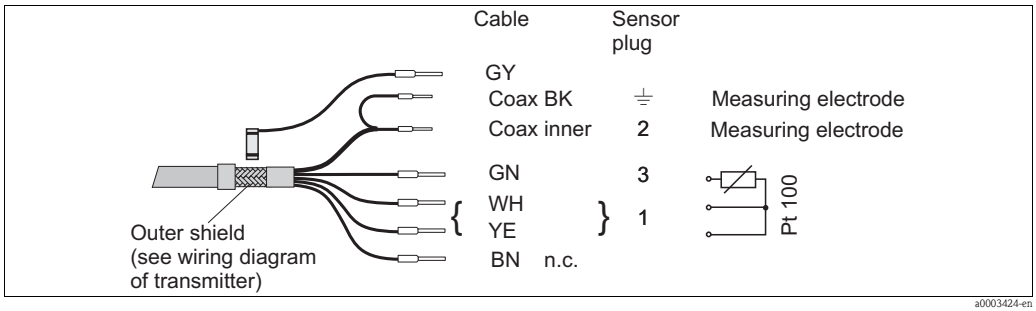
Temperature sensor

CLS21: Pt 100
CLS21D: NTC

Cable specification

CLS21

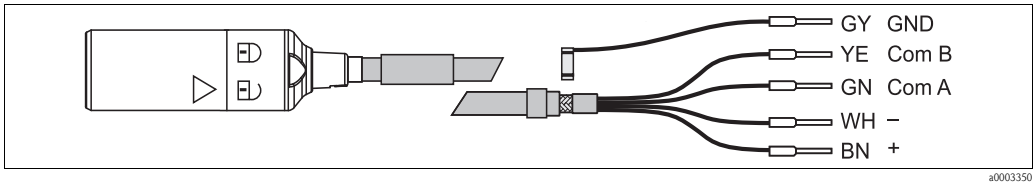
CLS21 is connected to the measuring transmitter using the special measuring cable CYK71 or CYK71-Ex or the fixed cable.



CYK71/CYK71-Ex or fixed cable

CLS21D

CLS21D is connected to the transmitter using the Memosens data cable CYK10.



Special measuring cable CYK10

Performance characteristics

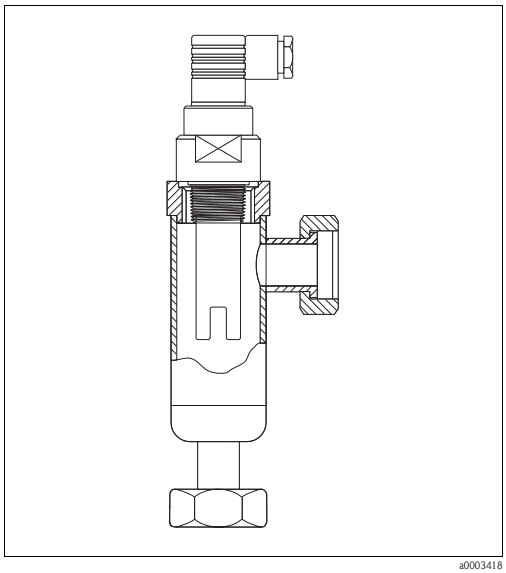
Measured error

Each individual sensor is factory measured in a solution of approx. 5 mS/cm on a reference measuring system referred to NIST or DKD. The accurate cell constant is entered in the supplied quality certificate. The maximum measured error in cell constant determination is 1.0 %.

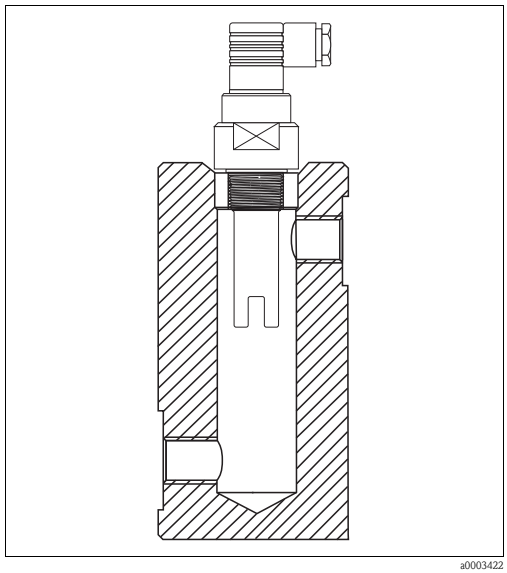
Installation

Installation instructions

The sensors are mounted directly via the process connection.
Optionally, they can be installed in flow assemblies.

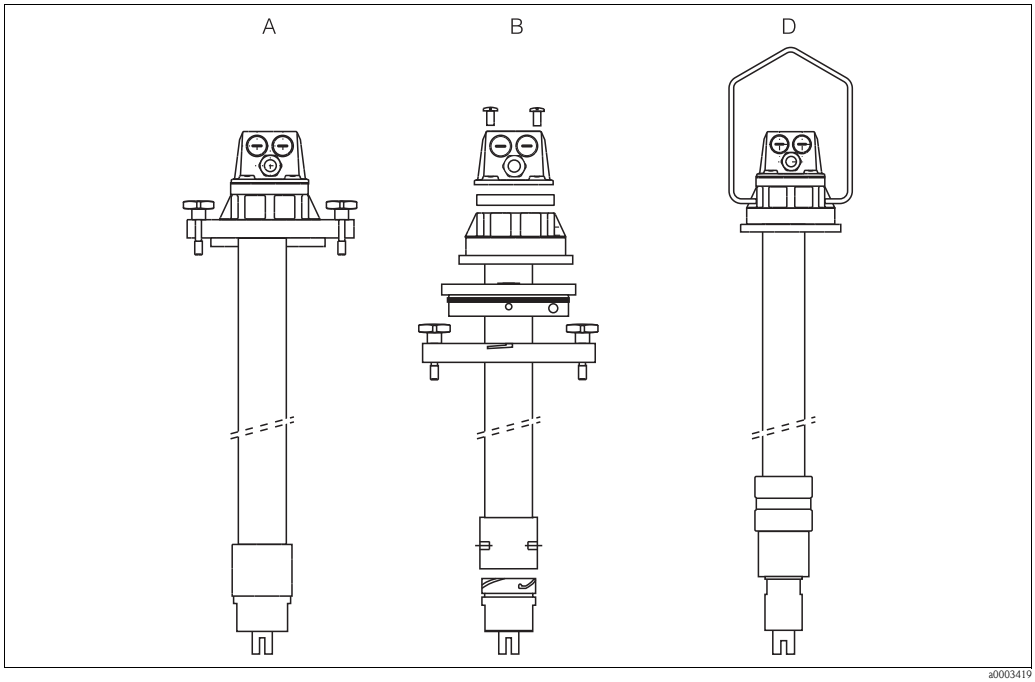


Installation in the CLA751 flow assembly



Installation in the CLA752 flow assembly

For installation of sensors with G1 thread in tanks, the CLA111 immersion and process assembly is available (see Accessories).



Dipfit CLA111, mounting versions A, B and D

Note!
The measuring surfaces must be completely immersed in the medium during operation.

Environment

Ingress protection

CLS21
- Fixed cable: IP 67 (≙ NEMA 6)
- Plug-in head: IP 65 (≙ NEMA 4X)

CLS21D: IP 68 (≙ NEMA 6)

Process

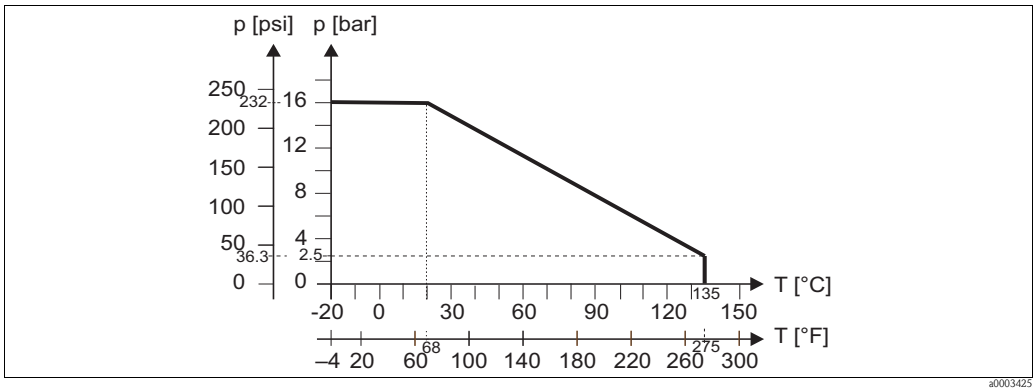
Process temperature

-20 to +135 °C @ 2.5 bar (-4 to +275 °F @ 36.3 psi)

Process pressure

16 bar @ 20 °C (232 psi @ 68 °F)

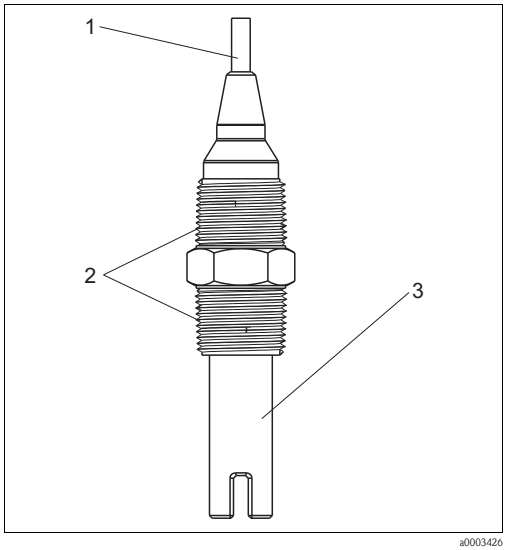
Pressure/temperature load curve



Mechanical pressure-temperature stability of the sensor

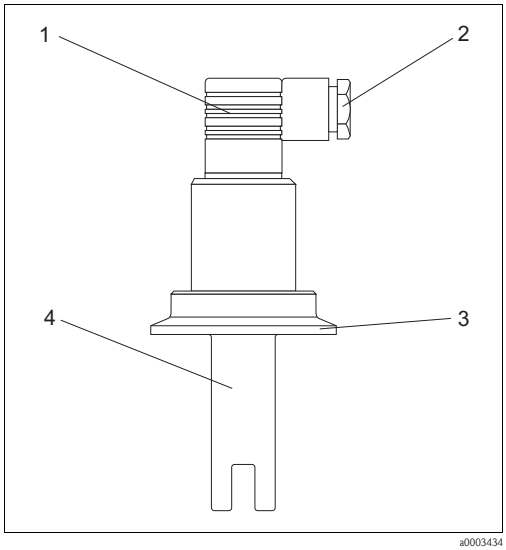
Mechanical construction

Design, dimensions CLS21



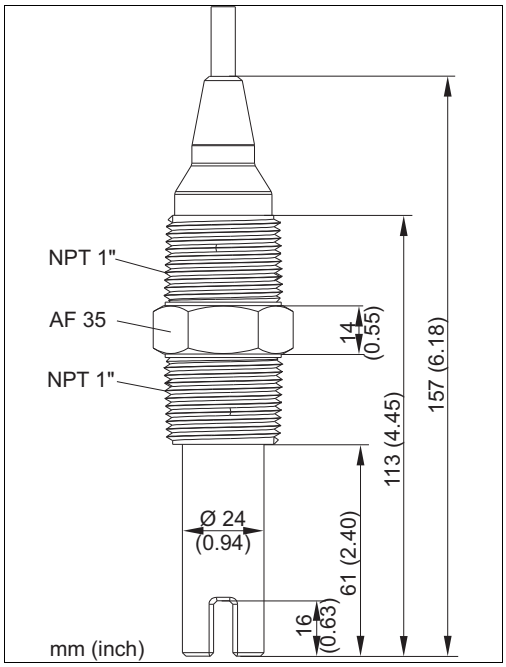
Fixed cable version with NPT 1" thread

1 Fixed cable
2 NPT 1" thread
3 Sensor shaft

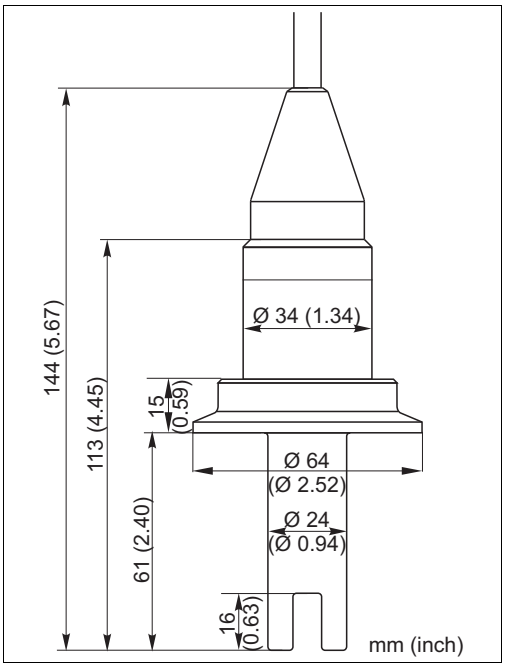


Connector version with 2" clamp

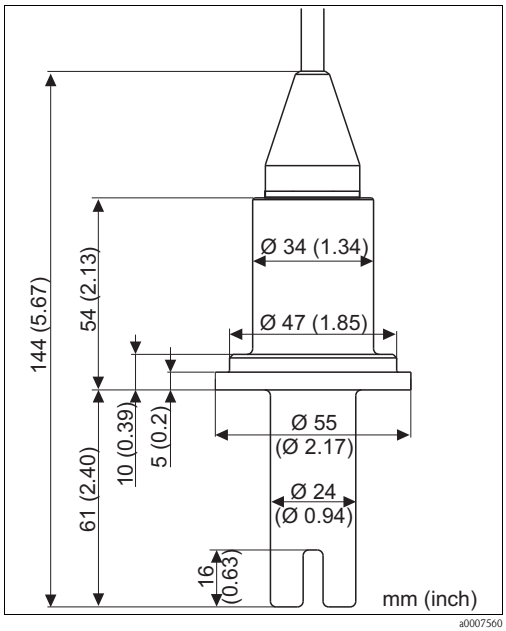
1 Four-pole connector
2 Pg 9 cable gland
3 2" clamp
4 Sensor shaft



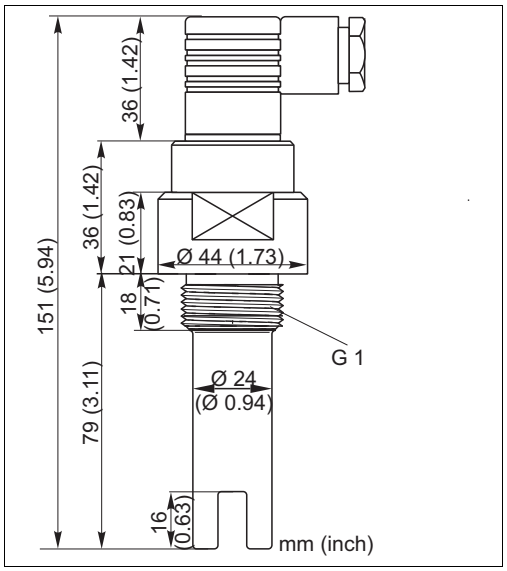
Dimensions of fixed-cable version with NPT 1" thread



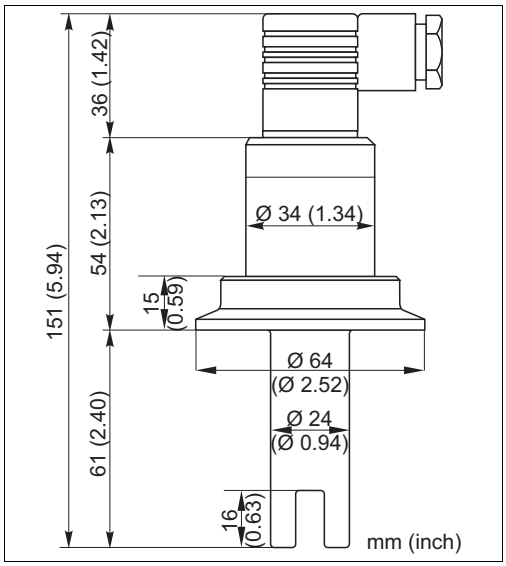
Dimensions of fixed-cable version with 2" clamp



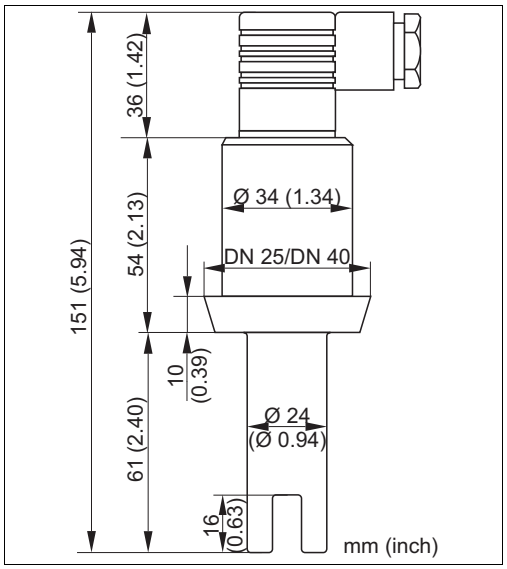
Dimensions of fixed-cable version with SMS thread



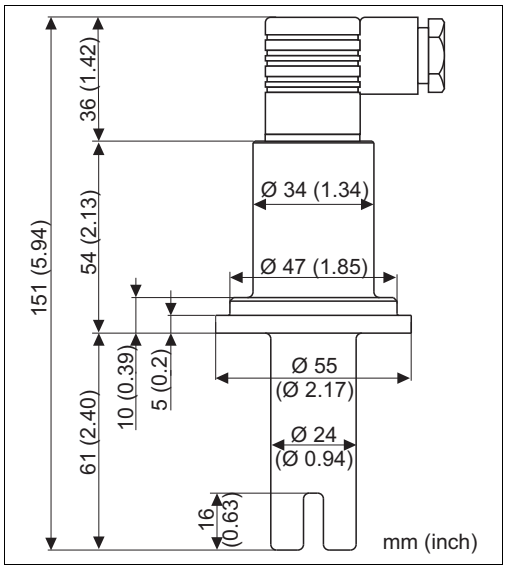
Dimensions of plug-in head version with G 1 thread



Dimensions of plug-in head version with 2" clamp

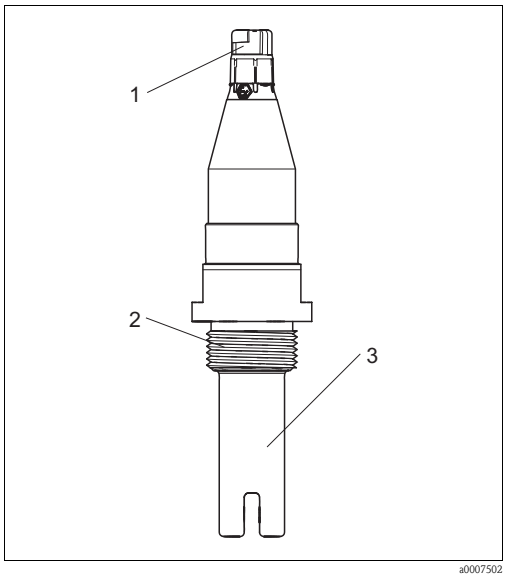


Dimensions of plug-in head version with dairy fitting



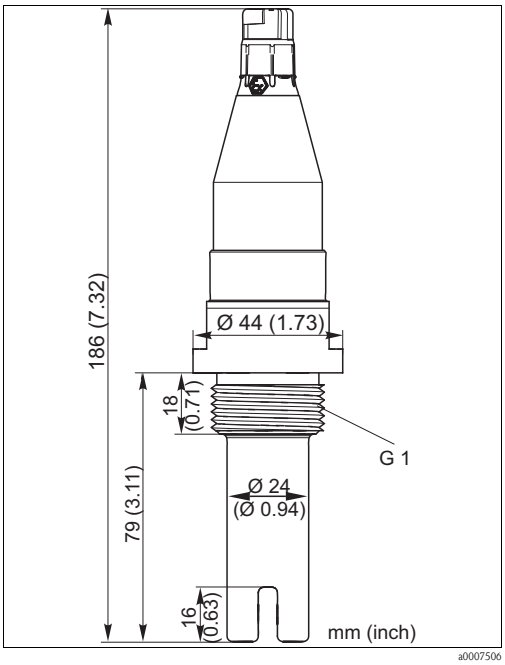
Dimensions of plug-in head version with SMS thread

Design, dimensions CLS21D

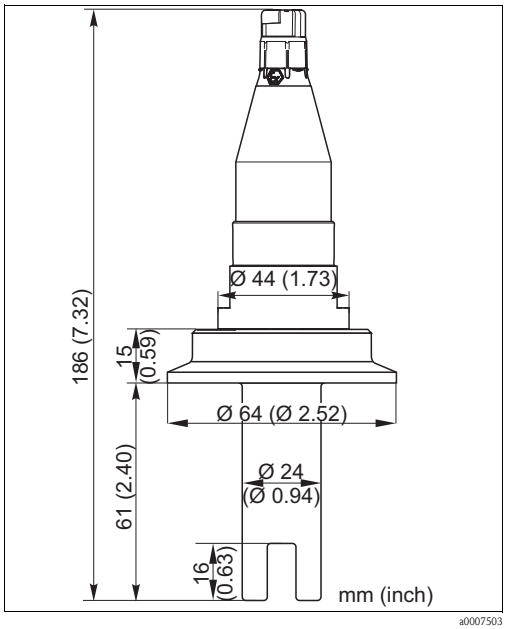


Version with G 1 thread

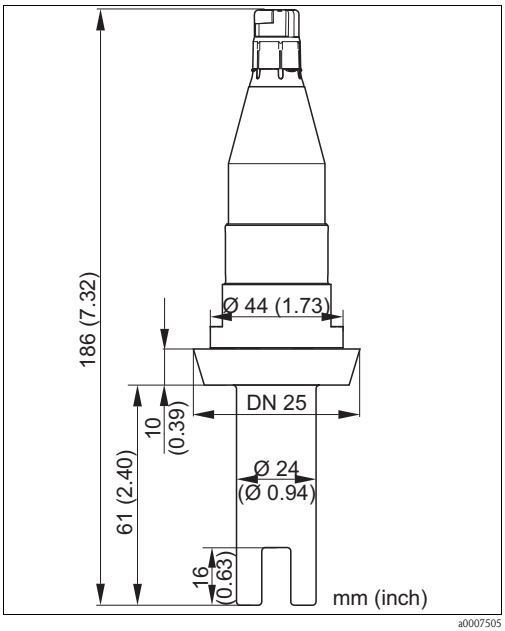
1 Memosens plug-in head
2 G 1 thread
3 Sensor shaft



Dimensions of version with G 1 thread



Dimensions of version with 2" clamp



Dimensions of version with dairy fitting

Weight

Depending on version, approx. 0.3 kg / 0.7 lb.

Materials

Electrodes:	graphite
Sensor shaft:	polyethersulfone (PES-GF20)
Thermal conductivity socket for temperature sensor:	titanium 3.7035

Process connections

CLS21:

Fixed-cable version:
Thread NPT 1"
Clamp 2" acc. to ISO 2852
SMS DN 38 (1½")

Plug-in head version:
Thread G 1
Clamp 2" acc. to ISO 2852
SMS DN 38 (1½")
Dairy fitting DN 25 or DN 40 acc. to DIN 11851

CLS21D:

Thread G 1
Thread NPT 1"
Clamp 2" acc. to ISO 2852
Dairy fitting DN 25 acc. to DIN 11851

Note!
Clamp connection:
Sensors with clamp connections can be fixed using sheet metal brackets or solid brackets.
Sheet metal brackets have a lower dimensional stability, uneven bearing surfaces causing point loads and sometimes sharp edges that can damage the clamp.
We strongly recommend to always use solid brackets because of their higher dimensional stability. Solid brackets may be applied over the total pressure-temperature range (see temperature-pressure load curve).

Certificates and approvals

Ex approval

- ATEX II 1G Ex ia IIC T3 / T4 / T6
- NEPSI Ex ia IIC T3 / T4 / T6 (CLS21D)
- FM/CSA IS/NI CL I Div. 1 & 2 GP A - D in combination with the Liquiline CM42 and Mycom CLM153 transmitters (CLS21)
- For CLS21D-***V:
  ATEX/NEPSI II 3G Ex nL IIC T3 / T4 / T6 for the use in Zone 2 with transmitter Liquiline CM42-KV***

for all product versions listed in the product structure (see Ordering Information)

Note!
Ex versions of digital sensors with Memosens technology are indicated by an orange-red ring in the plug-in head (not valid for versions CLS**D-***V).

Quality certificate

With statement of the individual cell constant

Ordering information

Product structure Condumax CLS21

Measuring range and cell constant					
	C	Measuring range: 10.0 µS ... 20 mS/cm (k = 1)			
Process connection and materials					
		1E	Thread G 1, PES (plug-in head version only)		
		1N	Thread NPT 1", PES (fixed-cable version only)		
		2A	Dairy fitting DN 25, DIN 11851, PES (plug-in head version only)		
		2B	Dairy fitting DN 40, DIN 11851, PES (plug-in head version only)		
		2C	Process connection SMS DN 38, PES		
		3B	Clamp 2", PES		
Measuring cable connection					
			2	with 5 m / 16.41 ft fixed cable	
			3	with 10 m / 32.81 ft fixed cable	
			4	four-pole DIN connector with Pg 9, DIN 43650-A	
Temperature sensor					
				A	Integrated Pt 100 temperature sensor
				D	No temperature sensor
CLS21-					**complete order code**

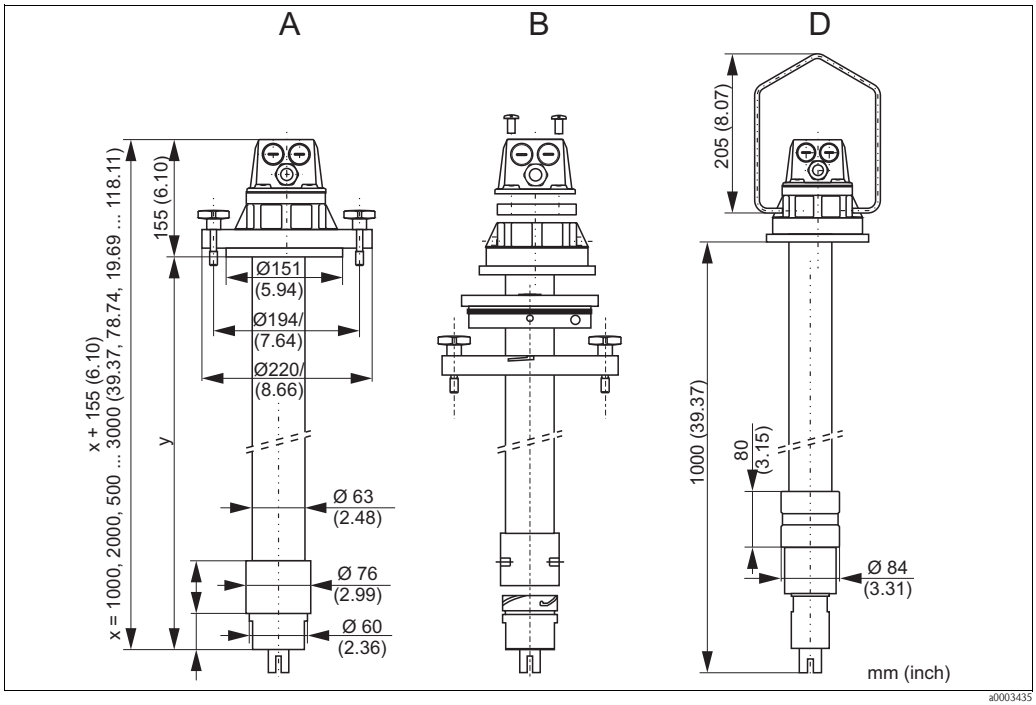
Product structure Condumax CLS21D

Measuring range and cell constant				
	C	Measuring range: 10.0 µS to 20 mS/cm (k = 1)		
	L	PWIS-free for measuring range 10.0 µS/cm to 20 mS/cm (k = 1)		
Process connection and materials				
		1E	Thread G 1, PES	
		1N	Thread NPT 1", PES	
		2A	Dairy fitting DN 25, DIN 11851, PES	
		3B	Clamp 2", PES	
Approval				
			G	ATEX/NEPSI II 1G Ex ia IIC T3/T4/T6
			O	FM/CSA IS/NI Cl I Div. 1 & 2 GP A - D
			V	ATEX/NEPSI II 3G Ex nL IIC T3/T4/T6
			1	Non-hazardous areas
CLS21D-				**complete order code**

Accessories

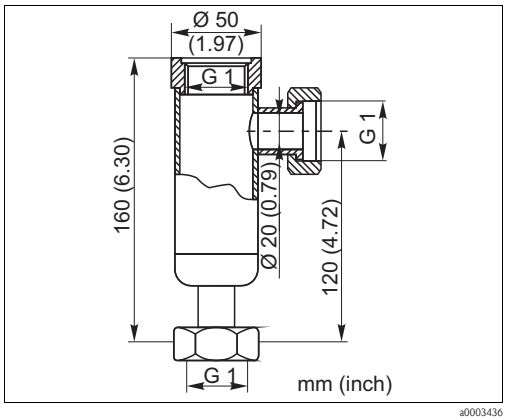
Assemblies

- Dipfit CLA111 immersion and process assembly
  For open and closed tanks with DN 100 flange,
  for ordering information, see Technical Information Dipfit CLA111 (TI135C/07/en)



Dipfit CLA111, DN 100 flange or suspension bracket, mounting versions A, B and D

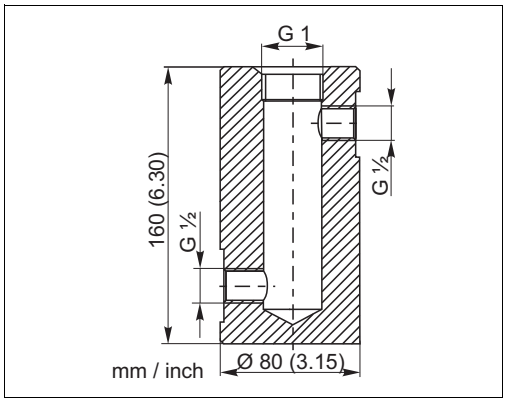
- CLA751 flow assembly



CLA751 flow assembly

For installation of conductivity sensors with G 1 thread.
Inlet (bottom) and outlet (lateral) DN 20 with union nuts G 1.
Stainless steel 1.4571 (AISI 316Ti)
Max. temperature: 160 °C (320 °F)
Max. pressure: 12 bar (174 psi)
Order no.: 50004201

- CLA752 flow assembly



CLA752 flow assembly

For installation of conductivity sensors with
G 1 thread
Inlet (lateral) and outlet (lateral) DN 20 with G ½ internal thread
Polypropylene (PP)
Max. temperature: 90 °C (194 °F)
Max. pressure: 6 bar (87 psi)
Order no.: 50033772

Connection

Measuring cables

CYK71 measuring cable
- Non-terminated cable for the connection of sensors (e.g. conductivity sensors) or the extension of sensor cables
- Sold by the meter, order numbers:
  - non-Ex version, black: 50085333
  - Ex version, blue: 51506616

CYK10 Memosens data cable
- For digital sensors with Memosens technology
- Ordering according to product structure, see below

	Certificates	
	A	Standard, non-Ex
	G	ATEX II 1G Ex ia IIC T6/T4/T3, FM/CSA IS/NI Cl I DIV 1&2 GP A-D
	L	LABS free, non-Ex
	O	FM IS/NI Cl I DIV 1&2 GP A-D
	S	CSA IS/NI Cl I DIV 1&2 GP A-D
	T	TIIS
	V	ATEX/NEPSI II 3G Ex nL IIC

		Cable length	
		03	Cable length: 3 m (9.8 ft)
		05	Cable length: 5 m (16 ft)
		10	Cable length: 10 m (33 ft)
		15	Cable length: 15 m (49 ft)
		20	Cable length: 20 m (66 ft)
		25	Cable length: 25 m (82 ft)
		88	... m length
		89	... ft length

			Ready-made	
			1	Wire terminals
			2	M12 plug

CYK10-				complete order code

CYK81 measuring cable
- Non-terminated measuring cable for extension of sensor cables of e.g. Memosens sensors, CUS31/CUS41
- 2 wires, twisted pair with shield and PVC-sheath (2 x 2 x 0.5 mm^2 + shield)
- Sold by the meter, order no.: 51502543

Junction boxes

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

Junction box VBM-Ex
- For cable extension in hazardous areas
- 10 terminals (blue)
- Cable entries: 2 x Pg 13.5
- Material: aluminum
- Ingress protection: IP 65 (≙ NEMA 4X)
- Order no.: 50003991

Junction box RM
- For cable extension (e.g. for Memosens sensors)
- 5 terminals
- Cable entries: 2 x Pg 13.5
- Material: PC
- Ingress protection: IP 65
- Order no.: 51500832

Calibration solutions

- Calibration solutions
  Precision solutions referred to SRM (Standard Reference Material) of NIST for qualified calibration of conductivity measuring systems according to ISO, with temperature table,
  – CLY11-A
    74 µS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz);
    order no. 50081902
  – 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

For further information on calibration solutions see Technical Information TI162C/07/en.

Transmitters

Liquiline 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 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 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)

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People for Process Automation

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