

Technical Information

ISEmax CAS40D

Ion-selective sensor for continuous measurement of ammonium, nitrate and other ions

Online measurement of nutrient parameters in municipal wastewater treatment plants



Application

The ion-sensitive sensor works directly in the activated sludge basin of municipal wastewater treatment plants without any additional sample conditioning or sample transportation.

The sensor is used to monitor the ammonium and nitrate content

- In the activated sludge basin
- In the primary clarifier outlet

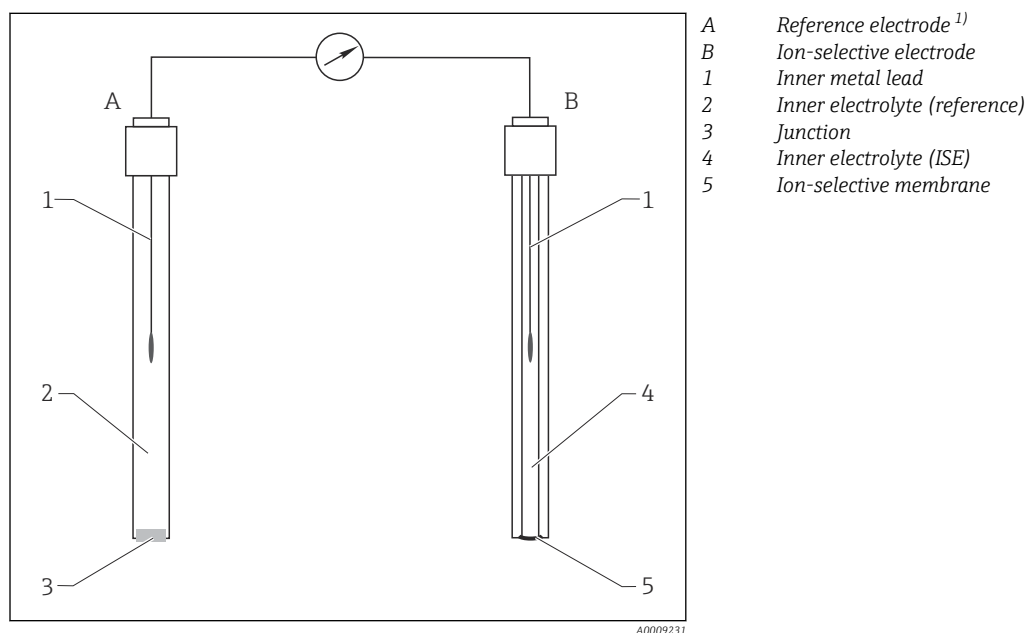
Your benefits

- Reliable, cost-saving unit:
 - Direct measurement of ammonium or nitrate without costly sample conditioning
 - Optional potassium and/or chloride measurement, also to compensate high concentrations of interference ions
 - pH measurement as standard
 - Low operating costs since no reagent used
- Versatile and flexible:
 - Large measuring range 0.1-1000 mg/l NH₄-N or 0.1-1000 mg/l NO₃-N
- Easy-to-use and safe:
 - Installed directly on the basin rim, no measuring container or sample-conveying pump required
 - Minimum maintenance thanks to compressed air cleaning
 - Long electrode service life, membrane cap must be replaced every 6 months approximately
 - Standardized digital communication enables Plug&Play

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 integrated into the membrane which facilitates the selective "migration" of a specific type of ion (e.g. ammonium or nitrate) to the electrode. As a result of ion migration, a change in the charge occurs, causing the creation of a potential that is proportional to the ion concentration logarithm. The potential is measured against a reference electrode with a constant potential and converted to a concentration using the Nernst equation. With the potentiometric measuring principle, the color and turbidity do not affect the measurement result.



1 General measuring principle of an ion-selective electrode

- 1) When using a pH single-rod measuring cell, such as the CPS11, its reference is also the reference electrode for the overall sensor and for the pH electrode itself.

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 measuring errors. When measuring in wastewater, the potassium ion which is chemically similar to the ammonium ion can cause higher measured values. The measured values for nitrate can be too high due to high concentrations of chloride. To reduce measuring 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.

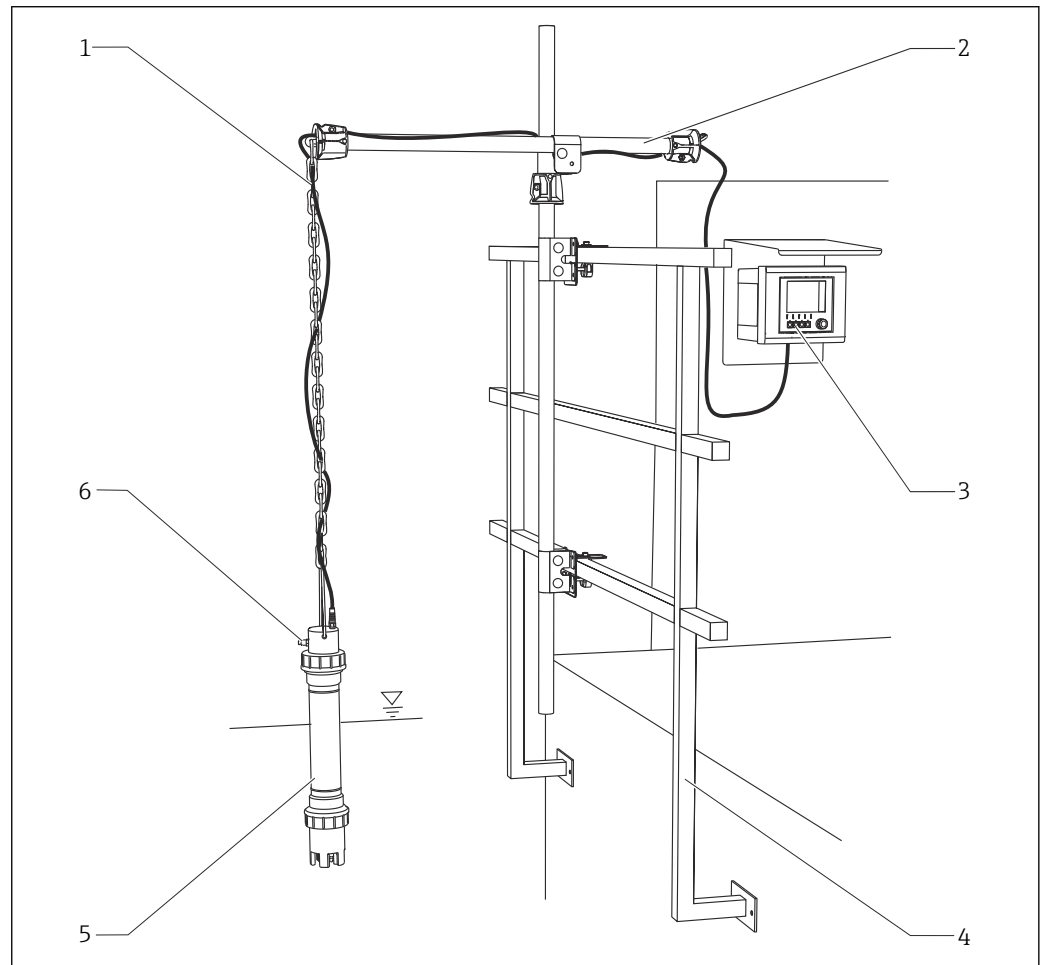
Measuring system

A complete measuring system comprises:

- Sensor CAS40D
 - Ion-selective electrode(s) for ammonium, nitrate, potassium or chloride
 - pH glass electrode, Orbisint CPS11-1AS2GSA
 - Temperature sensor, CTS1
- Transmitter Liquiline CM44x

Optional:

- Assembly holder, e.g. CYH112
- Weather protection cover: absolutely essential if mounting the transmitter outdoors!
- Compressed air generator (if no compressed air available on site)



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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 Sensor CAS40D with ion-selective electrodes
- 6 Connection for optional compressed air cleaning (not in graphic)

Input

Measured values

Depending on version:

- Ammonium: $\text{NH}_4\text{-N}$, NH_4^+ [mg/l]
- Nitrate: $\text{NO}_3\text{-N}$, NO_3^- [mg/l]
- Potassium, K^+ [mg/l]

- Chloride, Cl^- [mg/l]
- pH value
- Temperature

Measuring ranges

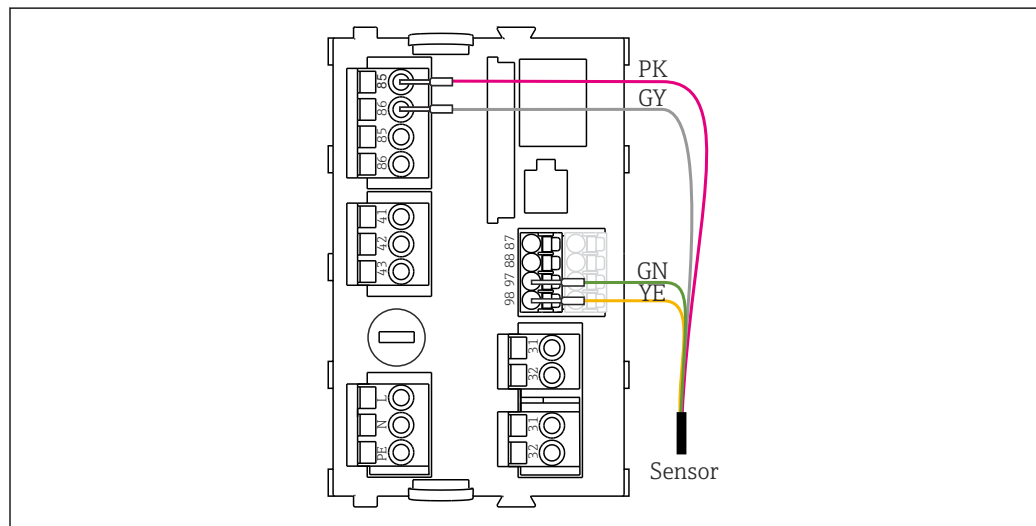
- Ammonium:
0.1 to 1000 mg/l ($\text{NH}_4\text{-N}$)
- Nitrate:
0.1 to 1000 mg/l ($\text{NO}_3\text{-N}$)
- Potassium:
1 to 1000 mg/l
- Chloride:
1 to 1000 mg/l

Power supply

Electrical connection

Options for connecting to Liquiline CM44x transmitter

- M12 connector (version: fixed cable, M12 connector)
- Fixed cable at the terminal blocks (version: fixed cable, ferrules)



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3 Sensor connection

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

Performance characteristics

Response time t_{90} of the ion-selective sensors < 2 min.
For a change between 0.5 and 1 mmol/l in both directions, at 25 °C (77 °F).

Measured error $\pm 5\%$ of the measured value ± 0.2 mg/l

Repeatability $\pm 3\%$ of the display value

Compensation

Sensor	Temperature	pH	Potassium ^{1) 2)}	Chloride ^{3) 4)}
Ammonium	2 to 40 °C (36 to 100 °F)	pH 8.3 to 10	1 to 1000 mg/l (ppm)	-
Nitrate		-	-	10 to 1000 mg/l (ppm)
Potassium		-	-	-
Chloride		-	-	-

- 1) The concentration fluctuations, not the absolute value, are decisive
- 2) Recommendation: Use as compensation electrode for potassium concentrations > 40 mg/l in the case of simultaneously fluctuating values of ± 20 mg/l, or apply an offset in the case of non-fluctuating values.
- 3) The concentration fluctuations, not the absolute value, are decisive
- 4) 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.

Max. operating life Membrane and electrolyte

- Use: approx. 0.5 years
- Storage: 2 years

Automatic cleaning

- Cleaning medium: Air
- Pressure: 3 to 3.5 bar (45 to 50 psi)
- Volume of air required per cleaning cycle: 3 to 4 l (0.8 to 1 US gal)
- Cleaning duration: 4 to 15 s
- Cleaning intervals (at $T > 10$ °C (50 °F)):
 - Sludge activation inlet: 15 s cleaning, 30 min pause
 - Sludge activation: 15 s cleaning, 1 hr pause

Environment

Ambient temperature -20 to 50 °C (-4 to 122 °F)

Storage temperature 2 to 40 °C (36 to 104 °F)

Degree of protection IP68 (2 m water column, 25 °C, 48 h)

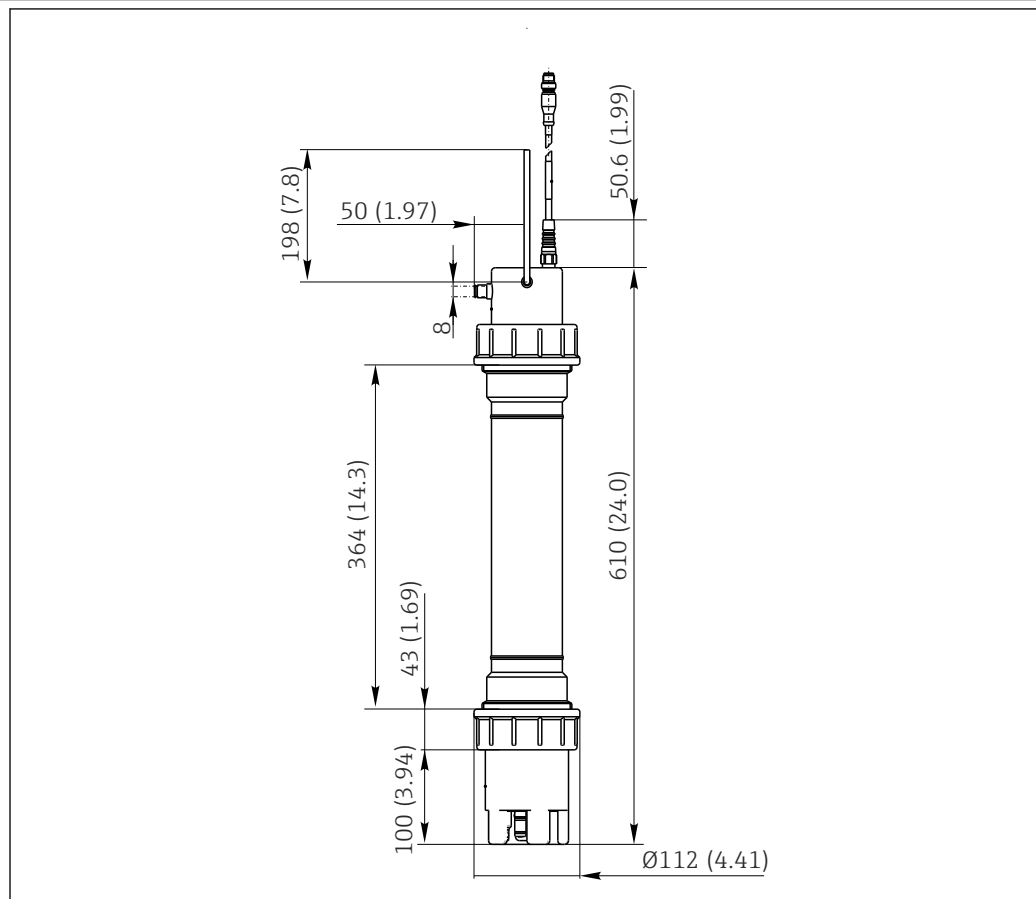
Electromagnetic compatibility Interference emission and interference immunity as per EN 61 326, Namur NE21

Process

Process temperature	2 to 40 °C (36 to 104 °F)
Process pressure	400 mbar (160 in H ₂ O) max. permitted overpressure
pH value of the medium	<ul style="list-style-type: none"> ■ Ammonium: pH 5 to 8.3 (without pH compensation) pH 5 to 10 (with pH compensation) ■ Nitrate: pH 2 to 12 ■ Potassium: pH 2 to 12 ■ Chloride: pH 1 to 10

Mechanical construction

Dimensions



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4 Dimensions in mm (inch)

Weight	Approx. 3.5 kg (7.7 lbs)
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Materials**Sensor:**

Protective cage:	POM
Electrode holder:	POM
Radial seal for sensor head and electrode holder:	Silicone
O-rings in ISE holder:	EPDM
O-rings for air nozzle:	VITON
Sensor pipe with coupling nut:	PP
Retaining bracket:	Stainless steel
Sensor head:	POM
Temperature sensor:	Glass
pH single-rod measuring cell with reference electrode:	Glass, PTFE

Ion-selective electrodes

Membrane cap:	POM
Shaft:	POM
Color ring:	PP
Membrane:	PVC, plasticizer
O-rings:	EPDM

Materials not in contact with the medium

 The following specifications refer to the built-in temperature sensor CTS1.

Information according to REACH Regulation (EC) 1907/2006 Art. 33/1:

The potting compound in the sensor shaft contains the SVHC substance terphenyl, hydrogenated (CAS number ¹⁾ 61788-32-7) with more than 0.1 % (w/w). The product does not present a hazard if it is used as designated.

Electrode process connection	Pg 13.5
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Compressed air connection	For hose, OD 8 mm
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Certificates and approvals

CE mark**Declaration of Conformity**

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.

Additional certification**EAC**

The product has been certified according to guidelines TP TC 004/2011 and TP TC 020/2011 which apply in the European Economic Area (EEA). The EAC conformity mark is affixed to the product.

Ordering information

Product page	www.endress.com/cas40d
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Product Configurator

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
 - ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
 - ↳ In this way, you receive a valid and complete order code for the device.

1) CAS = Chemical Abstracts Service, international identification standard for chemical substances

3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.



For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

Scope of delivery


The scope of delivery comprises:

- 1 sensor, version as ordered
- 1 socket wrench
- 1 tube silicone grease
- 1 Operating Instructions

Accessories

The following are the most important accessories available at the time this documentation was issued.

- For accessories not listed here, please contact your Service or Sales Center.

Assembly holder	<p>Flexdip CYH112</p> <ul style="list-style-type: none"> ■ 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 <p> Technical Information TI00430C</p>
Maintenance kits	<p>Membrane kit</p> <ul style="list-style-type: none"> ■ 2 membrane caps (apart from chloride, where there is only one cap, with crystal) ■ Electrolyte ■ Order numbers: <ul style="list-style-type: none"> ■ Ammonium: 71072574 ■ Nitrate: 71072575 ■ Potassium: 71072576 ■ Chloride: 71072577 <p>Maintenance kit for chloride electrode</p> <ul style="list-style-type: none"> ■ Sandpaper ■ Electrolyte ■ Order number: 71085727
Electrodes	<p>Ion-selective electrode</p> <ul style="list-style-type: none"> ■ Electrode, complete, length 120 mm ■ Order numbers: <ul style="list-style-type: none"> ■ Ammonium: 71109938 (color identification red) ■ Nitrate: 71109937 (color identification blue) ■ Potassium: 71109936 (color identification yellow) ■ Chloride: 71109939 (color identification green) <p>pH electrode with reference Order number: CPS11-1AS2GSA</p> <p>Temperature sensor Order number: CTS1-A2GSA</p> <p>Dummy electrode Order number: 71123812</p>
Standard solutions	<p>CAY40</p> <ul style="list-style-type: none"> ■ Standard solutions for ammonium, nitrate, potassium and chloride ■ Ordering information: www.endress.com/cas40d under "Accessories/spare parts" <p>High-quality buffer solutions from Endress+Hauser - CPY20</p> <p>The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) or to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a laboratory accredited by the DAkkS (German accreditation body) according to DIN 17025.</p> <p>Product Configurator on the product page: www.endress.com/cpy20</p>

Compressed air cleaning**Not suitable for continuous operation!**

- Operating interval: max. 3 minutes cleaning, break for at least six times the cleaning time.
- Avoid condensation in the pressurized hoses.

Cleaning unit in the housing

- 230 V or 115V, IP 65
- Conveying rate at atmospheric pressure: 50 l/min (13.2 gal/min)
- Power consumption: 240 W
- Current consumption: 1.3 A
- Overheating protection: automatic switch off at $T > 130\text{ °C}$ (266 °F)
- Order no.
 - 230 V: 71072583
 - 115 V: 71194623
 - Hose reducer coupling AD 8/6 mm: 71082499



www.addresses.endress.com
