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 MΩ·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 °C (302 °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 of Memosens technology**

- Maximum process safety
- Data security thanks to digital data transmission
- Very easy to use as sensor data saved in the sensor
- Recording of sensor load data in the sensor enables predictive maintenance
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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.

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

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 operating hours 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.
- The availability of sensor data means that maintenance intervals can be accurately defined and predictive maintenance is possible.
- The sensor history can be documented with external storage media and evaluation programs.
- The application range of the sensor can be determined based on its previous history.

Interference immunity

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**
- Conductivity
- Temperature

**Measuring ranges**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>40 nS/cm to 500 µS/cm</td>
</tr>
<tr>
<td>Temperature</td>
<td>-5 to 150 °C (23 to 302 °F)</td>
</tr>
</tbody>
</table>

1) In relation to water at 25 °C (77 °F)

**Cell constant**

\[ k = 0.1 \text{ cm}^{-1} \]

**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 measuring cable CYK10.

![Measuring cable CYK10](image)

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**Performance characteristics**

**Measurement uncertainty**

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 certificate supplied. The uncertainty of measurement in determining the cell constant is 1.0 %.

**Response time**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>( t_{95} \leq 2 \text{ s} )</td>
</tr>
<tr>
<td>Temperature</td>
<td>( t_{90} \leq 9 \text{ s} )</td>
</tr>
</tbody>
</table>

1) DIN VDI/VDE 3522-2 (0.3 m/s laminar)

**Measurement error**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>( \leq 2 % ) of reading, in specified measuring range</td>
</tr>
<tr>
<td>Temperature</td>
<td>( \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)</td>
</tr>
</tbody>
</table>

**Repeatability**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>( \leq 0.2 % ) of reading, in specified measuring range</td>
</tr>
<tr>
<td>Temperature</td>
<td>( \leq 0.05 \text{ K} )</td>
</tr>
</tbody>
</table>

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**Mounting**

**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 rating

4  Mechanical pressure-temperature resistance
A  Can be sterilized for a short time (45 min.)
Mechanical construction

**Design**

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**

6. Version with Clamp ISO2852. Unit of measurement mm (in)
   * CLS16E: **CA**: 1 ½" = 50.5 mm
   * CLS16E: **CB**: 2" = 64 mm

7. Version with BioControl. Unit of measurement mm (in)
**Memosens CLS16E**

**Version with Varivent. Unit of measurement mm (in)**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Approx. 0.13 to 0.75 kg (0.29 to 1.65 lbs) depending on version</th>
</tr>
</thead>
</table>
| Materials (in contact with medium) | Electrodes: Electroplished, stainless steel 1.4435 (AISI 316L)  
Sealing: Depending on order version:  
• Gasket seal ISOLAST (FFKM) or  
• Gasket seal EPDM |
| 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 | $R_a \leq 0.38 \, \mu m$, electropolished |

## Certificates and approvals

Current certificates and approvals for the product are available at [www.endress.com](http://www.endress.com) on the relevant product page:

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

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

### Ex 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
### Memosens CLS16E

**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.  
| 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's certificate  
|--------------|-----------------------------  
| Stating the individual cell constant  
| Surface roughness test  
| Stainless steel surfaces in contact with medium tested to $\leq R_a 0.38 \mu m$. |

| 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 (→ Product Configurator on the product page). |

| External 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](http://www.endress.com/cls16e)

**Product Configurator**  
1. **Configure**: Click this button on the product page.  
2. Select **Extended selection**.  
   - The Configurator opens in a separate window.  
3. Configure the device according to your requirements by selecting the desired option for each feature.  
   - In this way, you receive a valid and complete order code for the device.
4. **Accept**: Add the configured product to the shopping cart.

- For many products, you also have the option of downloading CAD or 2D drawings of the selected product version.

5. **CAD**: Open this tab.
   - The drawing window is displayed. You have a choice between different views. You can download these in selectable formats.

### 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.

Listed accessories are technically compatible with the product in the instructions.

1. Application-specific restrictions of the product combination are possible.
   - Ensure conformity of the measuring point to the application. This is the responsibility of the operator of the measuring point.

2. Pay attention to the information in the instructions for all products, particularly the technical data.

3. 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](http://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](http://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 μS/cm
  - Product Configurator on the product page: [www.endress.com/cly421](http://www.endress.com/cly421)
  - Technical Information TI00496C/07/EN