

Technical Information

Memosens CLS16E

Digital conductivity sensor with Memosens technology



Cell constant $k = 0.1 \text{ cm}^{-1}$

Application

Measurements in pure and ultrapure water

Typical applications include:

- Monitoring of ion exchangers
- Reverse osmosis
- Distillation
- Electrodeionization
- WFI (water for injection) in the pharmaceutical industry

Sensors with temperature probes are used in conjunction with conductivity measuring devices that support automatic temperature compensation:

- Liquiline CM442/CM444/CM448
- Liquiline CM42
- Liquiline CM14

The resistivity in $\text{M}\Omega \cdot \text{cm}$ can also be measured using these transmitters.

Your benefits

- High measuring accuracy as cell constant is individually measured
- Manufacturer inspection certificate stating the individual cell constant
- Hygienic process connections for installation in pipes or flow vessel
- Easy to clean thanks to electropolished surfaces
- Can be sterilized up to $150 \text{ }^\circ\text{C}$ ($302 \text{ }^\circ\text{F}$)
- Stainless steel 1.4435 (AISI 316L) meets the highest demands of the pharmaceutical industry
- Certified according to EHEDG, Document 8
- Certificate according to United States Pharmacopeia 87, USP 88 Class VI (optional)
- Inspection certificate EN 10204 3.1 (optional)

Other advantages provided by Memosens technology

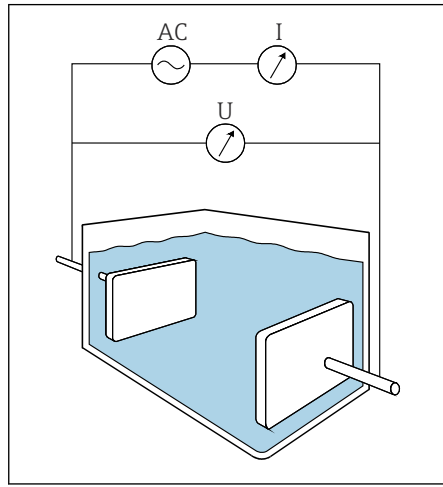
- Maximum process safety
- Data security thanks to digital data transmission
- Very easy to use as sensor data are saved in the sensor
- Predictive maintenance can be performed by recording sensor load data in the sensor

Table of contents

Function and system design	3	Other standards and guidelines	10
Measuring principle	3	Ordering information	10
Measuring system	3	Product page	10
Communication and data processing	4	Product Configurator	10
Dependability	4	Scope of delivery	10
Reliability	4	Accessories	10
Maintainability	4	Measuring cable	10
Integrity	4	Sensor regeneration	10
Input	5	Calibration solutions	10
Measured variables	5	Calibration set	11
Measuring ranges	5		
Cell constant	5		
Temperature compensation	5		
Power supply	5		
Electrical connection	5		
Performance characteristics	5		
Uncertainty of measurement	5		
Response time	5		
Measured error	5		
Repeatability	5		
Installation	5		
Installation instructions	5		
Environment	6		
Ambient temperature	6		
Storage temperature	6		
Degree of protection	6		
Process	6		
Process temperature	6		
Process pressure	6		
Temperature/pressure ratings	6		
Mechanical construction	7		
Design	7		
Dimensions in mm (in)	8		
Weight	8		
Materials (in contact with medium)	8		
Process connection	8		
Surface roughness	8		
Certificates and approvals	9		
CE mark	9		
Hazardous area approvals	9		
Hygienic compatibility	9		
Pharmaceutical compatibility	9		
CRN approval	9		
Test reports	9		
Additional certification	9		

Function and system design

Measuring principle



Conductivity of liquids is determined with a measuring arrangement where two electrodes are located in the medium. An alternating voltage that causes a current to flow through the medium is applied at these electrodes. The electrical resistance, or its reciprocal value - conductance G - is calculated based on Ohm's law. The specific conductance κ is determined from the conductance value using the cell constant k , which depends on the sensor geometry.

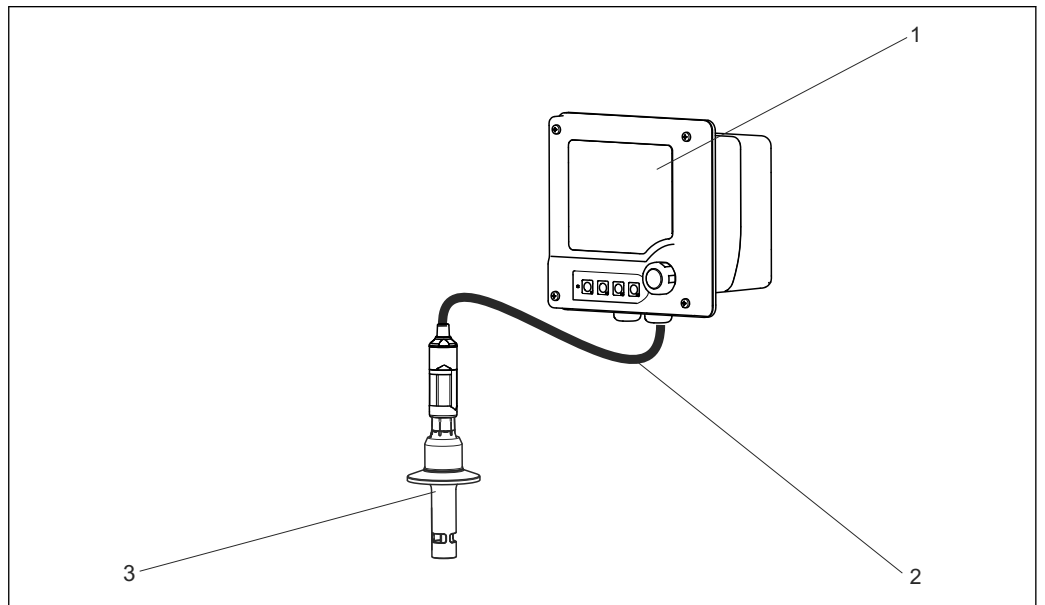
1 Conductive measurement of conductivity

- AC Alternating voltage source
- I Current intensity measurement
- U Voltage measurement

Measuring system

A complete measuring system comprises at least:

- Conductivity sensor Memosens CLS16E
- Transmitter, e.g. Liquiline M CM42
- Measuring cable, e.g. Memosens data cable CYK10




2 Example of a measuring system (with Memosens sensor)

- 1 Liquiline M CM42 transmitter
- 2 Memosens data cable
- 3 Memosens CLS16E

Communication and data processing

Communication with the transmitter

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

Digital sensors can store measuring system data in the sensor. These include the following:

- Manufacturer data
 - Serial number
 - Order code
 - Date of manufacture
- Calibration data
 - Calibration date
 - Cell constant
 - Delta cell constant
 - Number of calibrations
 - Serial number of the transmitter used to perform the last calibration or adjustment
- Operating data
 - Temperature application range
 - Conductivity application range
 - Date of initial commissioning
 - Maximum temperature value
 - Hours of operation at high temperatures

Dependability

Reliability

Memosens technology digitizes the measured values in the sensor and transmits the data to the transmitter via a . The result:

- If the sensor fails or there is an interruption in the connection between the sensor and transmitter, this is reliably detected and reported.
- The availability of the measuring point is reliably detected and reported.

Maintainability

Easy handling

Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total hours of operation or operating hours under extreme measuring conditions). Once the sensor has been connected, the sensor data are transferred automatically to the transmitter and used to calculate the current measured value. As the calibration data are stored in the sensor, the sensor can be calibrated and adjusted independently of the measuring point. The result:

- Easy calibration in the measuring lab under optimum external conditions increases the quality of the calibration.
- Pre-calibrated sensors can be replaced quickly and easily, resulting in a dramatic increase in the availability of the measuring point.
- Thanks to the availability of the sensor data, maintenance intervals can be accurately defined and predictive maintenance is possible.
- The sensor history can be documented with external data carriers and evaluation programs.
- Thus, the current application of the sensors can be made to depend on their previous history.

Integrity

With inductive transmission of the measured value using a non-contact connection, Memosens guarantees maximum process safety and offers the following benefits:

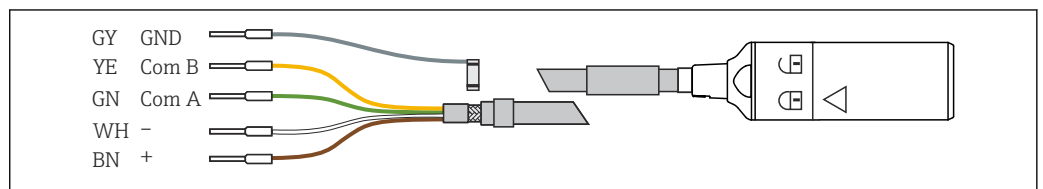
- All problems caused by moisture are eliminated.
 - Plug-in connection remains free from corrosion
 - Measured value distortion from moisture is not possible.
 - The plug-in system can even be connected under water.
- The transmitter is galvanically decoupled from the medium.
- EMC safety is guaranteed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

Input

Measured variables	<ul style="list-style-type: none"> ■ Conductivity ■ Temperature 	
Measuring ranges	Conductivity ¹⁾ 1) In relation to water at 25 °C (77 °F)	40 nS/cm to 500 µS/cm
	Temperature	-5 to 150 °C (23 to 302 °F)
Cell constant	k = 0.1 cm ⁻¹	
Temperature compensation	Pt1000 (Class A according to IEC 60751)	

Power supply

Electrical connection The electrical connection of the sensor to the transmitter is established using the measuring cable CYK10.



3 Measuring cable CYK10

A0024019

Performance characteristics

Uncertainty of measurement	Each individual sensor is factory-measured in a solution with approx. 5 µS/cm using a reference measuring system traceable to NIST or PTB. The exact cell constant is entered into the manufacturer inspection certificate supplied. The uncertainty of measurement in determining the cell constant is 1.0 %.	
Response time	Conductivity Temperature ¹⁾	$t_{95} \leq 2 \text{ s}$ $t_{90} \leq 9 \text{ s}$
	1) DIN VDI/VDE 3522-2 (0.3 m/s laminar)	
Measured error	Conductivity Temperature	$\leq 2 \%$ of reading, in specified measuring range $\leq 0.5 \text{ K}$, in measuring range -5 to 120 °C (23 to 248 °F) $\leq 1.0 \text{ K}$, in measuring range 120 to 150 °C (248 to 302 °F)
Repeatability	Conductivity Temperature	$\leq 0.2 \%$ of reading, in specified measuring range $\leq 0.05 \text{ K}$

Installation

Installation instructions The sensors are installed directly via the process connection.

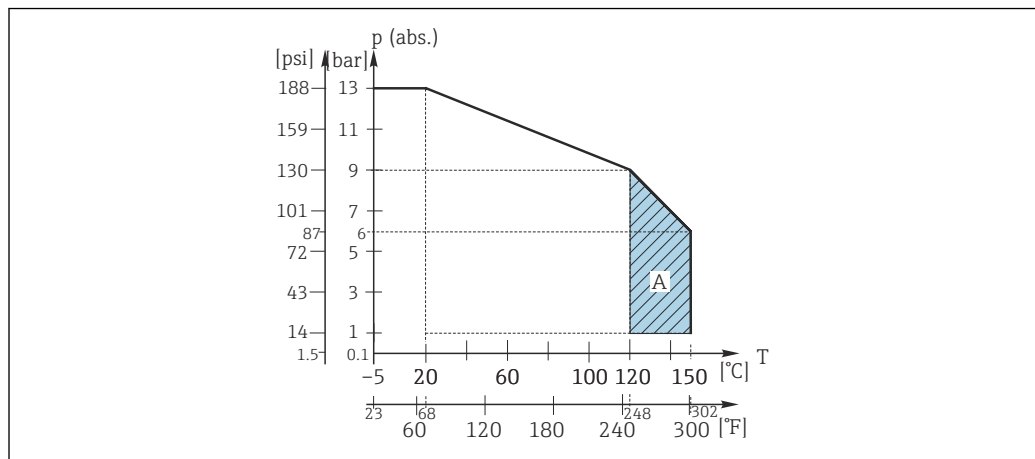
Environment

Ambient temperature	-20 to 60 °C (-4 to 140 °F)
Storage temperature	-25 to +80 °C (-10 to +180 °F)
Degree of protection	IP 68 / NEMA type 6P (1 m water column, 25 °C, 24 h)

Process

Process temperature	Normal operation	-5 to 120 °C (23 to 248 °F)
	Sterilization (max. 45 min)	Max. 150 °C (302 °F) at 6 bar (87 psi) absolute
Process pressure	13 bar (188 psi) absolute, at 20 °C (68 °F)	
	9 bar (130 psi) absolute, at 120 °C (248 °F)	
	0.1 bar (1.5 psi) absolute (negative pressure), at 20 °C (68 °F)	

Temperature/pressure ratings



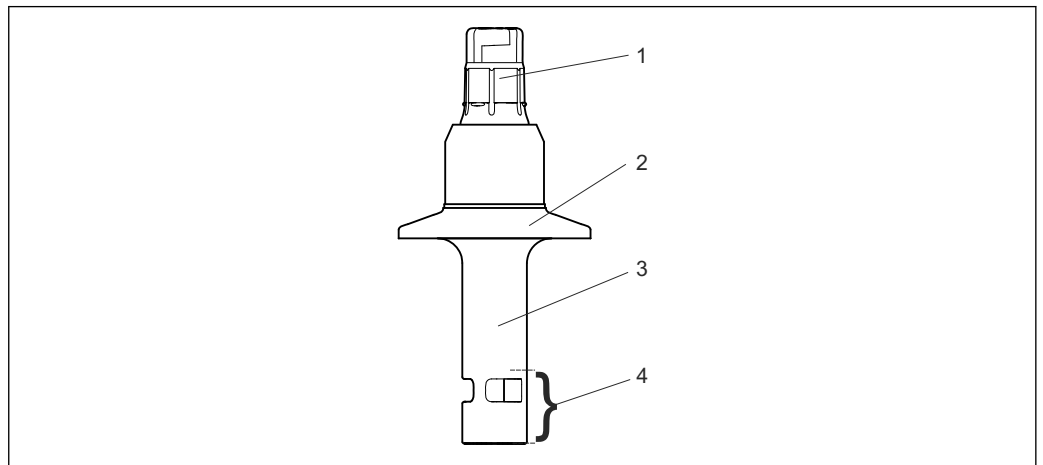
A0044756

4 Mechanical pressure-temperature resistance

A Can be sterilized for a short time (45 min.)

Mechanical construction

Design



A0024294

5 Sensor

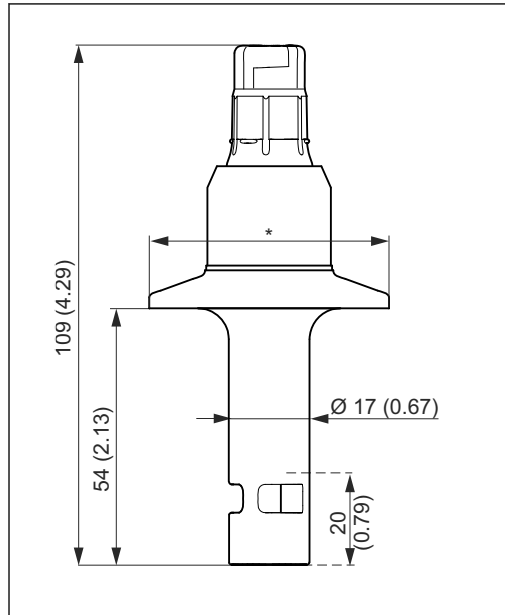
1 Memosens plug-in head

2 Process connection made of electropolished stainless steel 1.4435 (AISI 316 L) (Clamp, Varivent, BioControl)

3 Coaxial measuring electrode made of electropolished stainless steel 1.4435 (AISI 316 L)

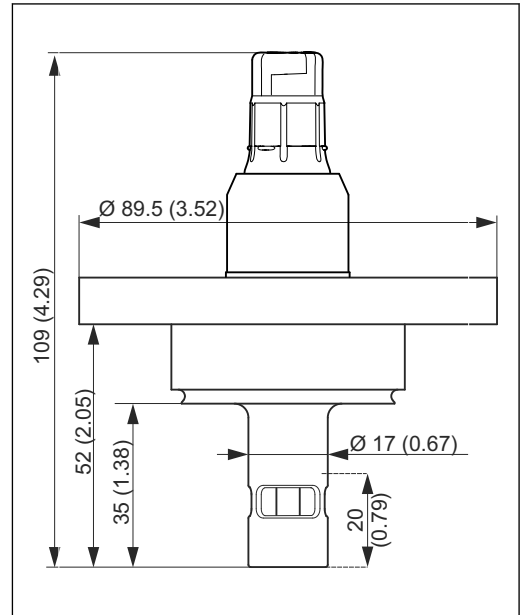
4 Minimum immersion depth

Dimensions in mm (in)



A0024297

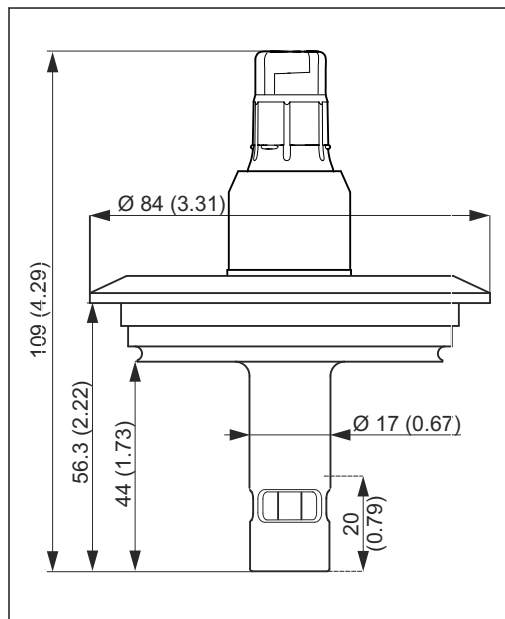
6 Version with Clamp



A0024295

7 Version with BioControl

- * CLS16D, Clamp 1" = 50.5 mm
- CLS16D, Clamp 1.5" = 50.5 mm
- CLS16D, Clamp 2" = 64 mm



A0024296

8 Version with Varivent

Weight	Approx. 0.13 to 0.75 kg (0.29 to 1.65 lbs) depending on version	
Materials (in contact with medium)	Electrodes	Electropolished, stainless steel 1.4435 (AISI 316L)
	Seal	Gasket seal ISOLAST (FFKM)
Process connection	1½", 2" as per ISO 2852 (also suitable for TRI-CLAMP, DIN 32676) Tuchenhagen VARIVENT N DN 50 to 125, DN40 to 125 NEUMO BioControl D50	
Surface roughness	R _a ≤ 0.38 µm, electropolished	

Certificates and approvals



Certificates and approvals are optional, i.e. they depend on the product version.

CE mark

EU Declaration of Conformity

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the **CE** mark.

Hazardous area approvals

CLS16E-BA

II 1 G Ex ia IIC T3/T4/T6 Ga

CLS16E-CI

CSA C/US IS Cl. I Div. 1 GP A-D

T3/T4/T6 + CSA C/US IS Cl. I Zone 0

AEx ia IIC T3/T4/T6

CLS16E-GA

EAC Ex, 0Ex ia IIC T3/T4/T6 Ga X

CLS16E-IA

Ex ia IIC T3/T4/T6 Ga

CLS16E-NA

NEPSI Ex ia IIC T3/T4/T6 Ga

Hygienic compatibility

EHEDG

The hygienic process connections are certified in accordance with EHEDG Type EL Class I.

Regulation (EC) No. 1935/2004

Meets the requirements of Regulation (EC) No. 1935/2004

The product therefore meets the requirements for materials that come into contact with food.

FDA

All materials in contact with the medium meet the requirements of the FDA.

Chinese standard for food contact materials

Meets the requirements of the GB4806.1-2016 Standard.

Pharmaceutical compatibility

Compliance with requirements derived from cGMP

Certificate of conformity for pharmaceutical requirements, confirms conformity with biological reactivity test USP 87, USP 88 Class VI, FDA material conformity, TSE-/BSE-free, surface roughness

ASME BPE

Produced according to the criteria of the ASME BPE that is currently valid.

CRN approval

As the sensor can be operated with a nominal pressure greater than 15 psi (approx. 1 bar), it has been registered according to CSA B51 ("Boiler, pressure vessel, and pressure piping code"; category F) with a CRN (Canadian Registration Number) in all Canadian provinces. The CRN can be found on the nameplate.

Test reports

Manufacturer inspection certificate

Stating the individual cell constant

Surface roughness test

Stainless steel surfaces in contact with medium tested to $\leq R_a$ 0.38 μm .

Additional certification

Inspection certificate in accordance with EN 10204 3.1

A test certificate 3.1 in accordance with EN 10204 is supplied depending on the version (\rightarrow Product Configurator on the product page).

Other standards and guidelines**EAC**

The product has been certified according to guidelines TP TC 004/2011 and TP TC 020/2011 which apply in the European Economic Area (EEA). The EAC conformity mark is affixed to the product.

Ordering information

Product page

www.endress.com/cls16e

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 includes:

- Sensor in the version ordered
- Operating Instructions

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.

Measuring cable**Memosens data cable CYK10**

- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk10



Technical Information TI00118C

Memosens data cable CYK11

- Extension cable for digital sensors with Memosens protocol
- Product Configurator on the product page: www.endress.com/cyk11



Technical Information TI00118C

Sensor regeneration

Replacement of seals and recalibration in the factory
Order No. 51505585

Calibration 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-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



Technical Information TI00162C

Calibration set

Conducal CLY421

- Conductivity calibration set (case) for ultrapure water applications
- Complete, factory-calibrated measuring system with certificate, traceable to SRM by NIST and PTB, for comparison measurement in ultrapure water up to max. 20 $\mu\text{S}/\text{cm}$
- Product Configurator on the product page: www.endress.com/cly421



Technical Information TI00496C/07/EN



www.addresses.endress.com
