

Technical Information

OUSA46

Optical sensor with the OUA260 flow assembly for the measurement of UV absorption



Application

The sensor measures the spectral absorption of process liquids in the ultraviolet region of the electromagnetic spectrum.

- Measurement of protein concentrations
- Chromatography monitoring
- Filtration monitoring
- Concentration measurement of organic compounds
- Detection of aromates

Your benefits

- Improved process control and easier quality control thanks to quick and reliable monitoring of product concentration
 - Measuring range up to 2.5 AU or 50 OD (depending on optical path length)
 - Measurement of UV absorption at discrete wavelengths between 254 nm and 313 nm
 - Outstanding filter properties for highest linearity
 - Direct concurrence with laboratory values
 - Integrated reference detector for lamp compensation
 - Gas discharge lamp for long service life and stable measured values
- FM- and ATEX-approved lamps for applications in the hazardous area
- Compliance with life sciences sector thanks to hygienic design and FDA- and USP-compliant sealing materials
- High degree of product safety as SIP/CIP-resistant
- High product yield thanks to low volume requirements
- Maximum durability in all applications owing to wide range of materials and process connections
- Can be adapted to process requirements:
Optional air purge ports to prevent the formation of condensate on the optical windows

Function and system design

Measuring principle

Light absorption

The measuring principle is based on the Lambert-Beer law.

There is a linear dependency between the absorption of light and the concentration of the absorbing substance:

$$A = -\log(T) = \varepsilon \cdot c \cdot \text{OPL}$$

$$T = I/I_0$$

T ... Transmission

I ... Intensity of received light at detector

I₀ ... Intensity of transmitted light of light source

A ... Absorption

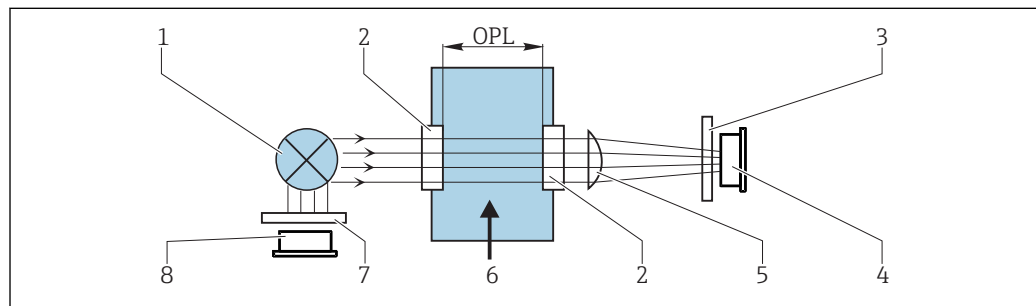
ε ... Extinction coefficient


c ... Concentration

OPL ... Optical path length

A light source emits radiation through the medium and the incident radiation is measured on the detector side.

The subsequent conversion to absorbance units (AU, OD) is performed in the associated transmitter.



 1 Absorption measurement with reference

1 Light source

2 Optical windows

3 Measurement filter


4 Measuring detector

5 Lens

6 Medium flow

7 Reference filter

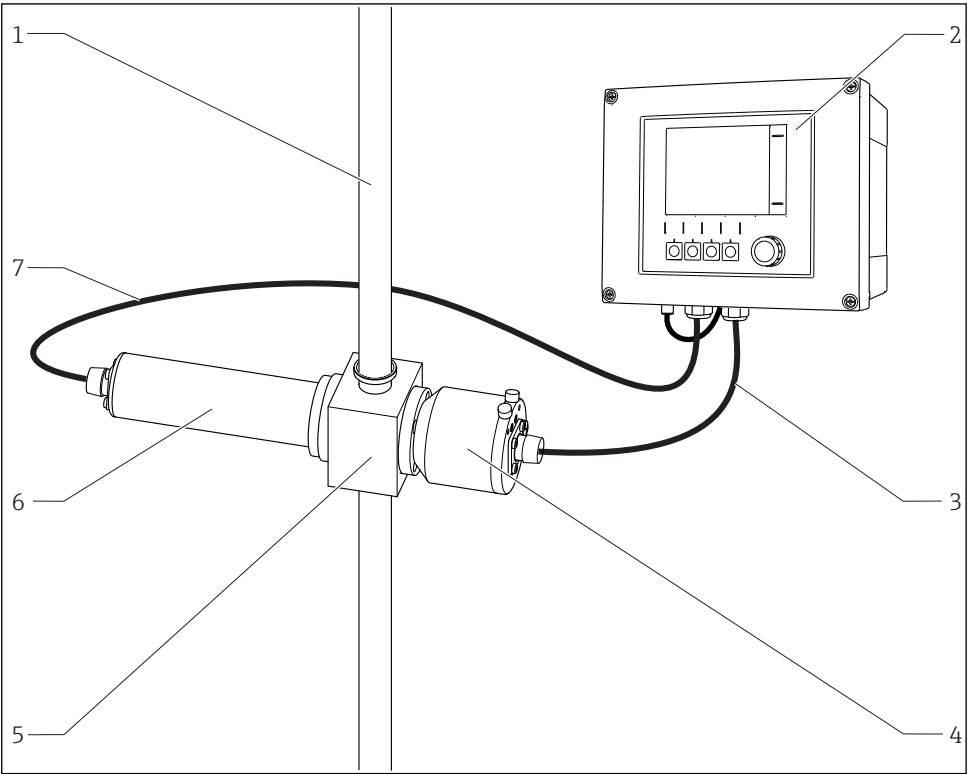
8 Reference detector

 OUSA46 has 2 pairs of reference and measuring detectors (= 2 channels). Only one channel is shown for the sake of simplicity.

Measuring system

An optical measuring system comprises:

- Sensor (photometer) OUSA46
- Transmitter, e. g. Liquiline CM44P
- Cable set, e. g. CUK80
- Assembly OUA260



2 Example of a measuring system with a photometer sensor

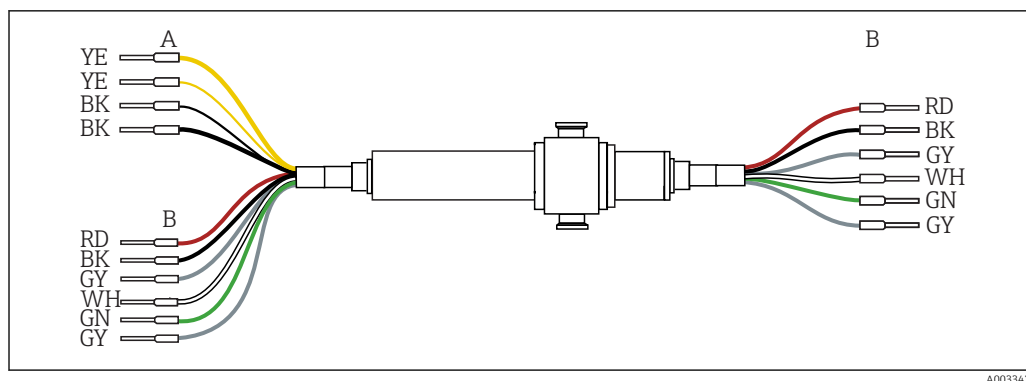
| | | | |
|---|-------------------|---|-----------------------------|
| 1 | pipe | 5 | Flow assembly OUA260 |
| 2 | Transmitter CM44P | 6 | Sensor: light source (lamp) |
| 3 | CUK80 cable set | 7 | CUK80 cable set |
| 4 | Sensor: detector | | |

Input

| | |
|-------------------|---|
| Measured variable | UV-absorption |
| Measuring range | <div><div>■ 0 to 2.5 AU</div><div>■ Max. 50 OD (depending on the optical path length)</div></div> |
| Wavelength | Discrete wavelength at 254, 280, 295 or 313 nm |

Power supply

| | |
|-----------------------|--|
| Electrical connection | The sensor is connected to the transmitter using the pre-terminated or labeled cable set CUK80 (for connection to CM44P) or OUK (for connection to CVM40) . The terminals and labeling may vary depending on the transmitter in use. The cable set must be ordered separately. |
|-----------------------|--|



A0039423

3 OUSA46 connecting cable

A Light source (lamp) power supply

B Signals of measurement and reference detector

| CM44P terminal | CVM40 terminal | Cable color | Assignment |
|----------------|----------------|-------------|---------------------------------------|
| PEM module 1 | | | |
| P+ | V1.1 | YE (thick) | Lamp voltage + |
| S+ | V1.3 | YE (thin) | Detection of lamp voltage + |
| S- | V1.4 | BK (thin) | Detection of lamp voltage - |
| P- | V1.2 | BK (thick) | Lamp voltage - |
| A (1) | S1.1 | RD | Channel 1 Sensor measuring detector + |
| C(1) | S1.2 | BK | Channel 1 Sensor measuring detector - |
| SH (1) | S1.S | GY | Channel 1 Shield |
| A (2) | S2.1 | WH (lamp) | Channel 1 Sensor reference + |
| C(2) | S2.2 | GN (lamp) | Channel 1 Sensor reference - |
| SH (2) | S2.S | GY (lamp) | Channel 1 Shield |
| PEM module 2 | | | |
| A (1) | S3.1 | WH | Channel 2 Sensor measuring detector + |
| C(1) | S3.2 | GN | Channel 2 Sensor measuring detector - |
| SH (1) | S3.S | GY | Channel 2 Shield |
| A (2) | S4.1 | RD (lamp) | Channel 2 Sensor reference + |
| C(2) | S4.2 | BK (lamp) | Channel 2 Sensor reference - |
| SH (2) | S4.S | GY (lamp) | Channel 2 Shield |

Cable length Maximum 100 m (330 ft)

Lamp voltage

| Sensor version | Lamp type | Lamp voltage [V] |
|----------------|---------------------------|------------------|
| OUSA46-xxxx | Low-pressure mercury lamp | 10.0 ± 0.1 |

Versions for use in hazardous areas ¹⁾



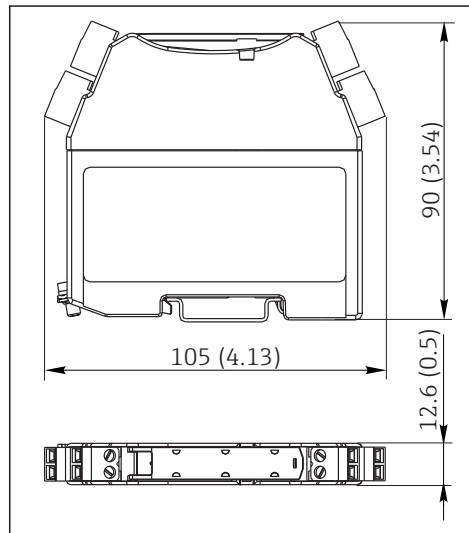
Safety instructions for electrical apparatus in explosion-hazardous areas, XA01403C

Connecting the detector using a safety barrier

The photometer sensors use silicon photovoltaic cells as detectors which are operated in the current mode. The detectors are intrinsically safe and can be deployed in Zone 1 and Class I, Division 1 environments.

¹⁾ Applies only to measuring points consisting of a photometer, CUK80 cable set and Liquiline CM44P transmitter.

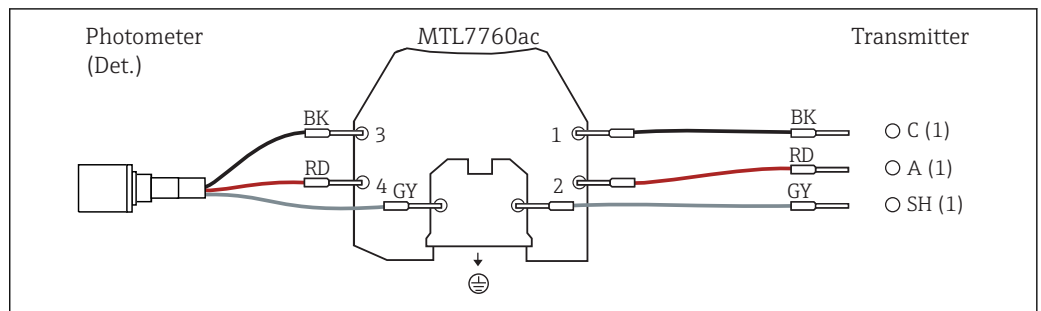
The safe area is separated from the hazardous area by safety barrier MTL7760AC.



4 Safety barrier, dimensions in mm (inch)

i The safety barrier may only have a very low leak current since the optical signals from the sensor can be in the nanoampere range. Therefore, the sensor cable shield is connected to the ground terminal of the barrier.

On delivery, the CUK80 detector cable is permanently wired to the . All you have to do is simply connect the individual cable ends to the detector and transmitter.



Connecting the hazardous area lamp using a junction box

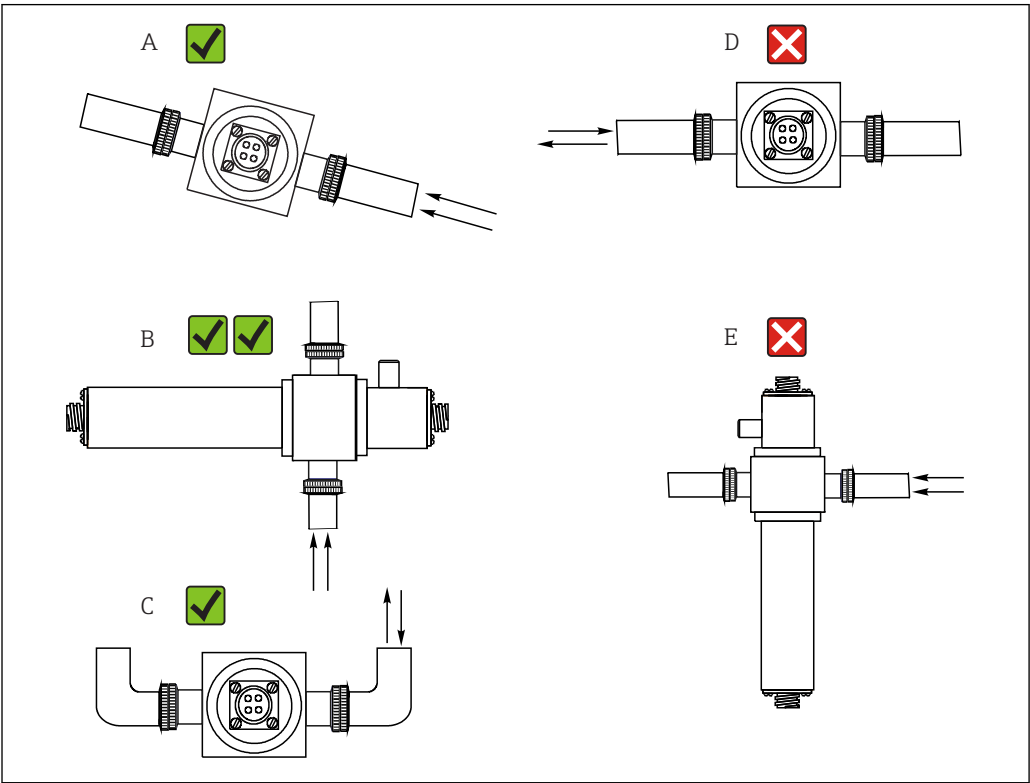
The hazardous area lamp (EXP-1) must be connected to the transmitter using a certified junction box.

i For versions with FM approval, the junction box is included in the delivery and already pre-terminated on the lamp side. You simply have to connect the cable of the transmitter (CUK80) to the terminals of the junction box.

For versions with ATEX approval, the junction box is not included in the delivery and it and the cable glands required must be provided by the customer at the place of installation. You must connect the cables entirely on your own (CUK80 of transmitter and lamp cable of photometer sensor).

Installation

Installation instructions



5 Mounting angles. The arrows indicate the direction of medium flow in the pipe.

A Suitable mounting angle, better than C
B Optimum mounting angle, best installation position
C Acceptable mounting angle
D Mounting angle to be avoided
E Forbidden mounting angle

Environment

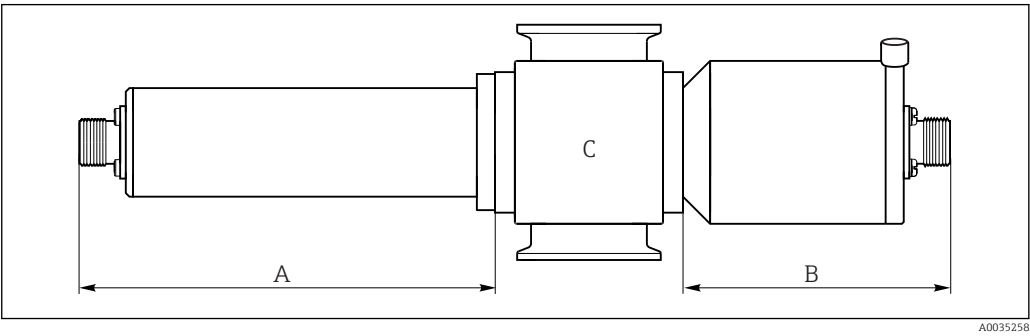
| | |
|----------------------|--------------------------------------|
| Ambient temperature | 0 to 55 °C (32 to 131 °F) |
| Storage temperature | -10 to +70 °C (+10 to +160 °F) |
| Humidity | 5 to 95 % |
| Degree of protection | IP 65 (NEMA 4) for all optical parts |


Process

| | |
|---------------------|--|
| Process temperature | 0 to 90 °C (32 to 194 °F) continuous Max. 130 °C (266 °F) for 2 hours |
| Process pressure | Max. 100 bar (1450 psi) absolute, depending on the material, pipe size and process connection of the flow assembly |

Mechanical construction

Design, dimensions




 6 *Sensor module*
A *Dimension of lamp → Table*
B *Dimension of detector → Table*
C *Assembly, see Technical Information for assembly*

| Lamp type | Dimension A in mm (inch) |
|-----------------------------------|--------------------------|
| Standard lamp | 146.1 (5.75) |
| Detector type | Dimension B in mm (inch) |
| Standard version with test filter | 80 (3.15) |
| Easycal | 94 (3.70) |

 The total length of the sensor module is derived from the lengths of the lamp, the detector and the assembly.

The dimensions of the OUA260 assembly are provided in Technical Information, TI00418C.



- ▶ Allow an additional gap of 5 cm (2") on both the lamp side and detector side of the sensor to connect the sensor cable.

| | | |
|--------------|--|------------------------------------|
| Weight | Sensor | |
| | UV lamp | 0.58 kg (1.28 lbs) |
| | UV lamp with wire-braided cable (1.2 m (4 ft)) and junction box (sensor for hazardous area) | 3.2 kg (6.66 lbs) |
| | Easycal detector | 0.53 kg (1.17 lbs) |
| | Standard detector | 0.78 kg (1.71 lbs) |
| Materials | Sensor housing | Stainless steel 316 |
| | Assembly OUA260 | Stainless steel 316, 316L or Kynar |
| | Cable connector ends | Nickel-plated brass |
| Light source | Low-pressure mercury lamp | |
| | Lamp operating life: typically 3000 h | |
| |  The lamp will not operate at full capacity until a warm-up period of 30 minutes has elapsed. | |
| Detector | UV silicon detector, hermetically sealed | |
| Filter | Multilayer interference filter, designed for extreme UV conditions | |

Certificates and approvals

| | |
|-----------------------|--|
| CE mark | Declaration of Conformity <p>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.</p> |
| Ex approvals | <ul style="list-style-type: none"> ■ ATEX II 2G Ex db IIC T5 Gb ■ FM Cl.1, Div. 1, Groups B, C, D |
| FDA conformity | <p>All non-metal parts in contact with medium, such as rubber and plastic parts, meet the requirements of FDA 21 CFR 177.2600. The plastic and elastomer parts of the sensor in contact with medium have passed the biological reactivity tests according to USP <87> and <88> Class VI.</p> |

Ordering information

| | |
|-----------------------------|--|
| Product page | www.endress.com/ousaf46 |
| Product Configurator | <p>On the product page there is a Configure button to the right of the product image.</p> <ol style="list-style-type: none"> 1. Click this button. <ul style="list-style-type: none"> ↳ The Configurator opens in a separate window. 2. Select all the options to configure the device in line with your requirements. <ul style="list-style-type: none"> ↳ 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. <p> 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.</p> |
| Scope of delivery | <p>The scope of delivery consists of the following :</p> <ul style="list-style-type: none"> ■ Detector and lamp module without flow assembly or ■ Detector and lamp module mounted on flow assembly ■ Operating Instructions <p> Ordering the sensor together with a transmitter:</p> <p>If you select the calibration option in the Product Configurator for the transmitter, the complete measuring system (transmitter, sensor, cable) is factory-calibrated and shipped as one package.</p> <p>► If you have any queries: Please contact your supplier or local sales center.</p> |

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.

Flow assembly

OUA260

- Flow assembly for hygienic sensors
- For sensor installation in pipes
- Materials: stainless steel 316, 316L or Kynar (other materials available on request)
- Wide variety of process connections and path lengths available
- Product Configurator on the product page: www.endress.com/oua260



Technical Information TI00418C

Cable

CUK80 cable set

- Pre-terminated and labeled cables for connecting analog photometer sensors
- Product Configurator on the product page: www.endress.com/cuk80

Calibration

Kit OUSAF46 EasyCal retrofit kit

- Patented system traceable to NIST for the calibration of UV absorption sensors
- Order numbers:
 - 254 nm: 71210149
 - 280 nm: 71210150
 - 295 nm: 71210156
 - 313 nm: 71210151

Reference rod

Order number: 71108543

www.addresses.endress.com
