



Technical Information

Memosens Wave CKI50

Process spectrometer for the measurement of color



Application

The process spectrometer is used for the in-line analysis of liquids. It is used to detect color using VIS spectroscopy (VIS = visible). The device can measure and determine color, color variations or the accuracy of the color in liquids.

Your benefits

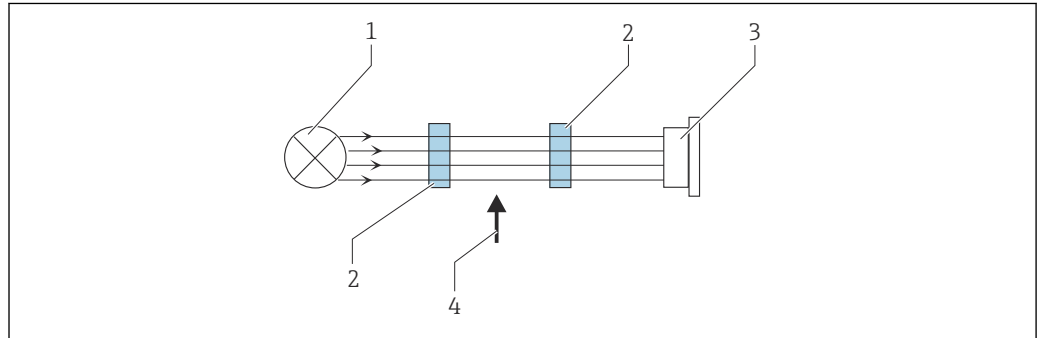
- Integrated data models and methods
- Simple process integration with the process connection
- Optimum adaptation to process conditions, even in hygienic environments
- In-line measurements in real time
- Robust version for industrial use

Function and system design

Measuring principle

The process spectrometer uses optical signals to analyze the medium. Information about the medium is then output as measurement parameters. The transmitter displays the measurement parameters. These are used to monitor or directly control a process.

The process spectrometer measures the portion of the sample that is located in the measurement gap of the measuring head. The sample is illuminated with light and an interaction takes place between the sample and the introduced light. The transmitted light is collected again via the observation window and analyzed in the electronics unit. The spectrum of the collected light is then analyzed and the corresponding measurement parameter is calculated.



1 Absorption measurement

- 1 Light source
- 2 Optical windows
- 3 Detector
- 4 Direction of medium flow

A light source sends a beam of light through the medium via the optical windows. The incident light beam is measured on the detector side → 1, 2.

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:

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

A	Absorption
I	Intensity of received light at detector
I ₀	Intensity of transmitted light of light source
ε	Extinction coefficient
c	Concentration
OPL	Optical path length

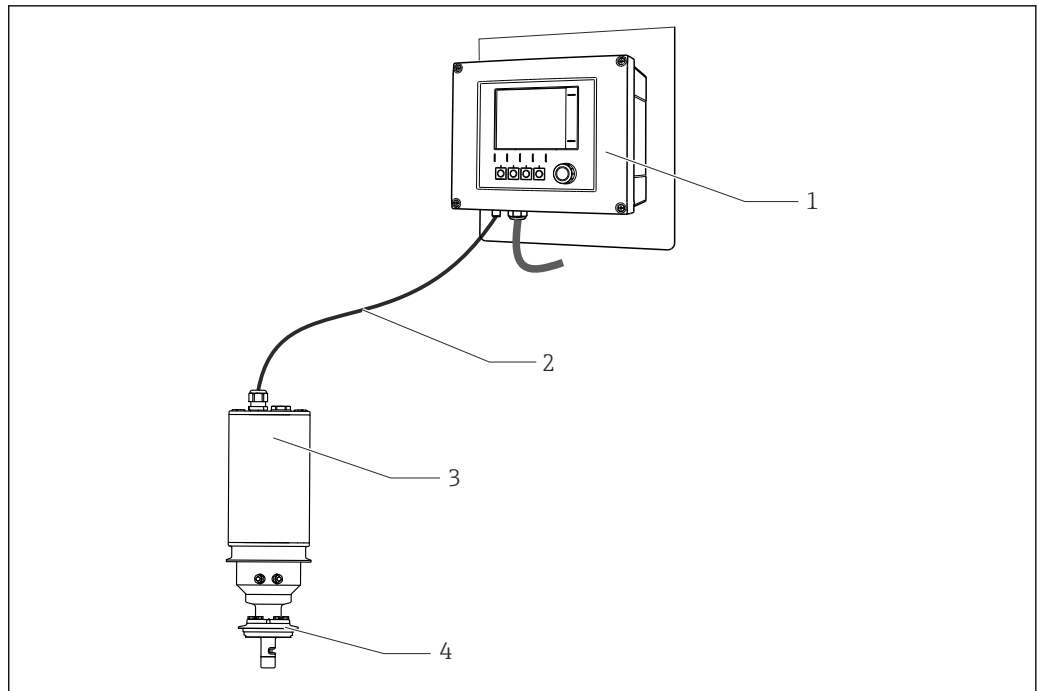
Measuring system

The complete measuring system comprises at least:

- Process spectrometer CKI50
- Liquiline CM44P transmitter
- Process connection Varivent N DN50 - 125 immersion depth 68 mm (2.7 in) (included in the delivery)



Pay attention to the specifications for the process connection Varivent N DN50 - 125.



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2 Example of a measuring system with a process spectrometer

- 1 Liquiline CM44P transmitter
- 2 Fixed cable (15 m (49.2 ft))
- 3 Process spectrometer CKI50
- 4 Process connection

Communication and data processing

Communication with the transmitter

Always connect digital sensors with Memosens technology to a transmitter with Memosens technology.

i 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
- Operating data
 - Temperature application range
 - Date of initial commissioning

Reliability

Ease of maintenance

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

Data security thanks to digital data transmission

Memosens technology digitizes the measured values in the sensor and transmits the data to the transmitter via a non-contact connection that is free from potential interference. The result:

- Automatic error message if sensor fails or connection between sensor and transmitter is interrupted
- Immediate error detection increases measuring point availability

Input

Measured variable

CIE $L^*a^*b^*$ ¹⁾, observer 2°, illuminant D65, as per DIN EN ISO 11664-4

CIE $L^*a^*b^*$ is a device-independent color space consisting of 3 color values:

- L^* lightness axis
Specified operational range: 0 to 100
- a^* green-red axis
Specified operational range: -150 to 100
- b^* yellow-blue axis
Specified operational range: -100 to 150

Measuring range

Application	Specified operational range
Halogen wavelength range	380 to 830 nm
CIE $L^*a^*b^*$	$L^* = 0$ to 100 $a^* = -150$ to 100 $b^* = -100$ to 150

Energy supply

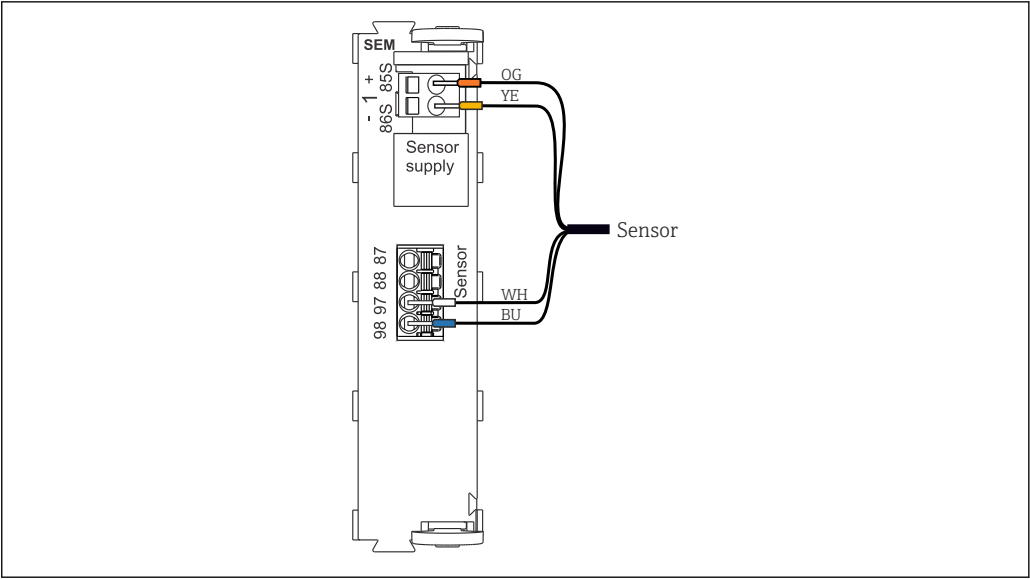
Electrical connection

Connecting the device

The device can be connected as follows:

Via the cable of the process spectrometer to the plug-in terminals of an input on the transmitter (version: fixed cable, end sleeves)

1) $L^*a^*b^*$ color model defined by the International Commission of Illumination



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3 Connection of the process spectrometer to the input

The cable length is 15 m (49.2 ft).

Performance characteristics

Reference conditions 25 °C (77 °F), 1013 hPa (15 psi), heat-up time 5 hours

Repeatability	Repeatability	
	Specified operational range	Repeatability
L*	0 to 100	< 0.1 % of the span of the specified operational range ¹⁾
a*	-150 to 100	
b*	-100 to 150	

1) Measured according to DIN ISO 15839 with liquid color solutions in the range L* from 60 to 100, a* from -47 to 85; b* from -44 to 98

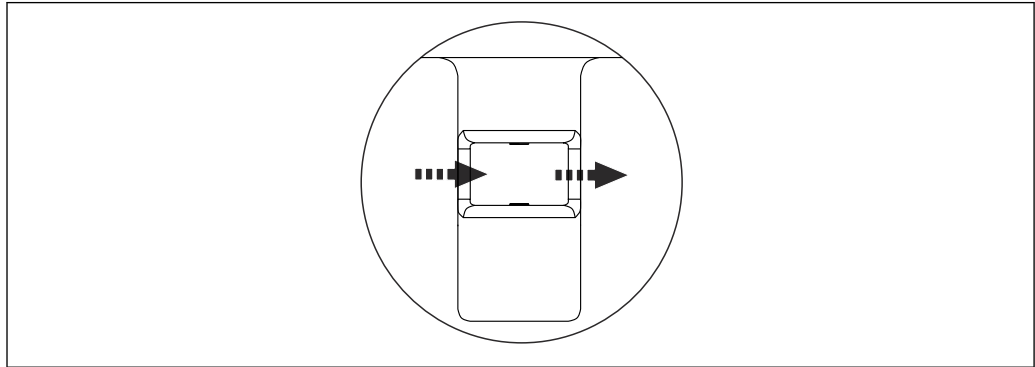
Long-term reliability	Drift per 24h	
	Specified operational range	Drift per 24h
L*	0 to 100	< 0.03 % of the span of the specified operational range ¹⁾
a*	-150 to 100	
b*	-100 to 150	

1) Measured according to DIN ISO 15839 with liquid color solutions in the range L* from 60 to 100, a* from -47 to 85; b* from -44 to 98

Regular referencing ensures the drift is largely compensated.

Mounting the device

Orientation



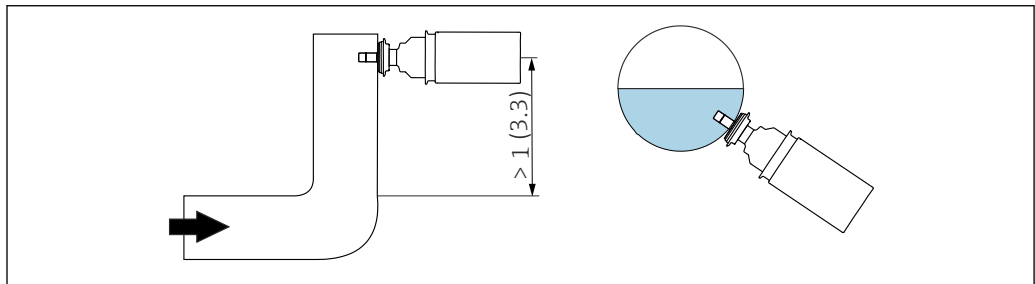
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4 Flow direction of the medium (arrows)

- Align the device in such a way that the medium flows through the measurement gap.

i To align the device, pay attention to the orientation and the installation marking on the process connection → 7, 7.

Orientation in pipes

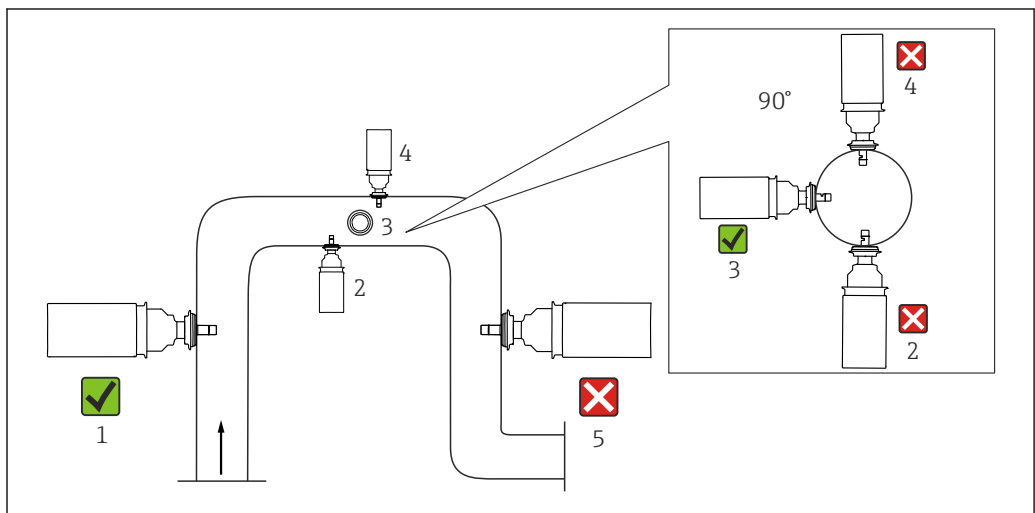


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5 Orientation of process spectrometer and flow direction (arrows). Engineering unit: m (ft)

Changes in the flow direction after pipe bends can cause turbulence in the medium.

The distance between the process spectrometer and a pipe bend must be at least 1 m (3.28 ft).

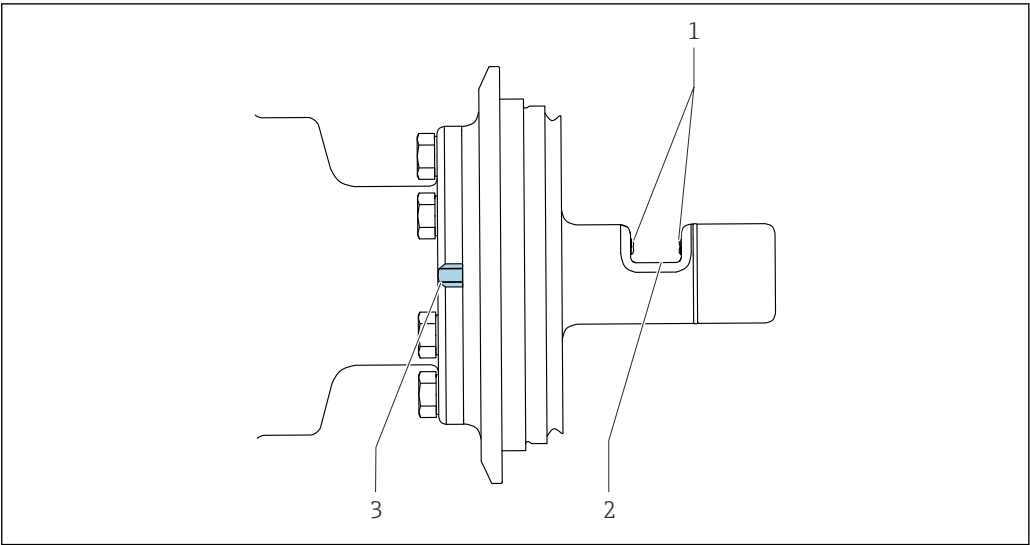


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6 Permitted and forbidden orientations in a pipe

The best installation location is in the ascending pipe (item 1).

Installation marking



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 7 Installation marking for alignment

- 1 Optical windows
- 2 Measurement gap
- 3 Installation marking

The installation markings are located on both sides of the process connection.

- Align the process spectrometer so that the installation markings follow the flow direction.

Installation instructions

- Choose a mounting location that can be easily accessed at a later stage. Installation in a bypass is particularly suitable for this.
- Install the device upstream from the pressure regulators. The operation of the device under pressure helps prevent the formation of air or gas bubbles.
- Install the device in places with uniform flow conditions.
- Install the device in places with low vibration.
- Do not install the process spectrometer in places where air may collect and foam bubbles form or where suspended particles may settle.
- Align the device so that the measurement gap is rinsed by the flow of medium.
- Install the device so that it can be cleaned in the process.

Environment

Ambient temperature range	–20 to 45 °C (–4 to 113 °F) The temperature displayed can deviate significantly from the temperature of the medium due to the ambient conditions and the internal heating of the process spectrometer.
Storage temperature	–20 to 70 °C (–4 to 158 °F)
Degree of protection	■ IP 69 ■ NEMA 6P (1.8 m (5.9 ft) water column over 24 hours, 1 mol/l KCl)
Electromagnetic compatibility (EMC)	Interference emission and interference immunity according to: ■ EN 61326-1:2013 ■ EN 61326-2-3:2013 ■ NAMUR NE21: 2012

Process

Process temperature range

–20 to 60 °C (–4 to 140 °F)

60 to 140 °C (140 to 284 °F) with water cooling



The process spectrometer must be cooled depending on the duration of operation and the ambient temperature → 8.

NOTICE

The process spectrometer can be permanently damaged at process temperatures of 60 °C (140 °F) and higher without cooling!

- Ensure the device is sufficiently cooled at process temperatures of 60 °C (140 °F) and higher.

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.

Thermal insulation

Water cooling

Recommended flow	10 l/h (2.64 gal/h)
Recommended inlet temperature	20 °C (68 °F)
Pressure	Maximum 2 bar (29 psi)
Connection	Male thread M6
Coolant	Water



The use of any coolant other than water is not recommended.

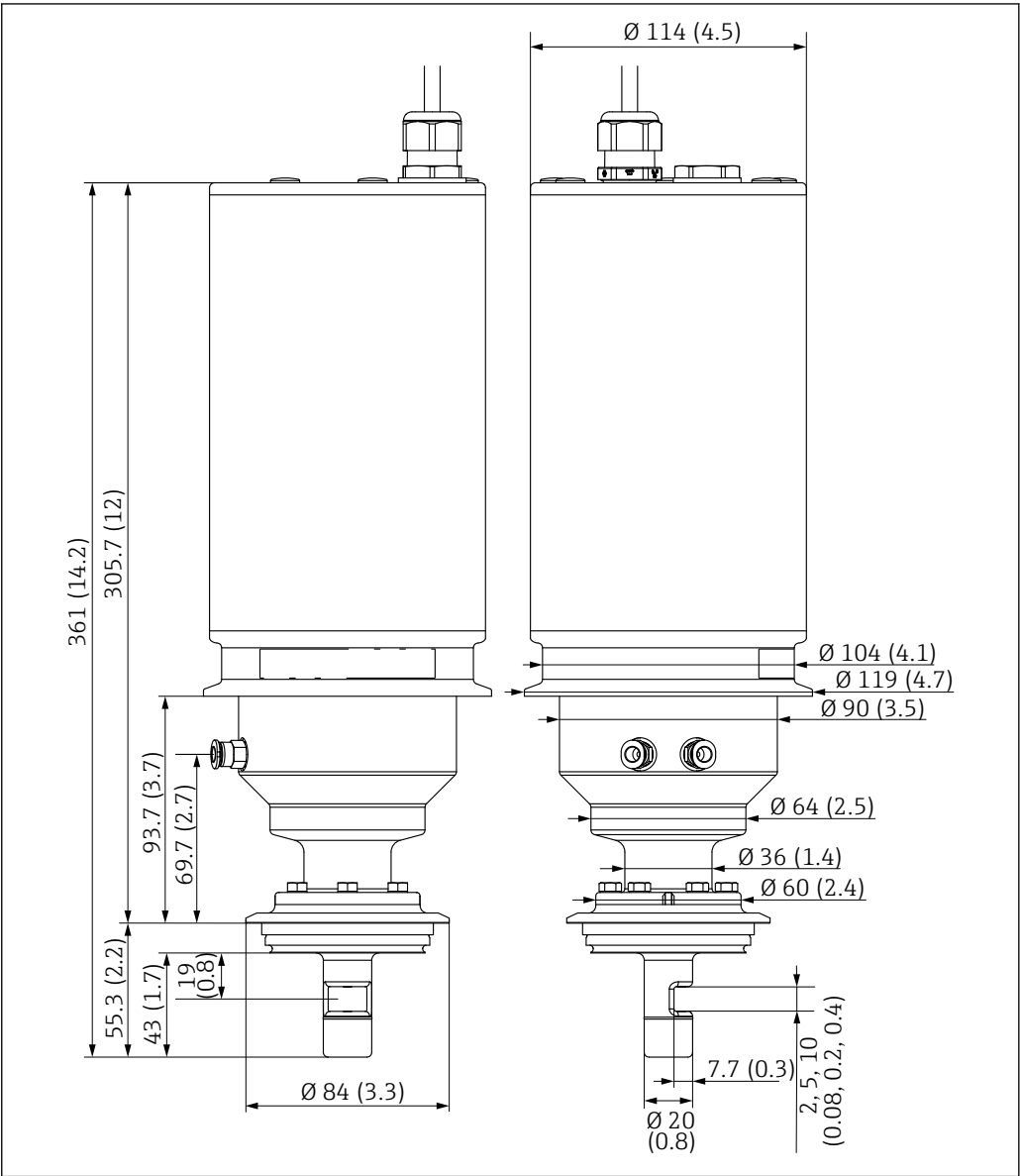
Mechanical construction

Design, dimensions

Measurement gap with 3 different gap widths:

- 2 mm (0.08 in)
- 5 mm (0.2 in)
- 10 mm (0.4 in)

Dimensions



8 Dimensions of CKI50. Dimensions: mm (in)

Weight

With a cable length of 15 m (49.2 ft) with clamp:
7.9 kg (17.4 lb)

Materials

Materials in contact with the medium

Measuring head: 1.4404/AISI316L
Window: Sapphire
O-rings: FFKM
Gasket seal: PEEK

Materials not in contact with the medium

Housing: 1.4404/AISI316L

Process connections

Varivent N DN50 - 125 immersion depth 68 mm (2.7 in)

Certificates and approvals

The following is a list of all relevant certificates and approvals at the time of issuing this document.

► For the latest information, see our product page →  10.

CE mark	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.
Ex-approval	ATEX II 1/2G Ex ia op is/db [ia Ga] IIC T6...T3 Ga/Gb IECEX II 1/2G Ex ia op is/db [ia Ga] IIC T6...T3 Ga/Gb UKEx II 1/2G Ex ia op is/db [ia Ga] IIC T6...T3 Ga/Gb
Hygienic compatibility	3-A Standard Certified according to 3-A Standard 74- ("3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Milk and Milk Products Equipment"). FDA All materials in contact with the product are listed with the FDA. EHEDG Certified cleanability according to EHEDG Type EL Class 1.  When using in hygienic applications, please note that the cleanability of a sensor also depends on the way the sensor is installed. For installation in a pipe, use the EHEDG-certified flow vessels that are suitable for the particular process connection. Regulation EC 1935/2004 The sensor meets the requirements of EC Regulation No. 1935/2004 on materials and articles intended to come into contact with food.
Additional certification	ADI-free No materials or ingredients derived from animals are used during the entire production of all the parts in contact with the process.

Order information

Scope of delivery	The scope of delivery comprises: ■ 1 process spectrometer, version as ordered ■ 1 USB stick ■ 1 x Operating Instructions ■ Safety instructions for hazardous areas (for devices with hazardous area approval)
Product page	www.endress.com/cki50
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.



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