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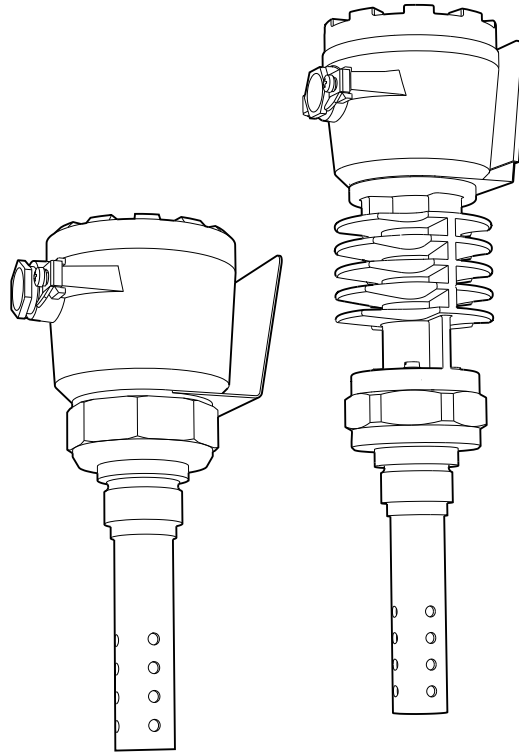
# Operating Instructions
# **Condumax CLS12/CLS13**

Conductivity sensors for high-temperature applications



Endress+Hauser
People for Process Automation

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# 1 Document information

## 1.1 Warnings

| Structure of information | Meaning |
|---|---|
| DANGER<br>**Causes (/consequences)**<br>If necessary, Consequences of non-compliance (if applicable)<br>▶ Corrective action | This symbol alerts you to a dangerous situation.<br>Failure to avoid the dangerous situation **will** result in a fatal or serious injury. |
| WARNING<br>**Causes (/consequences)**<br>If necessary, Consequences of non-compliance (if applicable)<br>▶ Corrective action | This symbol alerts you to a dangerous situation.<br>Failure to avoid the dangerous situation **can** result in a fatal or serious injury. |
| CAUTION<br>**Causes (/consequences)**<br>If necessary, Consequences of non-compliance (if applicable)<br>▶ Corrective action | This symbol alerts you to a dangerous situation.<br>Failure to avoid this situation can result in minor or more serious injuries. |
| NOTICE<br>**Cause/situation**<br>If necessary, Consequences of non-compliance (if applicable)<br>▶ Action/note | This symbol alerts you to situations which may result in damage to property. |

## 1.2 Symbols

| Symbol | Meaning |
|---|---|
| | Additional information, tips |
| | Permitted or recommended |
| | Not permitted or not recommended |
| | Reference to device documentation |
| | Reference to page |
| | Reference to graphic |
| | Result of a step |

# 2 Basic safety instructions

## 2.1 Requirements for personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.

Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

## 2.2 Designated use

The sensor measures conductivity in water or steam circuits, such as in the power plant and energy industry:
- Condensate monitoring
- Boiler feedwater monitoring
- Boiler blowdown monitoring

The sensor can be used in all applications with a low conductivity and high, CLS13 with very high, temperatures and pressures.

Sensor versions with explosion protection approval according to ATEX, FM or CSA are suitable for use in hazardous areas.

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

## 2.3 Occupational safety

As the user, you are responsible for complying with the following safety conditions:
- Installation guidelines
- Local standards and regulations
- Regulations for explosion protection

**Electromagnetic compatibility**
- The product has been tested for electromagnetic compatibility in accordance with the applicable European standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

## 2.4 Operational safety

1. Before commissioning the entire measuring point, verify that all connections are correct. Ensure that electrical cables and hose connections are undamaged.
2. Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Label the damaged product as defective.
3. If faults cannot be rectified:

   Take the products out of operation and safeguard them to ensure that they are not operated inadvertently.

## 2.5 Product safety

### 2.5.1 State of the art

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and European standards have been observed.

### 2.5.2 Electrical equipment in hazardous areas

- The sensors CLS12 / CLS13 have been developed and manufactured in compliance with applicable European standards and guidelines and are suitable for use in hazardous areas. The EC type examination certificate confirms compliance with the harmonized European standards for using the sensors in hazardous areas. The corresponding EU declaration of conformity is part of this document.
- The sensors may only be operated on suitable intrinsically safe circuits. Make sure that the maximal permissible sensor input characteristic values, the maximum permissible inductance $L_i$ and capacitance values $C_i$ in these circuits and the ambient temperature ranges indicated are not exceeded.
- The electrical connection must be made according to the wiring diagram of the transmitter.
- Metallic process connection parts must be mounted at the mounting location electrostatically conductive (< 1 MΩ).
- The maximum permissible cable length is limited by the maximum permissible characteristic values of the transmitter: the total of the maximum permissible inductance $L_i$ and capacitance values $C_i$ for the sensor and measuring cable may not exceed the maximum permissible inductance $L_o$ and capacitance values $C_o$ for the transmitter.
- The sensors CLS12 and CLS13 must be installed in such a way that they are protected against friction and impact.
- Full compliance with regulations for electrical systems in hazardous areas (e.g. EN/IEC 60079-14) is mandatory when using the devices and sensors.

*Temperature classes*

| Name | Type | | | | | | Medium temp. $T_a$ for temperature class (Tn) | Cat. |
|---|---|---|---|---|---|---|---|---|
| | | | x1 | x2 | x3 | x4 | | |
| Condumax | CLS12 | - | * | ** | * | A | -20 °C ≤ Ta ≤ +160 °C (T3)<br>-20 °C ≤ Ta ≤ +125 °C (T4)<br>-20 °C ≤ Ta ≤ +75 °C (T6) | II 1G |
| Condumax | CLS13 | - | * | ** | * | A | -20 °C ≤ Ta ≤ +250 °C (T2)<br>-20 °C ≤ Ta ≤ +190 °C (T3)<br>-20 °C ≤ Ta ≤ +125 °C (T4)<br>-20 °C ≤ Ta ≤ +75 °C (T6) | II 1G |

x1 … Measuring range and cell constant (no Ex relevance)
x2 … Process connection / material (no Ex relevance)
x3 … Cable entry (no Ex relevance)
x4 … Temperature sensor: A = Pt 100

If the specified medium temperatures are complied with, temperatures that are not permitted for the respective temperature class will not occur on the equipment.

*The following connection values are safety limits which may not be exceeded when connecting to the transmitter:*

| Parameters | Connection data |
|---|---|
| | |
| Supply circuit | Intrinsically safe |
| Maximum input voltage $U_i$ | 15 V |
| Maximum input current $I_i$ | 30 mA |
| Maximum input power $P_i$ | 130 mW |
| | |
| Maximum internal capacitance $C_i$ | Negligible |
| Maximum internal inductance $L_i$ | Negligible |
| | |
| Measuring cable CYK71 | |
| Maximum internal capacitance $C_i$ | 1 nF/m |
| Maximum internal inductance $L_i$ | 6 µH/m |

### FM/CSA IS/NI Cl.1 Div.1&2 Gr. A-D

Observe the documentation and the control drawings of the transmitter.

# 3 Incoming acceptance and product identification

## 3.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify your supplier of any damage to the packaging.
   Keep the damaged packaging until the matter has been settled.
2. Verify that the contents are undamaged.
   ↳ Notify your supplier of any damage to the delivery contents.
   Keep the damaged products until the matter has been settled.
3. Check the delivery for completeness.
   ↳ Check it against the delivery papers and your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
   ↳ The original packaging offers the best protection.
   The permitted ambient conditions must be observed (see "Technical data").

If you have any questions, please contact your supplier or your local sales center.

## 3.2 Product identification

### 3.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Extended order code
- Serial number
- Safety information and warnings
- Cell constant (nominal value)
- Protection class
- Ex labeling on hazardous area versions

► Compare the data on the nameplate with your order.

### 3.2.2 Product identification

#### Interpreting the order code

The order code and serial number of your product can be found in the following locations:
- On the nameplate
- In the delivery papers

#### Obtaining information on the product

1. Go to the product page for your product on the Internet.
2. At the bottom of the page, select the "Online Tools" link followed by "Check your device features".
   ↳ An additional window opens.

3. Enter the order code from the nameplate into the search field, and then select "Show details".
   ↳ You will receive information on each feature (selected option) of the order code.

**Manufacturer's address**

Endress+Hauser Conducta GmbH+Co. KG
Dieselstraße 24
D-70839 Gerlingen

## 3.3 Scope of delivery

The scope of delivery includes:
- Sensor in the version ordered
- Operating Instructions

## 3.4 Certificates and approvals

### 3.4.1 CE mark

**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.

### 3.4.2 Hazardous area approvals

ATEX II 1G Ex ia IIC T3/T4/T6 Ga (CLS12)
ATEX II 1G Ex ia IIC T2/T3/T4/T6 Ga (CLS13)

In conjunction with Liquiline M CM42 transmitter:
FM/CSA IS/NI Cl.I, Div.1&2 Gr. A-D T6 Ta
Cl.I Zone 0 AEx ia IIC T6 Ta
CI.I Zone 2 IIC T6 Ta

### 3.4.3 Manufacturer inspection certificate

Stating the individual cell constant

### 3.4.4 Ex-certification body

**TÜV Rheinland Industrie Service GmbH**
Cologne

# 4 Installation

## 4.1 Mounting the sensor

▶ Mount the sensor directly on a process connection that matches the version. Alternatively you can install the sensor in a flow assembly CLA751.

Ensure that the electrodes are fully immersed in the medium during measurement. If the sensor is being used in the ultrapure water range, you must work under air-evacuated conditions. Otherwise the $CO_2$ in the air can dissolve in the water and its (weak) dissociation can increase the conductivity by up to 3 µS/cm.

## 4.2 Post-installation check

- Are the sensor and cable undamaged?
- Is the sensor installed in the process connection and is not suspended from the cable?

# 5 Electrical connection

**WARNING**

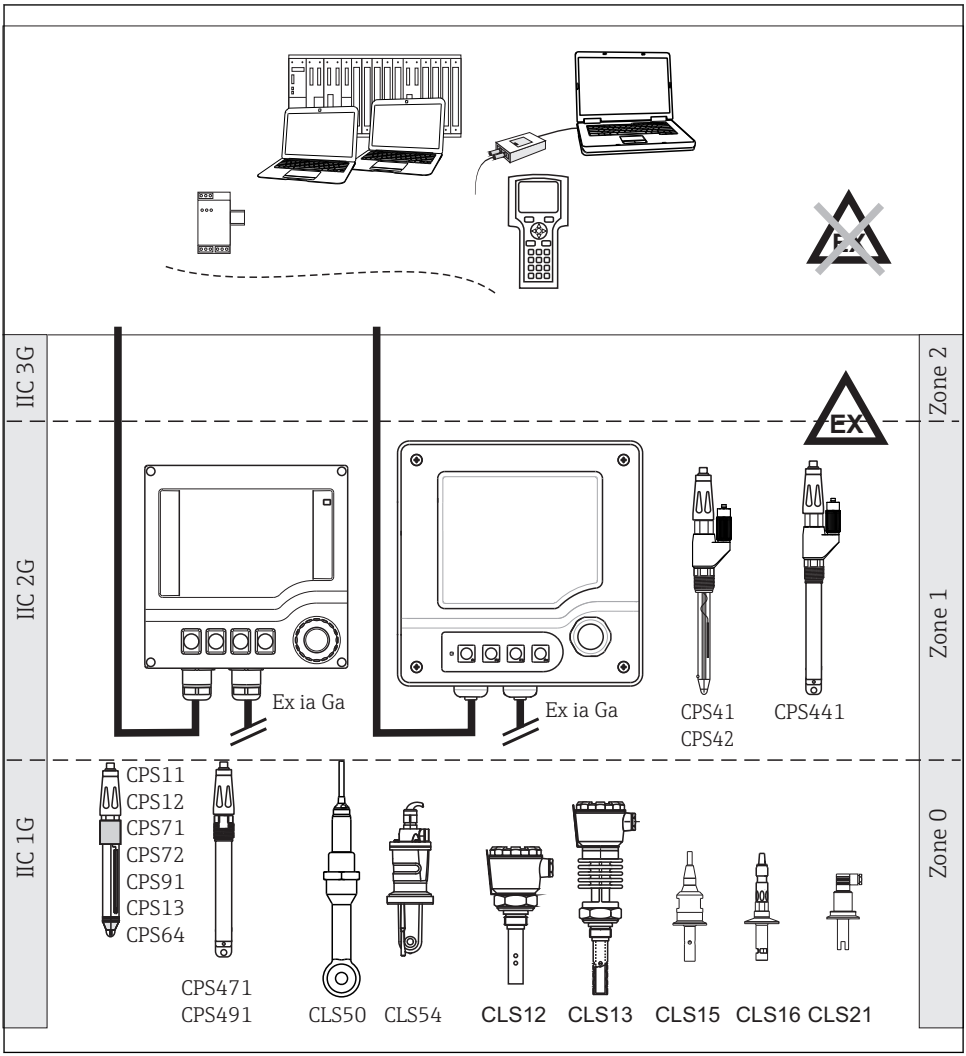
**Device is live**

Incorrect connection may result in injury or death

▶ The electrical connection may be performed only by an electrical technician.
▶ The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
▶ **Prior** to commencing connection work, ensure that no voltage is present on any cable.

## 5.1 Connection conditions

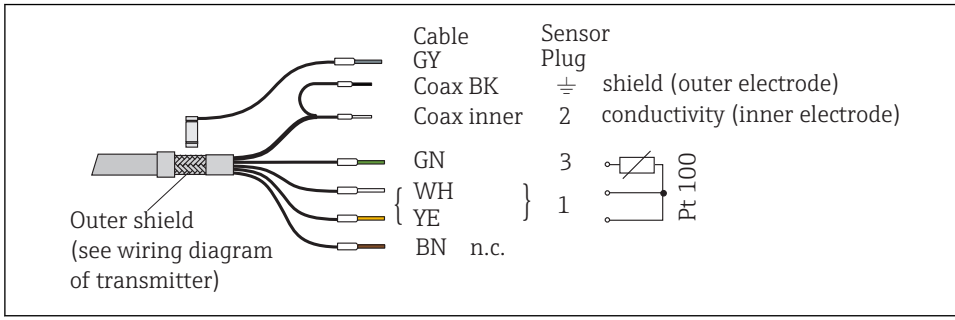
### 5.1.1 Connection at a glance




*1 Electrical connection in hazardous areas*

## 5.2 Connecting the sensor

The sensor is connected via the CYK71 measuring cable with a shield. The wiring diagram is provided in the Operating Instructions of the transmitter used.




2 *Measuring cable CYK71*

A VMB junction box and another CYK71 cable are required for the cable extension.

## 5.3 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions and which are necessary for the required, designated use, may be carried out on the device delivered.

► Exercise care when carrying out the work.

Otherwise, the individual types of protection (Ingress Protection (IP), electrical safety, EMC interference immunity) agreed for this product can no longer be guaranteed due, for example, to covers being left off or cable (ends) which are loose or insufficiently secured.

## 5.4 Post-connection check

| **Device condition and specifications** | **Notes** |
|---|---|
| Are the outside of the sensor, assembly, cable undamaged? | Visual inspection |
| **Electrical connection** | **Notes** |
| Are the installed cables strain-relieved and not twisted? | |
| Is a sufficient length of the cable cores stripped, and is it positioned in the terminal correctly? | Check the fit (by pulling gently) |
| Are all the screws terminals properly tightened? | Tighten |
| Are all cable entries mounted, tightened and leak-tight? | For lateral cable entries, make sure the cables loop downwards to allow water to drip off |
| Are all cable entries installed downwards or mounted laterally? | |

# 6 Commissioning

Before first commissioning, check if:
- the sensor is correctly installed
- the electrical connection is correct.

If using an assembly with automatic cleaning, check that the cleaning medium (e.g. water or air) is connected correctly.

**⚠ WARNING**

**Escaping process medium**

Risk of injury from high pressure, high temperatures or chemical hazards
- ▶ Before applying compressed air to an assembly with cleaning facility, make sure the connections are correctly fitted.
- ▶ Do not install the assembly in the process if you cannot make the correct connection reliably.

# 7 Maintenance

**⚠ CAUTION**

**Corrosive chemicals**

Danger of chemical burns to the eyes and skin. Danger of damage to clothing and equipment
- ▶ It is absolutely essential to protect the eyes and hands properly when working with acids, bases and organic solvents!
- ▶ Wear protective goggles and safety gloves.
- ▶ Clean away splashes on clothes and other objects to prevent any damage.
- ▶ Pay particular attention to the information provided in the safety data sheets for the chemicals used.

**⚠ WARNING**

**Hydrofluoric acid and mineral acids**

Risk of serious or fatal injury from caustic burns
- ▶ Wear protective goggles to protect your eyes.
- ▶ Wear protective gloves and appropriate protective clothing.
- ▶ Avoid all contact with the eyes, mouth and skin.
- ▶ If using hydrofluoric acid, only use plastic vessels.

**⚠ WARNING**

**Thiocarbamide**

Harmful if swallowed. Limited evidence of carcinogenicity. Possible risk of harm to the unborn child. Dangerous for the environment with long-term effects.
- ▶ Wear protective goggles, protective gloves and appropriate protective clothing.
- ▶ Avoid all contact with the eyes, mouth and skin.
- ▶ Avoid releases into the environment.

Clean away fouling on the sensor as follows depending on the type of fouling:

1. Oily and greasy films:
   Clean with grease remover, e.g. alcohol, as well as hot water and (alkaline) agents containing surfactants (e.g. dishwashing detergent).
2. Lime, cyanide and metal hydroxide buildup and low solubility organic buildup:
   Dissolve buildup with diluted hydrochloric acid (3 %) and then rinse thoroughly with plenty of clear water.
3. Sulfidic buildup (from flue gas desulfurization or sewage treatment plants):
   Use a mixture of hydrochloric acid (3 %) and thiocarbamide (commercially available) and then rinse thoroughly with plenty of clear water.
4. Buildup containing proteins (e.g. food industry):
   Use a mixture of hydrochloric acid (0.5 %) and pepsin (commercially available) and then rinse thoroughly with plenty of clear water.
5. Readily soluble biological buildup:
   Rinse with pressurized water.

After cleaning or regeneration, you must rinse the sensor thoroughly with water .

# 8 Repair

## 8.1 Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions at www.endress.com/support/return-material.

## 8.2 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.

Observe the local regulations.

# 9 Technical data

## 9.1 Input

### 9.1.1 Measured values

- Conductivity
- Temperature

### 9.1.2 Measuring ranges

| | |
|---|---|
| **Conductivity** | (in relation to water at 25 °C (77 °F)) |
| CLS12 / CLS13 -A | 0.04 to 20 µS/cm |
| CLS12 / CLS13 -B | 0.10 to 200 µS/cm |
| **Temperature** | |
| CLS12 | -20 to 160 °C (-4 to 320 °F) |
| CLS13 | -20 to 250 °C (-4 to 480 °F) |

### 9.1.3 Cell constant

| | |
|---|---|
| CLS12 / CLS13 -A | $k = 0.01\ cm^{-1}$ |
| CLS12 / CLS13 -B | $k = 0.1\ cm^{-1}$ |

### 9.1.4 Temperature compensation

Pt 100 (class B as per IEC 60751)

## 9.2 Environment

### 9.2.1 Ambient temperature range

-20 to +60 °C (-4 to 140 °F)

### 9.2.2 Storage temperature

-25 to +80 °C (-10 to +180 °F)

### 9.2.3 Degree of protection

IP67

## 9.3 Process

### 9.3.1 Process temperature

**CLS12**

-20 to 160 °C (-4 to 320 °F)

**CLS13**

-20 to 250 °C (-4 to 480 °F)

### 9.3.2 Process pressure

**CLS12**

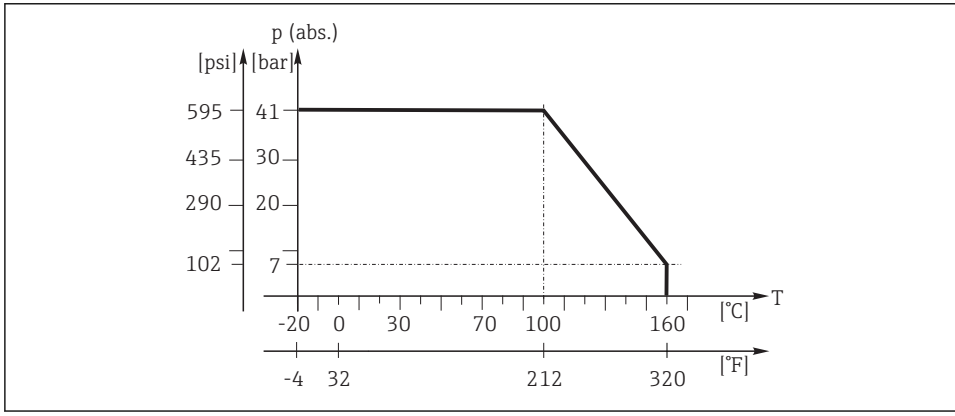
| | |
|---|---|
| **Without flow assembly CLA751** | Up to 100 °C (212 °F):<br>1 to 41 bar (15 to 595 psi), absolute<br>Up to 160 °C (320 °F):<br>1 to 7 bar (15 to 102 psi), absolute |
| **In flow assembly CLA751** | 1 to 13 bar (15 to 185 psi), absolute |

**CLS13**

1 to 41 bar (15 to 595 psi), absolute

### 9.3.3 Temperature/pressure ratings

**CLS12**

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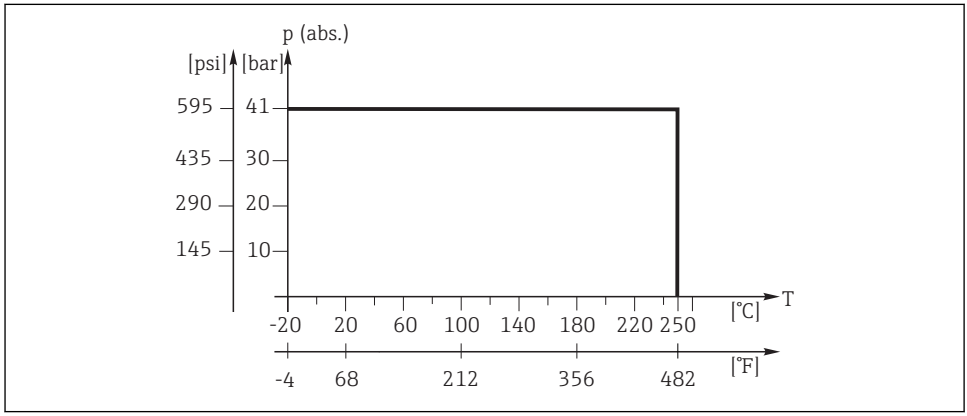
*3 Mechanical pressure-temperature resistance*

**CLS13**




*4 Mechanical pressure-temperature resistance*

## 9.4 Mechanical construction

### 9.4.1 Weight

**CLS12**

Approx. 1.4 kg (3.1 lbs) depending on version

**CLS13**

Approx. 1.7 kg (3.75 lbs) depending on version

### 9.4.2 Materials

**CLS12**

| | |
|---|---|
| Electrodes | Stainless steel 1.4571 (AISI 316Ti) |
| Process connection | Stainless steel 1.4571 (AISI 316Ti) |
| Terminal head | Die-cast aluminum |
| Insulator body | EPDM, PEEK |

**CLS13**

| | |
|---|---|
| Electrodes | Stainless steel 1.4571 (AISI 316Ti) |
| Process connection | Stainless steel 1.4571 (AISI 316Ti) |
| Terminal head | Die-cast aluminum |
| Dissipator | Die-cast aluminum |
| Seals | FFKM |
| Insulator body | Ceramic |

### 9.4.3 Process connection

**CLS12 and CLS13**

Thread G1
NPT 1" thread

# 10 EU Declaration of conformity

**EG/EU-Konformitätserklärung**
**EC/EU-Declaration of Conformity**
**Déclaration CE/UE de Conformité**

Endress+Hauser
People for Process Automation

CE

**Company** **Endress+Hauser Conducta GmbH+Co. KG**
**Dieselstraße 24, 70839 Gerlingen, Germany**
erklärt als Hersteller in alleiniger Verantwortung, dass das Produkt
declares as manufacturer under sole responsibility, that the product
déclare sous sa seule responsabilité en qualité de fabricant que le produit

**Product** **Condumax CLS12, CLS13, CLS15, CLS16, CLS21**

**Regulations** den folgenden Europäischen Richtlinien entspricht:
conforms to following European Directives:
est conforme aux prescription des Directives Européennes suivantes :

| | gültig bis/valid until/date d'expiration 19.04.2016 | gültig ab/valid from/valide à partir du 20.04.2016 |
|---|---|---|
| ATEX | 94/9/EC | 2014/34/EU |

**Standards** angewandte harmonisierte Normen oder normative Dokumente:
applied harmonized standards or normative documents:
normes harmonisées ou documents normatifs appliqués :

EN 60079-0 (2012) + A11 (2013)
EN 60079-11 (2012)

**Certification**

| | |
|---|---|
| EG-Baumusterprüfbescheinigung Nr.<br>EC-Type Examination Certificate No.<br>Numéro de l'attestation d'examen CE de type | TÜV 15 ATEX 7778 X |
| Ausgestellt von/issued by/délivré par | TÜV Rheinland Industrie Service GmbH (0035) |
| Qualitätssicherung/Quality assurance/Système d'assurance qualité | DEKRA Exam GmbH (0158) |

Gerlingen, 04.04.2016
Endress+Hauser Conducta GmbH+Co. KG

i.V. Jörg-Martin Müller
Technology

i.V. Robert Binder
Technology Certifications and Approvals

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## W


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