TI01522C/07/EN/04.25-00
71717084
2025-07-29

Technical Information
Memosens Wave CAS80E

Spectrometer for water analysis

Application

Memosens Wave CAS80E is a spectrometer for the measurement of a variety of parameters: SAC, spectral attenuation coefficient, TOCeq, CODeq, BODeq, turbidity (TU/TSS), nitrate (NO3-N, NO3), APHA Hazen color. The spectrometer ensures reliable measurements and efficient process monitoring in the following areas:

- Drinking water
- Wastewater
- Surface water

Your benefits

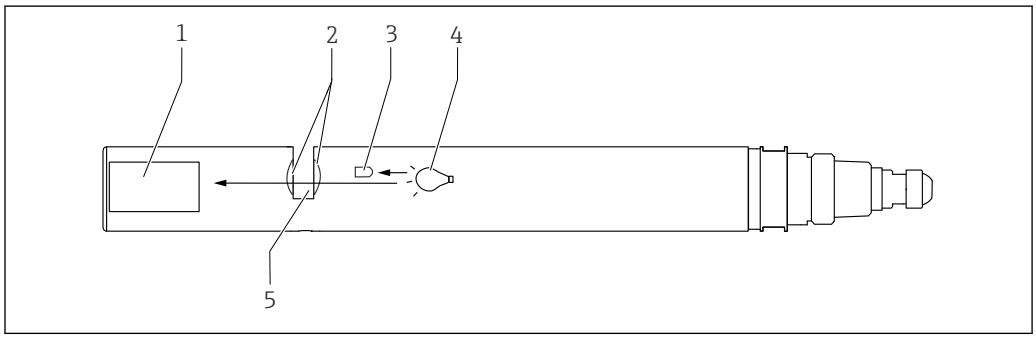
- Optimally adapted to process conditions
- 3 different optical path lengths
- Titanium version for demanding applications
- Sapphire window for a longer operating life
- Data conditioning in the spectrometer:
  - Minimum sensitivity to interference during signal transmission
  - Short response time
- Early, continuous detection of load peaks without delay
- Out of the box and ready to go: standardized communication (Memosens technology) enables "plug and play"
- Long maintenance intervals by using compressed air or mechanical cleaning
- Application-specific and customer calibrations - in the laboratory or at place of installation

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

The spectrometer consists of the following modules:
- Power supply
- High-voltage generation for the strobe lamp
- Xenon strobe lamp
- Monitor diode
- Measurement gap
- Spectrometer: UV-VIS 200 to 800 nm
- Microcontroller

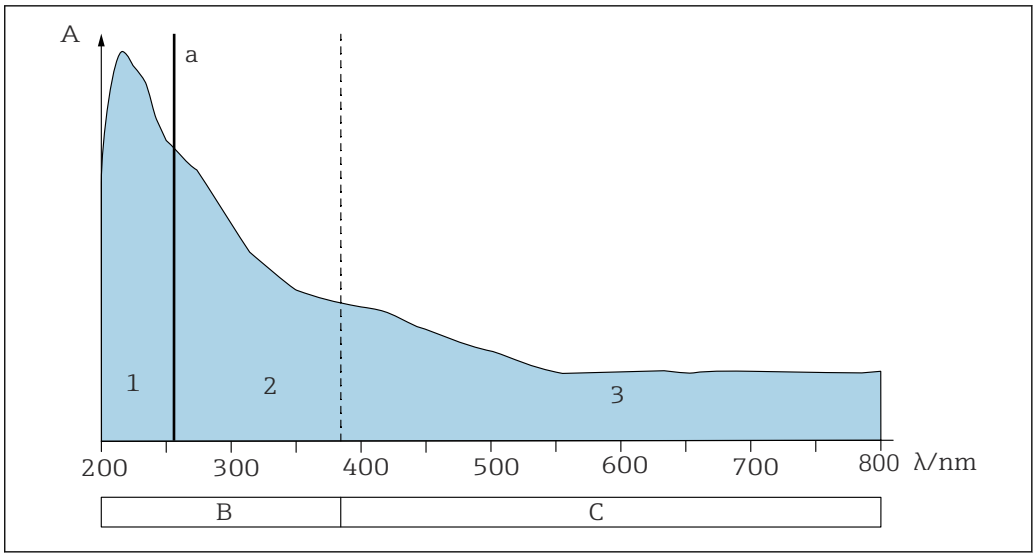


1 Product design

1 Spectrometer module
2 Lens
3 Monitor diode
4 Light source
5 Measurement gap

A light source sends a beam of light through the medium via the lenses. The medium under analysis is located in the measurement gap. In the spectrometer module, the beam of light is converted to electrical, measurable signals. A two-beam principle with compensation for lamp changes is applied → 1, 2.

The spectrometer uses the substance-specific absorption of electromagnetic radiation to indicate the measurement parameters from the recorded spectrum.



2 *Ranges of parameters in the absorption spectrum*

λ Wavelength range
A Absorption
B Ultraviolet light (UV)
C Visible light (VIS)
a 254 nm, SAC, SSK
1 Nitrate
2 Sum parameters BODeq, CODeq, TOCeq, DOCeq
3 Color, turbidity, TSS

A specific absorption spectrum can be assigned to every molecule. By comparing a zero spectrum I_0 determined previously in ultrapure water and the measuring spectrum with the intensity I, the absorption A can be calculated as follows:

$A = -\log_{10} (I/I_0) = \varepsilon \cdot c \cdot d$

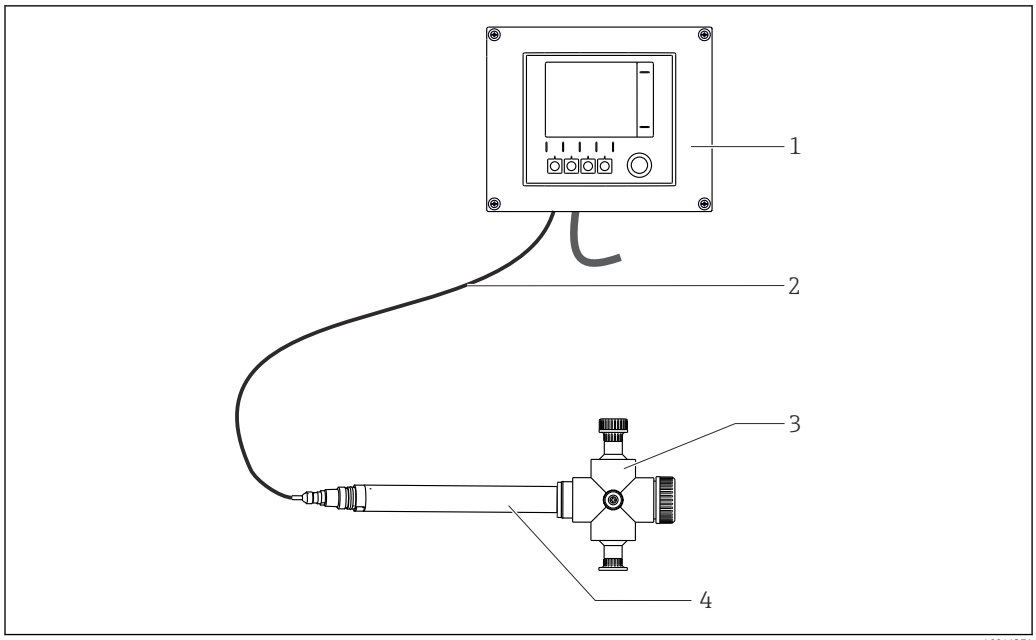
The absorption A depends directly on the concentration c, the optical path length d and the extinction coefficient ε.

Analytical models programmed into the spectrometer calculate the concentration of the parameters from the absorption spectra. These analytical models have been determined by correlating known parameter concentrations with their related absorption spectra.

The calculation uses the same wavelengths to determine different parameters. This results in what are termed "cross-sensitivities". For example, if turbidity increases less light is detected when determining the chemical oxygen demand (COD).

Measuring system

The complete measuring system comprises at least:
- Memosens Wave CAS80E spectrometer
- Liquiline CM44x transmitter
- Assembly, e.g. Flowfit CYA251 flow assembly



3 Example of a measuring system

1 Liquiline CM44x transmitter
2 Fixed cable
3 CYA251 assembly
4 Memosens Wave CAS80E spectrometer

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
  - Number of calibrations
  - Serial number of the transmitter used to perform the last calibration or adjustment
- Operating data
  - Temperature application range
  - Date of initial commissioning

Reliability

Dependability

Easy handling
Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total hours of operation or hours of operating 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.
- Precalibrated sensors can be replaced quickly and easily, resulting in a noticeable 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 on external data carriers and evaluation programs.
- Thus, the current application of the sensor can be determined depending on its previous history.

Input

Measured variable

- CODeq [1] (mg/l)
- BODeq (mg/l)
- TOCeq (mg/l)
- TSS (mg/l)
- TU (FAU)
- APHA Hazen [2] (TU compensated/True Color or TU uncompensated/Apparent Color)
- SAC [3] (1/m)
- SSK [4] (1/m)
- Nitrate NO3-N (mg/l)
- Nitrate NO3 (mg/l)

Measuring range

The measuring range that can actually be achieved can depend on the composition of the water matrix and the application. The data apply to homogeneous media.

The selection of the optimal optical measuring path length is based on the measuring ranges of the respective parameters. A longer measuring path length results in a smaller measuring range (measurement at low concentrations) and low limits of quantification and detection. A shorter measuring path length results in a larger measuring range (measurement at high concentrations) and higher limits of quantification and detection.

1) eq = equivalent
2) According to US Standard Methods 2120C (Single Wavelength Method) 23. Edition
3) Spectral absorption coefficient$_{SAK_254}$ according to DIN ISO 38404-3
4) Spectral attenuation coefficient$_{SSK_254}$ according to DIN ISO 38404-3

Wastewater treatment plant inlet

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
TSS	0 to 10 000 mg/l	0 to 2 000 mg/l	0 to 400 mg/l
SAC	0 to 1 000 1/m	0 to 200 1/m	0 to 40 1/m
CODeq	0 to 20 000 mg/l	0 to 4 000 mg/l	0 to 800 mg/l
TOCeq	0 to 8 000 mg/l	0 to 1 600 mg/l	0 to 320 mg/l
BODeq	0 to 5 000 mg/l	0 to 1 000 mg/l	0 to 200 mg/l

Wastewater treatment plant outlet

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	0 to 4 000 FAU	0 to 800 FAU	0 to 160 FAU
TSS	0 to 5 000 mg/l	0 to 1 000 mg/l	0 to 200 mg/l
SAC	0 to 1 000 1/m	0 to 200 1/m	0 to 40 1/m
CODeq	0 to 3 000 mg/l	0 to 600 mg/l	0 to 120 mg/l
TOCeq	0 to 1 200 mg/l	0 to 240 mg/l	0 to 48 mg/l
BODeq	0 to 450 mg/l	0 to 90 mg/l	0 to 18 mg/l
Nitrate NO3-N	0 to 1 000 mg/l	0 to 200 mg/l	0 to 40 mg/l
APHA Hazen true	0 to 12 500 Hazen [1)]	0 to 2 500 Hazen [1)]	0 to 500 Hazen
APHA Hazen apparent	0 to 12 500 Hazen [1)]	0 to 2 500 Hazen [1)]	0 to 500 Hazen

1) A minimum path length of 25 mm (0.98 in) is required in US Standard Methods 2120C (Single Wavelength Method) 23rd Edition

Drinking water

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	0 to 4 000 FAU	0 to 800 FAU	0 to 160 FAU
TSS	0 to 5 000 mg/l	0 to 1 000 mg/l	0 to 200 mg/l
SAC	0 to 1 000 1/m	0 to 200 1/m	0 to 40 1/m
SSK	0 to 1 000 1/m	0 to 200 1/m	0 to 40 1/m
TOCeq	0 to 2 000 mg/l	0 to 400 mg/l	0 to 80 mg/l
Nitrate NO3-N	0 to 1 000 mg/l	0 to 200 mg/l	0 to 40 mg/l
Nitrate NO3	0 to 4 000 mg/l	0 to 800 mg/l	0 to 160 mg/l
APHA Hazen true	0 to 12 500 Hazen [1)]	0 to 2 500 Hazen [1)]	0 to 500 Hazen
APHA Hazen apparent	0 to 12 500 Hazen [1)]	0 to 2 500 Hazen [1)]	0 to 500 Hazen

1) A minimum path length of 25 mm (0.98 in) is required in US Standard Methods 2120C (Single Wavelength Method) 23rd edition

Surface water

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	0 to 4 000 FAU	0 to 800 FAU	0 to 160 FAU
TSS	0 to 5 000 mg/l	0 to 1 000 mg/l	0 to 200 mg/l

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
SAC	0 to 1000 1/m	0 to 200 1/m	0 to 40 1/m
CODeq	0 to 5000 mg/l	0 to 1000 mg/l	0 to 200 mg/l
BODeq	0 to 750 mg/l	0 to 150 mg/l	0 to 30 mg/l
Nitrate NO3-N	0 to 1000 mg/l	0 to 200 mg/l	0 to 40 mg/l

Industrial wastewater

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
TSS	0 to 10000 mg/l	0 to 2000 mg/l	0 to 400 mg/l
SAC	0 to 1000 1/m	0 to 200 1/m	0 to 40 1/m
CODeq	0 to 20000 mg/l	0 to 4000 mg/l	0 to 800 mg/l
TOCeq	0 to 8000 mg/l	0 to 1600 mg/l	0 to 320 mg/l
BODeq	0 to 5000 mg/l	0 to 1000 mg/l	0 to 200 mg/l

Power supply

Power consumption

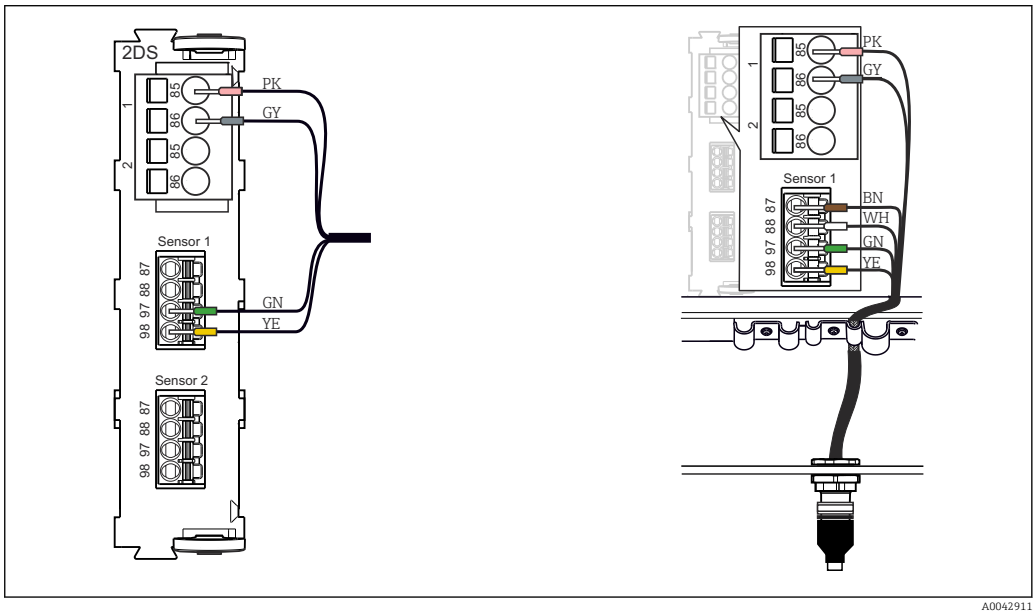
24V DC (-15 %/+ 20 %), 5 watt

Overvoltage protection

Overvoltage category 1

Electrical connection

The following connection options are available:
- Via M12 plug (version: fixed cable, M12 plug)
- Via the cable of the spectrometer to the plug-in terminals of a transmitter input (version: fixed cable, wire end ferrules)



4 *Spectrometer connection to input (left) or via M12 plug (right)*

The maximum cable length is 100 m (328.1 ft).

Performance characteristics

Reference operating conditions

20 °C (68 °F), 1013 hPa (15 psi)

Maximum measurement error

The maximum measurement error, defined in accordance with ISO 15839, was determined using standard solutions (nitrate or KHP) under laboratory conditions [5]:
- NO3-N: ≤ 3 % of the measured value
- COD: ≤ 3 % of the measured value

Long-term drift

The drift over 100 days is less than the limit of quantification multiplied by factor k. See the following table for factor k:

Measured variable	Factor k
TSS (Wastewater treatment plant inlet)	1.1
TSS (Wastewater treatment plant outlet, drinking water, surface water)	1
SAC	1
CODeq	1
TOCeq	1
BODeq	1
Turbidity	1
Nitrate NO3-N	1
APHA Hazen true	1
APHA Hazen apparent	1.5
SSK	2
Nitrate NO3	1

Limit of detection

The limits of detection were determined for the individual measured variables in ultrapure water under laboratory conditions based on DIN ISO 15839.

Wastewater treatment plant inlet

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
TSS	20 mg/l	4 mg/l	0.8 mg/l
SAC	1 1/m	0.2 1/m	0.04 1/m
CODeq	10 mg/l	2 mg/l	0.4 mg/l
TOCeq	4 mg/l	0.8 mg/l	0.16 mg/l
BODeq	2.5 mg/l	0.5 mg/l	0.1 mg/l

Wastewater treatment plant outlet

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	12.5 FAU	2.5 FAU	0.5 FAU
TSS	11.5 mg/l	2.3 mg/l	0.46 mg/l
SAC	1 1/m	0.2 1/m	0.04 1/m
CODeq	2 mg/l	0.4 mg/l	0.08 mg/l

5) 24 °C (75.2 °F), 1 bar, using a laboratory model

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
TOCeq	1 mg/l	0.2 mg/l	0.04 mg/l
BODeq	0.5 mg/l	0.1 mg/l	0.02 mg/l
Nitrate NO3-N	1 mg/l	0.2 mg/l	0.04 mg/l
APHA Hazen true	62.5 Hazen [1)]	12.5 Hazen [1)]	2.5 Hazen
APHA Hazen apparent	62.5 Hazen [1)]	12.5 Hazen [1)]	2.5 Hazen

1) A minimum path length of 25 mm (0.98 in) is required in US Standard Methods 2120C (Single Wavelength Method) 23rd edition

Drinking water

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	12.5 FAU	2.5 FAU	0.5 FAU
TSS	11.5 mg/l	2.3 mg/l	0.46 mg/l
SAC	1 1/m	0.2 1/m	0.04 1/m
SSK	1 1/m	0.2 1/m	0.04 1/m
TOCeq	1 mg/l	0.2 mg/l	0.04 mg/l
Nitrate NO3-N	1 mg/l	0.2 mg/l	0.04 mg/l
Nitrate NO3	4.5 mg/l	1 mg/l	0.2 mg/l
APHA Hazen true	62.5 Hazen [1)]	12.5 Hazen [1)]	2.5 Hazen
APHA Hazen apparent	62.5 Hazen [1)]	12.5 Hazen [1)]	2.5 Hazen

1) A minimum path length of 25 mm (0.98 in) is required in US Standard Methods 2120C (Single Wavelength Method) 23rd edition

Surface water

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	12.5 FAU	2.5 FAU	0.5 FAU
TSS	11.5 mg/l	2.3 mg/l	0.46 mg/l
SAC	1 1/m	0.2 1/m	0.04 1/m
CODeq	2 mg/l	0.4 mg/l	0.08 mg/l
BODeq	0.5 mg/l	0.1 mg/l	0.02 mg/l
Nitrate NO3-N	1 mg/l	0.2 mg/l	0.04 mg/l

Limit of quantification

The limits of quantification were determined for the individual measured variables in ultrapure water under laboratory conditions based on DIN ISO 15839.

Wastewater treatment plant inlet

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
TSS	66.7 mg/l	13.3 mg/l	2.7 mg/l
SAC	3.5 1/m	0.7 1/m	0.15 1/m
CODeq	33.3 mg/l	6.7 mg/l	1.35 mg/l

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
TOCeq	13.3 mg/l	2.7 mg/l	0.55 mg/l
BODeq	8.3 mg/l	1.7 mg/l	0.35 mg/l

Wastewater treatment plant outlet

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	42.5 FAU	8.5 FAU	1.7 FAU
TSS	37.5 mg/l	7.5 mg/l	1.5 mg/l
SAC	3.5 1/m	0.7 1/m	0.15 1/m
CODeq	7.5 mg/l	1.5 mg/l	0.3 mg/l
TOCeq	3.25 mg/l	0.75 mg/l	0.15 mg/l
BODeq	1 mg/l	0.2 mg/l	0.04 mg/l
Nitrate NO3-N	3.5 mg/l	0.7 mg/l	0.15 mg/l
APHA Hazen true	167.5 Hazen [1)]	33.5 Hazen [1)]	6.7 Hazen
APHA Hazen apparent	167.5 Hazen [1)]	33.5 Hazen [1)]	6.7 Hazen

1) A minimum path length of 25 mm (0.98 in) is required in US Standard Methods 2120C (Single Wavelength Method) 23rd edition

Drinking water

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	42.5 FAU	8.5 FAU	1.7 FAU
TSS	37.5 mg/l	7.5 mg/l	1.5 mg/l
SAC	3.5 1/m	0.7 1/m	0.15 1/m
SSK	3.5 1/m	0.7 1/m	0.15 1/m
TOCeq	3.25 mg/l	0.75 mg/l	0.15 mg/l
Nitrate NO3-N	3.5 mg/l	0.7 mg/l	0.15 mg/l
Nitrate NO3	14.8 mg/l	3 mg/l	0.6 mg/l
APHA Hazen true	167.5 Hazen [1)]	33.5 Hazen [1)]	6.7 Hazen
APHA Hazen apparent	167.5 Hazen [1)]	33.5 Hazen [1)]	6.7 Hazen

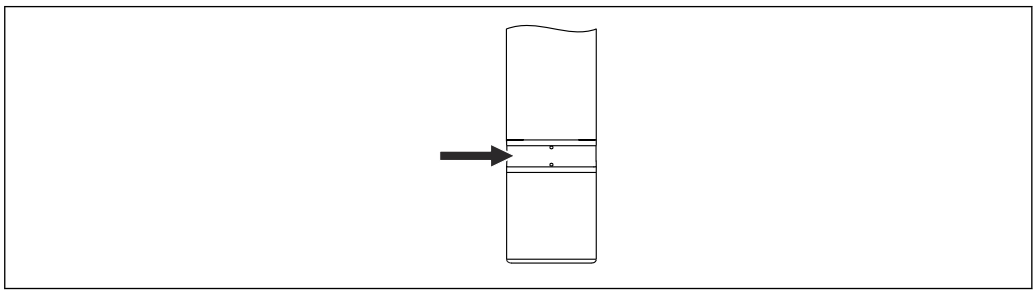
1) A minimum path length of 25 mm (0.98 in) is required in US Standard Methods 2120C (Single Wavelength Method) 23rd edition

Surface water

Measured variable	2 mm (0.08 in) gap	10 mm (0.4 in) gap	50 mm (1.97 in) gap
Turbidity	42.5 FAU	8.5 FAU	1.7 FAU
TSS	37.5 mg/l	7.5 mg/l	1.5 mg/l
SAC	3.5 1/m	0.7 1/m	0.15 1/m
CODeq	7.5 mg/l	1.5 mg/l	0.3 mg/l
BODeq	1 mg/l	0.2 mg/l	0.04 mg/l
Nitrate NO3-N	3.5 mg/l	0.7 mg/l	0.15 mg/l

Installation

Orientation



5 *Alignment, arrow points in the flow direction*

When aligning the spectrometer, pay attention to the following:
- The measurement gap is rinsed by the flow of medium
- Air bubbles can be rinsed away properly

Installation instructions

1. Do not install the device in places where air pockets and foam bubbles form.
2. Choose a mounting location that can be easily accessed at a later stage.
3. Ensure that upright posts and assemblies are fully secured and vibration-free.
4. Align the device so that the measurement gap is rinsed by the flow of medium.

To ensure correct measurement, the windows at the measurement gap must be free from any sedimentation. Compressed air or mechanical cleaning units (accessories) ensure that the windows remain free of deposits.

For horizontal orientations:

▶ Mount the spectrometer in such a way that air bubbles can escape from the measurement gap (do not point it downwards).

Environment

Ambient temperature range	–20 to 60 °C (–4 to 140 °F)
Storage temperature	–20 to 70 °C (–4 to 158 °F)
Relative humidity	Humidity 0 to 100 %
Operating height	3 000 m (9 842.5 ft) maximum
Degree of protection	▪ IP 68 (1.83 m (6 ft) water column over 24 hours, 1 mol/l KCl) ▪ Type 6P (for housing material 1.4404/1.4571)
Fouling	Degree of fouling 2 (micro environment)
Environmental conditions	For use in indoor and outdoor areas

Process

Process temperature range	0 to 50 °C (32 to 122 °F)

Process pressure range

0.5 to 10 bar (7.3 to 145 psi) (absolute)

Flow limit

Minimum flow

No minimum flow required.

For media that have a tendency to form deposits, ensure that the medium is mixed sufficiently.

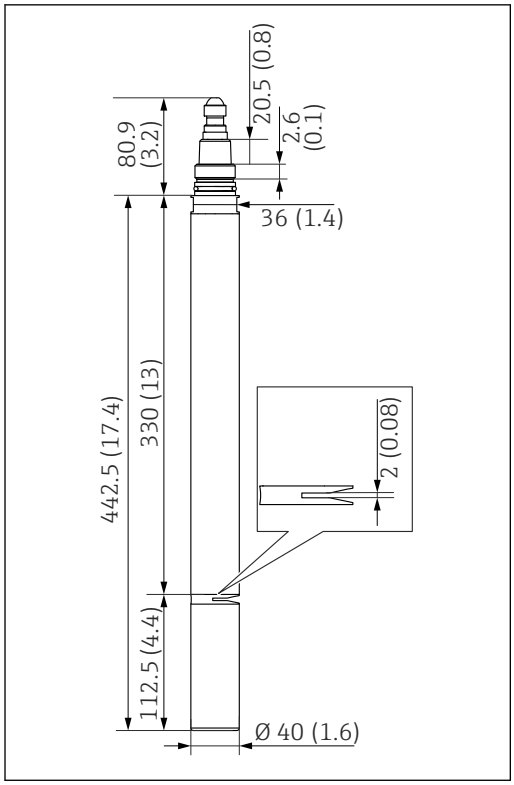
Mechanical construction

Design, dimensions

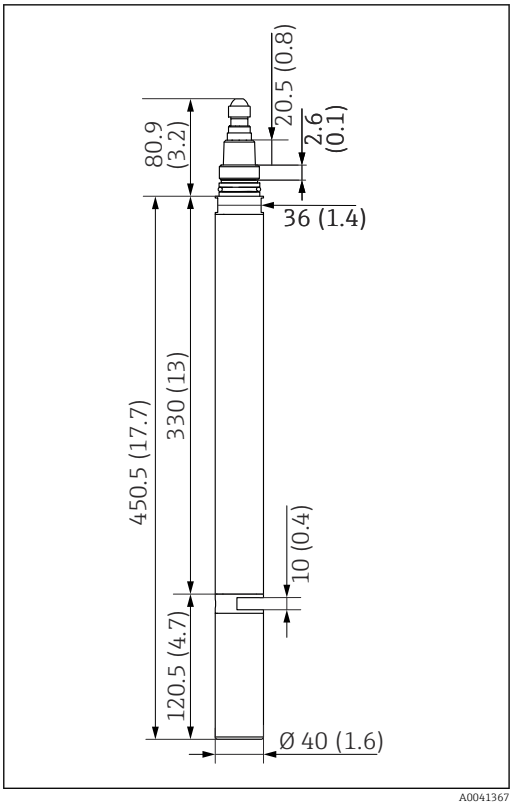
Measurement gap with 3 optical path lengths:
- 2 mm (0.08 in)
- 10 mm (0.4 in)
- 50 mm (1.97 in)

Spectrometers with 1 mm (0.04 in) and 100 mm (3.9 in) optical path lengths are available on request.

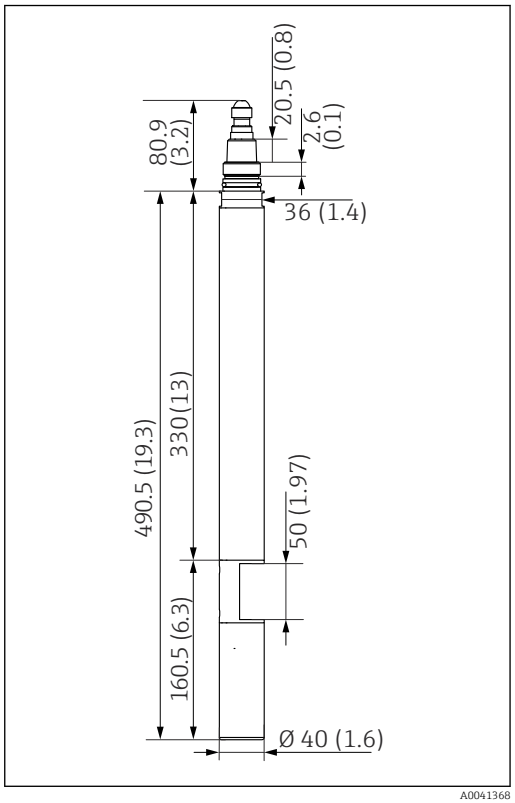
Dimensions



6 *Dimensions of spectrometer with 2 mm (0.08 in) optical path length. Unit: mm (in)*



7 *Dimensions of spectrometer with 10 mm (0.4 in) optical path length. Unit: mm (in)*



8 Dimensions of spectrometer with 50 mm (1.97 in) optical path length. Unit: mm (in)

Weight	1.6 kg (3.5 lb), without cables	
Materials	**Wetted materials**	
	Housing:	Stainless steel 1.4404 / AISI 316L and 1.4571 / AISI 316Ti or titanium 3.7035
	Optical windows:	Quartz glass or sapphire
	O-rings:	EPDM
Process connections	G1 and NPT ¾"	

Certificates and approvals

Current certificates and approvals for the product are available at 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**.

Device safety

- EN IEC 61010-1
- CAN/US General Purpose

Other certificates and declarations

The following test results, certificates and declarations (e.g. hygiene compliance) are available for the product depending on the order version selected:

Drinking Water Directive (EU) 2020/2184

Ordering information

Scope of delivery

The delivery comprises:
- Spectrometer, version as ordered
- Cleaning brush (x 2)
- 32GB SD card for data logging
- Operating Instructions

Product page

www.endress.com/cas80e

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.

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.

Device-specific accessories

Assemblies

Flexdip CYA112
- Immersion assembly for water and wastewater
- Modular assembly system for sensors in open basins, channels and tanks
- Material: PVC or stainless steel
- Product Configurator on the product page: www.endress.com/cya112

Technical Information TI00432C

Flowfit CYA251
- Connection: See product structure
- Material: PVC-U
- Product Configurator on the product page: www.endress.com/cya251

Technical Information TI00495C

CAV01
- Flow assembly
- Material: POM-C
- Product Configurator on the product page: www.endress.com/cav01

Technical Information TI01797C

Holder

Flexdip CYH112
- Modular holder system for sensors and assemblies in open basins, channels and tanks
- For Flexdip CYA112 water and wastewater assemblies
- Can be affixed anywhere: on the ground, on the coping stone, on the wall or directly onto railings.
- Stainless steel version
- Product Configurator on the product page: www.endress.com/cyh112

Technical Information TI00430C

Cleaning

CYR51 mechanical cleaning
- Sensors immersed in liquid can be cleaned directly in the basin or vessel.
- The mechanical cleaning unit is clipped onto the sensor and secured.
- Product Configurator on the product page: www.endress.com/cyr51

Technical Information TI01821C

Manual cleaning
- Cleaning brushes to clean the measurement gap (for all gap sizes)
- Order number: 71485097

Compressed air cleaning
- Connection: 6 mm (0.24 in) or 8 mm (0.31 in) (metric) or 6.35 mm (0.25 in)
- Optical path length 2 mm (0.08 in) or 10 mm (0.4 in):
  - 6 mm (0.24 in) (with 300 mm (11.81 in) hose and 8 mm (0.31) adapter)
    Order number: 71485094
  - 6.35 mm (0.25 in)
    Order number: 71485096
- Optical path length 50 mm (1.97 in):
  - 6 mm (0.24 in) (with 300 mm (11.81 in) hose and 8 mm (0.31) adapter)
    Order number: 71485091
  - 6.35 mm (0.25 in)
    Order number: 71485093

Compressor
- For compressed air cleaning
- 115 V AC, order number: 71194623

Additional accessories

Sensor adapter CYA251 for CAS80E
Order number: 71475982

Spray nozzle for CAS80E with optical path length 2 mm (0.08 in) or 10 mm (0.4 in)
- Material: stainless steel
- Order number: 71144328

Spray nozzle for CAS80E with optical path length 50 mm (1.97 in)
- Material: PVC
- Order number: 71144330

32GB SD card
Order number: 71467522

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