

Technical Information

Turbimax CUS71D

Ultrasonic interface sensor

Immersion sensor for interface measurement



Application

In many instances in process engineering, suspensions are separated into their solid and liquid components by sedimentation. To operate this process economically and efficiently in practice, it is indispensable to monitor the separation and transition zones of the clarification and settling phases continuously.

Turbimax CUS71D is a sensor for many applications of the interface measurement

- Wastewater treatment: primary clarifier, sludge thickener, secondary clarifier
- Water purification: settling basin after flocculant dosage, filter media expansion monitoring to optimize backwash operations, sludge height in contact sludge process
- Industry: static separation process

Your benefits

- Two different sensor models allow optimal adaption to the measurement task.
- Simple commissioning thanks to predefined calculation models.
- Intelligent sensor - all characteristics and calibration values are stored in the sensor.

Function and system design

Measuring principle

A piezoelectric crystal is integrated in a flat cylindrical plastic housing. When the crystal is excited by an electrical voltage, it generates a sonar signal. The ultrasonic waves are transmitted at a frequency of 657 kHz at an angle of 6° to scan the separation zones.

The parameter measured is the time it takes for the transmitted ultrasonic signal to reach the solid particles in the separation zone and return to the receiver.

A sensor version with wiper avoids film formation at the sensor membrane.

Function

The speed of the sound varies according to the physical properties of the measuring medium and is affected by temperature and air pressure. The liquid zones and solids content of the medium also vary. To obtain precise measurement results, it is therefore vital to adapt system variables to the process, e. g. pulse length and the speed of the sound.

The CM44x offers the following possibilities for signal evaluation:

- Mask out regions where the separation zone is not expected.
- Evaluate received signal strengths differently.
- Select leading or trailing signal edges in the evaluation.
- Amplify sensor signals at different rates, e. g. for floating sludge.
- Define a region (gate) above and below the separation zone. Signal evaluation only takes place in the defined region. The gate wanders with the separation zone. This makes smoothing algorithms unnecessary.

Sensor monitoring

The optical signals are continuously monitored and checked for plausibility. Discrepancies are reported via error messages by the transmitter.

The sensor check system of the Liquiline CM44x reports the following failure conditions:

- Implausible high or low measuring values
- Disturbed controlling due to erroneous measuring values

Sensor connection

- Liquiline CM442 transmitter:

You can connect only one ultrasonic interface sensor. In this case, the 2nd channel cannot be used to connect any other sensor.

- Liquiline CM444 and CM448 transmitters:

If you connect one or more ultrasonic interface sensors, you can connect a maximum of four sensors (no matter which type of sensor, ultrasonic or others).

Transmitter	Sensor CUS71D	Other sensors
CM442 (max. 2 channels)	1	0
CM444 (max. 4 channels)	any combination (max. 4 sensors)	
CM448 (max. 8 channels)	any combination (max. 4 sensors)	

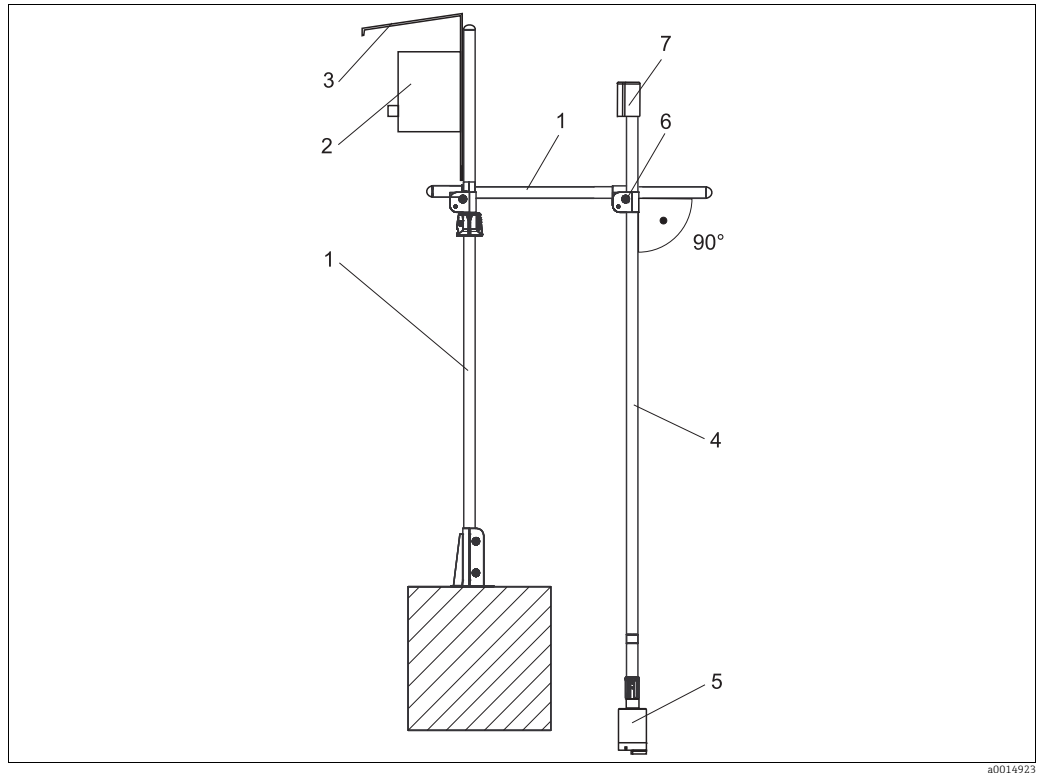
Measuring system

A complete measuring system comprises:

- Ultrasonic sensor Turbimax CUS71D
- Multi-channel transmitter Liquiline CM44x

and optional:

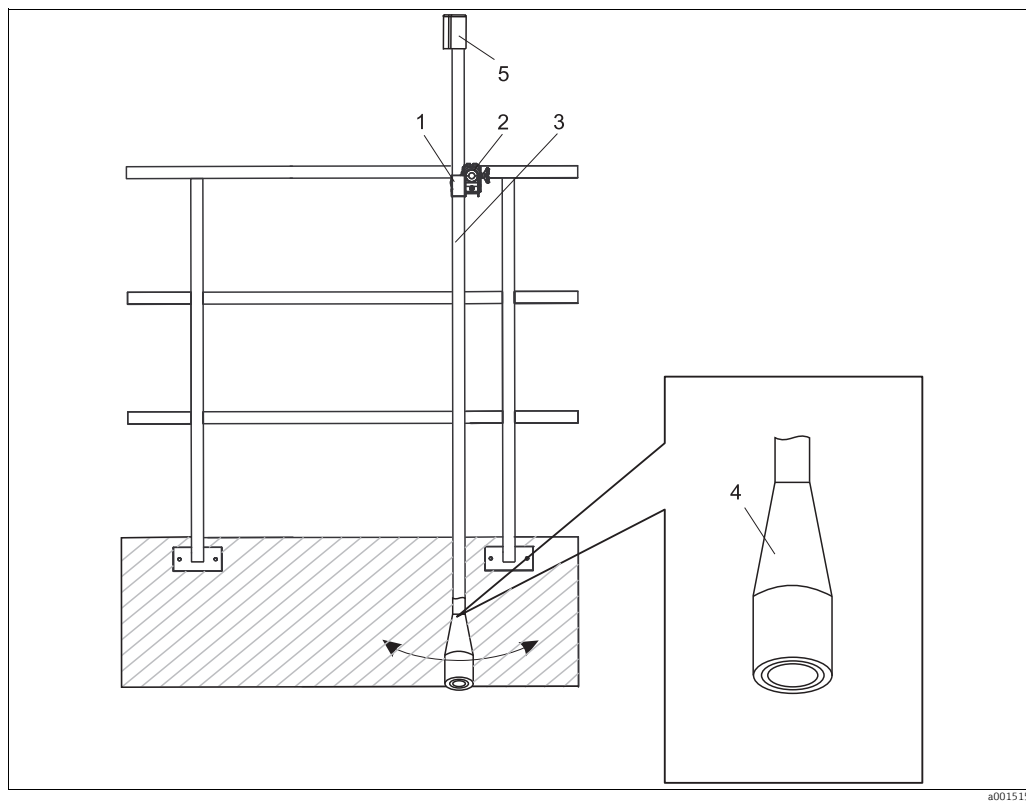
- Weather protection roof CYY101
- Holder system Flexdip CYH112
- Fixed or rotatable immersion pipe Flexdip CYA112



Ultrasonic sensor with holder system and multi-channel transmitter

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|---|---|---|-----------------------------------|
| 1 | Holder system Flexdip CYH112 | 4 | Assembly Flexdip CYA112 |
| 2 | Multi-channel transmitter Liquiline CM44x | 5 | Ultrasonic sensor Turbimax CUS71D |
| 3 | Weather protection roof | | |

Measuring system with pendulum adapter



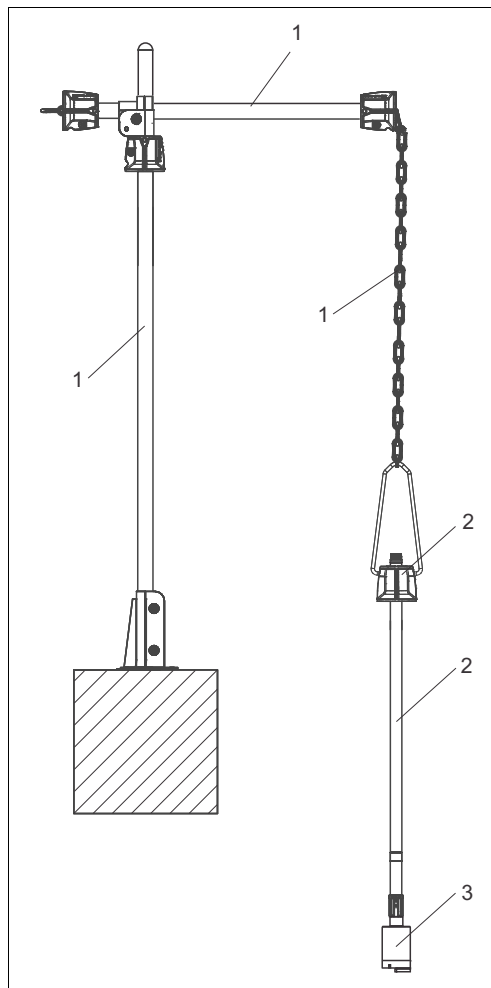
Measuring system with pendulum adapter

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|---|--|---|-------------------------------------|
| 1 | Cross clamp of holder system Flexdip CYH112 | 3 | Assembly Flexdip CYA112 with CUS71D |
| 2 | Pendulum adapter of holder system Flexdip CYH112 | 4 | PVC sensor protector |

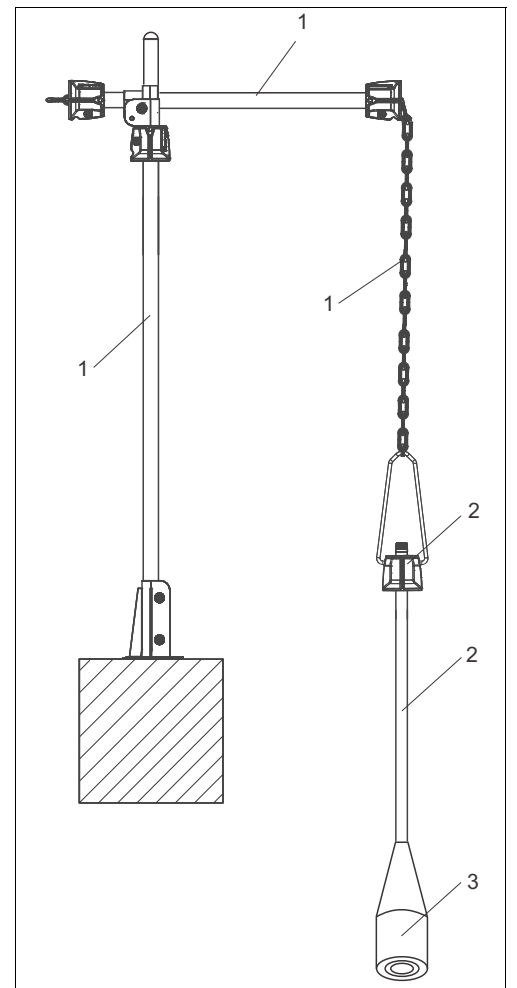
i The PVC sensor protector protects the ultrasonic sensor from getting damaged by the surface skimmer. Use only sensors without wiper.

Measuring system with chain holder



Measuring system with chain holder

- 1 Holder system Flexdip CYH112
- 2 Assembly Flexdip CYA112
- 3 Sensor CUS71D



Measuring system with chain holder

- 1 Holder system Flexdip CYH112
- 2 Assembly Flexdip CYA112
- 3 Sensor CUS71D with PVC sensor protector



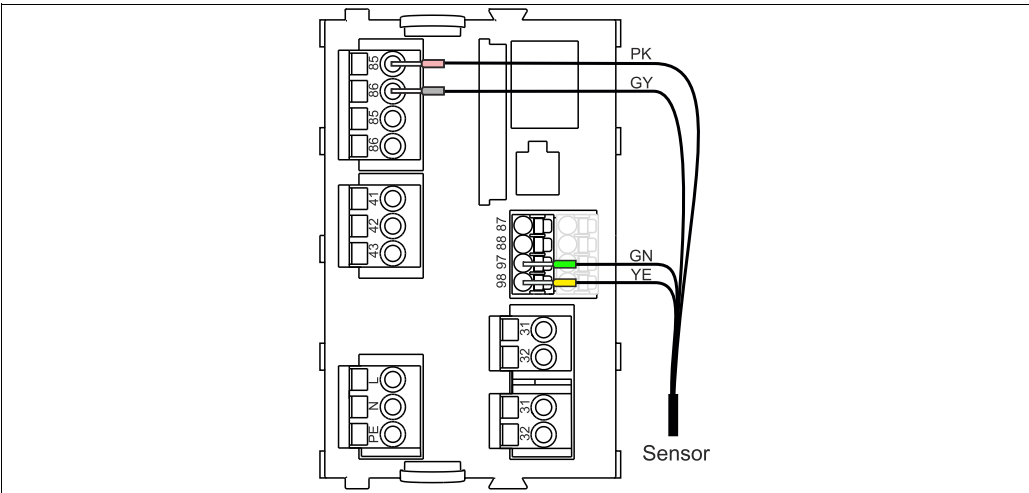
The PVC sensor protector protects the ultrasonic sensor from getting damaged by the surface skimmer. Use only sensors without wiper.

Input

Measuring variables	Standard sensor	Interface
	Sensor with wiper	Interface
Measuring range	Standard sensor	0.3 to 10.0 m (1.0 to 32 ft)
	Sensor with wiper	0.3 to 10.0 m (1.0 to 32 ft)

Power supply

The sensor is connected to the transmitter as follows:



Sensor connection

The maximum cable length is 100 m (328 ft).
To extend the sensor cable, the following accessories are recommended:

- Measuring cable CYK11 with ferrules and
- Junction box "cable / cable"

You can connect only 1 sensor to the transmitter Liquiline CM442.
You can connect up to 4 sensors to the transmitters Liquiline CM444 and CM448.

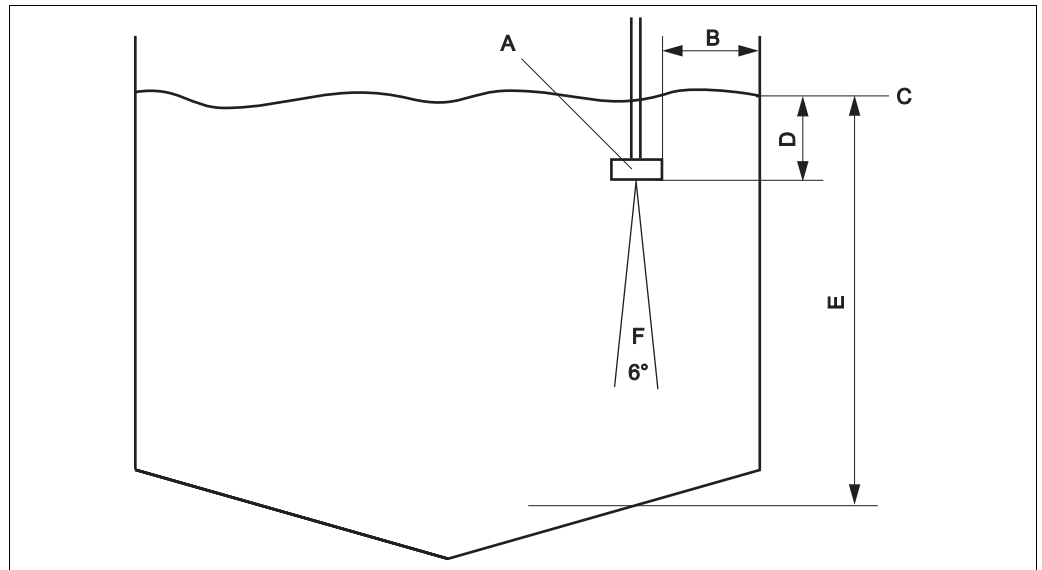
Performance characteristics

Maximum measured error	35 mm at 3.0 m
Measured value resolution	3 mm at 3.0 m
Measurement interval	Adjustable
Calibration	The sensor is factory calibrated delivered. The "speed of sound" is adjustable and preprogrammed for the application "water".
Radiation	$r = 0.52 \text{ m at } 10 \text{ m}$ $r = \tan \alpha / 2L$ (r = radius of the beam, $\alpha = 6^\circ$, L = distance of the beam)

Installation conditions

Installation instructions

Basin configuration



Basin configuration

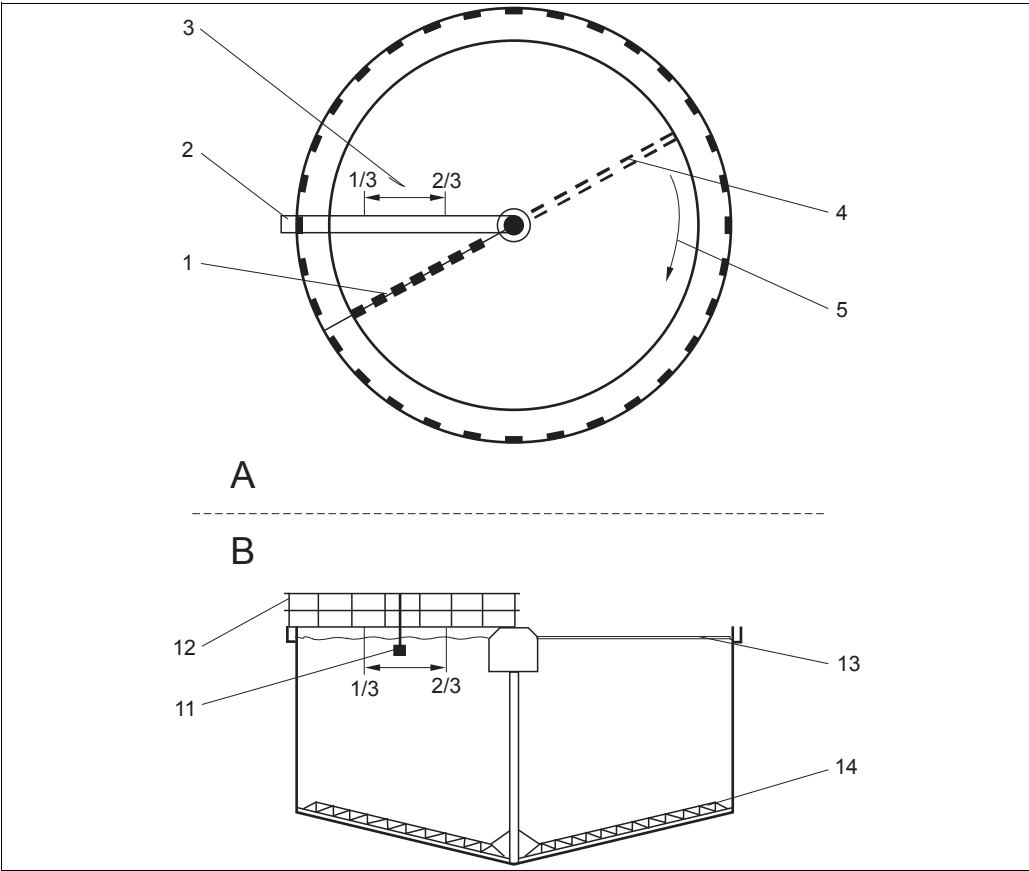
- A Sensor
- B Minimum distance of sensor to basin wall = 45 cm (1.48 ft.)
- C Reference point e.g. water surface
- D Zero point
- E Basin depth
- F Opening angle of ultrasonic cone, 6°

Installation instructions

Look at the construction drawing of the basin for a suitable position for the sensor. In doing so, you must take the following factors into account:

- The minimum distance between the basin wall and the sensor is 45 cm (1.48 ft.) (sensor emits ultrasound in conical form).
- There should not be any basin wall protrusions or piping in the measuring range below the sensor. Scrapers that are only temporarily in this area are permitted.
- Do not install the sensor in zones in which air bubbles, turbulence, high levels of turbid material or suspended matter or foam formation occur (e.g. inlet).
- Using an immersion tube, install the sensor 20 cm (0.66 ft.) beneath the surface of the water.
- The transmitter may not be installed in a second enclosure (heat accumulation).
- If possible, do not install the transmitter near high voltage sources. In addition, also avoid sources of magnetic fields, e.g. large transformers or frequency converters.
- The system can only detect a separation zone if there is a clear transition between the zones. Unclear transition from the liquid to the solid phase cannot be detected.

Circular Clarifier



Basin configuration in circular clarifier

- | | | | |
|---|-----------------|----|-----------------|
| A | View from top | B | Cross section |
| 1 | Surface skimmer | 11 | Sensor |
| 2 | Walk way | 12 | Hand rail |
| 3 | Sensor mounting | 13 | Surface skimmer |
| 4 | Bottom rake | 14 | Bottom rake |
| 5 | Rake direction | | |

Environment

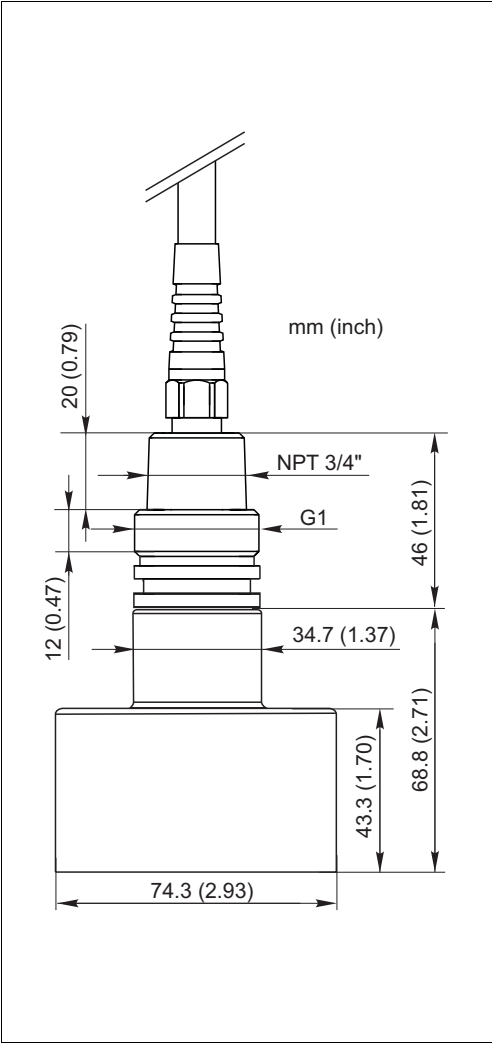
Storage temperature	-20 to 50 °C (-4 to 122 °F)
Ingress protection	IP 68 (test conditions: 1 m (3.3 ft) water column during 60 days, 1 mol/l KCl)

Process

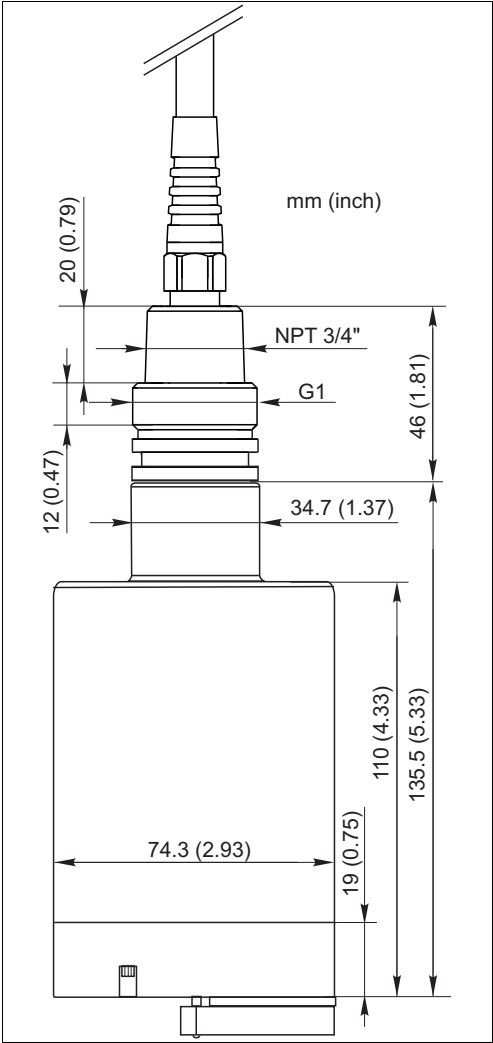
Process temperature	1 to 50 °C (34 to 122 °F)
Process pressure	Standard sensor 0,0 to 6 bar (0 to 87 psi) Sensor with wiper 0,0 to 0,3 bar (0 to 4.35 psi)

Mechanical construction

Dimensions



Dimensions of standard sensor



Dimensions of sensor with wiper

Weight	Standard sensor	1.02 kg (2.25 lb)
	Sensor with wiper	1.25 kg (2.75 lb)

Materials	Sensor	ABS and epoxy plastic
	Wiper	Rubber

Process connections	G1 and NPT ¾"
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Certificates and approvals

EMC compatibility	Interference emission and interference immunity complies with EN 61326: 2005, Namur NE 21:2007
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Ordering information

Selection

Standard sensor	Sensor with wiper
Clear water sedimentation tanks, secondary clarifier with surface skimmer, Primary clarifier with surface skimmer, secondary clarifier with less floating sludge	Primary clarifier, secondary clarifier, sludge tanks, flotation tanks

Product page

You can create a valid and complete order code online using the Configurator tool:

Enter the following address in your browser to access the product page:
www.products.endress.com/cus71d

Product Configurator

You can find the navigation area on the right of the product page.

1. Under "Device support", click "Configure the selected product".
↳ The Configurator opens in a new window.
2. Configure the device as per your requirements by selecting all the options.
↳ In this way, you receive a valid and complete order code.
3. Export the order code as a PDF file or Excel file. To do so, click the appropriate button at the top of the window.

Scope of delivery

The scope of delivery comprises:

- 1 sensor Turbimax CUS71D in the ordered version
- 1 Operating Instructions BA00490C/07/EN

Accessories

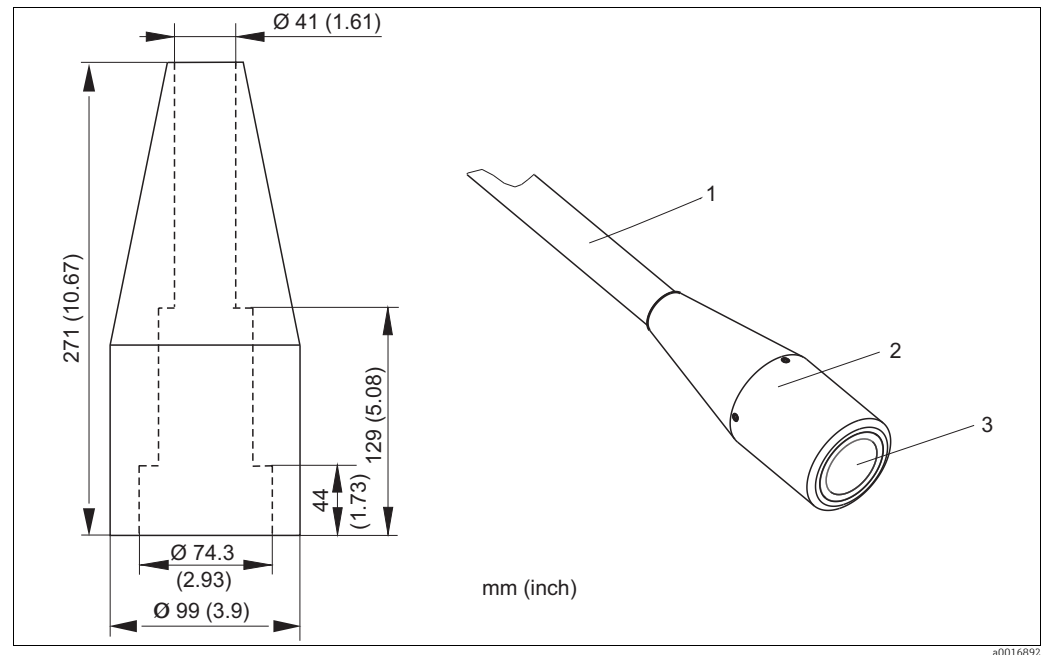
Assemblies

Wastewater assembly Flexdip CYA112

- Modular assembly system for sensors in open basins, channels and tanks
- Versions in stainless steel or PVC
- Ordering per product structure (--> Online configurator: www.products.endress.com/cya112)
- Technical Information TI00432C/07/EN

PVC protector for flexible mounting of CUS71D

- The PVC protector protects the ultrasonic sensor from getting damaged by the surface skimmer.
- Order number: TSP 71178584



PVC protector for CUS71D

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|---|--------------------------|
| 1 | Assembly CYA112 |
| 2 | PVC-protector |
| 3 | Ultrasonic sensor CUS71D |

Holder system

Holder system Flexdip CYH112 for water

- Modular holder system for sensors and assemblies in open basins, channels and tanks
- The holder system CYH112 works for nearly any type of fixing - fixing on the floor, wall or directly on a rail.
- Material: stainless steel
- Ordering acc. to product structure (--> Online configurator: www.products.endress.com/cyh112)
- Technical Information TI00430C/07/EN

Transmitter

Liquiline CM44x

- Multiple-channel transmitter for the connection of digital sensors with Memosens technology
- Power supply: 100 to 230 V AC, 24 V AC/DC
- Universally upgradeable
- SD card slot
- Alarm relay
- IP 66, IP 67, NEMA 4X
- Ordering acc. to product structure (Technical Information TI444C/07/en)

Cable extension

CYK11 Memosens data cable

- Extension cable for digital sensors with Memosens protocol
- Ordering as per product structure (--> Online configurator, www.products.endress.com/cyk11)

Junction box cable/cable

- Material: aluminum, painted
- Cable extension: Memosens sensors, Liquiline
- Order no. 71145499

www.addresses.endress.com
