

Operating Instructions

OUSAF11

Optical sensor for measurement of VIS/NIR
absorption



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1 About this document

1.1 Warnings

Structure, signal words and color coding of warning information are in compliance with ANSI Z535.6 specifications ("Product safety information in product manuals, instructions and other collateral materials").


Structure of information	Meaning
<p>⚠ DANGER Causes (/consequences) Possible consequences if ignored ► Corrective action</p>	<p>This symbol alerts you to a dangerous situation . Failure to avoid the situation will result in a fatal or serious injury.</p>
<p>⚠ WARNING Causes (/consequences) Possible consequences if ignored ► Corrective action</p>	<p>This symbol alerts you to a dangerous situation . Failure to avoid the situation can result in a fatal or serious injury.</p>
<p>⚠ CAUTION Causes (/consequences) Possible consequences if ignored ► Corrective action</p>	<p>This symbol alerts you to a dangerous situation . Failure to avoid this situation can result in minor or more serious injuries.</p>
<p>NOTICE Cause/situation Possible consequences if ignored ► Measure/note</p>	<p>This symbol alerts you to situations which may result in damage to property.</p>

1.2 Symbols

-  Additional information, tip
-  Permitted or recommended
-  Not permitted or not recommended

2 Basic safety instructions

2.1 Requirements for personnel

- ▶ Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
 - ▶ The technical personnel must be authorized by the plant operator to carry out the specified activities.
 - ▶ The electrical connection may only be performed by an electrical technician.
 - ▶ The technical personnel must have read and understood these Operating Instructions and must follow the instructions they contain.
 - ▶ Measuring point faults may only be rectified by authorized and specially trained personnel.
-  Repairs not described in the enclosed Operating Instructions may only be carried out directly at the manufacturer's or by the service organization.

2.2 Designated use

The OUSAF11 sensor is used for determining the VIS/NIR absorption of a liquid medium. It is suitable for a variety of applications:

- Product interphase detection
- Dairy applications:
 - Milk detection in CIP solutions
 - Phase separation milk/water
 - Product loss detection in effluent
- Suspended solids measurement in:
 - Primaries
 - Mining

Any other use than the one described here compromises the safety of persons and the entire measuring system and is not permitted. The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:

- Regulations for explosion protection
- Installation instructions
- Local standards and regulations

2.4 Operational safety

- ▶ Before commissioning the entire measuring point, make sure all the connections are correct. Ensure that the electrical cables and hose connections are not damaged.
- ▶ Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Mark the damaged product as defective.
- ▶ If faults cannot be rectified, the products must be taken out of service and secured against unintentional commissioning.

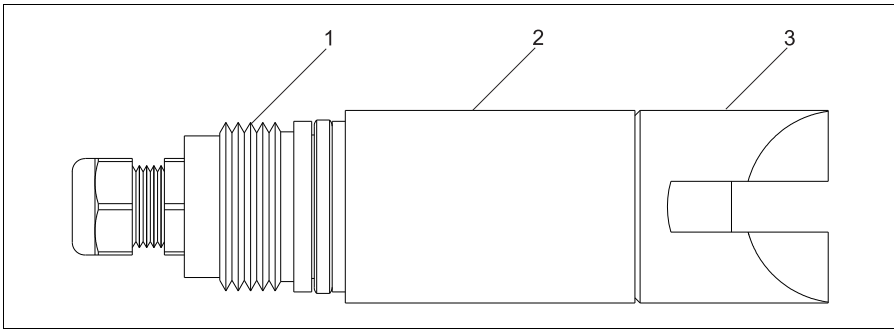
2.5 Product safety

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.

Relevant regulations and European standards have been observed.

3 Product description

3.1 Design of OUSAf11



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Fig. 1: Design of OUSAf11

1 Thread

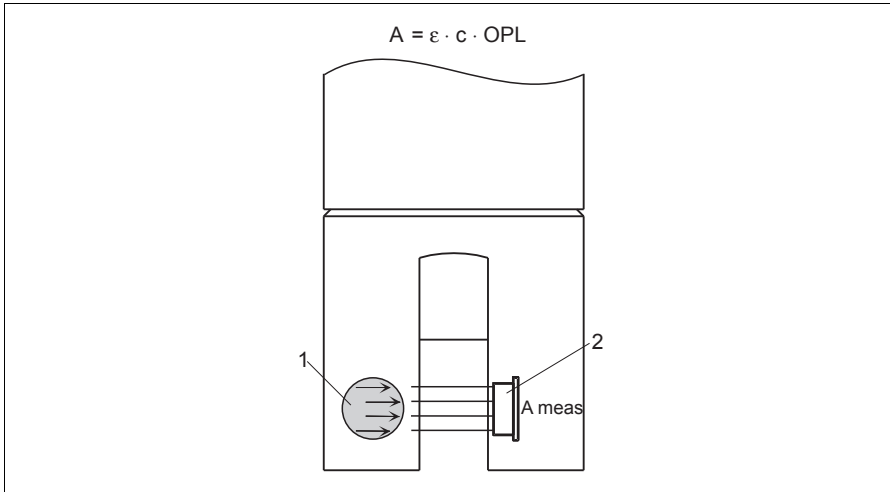
2 Sensor body

3 Sensor head

3.2 Measuring principle

Absorption light method

The measuring principle is based on the Lambert-Beer law. There is a linear dependency between the light absorption and the concentration of the absorbing substance. A light source emits radiation through the medium and the transmitted radiation is measured on the detector side. The light intensity is determined by a photodiode and converted into a photo current. The final conversion into absorption units (AU, OD) is done by the related transmitter.



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Fig. 2: Single-wavelength absorption sensor

A	Absorption	1	Light source
ϵ	Extinction coefficient	2	Measurement detector
c	Concentration		
OPL	Optical pathlength		

4 Incoming acceptance and product identification

4.1 Incoming acceptance

- Make sure the packaging is undamaged!
Inform the supplier about any damage to the packaging.
Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
Inform the supplier about damage to the contents. Keep the damaged products until the matter has been settled.
- Check that the order is complete and agrees with your shipping documents.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your local sales center.

4.2 Product identification

4.2.1 Nameplate

Nameplates can be found:

- On the outside of the housing
- On the packaging (adhesive label, portrait format)


The nameplate provides you with the following information on your device:

- Order code
- Extended order code
- Serial number
- Protection class
- Environment

Compare the data on the nameplate with your order.

4.2.2 Product identification

The order code and serial number of your device can be found in the following locations:

- On the nameplate
-  To find out what device version you have, enter the serial number indicated on the nameplate in the search screen at the following address:
www.products.endress.com/OUSAF11

4.3 Scope of delivery

The scope of delivery includes:

- Optical sensor OUSAF11
- Operating Instructions, English

When the sensor is ordered together with a transmitter, the complete measuring system is factory-calibrated and shipped as one package.

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

4.4 Certificates and approvals

4.4.1 FDA conformity

All non-metallic wetted parts comply with FDA Regulations 21 CFR 177.2600. The plastic and elastomeric wetted parts of the sensor have passed the bio-reactivity tests according to USP <87> and <88> class VI.

4.4.2 3-A

Certified according to 3-A Standard 46-03 ("3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Milk and Milk Products Equipment") for versions with Tri-Clamp and Varivent process connections.

5 Mounting

5.1 Mounting conditions

5.1.1 Measuring system

A complete measuring system as insertion sensor in pipes and vessels is comprised of:

- Transmitter Memograph CVM40
- Optical sensor OUSAF11

For applications in open tanks and basins a typical measuring system is comprised of:

- Transmitter Memograph CVM40
- Optical sensor OUSAF11
- Assembly Flexdip CYA112 and holder system Flexdip CYH112

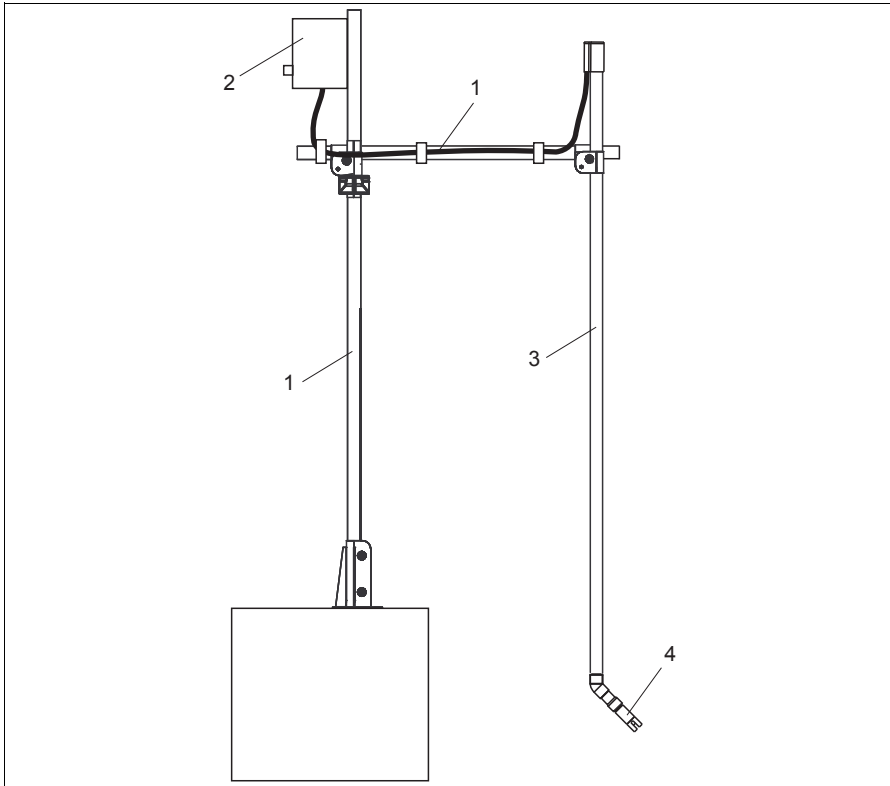


Fig. 3: Example of a measuring system with immersion assembly

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- 1 Holder system Flexdip CYH112
- 2 Transmitter Memograph CVM40
- 3 Assembly Flexdip CYA112
- 4 Optical sensor OUSAF11

NOTICE

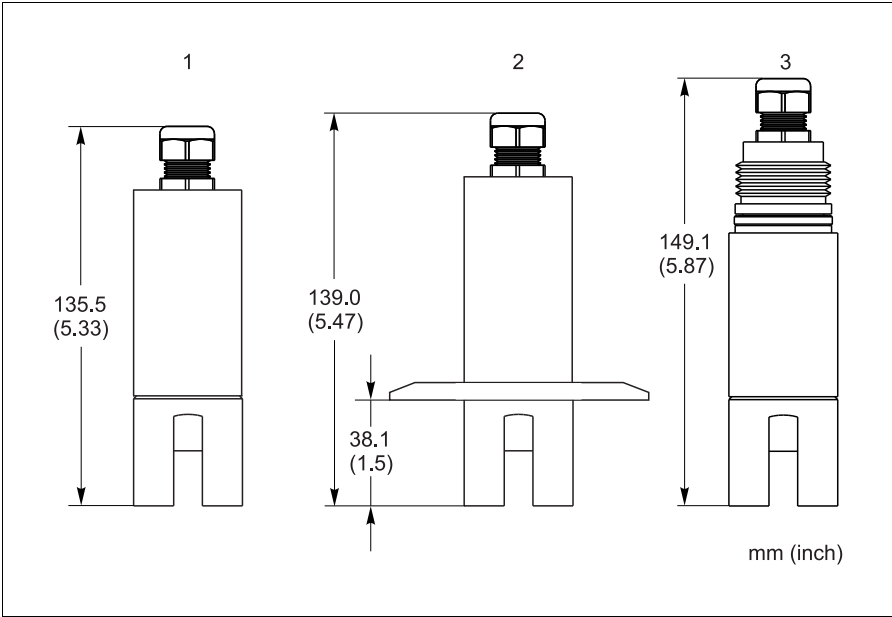
External forces

Make sure to leave enough space when installing the sensor to prevent sensor damage. Make sure the cable is not twisted.

- ▶ Ensure that sensor bodies are protected against damage caused by external forces.
- ▶ Avoid exerting excessive tensile force on the cable.

- i** When using metallic assemblies and installation equipment, comply with national grounding regulations.

5.1.2 Dimensions



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Fig. 4: Design and dimensions of OUSAF11

- 1 Immersion sensor OUSAF11
- 2 OUSAF11 with Tri-Clamp or Varivent flange
- 3 Immersion sensor OUSAF11 with external thread

5.1.3 Mounting angle

The sensor can be installed up to the horizontal in an assembly, holder or a suitable process connection.

Other installation positions are not recommended. Do **not** install the sensor vertically through the bottom of a pipe. This avoids possible sediment formation and guarantees steady flow through the measuring section. It ensures correct measured values and proper drainage required in sanitary applications.

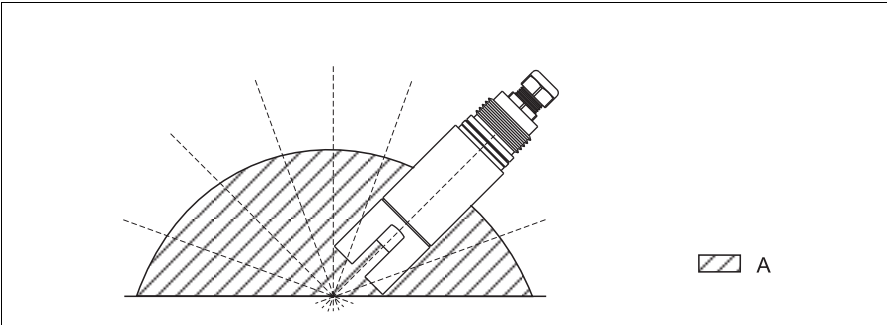


Fig. 5: Angle of installation

A Permissible installation positions: 0 ... 180 °

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5.2 Pipe installation

The following figure illustrates various installation positions in pipes and indicates whether they are permitted or not.

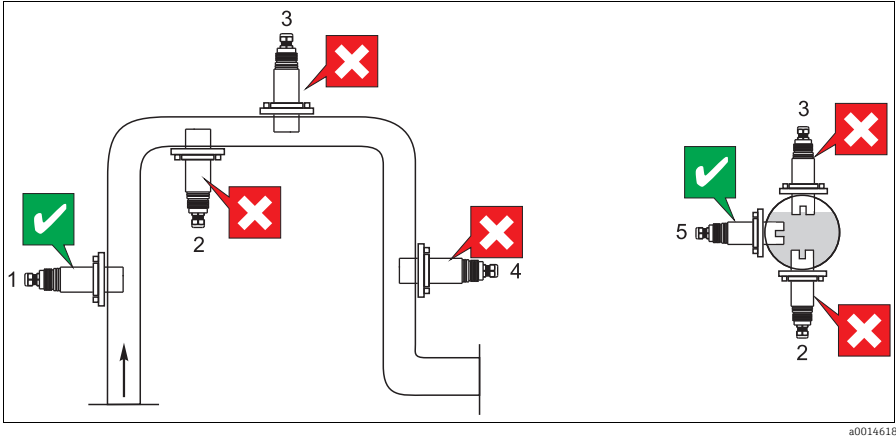


Fig. 6: Orientation and installation positions

- The pipeline diameter must be at least 50 mm (2").
- Install the sensor in places with uniform flow conditions.
- The best installation location is in the ascending pipe (item 1). Installation is also possible in the horizontal pipe (item 5).
- Do not install the sensor in places where air may collect or foam bubbles form (item 3) or where suspended particles may settle (item 2).
- Avoid installation in the down pipe (item 4).
- Orientate the sensor in such a way that the medium flows through the measurement section (self-cleaning effect), refer to figure 7: Orientation of OUSAF11.

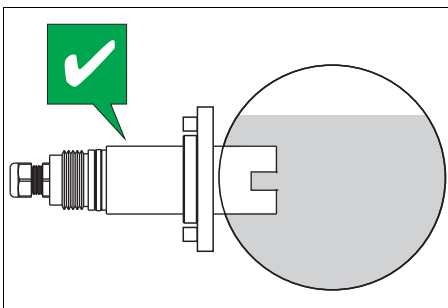


Fig. 7: Orientation of OUSAF11

5.3 Post-mounting check

- Sensor and cable undamaged?
- Compliance with permissible sensor installation position?

6 Electrical connection

⚠ WARNING

Device is energized

Inappropriate connection can cause serious injuries or death

- ▶ The electrical connection must only be carried out by a certified electrician.
- ▶ Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- ▶ **Prior to beginning** any wiring work, make sure voltage is not applied to any of the cables.

6.1 Connecting the sensor

Terminals and labeling might vary with the transmitter in use.

Up to two sensors can be connected to the transmitter Memograph CVM40.

i Cable length should only be extended using original cables from manufacturer.

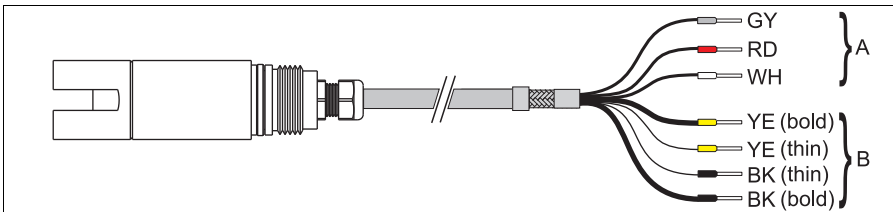


Fig. 8: Connection to transmitter Memograph CVM40

- A Signal transmission of detector
- B Power supply for lamp and lamp voltage signal

Terminal CVM40	Sensor OUSAF11	
	Core	Assignment
S1.5	GY	Shield
S1.1	RD	Sensor +
S1.2	WH	Sensor -
V1.1	YE (bold)	Lamp voltage +
V1.3	YE (thin)	Lamp sense +
V1.4	BK (thin)	Lamp sense -
V1.2	BK (bold)	Lamp voltage -

Lamp voltage adjustment with the lamp voltage sense tool

The lamp of OUSAF11 needs a supply voltage of 4.9V +/-0.1V. More than 4.9V +/-0.1V will reduce the life time of the lamp. The lamp voltage is adjusted in factory but for every commissioning it should be checked to avoid lamp damages.

Refer to the operating instructions of the Memograph CVM40 (BA457C), chapter Electrical Connection, on how to use the lamp voltage sense tool.

6.2 Post-connection check

Instrument status and specifications	Remarks
Are the sensor, assembly or cable damaged?	Visual inspection
Electrical connection	Remarks
Are the installed cables strain-relieved and not twisted ?	
No loops and cross-overs in the cable run?	Check seating (pull slightly)
Are the signal cables correctly connected according to the wiring diagram?	
Are all screw terminals tightened?	
Are all cable entries installed, tightened and sealed?	
Are the PE distributor rails grounded (if present)?	Grounding at place of installation

7 Commissioning

7.1 Function check

Before first commissioning, check if:


- the sensor is installed correctly
- the electrical connection is correct

7.2 Sensor calibration

Calibration is a means of adapting the transmitter to the characteristic values of the sensor.

When ordered as a complete measuring loop, the OUSAF11 sensor has been factory-calibrated. Therefore, an optical calibration is not needed.

Perform a zero-point adjustment (optical zero) each time after lamp replacement. Check optical zero regularly.

 Before calibrating, the unit has to be powered up for at least 30 minutes to warm up the lamp.

To calibrate the sensor, proceed as follows:

1. Ensure that the unit is powered up for at least 30 minutes.
2. Select in the main menu of CVM40 "Diagnosis/simulation" and then "Optical calibration".
3. Define concentration of zero solution and standard solution.
4. Select "Start calibration Opt. sensor 1".
5. Put sensor into beaker with zero solution (DI water) and press OK.
6. Put sensor into beaker with standard solution and press OK.

8 Maintenance

Certain maintenance procedures need to be performed for OUSAF11 sensors. The service and maintenance interval times are application dependent. Perform a visual inspection once a month and clean the sensor if necessary. The cleaning intervals depend on the medium.

NOTICE

Sensitive optical components

If not handled carefully optical components can be damaged or contaminated.

- ▶ The procedures described in this section should only be carried out by qualified maintenance staff.
- ▶ Wear talc-free latex or cotton gloves when doing the maintenance.
- ▶ Clean all optical components with a suitable lint free lens cleaning tissue and ethanol.

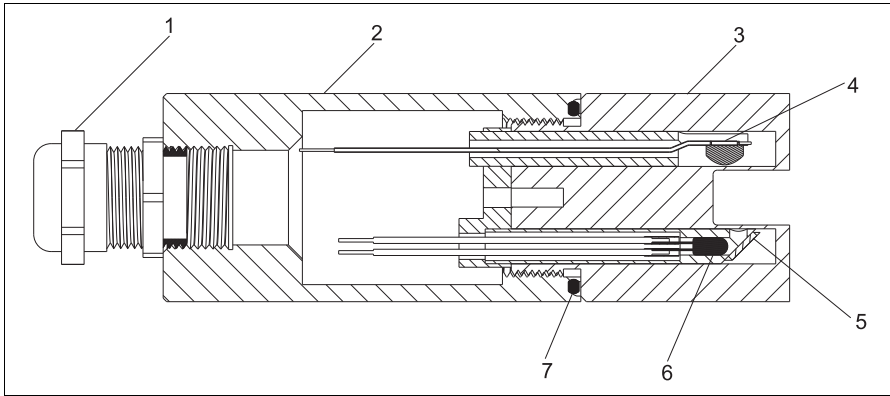


Fig. 9: Cross-sectional view of an immersion sensor OUSAF11

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- | | | | |
|---|-------------|---|-------------|
| 1 | Cable gland | 5 | Mirror |
| 2 | Sensor body | 6 | Bi-pin lamp |
| 3 | Sensor head | 7 | O-ring |
| 4 | Detector | | |

8.1 Cleaning the sensor

Sensor fouling can affect the measurement results and even cause a malfunction. The sensor must be cleaned at regular intervals to ensure reliable measurement results. The frequency and intensity of the cleaning process depends on the medium.

Clean the sensor:

- Before every calibration/ before zero point adjustment
- Before returning the sensor for repair

Type of fouling	Cleaning measure
Lime deposits	Immerse the sensor in 1-5 % hydrochloric acid (for a few minutes).
Dirt particles on the optical windows	Fold a cloth and pass it through the cuvette.

NOTICE

Residue of cleaning agents

Any residue of cleaning agents may impair measurement.


- ▶ After cleaning, thoroughly rinse the sensor with water.

8.2 Lamp replacement

Whenever maintenance is performed on the sensor, make sure there is no power applied to the sensor.

To replace the lamp, proceed as follows (refer to figure 9: Lamp replacement):

1. Let the lamp cool down.
2. Loosen the cable gland. Unscrew the sensor head by screwing it counterclockwise (CCW). When removing the sensor head, be sure to fix the cable, so that it will not rotate.
3. Loosen set screw (item 2) with Allen wrench.
4. Pull lamp assembly (item 3) out of sensor head (item 1).
5. Remove bi-pin lamp (item 4) from socket and replace with new one. Use a lens tissue when inserting the new lamp.
6. Clean the new lamp with lens tissue and ethanol if available. After cleaning, do not touch these optical surfaces.
7. Reinsert lamp assembly into sensor head until it is seated. Slightly tighten the lamp retaining set screw (item 2).
8. Re-assemble in the reverse order.

 Replace the o-ring whenever the lamp is replaced, see section "O-ring replacement".

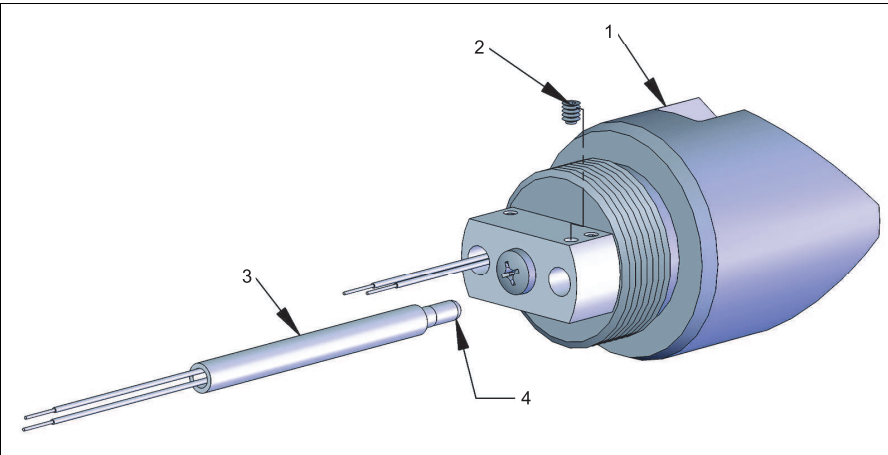


Fig. 10: Lamp replacement OUSAF11

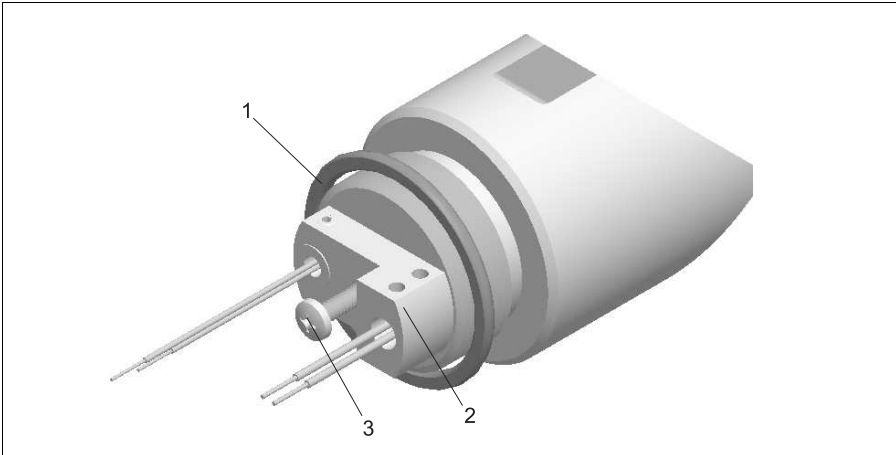
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- | | |
|---|---------------|
| 1 | Sensor head |
| 2 | Set screw |
| 3 | Lamp assembly |
| 4 | Bi-pin lamp |

8.3 O-ring replacement

To replace the o-ring, proceed as follows, (refer to figure 10: O-ring replacement):

1. Remove the screw (item 3) of the lamp/detector assembly (item 2) with a flat screwdriver.
2. Remove the lamp/detector assembly (item 2) from the sensor head.
3. Remove the old o-ring (item 1) and replace it with a new o-ring.
4. Re-assemble the lamp/detector assembly into the sensor head.
5. Re-assemble in the reverse order.



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Fig. 11: O-ring replacement OUSAF11

- | | |
|---|------------------------|
| 1 | O-ring |
| 2 | Lamp/detector assembly |
| 3 | Screw |

9 Repair

9.1 List of spare parts OUSAF11 sensor

Order no.	Identifier
71122199	Kit OUSAF11 Incandescent Lamp
71125626	Kit OUSAF11 10 mm Lamp-Detector Assy. NIR
71125627	Kit OUSAF11 10 mm Lamp-Detector Assy. VIS
71125628	Kit OUSAF11 5 mm Lamp-Detector Assy. NIR
71125629	Kit OUSAF11 5 mm Lamp-Detector Assy. VIS
71122298	Kit OUSAF11 10 mm Sensor Head
71122299	Kit OUSAF11 5 mm Sensor Head
71125630	Kit OUSAF11 Cable Glands

9.2 Return

The device must be returned if repairs or a factory calibration are required, or if the wrong device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the internet site:

www.services.endress.com/return-material

9.3 Disposal

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

Please observe local regulations.

10 Accessories



In the following sections, you will find the accessories available at the time of issue of this documentation.

For information on accessories that are not listed here, please contact your local service or sales office.

10.1 Transmitters

CVM40 Memograph

- Graphic transmitter for inline photometers and data manager
- Ordering according to product structure, see Technical Information TI457C/07/EN

10.2 Assembly, holder

Wastewater assembly Flexdip CYA112

- Modular assembly system for sensors in open basins, channels and tanks
- Versions in stainless steel or PVC
- Ordering according to product structure (Technical Information TI432C/07/EN)

Holder system Flexdip CYH112 and assembly Flexdip CYA112

- Modular holder system for sensors and assemblies in open basins, channels and tanks
- The holder system CYH112 works for nearly any type of mounting - mounting on the floor, wall or directly on a rail.
- Material: stainless steel
- Ordering according to product structure (Technical Information TI430C/07/EN)

11 Technical data

11.1 Input

Measured variable	VIS/NIR absorption
Measuring range	0 to 3 AU, 0 to 6 OD (depending on optical pathlength)
Wavelengths	NIR, broadband (VIS and NIR)
Optical pathlengths	5 or 10 mm

11.2 Environment

Ambient temperature	0 ... 55 °C (32 ... 131 °F)
Storage temperature	-20 ... 70 °C (-4 ... 158 °F)
Relative humidity	5 ... 95 %
Ingress protection	IP 67 (NEMA 4) IP 68 when mounted with CYH112

11.3 Process

Process temperature	0 ... 90 °C (32 ... 194 °F) continuous, max. 130 °C (266 °F) for 2 hours
Process pressure (for version with Tri-Clamp and Varivent process connection)	10 bar (150 psi), at 20 °C (70 °F)

11.4 Mechanical construction

Dimensions	See section "Installation".	
Weight	appr. 0.82 kg (1.81 lbs)	
Materials	Sensor head:	FEP (Fluorinated Ethylene Propylene)
	Sensor body:	Stainless steel 316
	O-ring:	EPDM
Light source	Incandescent lamp	
	Lamp life:	10,000 hours typical
Detectors	VIS/NIR enhanced silicon detectors, hermetically sealed	
Filters	NIR or broadband filter integrated in detector	

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