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Technical Information
Memosens CAS41E

ISE sensor for the continuous measurement of ammonium, nitrate, potassium and chloride



Online measurement of nutrient parameters in municipal wastewater treatment plants

Application

Designed for biological wastewater treatment applications, particularly in aeration tanks at municipal wastewater treatment plants. It can also be used in selected industrial wastewater treatment and surface water monitoring applications.

Benefits

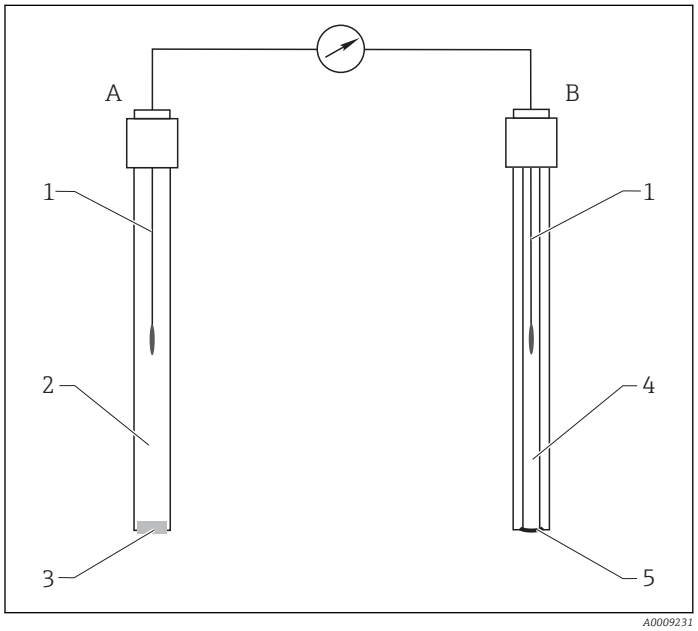
- Compact multiparameter sensor for efficient monitoring: Three configurable electrode slots enable flexible combinations of measurement and compensation electrodes in a single sensor, reducing installation effort and system complexity.
- Direct in-process installation with fully sealed design: Supports real-time monitoring and dynamic process optimization using Memosens technology.
- Easy electrode replacement for simplified maintenance: Allows quick and uncomplicated replacement of individual electrodes.
- Smart multipoint in-process calibration for reliable operation:
  Supports continuous sensor optimization through automated evaluation, integrated self-assessment and in-process calibration without process interruption.

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People for Process Automation

Function and system design

Measuring principle

At the heart of the ion-selective electrode (ISE) is a membrane that is selective for the ion to be measured. An ionophore is incorporated into the membrane, enabling the selective “migration” of a specific type of ion (e.g., ammonium or nitrate) into the electrode. As the ions migrate, a potential builds up between the internal lead and the membrane (see figure below, items 1 and 5). This potential depends on the concentration and is measured against a reference electrode with a constant potential and converted to a concentration using the Nernst equation. Color and turbidity have no effect on the measurement result when the potentiometric measuring principle is used.



A *Reference electrode*
B *Ion-selective electrode*
1 *Inner metal lead*
2 *Internal buffer (reference)*
3 *Junction*
4 *Internal buffer (ISE)*
5 *Ion-selective membrane*

1 *General measuring principle of an ion-selective electrode*

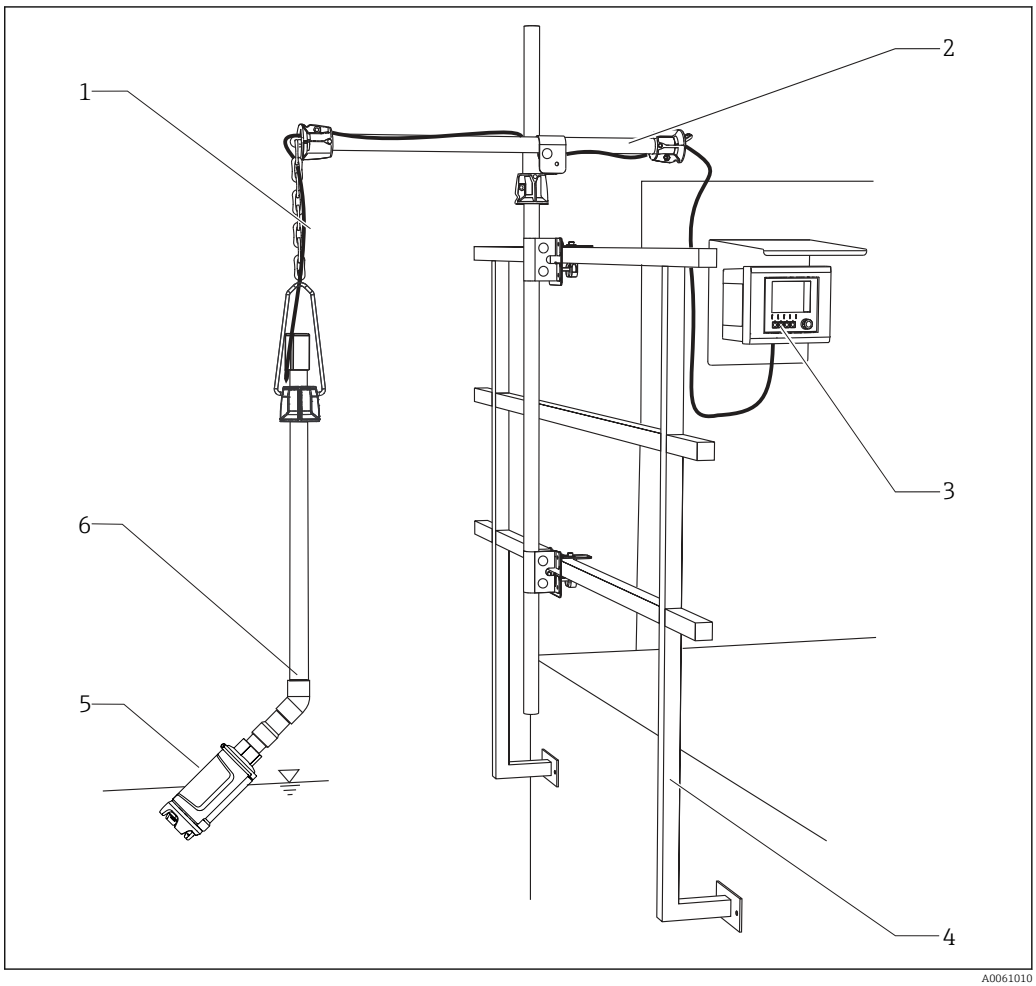
Interference

Depending on the selectivity of the ion-selective electrode vis-à-vis other ions (interference ions), and the concentration of these ions, such ions could also be interpreted as part of the measuring signal and thus cause measurement errors. When measuring in wastewater, the potassium ion—which is similar in size to the ammonium ion—can cause higher measured values. The measured values for nitrate may be too high due to high concentrations of chloride. To reduce measurement errors resulting from such cross-interference, the concentration of the potassium or chloride interference ion can be measured and compensated for with a suitable additional electrode.

Measuring system

A complete measuring system comprises:
- Memosens CAS41E as per order code
- Liquiline CM44x transmitter
- Memosens sensor cable
- Flexdip CYA112 assembly

Optional:
- Assembly holder, e.g., CYH112, transverse pipe and chain
- Weather protection cover required for the field installation of the transmitter.
- Compressed air generator (for compressed air option if no compressed air available on site)



2 Example: measuring system on basin rim

1 Sensor cable
2 Wastewater assembly holder, secure to rail, with transverse pipe and chain
3 Liquiline CM44x transmitter (in graphic: wall-mounted with weather protection cover)
4 Rail
5 Memosens CAS41E
6 Flexdip CYA112 assembly with 45° elbow piece

Input

Measured variables

Depending on version:
- Ammonium: NH_4-N, NH_4^+ [mg/l]
- Nitrate: NO_3-N, NO_3^- [mg/l]
- Potassium: K^+[mg/l]
- Chloride: Cl^- [mg/l]
- Temperature [°C] or [°F]

Measuring ranges

- Ammonium:
  0 to 1000 mg/l (NH_4-N)
- Nitrate:
  0 to 1000 mg/l (NO_3-N)
- Potassium:
  1 to 1000 mg/l
- Chloride:
  1 to 1000 mg/l

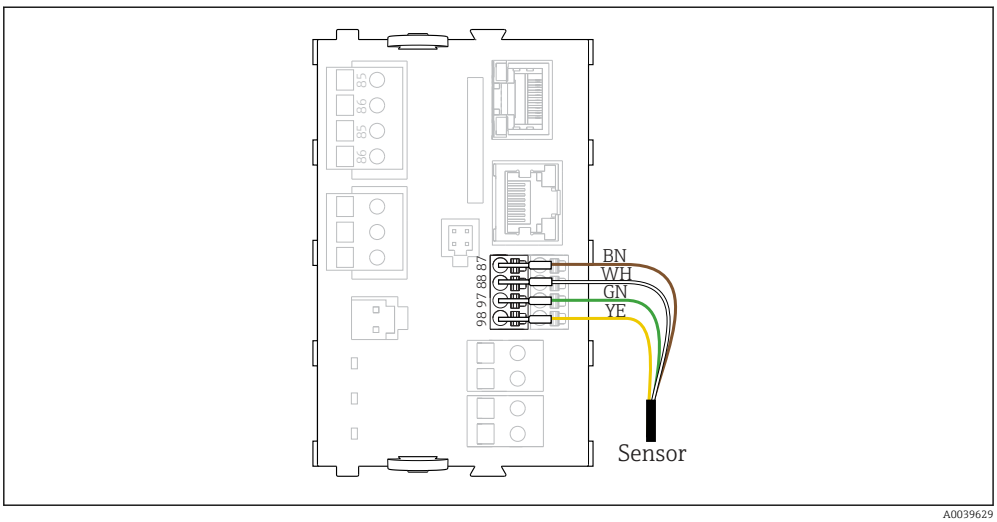
Power supply

Options for connecting to Liquiline CM44x transmitter

The maximum cable length is 100 m (328 ft).

Connection via a Memosens sensor cable with ferrules

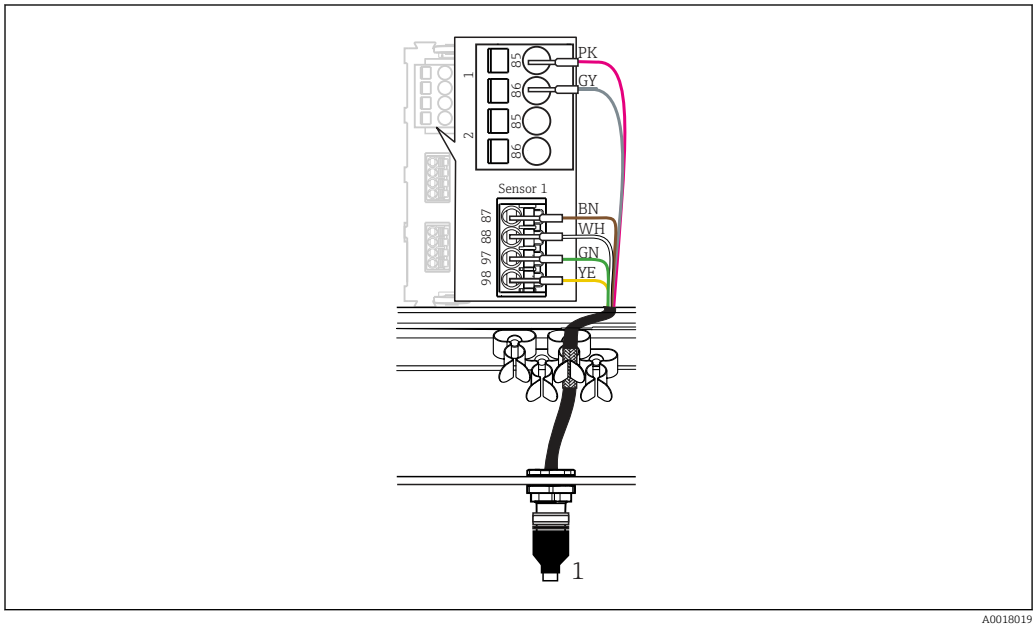
▶



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Connect the sensor cable to a Memosens input of the transmitter. Observe the Operating Instructions for the transmitter for this.

Connection via a Memosens sensor cable with M12 socket



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3 Connection on sensor module 2DS, for example

1 Sensor with M12 plug

The M12 socket is connected to a Memosens input of the transmitter.

- Connect the sensor cable to the M12 socket. Observe the Operating Instructions for the transmitter for this.

Performance characteristics

Response time t_{90} of the ISE sensors

< 2 min.

Measurement error

Ammonium: ± 5 % of reading or ± 0.2 mg/l

Nitrate: ± 5 % of reading or ± 0.6 mg/l

Potassium, chloride: ± 10 % of reading or ± 5 mg/l

Repeatability

±3 % of the display value

Compensation

Sensor	Temperature	pH	Potassium [1) 2)]	Chloride [1) 3)]
Ammonium	2 to 40 °C (36 to 100 °F)	pH 7.9 to pH 10	1 to 1000 mg/l (ppm) or measuring range of the potassium electrode	-
Nitrate		-	-	1 to 1000 mg/l (ppm) or measuring range of the chloride electrode
Potassium		-	-	-
Chloride		-	-	-

1) The concentration fluctuations, not the absolute value, are decisive
2) Recommendation: dynamic compensation: Use as compensation electrode for potassium concentrations > 40 mg/l in the case of simultaneously fluctuating values of ± 5 mg/l or static compensation: apply an offset in the case of non-fluctuating values.
3) Recommendation: Use as compensation electrode for chloride concentrations > 500 mg/l in the case of simultaneously fluctuating values of ± 100 mg/l, or apply an offset in the case of non-fluctuating values.

Operating time

An electrode does not fail completely after the specified time. The response time of t_{90} extends with increasing wear.

Electrode/Parameter	Service life under low load [1)]
Ammonium	9 months
Nitrate	9 months
Potassium	9 months
Chloride	2 to 3 years
Reference electrode	1 year

1) The service life values provided are recommendations based on the average load at a municipal wastewater treatment plant. The actual service life depends on the specific load in the process and can deviate from the values indicated.

Automatic cleaning	▪ Cleaning medium: Air ▪ Pressure: 1.5 to 3.5 bar (22 to 50 psi) ▪ Recommended cleaning duration: 30 s ▪ Guideline values for cleaning intervals (at T > 10°C (50°F)): Sludge activation inlet: 30 s cleaning, 30 min pause Sludge activation: 30 s cleaning, 1 hr pause Depending on the medium, different cleaning intervals may be required. The values indicated here are guideline values only.

Environment

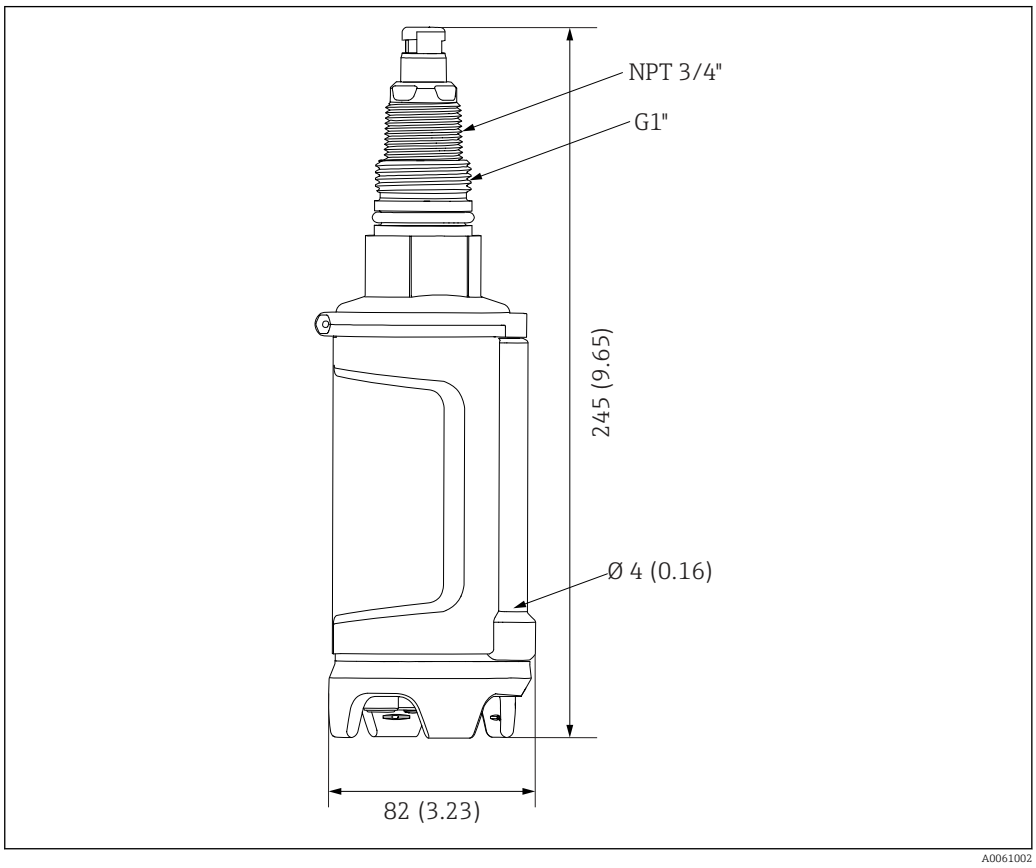
Ambient temperature	-20 to 55 °C (-4 to 130 °F)
Short-term storage temperature (max. 2 weeks)	2 to 40 °C (36 to 104 °F)
Long-term storage temperature	5 to 25 °C (41 to 77 °F)
Degree of protection	IP68 (5 m water column, 25 °C, 24 h)

Process

Process temperature	2 to 40 °C (36 to 104 °F)
Process pressure	Max. 0.5 bar (7.25 psi)
pH value of the medium	▪ Ammonium: pH 5 to 7.9 (without pH compensation) pH 5 to 10 (with pH compensation) ▪ Nitrate: pH 2 to 10 ▪ Potassium: pH 2 to 10 ▪ Chloride: pH 1 to 10

Mechanical construction

Design, dimensions



4 *Dimensions in mm (inch)*

Weight

Approx. 0.8 kg (1.8 lbs)

Materials

Sensor:	
Memosens coupling, housing	PPS-GF40
KLSS locking ring	PBT-GF20
Housing ring	PBT-GF10
Hose holder	PBT-GF20
Hose protection	PBT-GF10
Casing pipe	Stainless steel 1.4404
Top housing section	PBT-GF10
Bottom housing section	POM
Counter electrode	Stainless steel 1.4404
Hose bracket nut and screw	Stainless steel 1.4301
Protection cage with air cleaning	PA12
Protection cage	POM
Hose connection	Stainless steel 1.4401
O-rings	EPDM
ISE electrodes	
Membrane cap	POM
Shaft	POM
Color ring	PP
Membrane	PVC, plasticizer
O-rings	EPDM
Reference electrode	
Junction	PTFE
Shaft	PC

Compressed air connection

For hose, OD 4 mm

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**.

Ex approval

CSA C/US
Class I Div 2 Groups A, B, C, D

Additional certification

EAC

The product has been certified in accordance with the TR CU 020/2011 directive applicable in the Eurasian Economic Union (EAEU). The EAC conformity mark has been affixed to the product.

Ordering information

Scope of delivery

The scope of delivery includes:
- Memosens CAS41E as per configuration
- Operating Instructions
- Safety instructions for hazardous area (for Ex versions)

Product page

www.endress.com/cas41e

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. **Add to cart**: 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.
   ↳ A 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 for 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.

Assembly

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

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Assembly 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

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Maintenance kits

O-ring set
Order code: 71765819

Ordering information: www.endress.com/onlinetools

Electrodes and maintenance kits
- Ammonium electrode (color identification red)
  Order code: XPC0033-11+RA
- Nitrate electrode (color identification blue)
  Order code: XPC0033-11+RB
- Potassium electrode (color identification yellow)
  Order code: XPC0033-11+RC
- Chloride electrode incl. maintenance kit (color identification black)
  Order code: XPC0033-11+RD
- Reference electrode
  Order code: XPC0033-11+RE
- Maintenance kit for chloride electrode available separately
  Order code: XPC0033-11+RF
- Dummy electrode
  Order code: XPC0033-11+RG

Ordering information: www.endress.com/onlinetools

Standard solutions

CAY40
- Standard solutions for ammonium, nitrate, potassium and chloride
- Ordering information: www.endress.com/onlinetools

Air purge	Air purge kit with protection cage Order code: 71765816 Ordering information: www.endress.com/onlinetools



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