

Technical Information

ISEmax CAS40D

Online measurement of nutrient parameters in municipal wastewater treatment plants



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

Application

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

A complete measuring system consists of a sensor with electrodes and a transmitter with display and operating elements.

The sensor is used to monitor the ammonium and nitrate content

- in the activated sludge basin
- in the preclarification outlet.

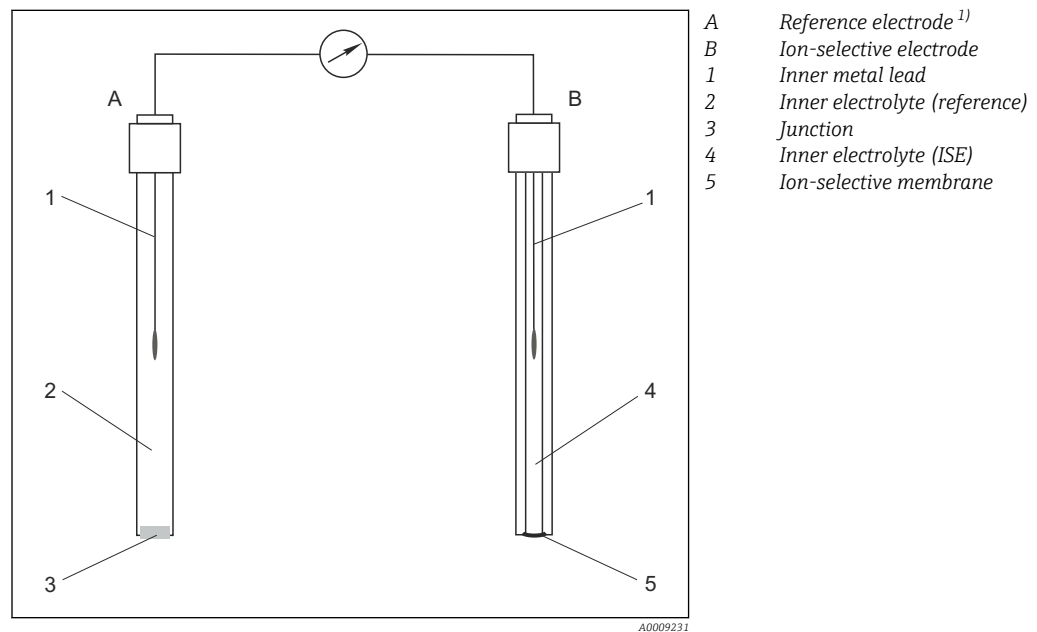
Your benefits

- 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.

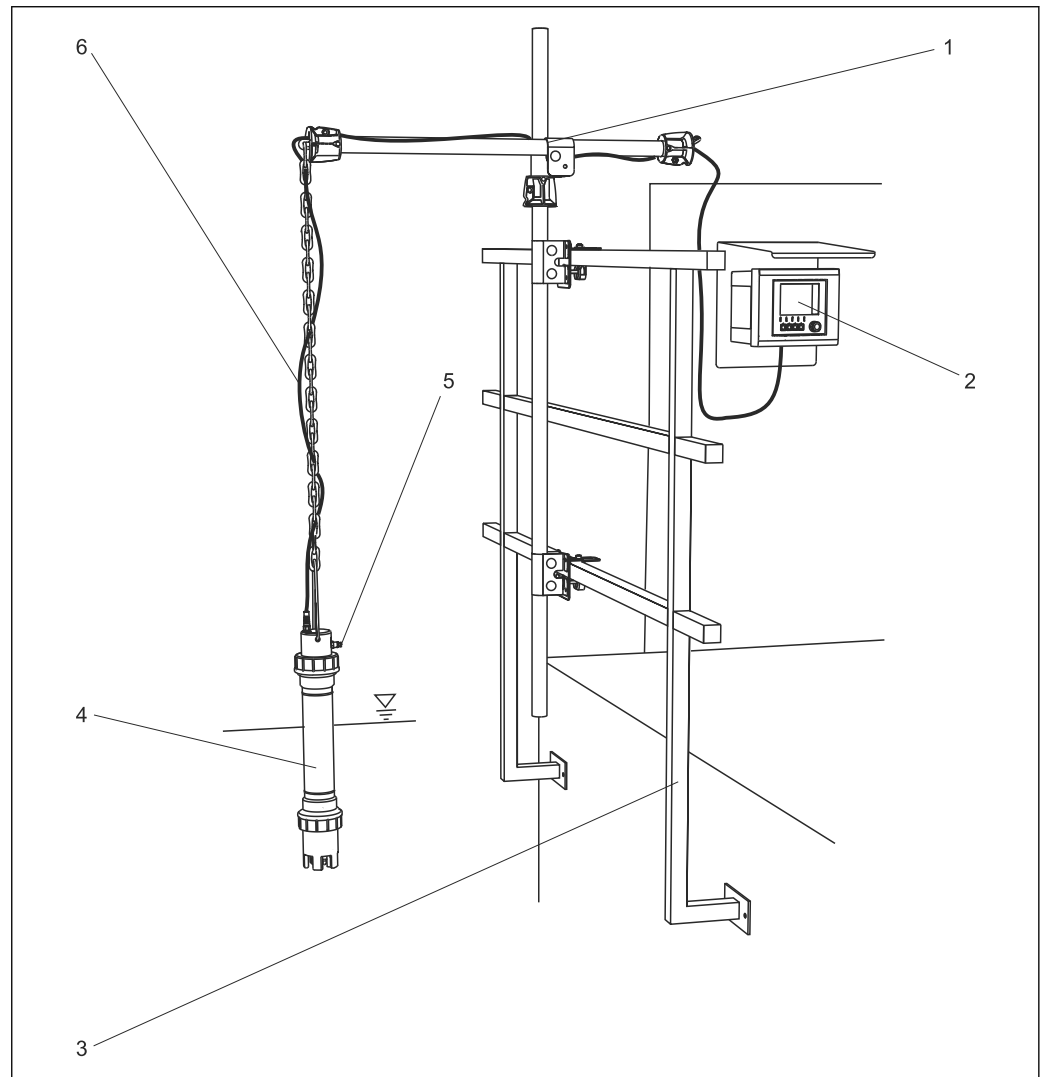
Measuring system

A complete measuring system comprises:

- Sensor CAS40D
 - Ion-selective electrode(s) for ammonium, nitrate, potassium or chloride
 - pH glass electrode, Orbisint CPS11-1AT2GSA
 - Temperature sensor, CTS1
- Liquiline CM44x transmitter

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 Wastewater assembly holder, secure to rail, with transverse pipe and chain
- 2 Liquiline CM44x transmitter (in graphic: wall-mounted with weather protection cover)
- 3 Rail
- 4 Sensor CAS40D with ion-selective electrodes
- 5 Connection for optional compressed air cleaning (not in graphic)
- 6 Sensor cable

Input

Measured variables

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

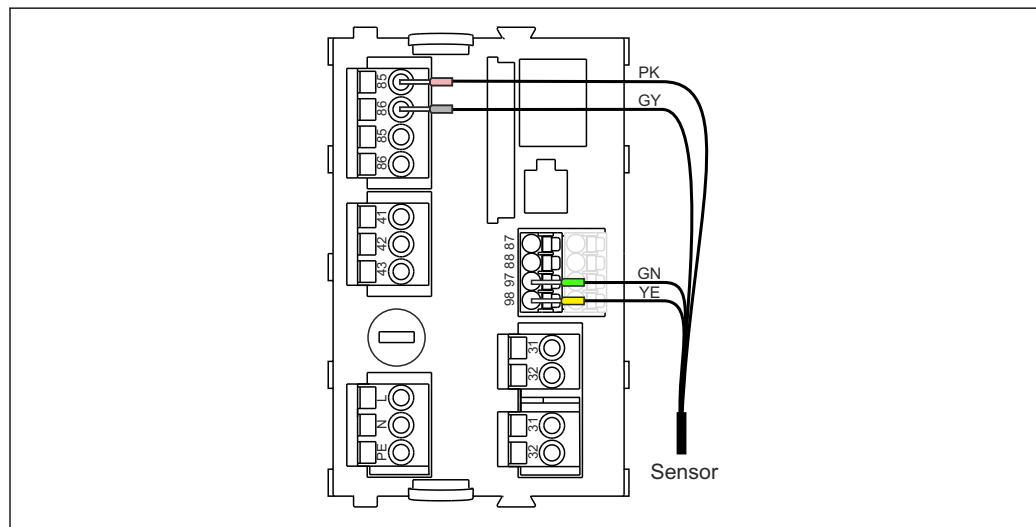
- Ammonium:
0.1 to 1000 mg/l ($\text{NH}_4\text{-N}$)
- Nitrate:
0.1 to 1000 mg/l ($\text{NO}_3\text{-N}$)
- Potassium:
1 to 1000 mg/l
- Chloride:
1 to 1000 mg/l

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).

Maximum 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 range -20 to 50 °C (-4 to 120 °F)

Storage temperature 2 to 40 °C (36 to 100 °F)

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

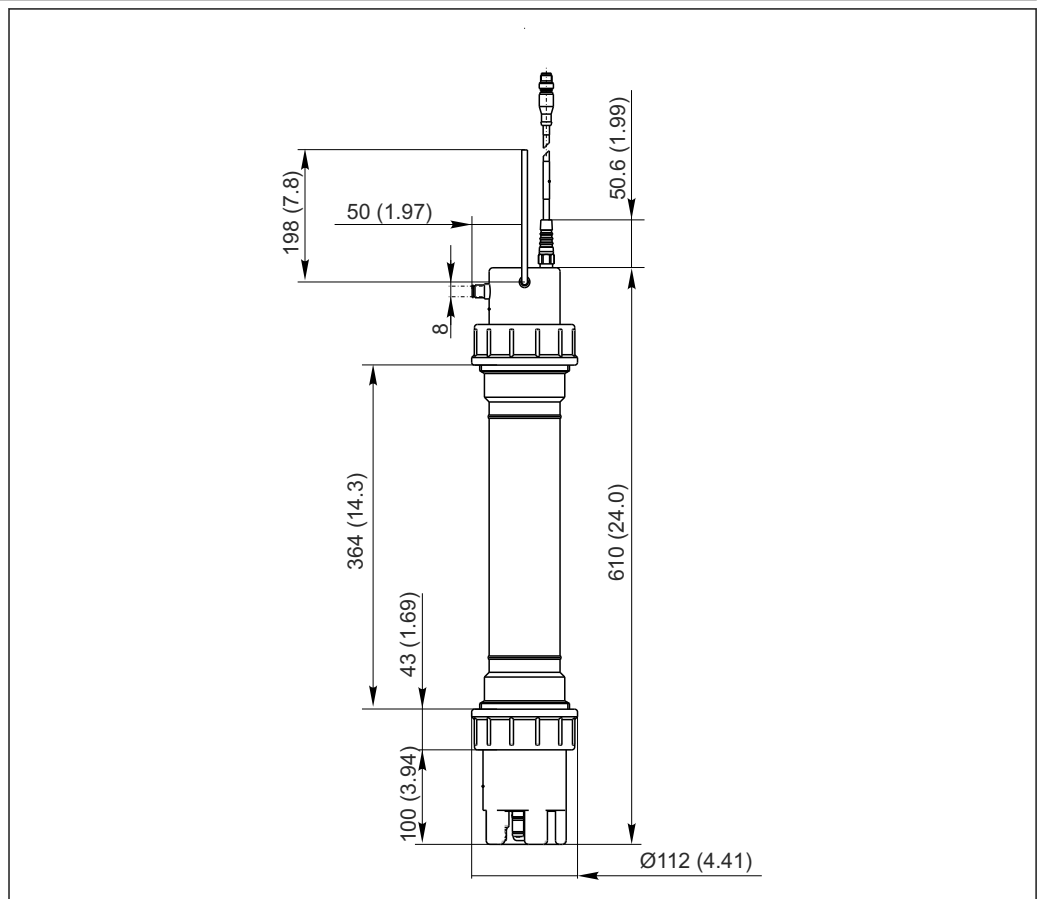
Electromagnetic compatibility Interference emission and interference immunity as per EN 61 326, Namur NE21

Process

| | |
|-------------------------------|---|
| Process temperature | 2 to 40 °C (36 to 100 °F) |
| Process pressure | 400 mbar (160 inH 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



4 Dimensions in mm (inch)

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| | |
|---------------|--------------------------|
| Weight | Approx. 3.5 kg (7.7 lbs) |
|---------------|--------------------------|

| | | |
|-------------------------------------|--|-----------------|
| Material | 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 | |
| Electrode process connection | Pg 13.5 | |
| Compressed air connection | For hose, OD 8 mm | |


Certificates and approvals

| | |
|----------------|--|
| CE mark | Declaration of Conformity <p>The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.</p> |
|----------------|--|

Ordering information

| | |
|-----------------------------|---|
| Product page | www.endress.com/cas40d |
| Product Configurator | <p>The navigation area is located on the right of the product page.</p> <ol style="list-style-type: none">Under "Device support" click "Configure your selected product".<ul style="list-style-type: none">The Configurator opens in a separate window.Select all the options to configure the device in line with your requirements.<ul style="list-style-type: none">In this way, you receive a valid and complete order code for the device.Export the order code as a PDF or Excel file. To do so, click the appropriate button at the top of the screen. |
| Scope of delivery | <p>The scope of delivery comprises:</p> <ul style="list-style-type: none">1 sensor, version as ordered1 socket wrench1 tube silicone grease1 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 office.

Assembly holder

Flexdip CYH112 holder for Flexdip CYA112 water and wastewater fittings

- Modular bracket system for sensors and fittings in open basins, channels and tanks
- The holder system can be secured anywhere: to the ground, to the top of the wall, on the wall or directly on a rail.
- Stainless steel version
- Product Configurator under www.endress.com/cyh112
- Technical Information TI00430C/07/EN

Maintenance kits

Membrane kit

- 2 membrane caps (apart from chloride, where there is only one cap, with crystal)
- Electrolyte
- Order numbers:
 - Ammonium: 71072574
 - Nitrate: 71072575
 - Potassium: 71072576
 - Chloride: 71072577

Maintenance kit for chloride electrode

- Sandpaper
- Electrolyte
- Order number: 71085727

Electrodes

Ion-selective electrode

- Electrode, complete, length 120 mm
- Order numbers:
 - Ammonium: 71109938 (color identification red)
 - Nitrate: 71109937 (color identification blue)
 - Potassium: 71109936 (color identification yellow)
 - Chloride: 71109939 (color identification green)

pH electrode with reference

Order number: CPS11-1AT2GSA

Temperature sensor

Order number: CTS1-A2GSA

Dummy electrode

Order number: 71123812

Standard solutions

CAY40

- Standard solutions for ammonium, nitrate, potassium and chloride
- Ordering information: www.endress.com/cas40d under "Accessories/spare parts"

High-quality buffer solutions from Endress+Hauser - CPY20

The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) and to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a DKD (German Calibration Service) accredited laboratory.

Product Configurator under: www.endress.com/cpy20

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 °C (266 °F)
- Order no.
 - 230 V: 71072583
 - 115 V: 71194623
 - Hose reducer coupling AD 8/6 mm: 71082499

www.addresses.endress.com
