

# N<sub>2</sub>O Wastewater Sensor User Manual



# N<sub>2</sub>O Wastewater Sensor Manual

UNISENSE ENVIRONMENT

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# 1. WARRANTY

## 1.1 N<sub>2</sub>O Wastewater Sensor Heads

N<sub>2</sub>O Wastewater Sensor heads are considered consumables and Unisense Environment guarantees that they will work according to the specifications for 4 months from the date of receipt.

THE LIMITED SENSOR WARRANTY SHALL UNDER NO CIRCUMSTANCES INCLUDE PHYSICAL DAMAGE TO THE TIP OF THE SENSOR.

The limited sensor warranty will terminate immediately if the sensors are not examined and tested immediately upon receipt. Unisense Environment will replace defective sensors if they have been tested according to the instructions in the manual within 14 days of receipt of the sensor(s).

The Customer shall notify Unisense Environment of any defect that occurs during the Warranty Period no later than five (5) business days after discovery of the defect, or after the defect should have been discovered by the Customer. The limited sensor warranty does only apply to defects that are discovered before the Warranty Period or reported to Unisense Environment within five (5) business days of being or should have been discovered.

If a defect arises and the Customer submits a valid claim to Unisense Environment in accordance with the section above, Unisense Environment will replace the sensor free of charge or refund to the Customer any amounts paid to Unisense Environment for the sensor. The replacement of the sensor or the refund of amounts shall be the Customer's sole remedy in case of a defect in a sensor.

For replacement of a defective sensor the Customer must contact Unisense Environment for a return authorization and thereafter return the sensor to Unisense Environment for inspection in the original sensor box and packed in accordance with instructions given by Unisense Environment staff.

Under no circumstances may the sensors be used in human diagnostic or therapeutic procedures.

### **Replacement of Sensor Heads:**

Unisense Environment replaces sensor heads that have been damaged during transportation provided that:

- The sensors were tested immediately upon receipt as specified in the General Terms of Sale and Delivery and the manual.
- The sensors are returned to Unisense Environment for inspection within two weeks
- The sensors are packed correctly during the return shipment to Unisense Environment (contact sales@unisense.com for instructions).

A standard N<sub>2</sub>O Wastewater Sensor Head is working correctly (at 21 degree Celsius=room temperature) if:

- The raw signal for zero nitrous oxide (in tap water or air) is below 3% after being mounted and turned on for >12 hours.
- If the slope after calibration is larger than ~15%
- It has a response time of <65 seconds

## 1.2 Calibration Kit

The N<sub>2</sub>O Calibration Kit is a consumable with a lifetime of 6 months as noted on the kit.

## 1.3 N<sub>2</sub>O Wastewater Operator Console, N<sub>2</sub>O Wastewater Connector Unit and Accessories

N<sub>2</sub>O Wastewater Operator Console, N<sub>2</sub>O Wastewater Connector Unit and accessories are covered by a 1-year limited warranty.

## 2. MANUFACTURER AND CONTACT INFORMATION

If you wish to order additional products or if you encounter any problems and need scientific/technical assistance, please contact our sales and support team. We strive to respond to your inquiry within one working day.

E-mail: [sales@unisense.com](mailto:sales@unisense.com)

Tel: +45 8944 9500

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Further documentation and support is available on our website: [unisense-environment.com](http://unisense-environment.com)

Note: If you find errors in this manual or have suggestions for improvements, please contact us.

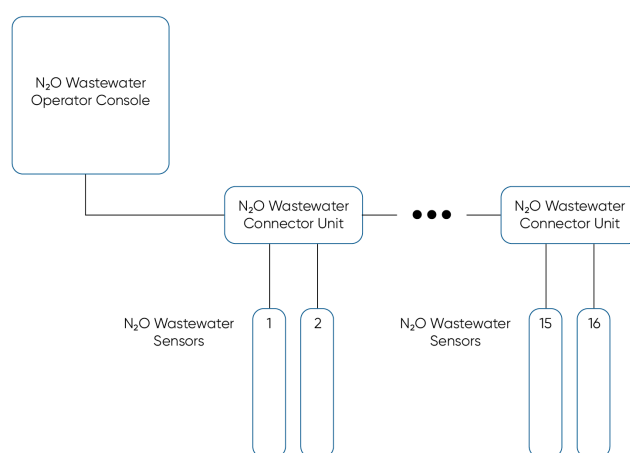
## 3. APPLICATION & COMPONENTS

### 3.1 Application

Unisense Environment's N<sub>2</sub>O Wastewater Sensor is designed to measure nitrous oxide (N<sub>2</sub>O) directly in wastewater where it can monitor nitrous oxide concentrations online 24/7 as well as calculate nitrous oxide emissions. The main application is to measure in the aerated or non-aerated liquid phase of an activated sludge process or other types of biological wastewater treatment.

### 3.2 Components

The N<sub>2</sub>O Wastewater System is comprised of an N<sub>2</sub>O Wastewater Operator Console, an N<sub>2</sub>O Wastewater Connector Unit and 1 or 2 N<sub>2</sub>O Wastewater Sensors. One N<sub>2</sub>O Wastewater Operator Console can manage up to 16 sensors.



*N<sub>2</sub>O Wastewater System setup and connections overview*

The N<sub>2</sub>O Wastewater Operator Console is used to manage and calibrate the nitrous oxide measurements. It can also be used for calculating the nitrous oxide emission rate with input from the aeration system. Unisense Environment advises setting up emission calculations directly in the WWTP SCADA as it provides maximum flexibility in data handling and process control.

By default the N<sub>2</sub>O Wastewater Operator Console is delivered with a 4-20mA and Modbus/TCP output that can be connected directly to the WWTP's control system. Another option is to connect the sensor to the SCADA system via -DP interface. Nitrous oxide measurements can furthermore be downloaded to a USB stick and be interpreted on a computer and a CSV-file, using any analytic software, e.g. Python.



*N<sub>2</sub>O Wastewater Operator Console*

The N<sub>2</sub>O Wastewater Sensor consists of 3 components: Sensor Head (1), Sensor Body (2) and Sensor Cap (3).



N<sub>2</sub>O Wastewater Sensor

The N<sub>2</sub>O Wastewater Sensor Body contains an N<sub>2</sub>O digital amplifier, a temperature sensor and is delivered with a standard 7 m cable. The N<sub>2</sub>O Wastewater Sensor Body and Sensor Cap are made of robust, surface-protected aluminium. The N<sub>2</sub>O Wastewater Sensor Cap protects the N<sub>2</sub>O Wastewater Sensor Head which is an extremely sensitive, electrochemical N<sub>2</sub>O sensor with a detection limit of <0.005 mg N<sub>2</sub>O-N per litre. For detailed specifications see [10. N<sub>2</sub>O Wastewater Sensor Specifications](#)

*IMPORTANT: Never leave the N<sub>2</sub>O Wastewater Sensor Body out in the open without an N<sub>2</sub>O Wastewater Sensor Head or black closure cap that it is shipped with. Alternatively cover well with e.g. a waterproof plastic bag. Water intrusion will damage electrical connections.*

The N<sub>2</sub>O Wastewater Operator Console can be mounted at a relevant spot at the WWTP using the already installed mounting brackets. Furthermore, the sensor can be secured by connecting a chain to the Sensor Chain Loop in the end of the sensor.

The N<sub>2</sub>O Wastewater Connector Unit connects up to 2 N<sub>2</sub>O Wastewater Sensors to the N<sub>2</sub>O Wastewater Operator Console. A status LED on the N<sub>2</sub>O Wastewater Connector Unit provides information about the N<sub>2</sub>O Wastewater Sensors connection. Furthermore the LED allows for a screenless calibration on site.



N<sub>2</sub>O Wastewater Connector Unit

**By default, the Unisense N<sub>2</sub>O Wastewater System consists of:**

- N<sub>2</sub>O Wastewater Sensor Body with Temperature sensor
- 7 m cable attached to sensor
- N<sub>2</sub>O Wastewater Sensor Cap
- N<sub>2</sub>O Wastewater Sensor Head
- N<sub>2</sub>O Wastewater Operator Console (with 4-20 mA and Modbus TCP/IP (default))
- N<sub>2</sub>O Wastewater Connector Unit
- N<sub>2</sub>O Calibration kit

**Optional equipment:**

- Extra cable (total length up to 30 m for each sensor)
- Chain

## 4. GETTING STARTED

### 4.1 Mounting & connecting the N<sub>2</sub>O Wastewater Sensor System

1. Find the correct location for the N<sub>2</sub>O Wastewater Sensor, N<sub>2</sub>O Wastewater Operator Console, and N<sub>2</sub>O Wastewater Connector Unit, and mount it safely, e.g. by using the Pipe Mounting Kit or in a suitable cabinet.
2. The N<sub>2</sub>O Wastewater Operator Console may be connected to the SCADA system of the WWTP. This will enable real time display of data in the SCADA system and logging of data together with other sensor data.
3. Remove the protective sticker from the N<sub>2</sub>O Wastewater Operator Console screen.
4. Connect the N<sub>2</sub>O Wastewater Operator Console to a power supply. The sensor measurements will be recorded in the N<sub>2</sub>O Wastewater Operator Console as soon as the sensors are connected through a N<sub>2</sub>O Wastewater Connector Unit.
5. Set the Modbus Bus Termination Switch inside the N<sub>2</sub>O Wastewater Connector Unit. Termination should be enabled only when the sensor is located at the physical ends of the Modbus line of N<sub>2</sub>O Wastewater Connector Units and otherwise be OFF to ensure proper signal integrity and reliable communication. See more in [7.1 Modbus Bus Termination Switch](#).
6. Use the DIP-switches inside the Connector Unit to configure the correct Modbus address for the N<sub>2</sub>O Wastewater Sensor *before* connecting the sensors. See [7.2 Setup Sensor Channels](#).
7. Connect the N<sub>2</sub>O Wastewater Connector Unit to the N<sub>2</sub>O Wastewater Operator Console. See [7. N<sub>2</sub>O Wastewater Connector Unit](#)
8. Connect up to two N<sub>2</sub>O Wastewater Sensors per N<sub>2</sub>O Wastewater Connector Unit. See Step-by-Step Guide: Installing the N<sub>2</sub>O Wastewater Sensor Head.  
It is recommended to place the N<sub>2</sub>O Wastewater Sensor in the wastewater using the Sensor Chain Loop to avoid strain on the cable.
9. Let the sensors stabilize sitting in a bucket of tap water for 12 hours (e.g. overnight), until the signal is stable and the Raw Signal is below 2%. The raw signal is read under Sensor Data on the N<sub>2</sub>O Wastewater Operator Console.
10. Continue with calibration of the sensors.

### 4.2 Calibration of the sensor

A two-point calibration is used to make the sensor operational. See the [Step-by-Step Guide: N<sub>2</sub>O Calibration](#).

In addition, note the following points:

- Calibration must take place at the same temperature as the wastewater which the sensor will be placed in. The calibration will be valid with minimal error for wastewater temperatures  $\pm 3^{\circ}\text{C}$  of the calibrated temperature.
- The sensor is calibrated using Unisense Environment's N<sub>2</sub>O calibration kit or similar equipment.
- A sensor must be calibrated at least every 2 months or if the wastewater temperature changes more than  $3^{\circ}\text{C}$ .
- A graduated beaker is recommended to measure out the 4L of water precisely.
- It is recommended to use two insulated buckets for holding the calibration liquid in order to ensure a stable temperature. By having one bucket for the zero solution and one for the standard, one can also perform the calibration of two sensors in a row using only one standard ampule.
- Furthermore, a digital thermometer is recommended for calibration.

*IMPORTANT: The built-in temperature sensor is located in the middle of the N<sub>2</sub>O Wastewater Sensor. Make sure it is submerged in water during calibration.*

## 5. N<sub>2</sub>O WASTEWATER SENSOR

### 5.1 Mounting the N<sub>2</sub>O Wastewater Sensor

The N<sub>2</sub>O Wastewater Sensor must be placed so that the entire metal body of the sensor is submerged in water. It is recommended to support the sensor's cable by mounting a chain along the cable and attaching it to the Sensor Chain Loop. The sensor must be placed in such a manner that it will not hit the tank wall or any other hard objects that could break the sensor. Possible changes in flow direction as well as the possibility of taking the sensor out of the water for calibration should be considered when placing it.

*WARNING: Do NOT fix screws or any kind of metal directly onto the N<sub>2</sub>O Wastewater Sensor as this will damage the surface protection of the aluminium by galvanic corrosion. Use only plastic material in contact with the sensor.*

### 5.2 Placement of the N<sub>2</sub>O Wastewater Sensor

The recommended measuring point for the N<sub>2</sub>O Wastewater Sensor is in the activated sludge process or alternative biological nitrogen removal process. More precise placement depends on the type of WWTP, e.g. whether the system has bottom aeration or surface aeration.

The sensor should be placed right below the water surface, fully submerged at all times.

*IMPORTANT: The sensor is sensitive to mechanical damage. Use proper mounting and placement to make sure it does not suffer e.g. from banging into a wall or similar.*

**Alternating processes:** In an alternating WWTP, the wastewater is typically fed continuously to multiple, connected tanks. The oxic and anoxic periods occur in the same tank. Typically, one sensor would be placed in each tank.

**Recirculation plants:** In a recirculation plant, the aerobic nitrification tank is separated from the denitrification process. It is suggested to place one sensor in each of the 2 process tanks: one by the outlet of the anoxic zone and the other 1/3 into the aerated zone.

**Bottom aeration:** In a plant with bottom aeration in only parts of the tanks, the sensor should be placed about 1/3 downstream in the aeration area. If two sensors are available in the same tank, one could be placed before and one above the bottom aeration.

**Surface aeration:** In plants with surface aeration, it would be appropriate to place the sensor right before the surface aeration rotor. If a second sensor is available, it can be placed in another part of the process that is not affected by the aeration.

**Side-stream processes:** The reject water from sludge dewatering typically contains high concentrations of ammonium and a low COD-content. These conditions provide a high potential for N<sub>2</sub>O formation. The nitrogen is primarily removed through anaerobic ammonium oxidation (Anammox process) also called the deammonification process. In reject water tanks, the wastewater is aerated with a low dissolved oxygen setpoint, so that about half of the ammonium is oxidized to nitrite and the other half is consumed through reaction with nitrite in the Anammox process. N<sub>2</sub>O can be used as a proxy for nitrite, which is more difficult to measure in real time. In these plants, one sensor should be placed in each process water tank.

## 5.3 Connection of the N<sub>2</sub>O Wastewater Sensor

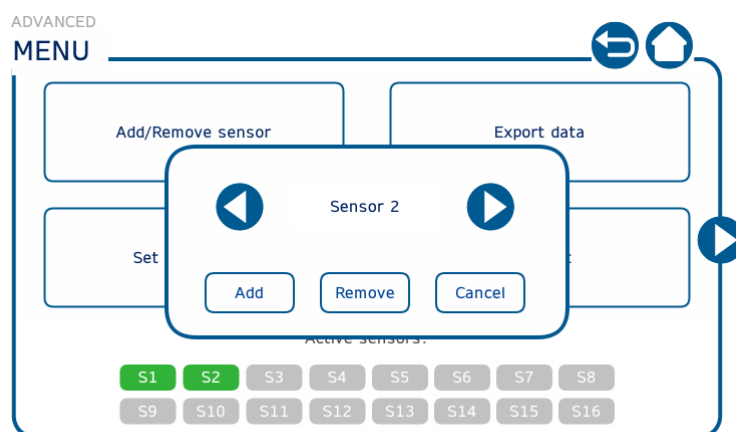
The N<sub>2</sub>O Wastewater Sensor is connected to the N<sub>2</sub>O Wastewater Operator Console, through the N<sub>2</sub>O Wastewater Connector Unit.

Make sure that the N<sub>2</sub>O Wastewater Connector Unit is connected to the N<sub>2</sub>O Wastewater Operator Console, and that the Modbus Bus Terminal Switch is set correctly. See [7. N<sub>2</sub>O Wastewater Connector Unit](#) for more information on how to install the N<sub>2</sub>O Wastewater Connector Unit.

The DIP-switch inside the N<sub>2</sub>O Wastewater Connector Unit must be set *before* connecting the N<sub>2</sub>O Wastewater Sensor. See [7.2 Setup Sensor Channels](#). There is a DIP-switch for each sensor, and make sure to set both of them if two sensors are connected.

At the end of the sensor's cable there is a binder plug that can be plugged directly into the N<sub>2</sub>O Wastewater Connector Unit. As soon as the sensor is plugged in, it is connected.

To complete the connection, the sensor must be added to the N<sub>2</sub>O Wastewater Operator Console. Go to the menu to add the sensor. The sensor you want to add corresponds to the address set on the DIP-switch. Example: When the Modbus address is set to 4 on the DIP-switch, it will be Sensor 4 on the N<sub>2</sub>O Wastewater Operator Console.



## 5.4 Installing and pre-polarization of the N<sub>2</sub>O Wastewater Sensor

Install an N<sub>2</sub>O Wastewater Sensor head, making sure that O-rings on the head and the aluminium tube are lubricated. See [Step-by-Step Guide: Installing the N<sub>2</sub>O Wastewater Sensor Head](#) for details.

When you connect the sensor to the N<sub>2</sub>O Wastewater Connector Unit and add it to the N<sub>2</sub>O Wastewater Operator Console, it will automatically start a 30-minute pre-polarization.

During pre-polarization, the raw signal will increase quickly. Afterwards the sensor switches to polarization. At this point, the raw signal will drop quickly at first, then decrease more slowly until it reaches a stable, low level. Wait until the signal is stable and below 2%. This may take up to 12 hours. During both pre-polarization and polarization, keep the sensor in a bucket of tap water.

If the signal does not stabilize or if it is too high, please go to [10. Troubleshooting](#) in this manual or contact [sales@unisense.com](mailto:sales@unisense.com).

## 5.5 The construction of the N<sub>2</sub>O Wastewater Sensor

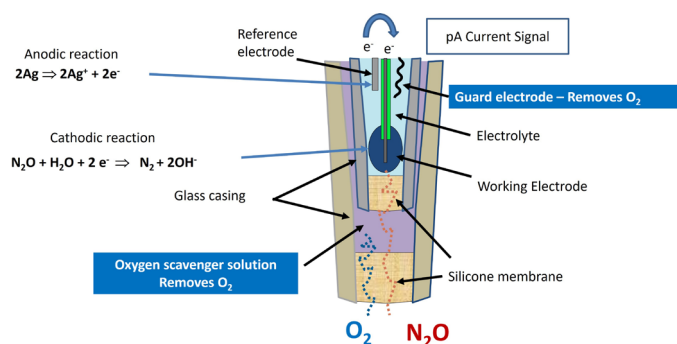
The N<sub>2</sub>O Wastewater Sensor Body contains the electronics and ensures that the sensor is automatically polarized as soon as it is connected to a powered N<sub>2</sub>O Wastewater Operator Console. The N<sub>2</sub>O Wastewater Sensor Body also contains a temperature sensor that is placed in the middle of the N<sub>2</sub>O Wastewater Sensor Body. The N<sub>2</sub>O Wastewater Sensor Body (2) and N<sub>2</sub>O Wastewater Sensor Cap (3) are made of robust, surface protected aluminium.



*The three components of the N<sub>2</sub>O Wastewater Sensor:  
N<sub>2</sub>O Wastewater Sensor Head (1), N<sub>2</sub>O Wastewater Sensor Body (2) and N<sub>2</sub>O Wastewater Sensor Cap (3)*

The N<sub>2</sub>O Wastewater Sensor Head (1) is a Clark-type sensor with an internal reference, a cathode, a guard cathode, and a front oxygen trap with reducing medium. It removes oxygen so that this does not interfere with the nitrous oxide measurements. When the N<sub>2</sub>O Wastewater Sensor Head is connected to the N<sub>2</sub>O Wastewater Sensor Body, the cathode and the guard cathode in the N<sub>2</sub>O Wastewater Sensor Head are polarized against the internal reference. The depletion of oxygen from the electrolyte starts when the sensor head is connected but takes a while to be reduced to a stable background level. Therefore, the signal for zero nitrous oxide will be decreasing over the first hours after a sensor head is connected, and it is recommended to leave a newly connected N<sub>2</sub>O Wastewater Sensor Head to polarize overnight before calibration is performed.

Nitrous oxide enters the sensor through a silicone rubber membrane in the center of the 0.5 mm diameter glass sensor tip. Inside the sensor, nitrous oxide is reduced to N<sub>2</sub> which generates an electrical current. This is the sensor signal.



*View of the sensor tip showing the measurement principle of the N<sub>2</sub>O sensor*

## 5.6 Calibration

Calibration of the sensors can be done using the N<sub>2</sub>O Calibration Kit or similar equipment. It should be performed at least every 2 months and also if the process temperature deviates by more than 3°C for more than a few days. Recalibration is not needed or recommended in case of short term temperature drops, e.g. due to heavy rain.



N<sub>2</sub>O Calibration Kit

The N<sub>2</sub>O Calibration Kit is used for a 2-point calibration of the N<sub>2</sub>O Wastewater Sensor. It contains enough standard solution for 3 calibrations.

The two-point calibration can be performed on the N<sub>2</sub>O Wastewater Operator Console or screenless with the N<sub>2</sub>O Wastewater Connector Unit. See the [Step-By-Step Calibration Guides](#).

For High Range Sensor Heads, note the modifications described in the Calibration for Standard, Medium and High Range Sensor Heads guide at [unisense-environment.com/manuals](http://unisense-environment.com/manuals).

A graduated beaker is recommended to measure 4L of water precisely. It is recommended to use two insulated buckets for holding the calibration liquid in order to ensure a stable temperature. By having one bucket for the zero solution and one for the standard, one can also perform the calibration of two sensors in a row using only one standard ampule. Furthermore, a digital thermometer is recommended for calibration.

The N<sub>2</sub>O Wastewater Sensor responds linearly to nitrous oxide within its dedicated working range. Therefore, only a two-point calibration is needed. This is done by exposing the N<sub>2</sub>O Wastewater Sensor to two concentrations of N<sub>2</sub>O, zero, and one known concentration of N<sub>2</sub>O. Tap water is used for the zero point and the N<sub>2</sub>O Calibration Kit will give 0.94 mg N<sub>2</sub>O-N/L, which is suitable for a Standard Range N<sub>2</sub>O Sensor Head.

The sensor signal for N<sub>2</sub>O is dependent on temperature. Therefore, the calibration should be performed at a temperature close to the measurement temperature. By default, the concentration value is compensated for a temperature ± 3 °C from the calibration temperature.

*IMPORTANT: Do not place the Standard Range N<sub>2</sub>O Wastewater Sensor in a nitrous oxide concentration of more than 1.5 mg N<sub>2</sub>O-N/L, as this will damage the sensor. The recommended calibration concentrations for non-standard N<sub>2</sub>O Wastewater Sensors can be found in [11. Specifications](#).*

Unisense Environment offers a standard N<sub>2</sub>O Wastewater Sensor and a High Temperature N<sub>2</sub>O Wastewater Sensor. The sensors are available with:

- Standard Range (0-1.5 mg N<sub>2</sub>O-N/L)
- Medium Range (0-9 mg N<sub>2</sub>O-N/L)
- High Range (0-110 mg N<sub>2</sub>O-N/L).

The standard N<sub>2</sub>O Wastewater Sensors are designed to operate at temperatures between 0-27°C. The High Temperature N<sub>2</sub>O Wastewater Sensor is designed to operate at temperatures between 27-40°C.

The N<sub>2</sub>O Wastewater Sensors must never be exposed to N<sub>2</sub>O concentrations above their working range as this will damage the sensor. When using high range sensors on a 4-20 mA connection, the output ranges must be changed on the N<sub>2</sub>O Wastewater Operator Console.

For details on calibrating the alternative sensor heads see the [Calibration for Standard, Medium and High Range Sensor Heads](https://www.unisense-environment.com/manuals) guide at [unisense-environment.com/manuals](https://www.unisense-environment.com/manuals).

Target values for calibration (standard range head, at room temperature):

Slope: 15-150%

Zero value: >-0.5

## 5.7 Autozero

The measuring range of the sensor is extended into the negative, giving a maximum sensitivity at very low concentrations. If the sensor reads steady values between 0.00 and -0.05 N<sub>2</sub>O-N mg/L for 15 min, the Autozero feature will set this as new baseline. If the values are continuously lower than -0.05, Autozero will raise an alarm indicating the need to perform a new two-point calibration.

## 5.8 Replacement of an N<sub>2</sub>O Wastewater Sensor Head

Unisense Environment guarantees a lifetime of 4 months for the N<sub>2</sub>O Wastewater Sensor Head. However, the typical lifetime of the N<sub>2</sub>O Wastewater Sensor Head is 6 months. For obtaining continuous data series, we recommend replacing the N<sub>2</sub>O Wastewater Sensor Head every 6 months.

*IMPORTANT: Never leave the N<sub>2</sub>O Wastewater Sensor Body out in the open without an N<sub>2</sub>O Wastewater Sensor Head or black closure cap that it is shipped with. Alternatively cover well with e.g. a plastic bag. Water intrusion will damage electrical connections.*

N<sub>2</sub>O Wastewater Sensor Heads cannot be stored, therefore they are made to order. Prescheduled shipment of N<sub>2</sub>O Wastewater Sensor Heads can be arranged with every order. See the [Step-By-Step Guide: N<sub>2</sub>O Wastewater Sensor Head Replacement](#)

## 5.9 Temperature Sensor

The measurement of the N<sub>2</sub>O concentrations is temperature-dependent, and the N<sub>2</sub>O concentration measurements are, therefore, temperature corrected. The N<sub>2</sub>O Wastewater Sensor has a built-in temperature sensor.

As the temperature sensor is placed inside the aluminium housing, it responds slowly to changes outside the sensor body. The temperature sensor is factory calibrated and does not need further calibration.

During nitrous oxide measurements, it is important that the entire sensor (both the N<sub>2</sub>O Wastewater Sensor Head and the N<sub>2</sub>O Wastewater Sensor Body) is completely submerged in water. Only the black top of the sensor may be visible above the water.

## 5.10 Interferences

Avoid exposing the sensor to high concentrations of Hydrogen Sulfide (H<sub>2</sub>S), as this can influence the sensitivity of the sensor. Nitric Oxide (NO) can also interfere with the sensor's signal, but concentrations high enough typically only occur in special cases during research experiments. If you suspect the sensor is broken, repeat the calibration and read [10. Troubleshooting](#).

## 6. N<sub>2</sub>O WASTEWATER OPERATOR CONSOLE

The N<sub>2</sub>O Wastewater Operator Console can be installed outside, next to the wastewater treatment process. The Pipe Mounting Kit makes mounting easy for example on the rails of a boardwalk. Alternatively, it can be mounted in a cabinet.



*N<sub>2</sub>O Wastewater Operator Console*

Data from the sensors will always be logged on the N<sub>2</sub>O Wastewater Operator Console (for 2 sensors data storage for app. 1 year is available) but may also be sent directly to a SCADA system. The available protocols are 4-20 mA analog output, Modbus TCP/IP (default), Modbus Serial (optional), and Profibus-DP (optional). See [10. Specifications](#) for details. Data stored on the N<sub>2</sub>O Wastewater Operator Console may be downloaded to a USB memory stick for analysis on a PC with the PCA3000 software (license required).

The N<sub>2</sub>O emission rates may be calculated on the N<sub>2</sub>O Wastewater Operator Console, if the aeration rate is delivered via a 4-20 mA input.

For further information, please see the N<sub>2</sub>O Wastewater Operator Console Manual available at [www.unisense-environment.com](http://www.unisense-environment.com).

### 6.1 Connections

The N<sub>2</sub>O Wastewater Operator Console's, most frequently used connectivity options are described below:

**Power supply:** The N<sub>2</sub>O Wastewater Operator Console must be connected to a power supply (AC 100 to 240 V, 24V 2.5 A).

**N<sub>2</sub>O Wastewater Connector Unit and Sensor connections:** The N<sub>2</sub>O Wastewater Connector Unit is connected through the plugs in the N<sub>2</sub>O Wastewater Operator Console. The N<sub>2</sub>O Wastewater Sensors are connected through the N<sub>2</sub>O Wastewater Connector Units sensor channels located on the underside of the N<sub>2</sub>O Wastewater Connector Unit. The plug for sensor 1 is to the left and the plug for sensor 2 is to the right.

Install a suitable cable according to the required specifications: for distances up to 100 m (in total), use a 2×2×0.5 mm<sup>2</sup> twisted pair cable with overall shield (OS), and for distances up to 200 m (in total), use a 2×2×0.75 mm<sup>2</sup> twisted pair cable with overall shield (OS).

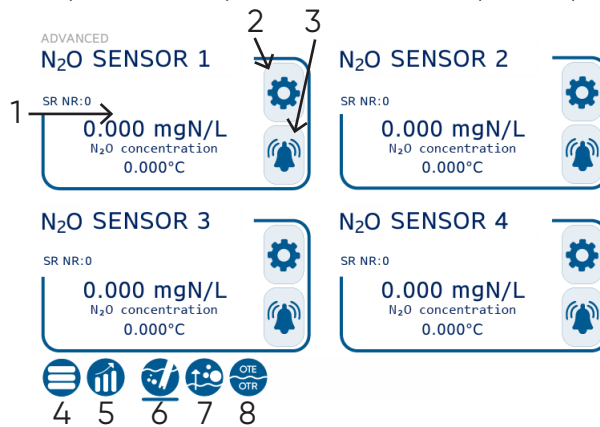
**Output (4-20 mA):** The nitrous oxide measurements and nitrous oxide emission rates can be sent directly from the N<sub>2</sub>O Wastewater Operator Console to the SCADA system with 4-20 mA outputs. In the default settings, 4 mA corresponds to 0 mg N<sub>2</sub>O-N/L and 20 mA corresponds to 2 mg N<sub>2</sub>O-N/L. When using high range sensor heads, consult the Specification Guides: Changing Analogue Signal Output (high range sensors) for alternative settings.

**Modbus TCP:**

Modbus TCP: Modbus TCP can be used as an alternative communication protocol. See Modbus TCP/IP Register Documentation for a description and setup guide.

## 6.2 Navigation

The N<sub>2</sub>O Wastewater Operator Console provides the option to connect and operate up to 16 sensors.

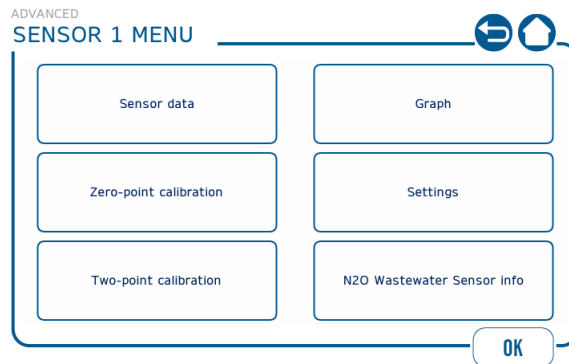


From the Sensor Main Screen (6), it is possible to go to: Sensor Information (1), Sensor Menu (2), Sensor Alarm (3), Menu (4), Graphs (5), Sensor Main Screen (6), Emission Main Screen (7), OTE/OTR Screen (8).

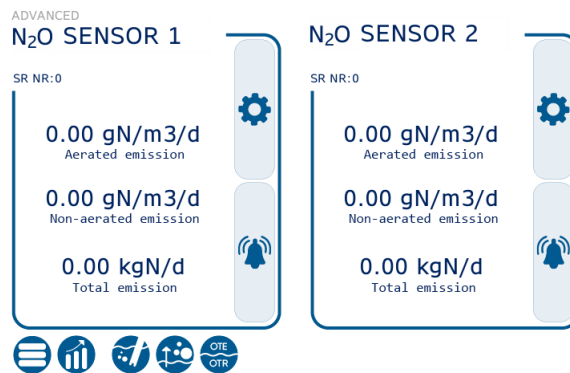
Under Sensor Information (1), you will find the key details for each device, including the current device status, raw measurement values, and the most recent calibration data.

In the Menu (4), you can log in with different access levels (Operator, Advanced, or Service), configure the system time, add or remove sensors, and access additional system settings.

Under Graphs (5), you can display and monitor live data from the selected sensors in graphical form.



The Sensor Menu (2) provides access to sensor-specific functions, including calibration options, settings, and other relevant sensor information.



The Emission Main Screen (7) encompasses all functionalities available on the Sensor Main Screen (6), with the distinction that it presents emission-specific data, including total emissions, prominently on the primary interface and under the Sensor Information.

## 6.3 N<sub>2</sub>O Wastewater Operator Console user login

To use the N<sub>2</sub>O Wastewater Operator Console, the user must log in.

Four access levels are available, each with different permissions (see table):

**Guest:** No password required.

**Operator:** No password is set by default. For security, it is recommended to set a password. The password can only be changed by an Advanced user.

**Advanced:** The default password is provided on the product invoice under the product information.

**Service:** Contact Unisense Environment to obtain the password.

Permissions	Console User Login			
	Guest	Operator	Advanced	Service
- View sensor data & graphs	x	x	x	x
- View sensor error/warning & status	x	x	x	x
- Calibrate sensors		x	x	x
- Operation logbook		x	x	x
- View System Error log		x	x	x
<b>Sensor Body configuration</b>				
- Change sensor measuring units			x	x
- Temperature & airflow inputs			x	x
- External input/output settings			x	x
- External input/output settings			x	x
- Emission Parameters			x	x
- Change TagName			x	x
<b>Operator Console configuration</b>				
- Change Operator password			x	x
- Enable Demo Mode			x	x
- Setup MODBUS TCP/IP			x	x
- Change screen brightness			x	x
- Firmware update console			x	x
<b>Other</b>				
- Change MODBUS configuration				x
- Firmware update sensor				x
- Advanced sensor data				x

## 7. N<sub>2</sub>O WASTEWATER CONNECTOR UNIT

The N<sub>2</sub>O Wastewater Connector Unit connects up to 2 N<sub>2</sub>O Wastewater Sensors to the N<sub>2</sub>O Wastewater Operator Console. A status LED on the N<sub>2</sub>O Wastewater Connector Unit provides information about the sensors connection. Furthermore, the LED allows for a screenless calibration on site.



*N<sub>2</sub>O Wastewater Connector Unit*

The N<sub>2</sub>O Wastewater Connector Unit is easily mounted, for example, on the rails of a boardwalk. Up to two sensors can be connected to the N<sub>2</sub>O Wastewater Connector Unit, each sensor connected via a 5 m cable. A cable of varying length is used between the N<sub>2</sub>O Wastewater Operator Console and the N<sub>2</sub>O Wastewater Connector Unit.

Additional N<sub>2</sub>O Wastewater Connector Units can be installed in a serial connection. Up to 8 N<sub>2</sub>O Wastewater Connector Units can be linked to each N<sub>2</sub>O Wastewater Operator Console, allowing for a total of 16 sensors.

To identify whether power is supplied to the N<sub>2</sub>O Wastewater Connector Unit, the LED will light up green shortly after the power is turned on. If it does not light up, there is a fault in the connection to the N<sub>2</sub>O Wastewater Connector Unit.

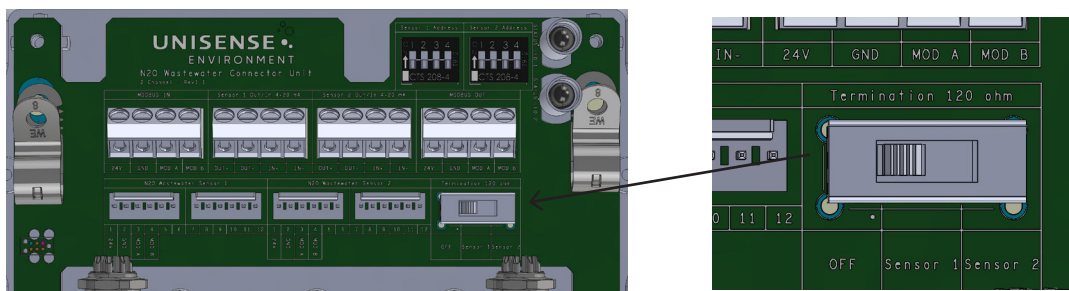
### 7.1 Modbus Bus Termination Switch

Before connecting the sensors, the Modbus Bus Termination Switch inside the N<sub>2</sub>O Wastewater Connector Unit must be set. Termination should be enabled only when the sensors are located at the physical ends of the Modbus line of N<sub>2</sub>O Wastewater Connector Units and otherwise be in OFF to ensure proper signal integrity and reliable communication.

The Modbus Bus Termination Switch on the connector unit located at the physical end of the Modbus line must be enabled.

- If 1 sensor is connected to the last N<sub>2</sub>O Wastewater Connector Unit, set the Termination Switch to Sensor 1.
- If 2 sensors are connected, set the Termination Switch to Sensor 2.

Ensure that the Modbus Out connector is fitted with a plug when the unit is the last one in the row, in order to protect against water ingress.

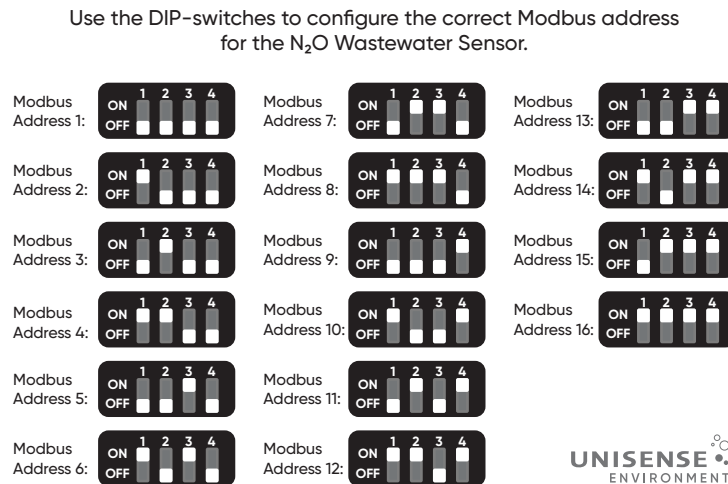


*The Modbus Bus Termination Switch. From the left: OFF, Sensor 1, Sensor 2*

## 7.2 Setup Sensor channels

Use the DIP-switches inside of the N<sub>2</sub>O Wastewater Connector Unit to configure the correct Modbus address for the N<sub>2</sub>O Wastewater Sensor.

There are two dip switches in the N<sub>2</sub>O Wastewater Connector Unit. One for each of the sensors that can be connected. Be sure to set the correct channel for the correct sensor. Instructions and a visual representation for finding the correct addresses is also inside the N<sub>2</sub>O Wastewater Connector Unit.



The DIP-switch must be set to the right address before connecting the sensor. When the sensor is connected and added on the N<sub>2</sub>O Wastewater Operator Console, the status LED on the N<sub>2</sub>O Wastewater Connector Unit will blink blue. If the connection fails, the LED will turn solid red.

## 7.3 Screenless calibration

A simple two-point calibration can be performed using the N<sub>2</sub>O Wastewater Connector Unit's status LEDs in combination with the sensor's motion detection.

This method allows you to calibrate the sensor without using the N<sub>2</sub>O Wastewater Operator Console, making it possible to perform the calibration directly at the sensor location, regardless of the distance to the N<sub>2</sub>O Wastewater Operator Console.

During the process, the status LED guides you through each step using specific colors and flashing patterns.

For detailed instructions, see the Step-by-Step Guide: Screenless Calibration.

## 8. STORAGE AND CLEANING

### 8.1 The N<sub>2</sub>O Wastewater Sensor

When the sensor is not used, it should be stored safely in the protection box, it is delivered in. However, long-term storage (more than 2 months) of the sensor head is not recommended.

Once the sensor has been in contact with wastewater, it should not be left to dry, to avoid biofilm drying up on the tip. If it should leave the wastewater and be used again at a later stage, store it with the tip in a bucket of water.

**Handling:** The N<sub>2</sub>O Wastewater Sensor Head is made of glass and is therefore sensitive to mechanical force. When handling the sensor, e.g. while taking it out of the wastewater for calibration or during installation, make sure to avoid any impact (e.g. knocking on the railing or the side of the calibration bucket) which may damage the instrument.

**Cleaning of glass tip:** Being placed in wastewater, biofilm can develop on the N<sub>2</sub>O Wastewater Sensor Body and Cap and the N<sub>2</sub>O Wastewater Sensor Head. From years of practical experience, it is known that the presence of biofilm on the N<sub>2</sub>O Wastewater Sensor Head does not interfere with measurements. This is because the outer sensor tip will stay free from biofilm due to its pointy geometry. Therefore, manual cleaning of the glass electrode is almost never necessary. If biofilm does develop on the outer tip of the sensor, it should be removed with running water and/or gentle wiping with soft tissue. Always wipe away from the tip.

**External cleaning:** Before re-calibrating the sensor, the bulk of biofilm accumulated on the N<sub>2</sub>O Wastewater Sensor Body and Cap (if present) and any larger objects (rags, hairs etc.) should be removed. This is done manually, by carefully rubbing the surface of the body with a soft brush or sponge – Making sure to not touch the sensor tip in the process. Cleaning should be assisted by rinsing with water.

While this cleaning procedure may not remove all biofilm present, it will suffice to ensure a stable calibration. If ragging is a constant issue at the site, removal of debris might be necessary more often to ensure that the tip of the sensor is exposed to the bulk liquid.



*The debris on the left picture should be removed, while the sensor tip on the right does not need to be cleaned before calibration. If the outer tip is fouled, clean only with running water and soft tissue, always wiping away from the tip.*

### 8.2 The N<sub>2</sub>O Wastewater Operator Console

The N<sub>2</sub>O Wastewater Operator Console must be protected against sun, wind and weather. Cleaning is done using tap water, mild soap, and a very soft brush.

### 8.3 The N<sub>2</sub>O Wastewater Connector Unit

Cleaning is done using tap water, mild soap, and a very soft brush.

## 10. TROUBLESHOOTING

<b>Problem</b>	Raw Sensor Values above 2% in air or tap water.
<b>Possible cause</b>	Air bubble in the tip of the N <sub>2</sub> O Wastewater Sensor.
<b>Solution</b>	<ol style="list-style-type: none"><li>1. Remove the air bubble by lifting the sensor above your head (tip pointing up) and give it a big "shake" downwards – as you would with an old-fashioned mercury thermometer. Be careful not to break the sensor. Find a video guide at <a href="https://unisense-environment.com/video-guides">unisense-environment.com/video-guides</a>.</li><li>2. If the raw Sensor Value remains high, it may be due to very small air bubbles in the tip. These may be removed from the tip by placing it in degassed water. For this, boil a few liters of water for about 10 min. Let the water cool down to ambient temperature without stirring and place the sensor in this water for 1 hour.</li></ol>
<b>Problem</b>	Raw Sensor Value is constantly high (99-100%) or low. No reaction to N <sub>2</sub> O.
<b>Possible cause</b>	<ol style="list-style-type: none"><li>1. The tip of the sensor or the sensor membrane is broken, likely due to physical damage.</li><li>2. Water has entered between the sensor body and sensor head, often due to mishandling.</li><li>3. N<sub>2</sub>O Wastewater Operator Console is faulty (e.g. loose wiring)</li></ol>
<b>Solution</b>	<ol style="list-style-type: none"><li>1. Replace sensor head. If in doubt, return the faulty sensor head to Unisense Environment for inspection*.</li><li>2. Test if the problem is with sensor body or controller by switching around two sensor body cables. Wait 30 min for the polarization procedure to take place. If applicable, return sensor body to Unisense Environment for repair*.</li><li>3. If possible, check if all wiring in console is correct and not loose. If no result, return the N<sub>2</sub>O Wastewater Operator Console to Unisense Environment for repair*.</li></ol>
<b>Problem</b>	N <sub>2</sub> O concentration value (mg N <sub>2</sub> O-N/L) fluctuates strongly when sensor is in tap water.
<b>Possible cause</b>	The previous calibration is faulty.
<b>Solution</b>	Start a two-point calibration and press 'Reset Calibration', this will reset the calibration. Make a new two-point calibration afterwards.
<b>Problem</b>	Baseline drift: baseline at < -0.01 or > 0.01 mg/L. (Mind that negative numbers are logged in SCADA as zeros, so a baseline drift towards negative values can be identified in SCADA by measuring zeros for a long time, not by negative numbers.)
<b>Possible cause</b>	<ol style="list-style-type: none"><li>1. The N<sub>2</sub>O Wastewater Sensor Head is more than 6 months old.</li><li>2. The wastewater temperature has changed more than 3°C since the last calibration.</li></ol>
<b>Solution</b>	<ol style="list-style-type: none"><li>1. Exchange the sensor head.</li><li>2. Perform a two-point calibration.</li></ol>
<b>Problem</b>	Increase of baseline over time.
<b>Possible cause</b>	<ol style="list-style-type: none"><li>1. N<sub>2</sub>O Wastewater Sensor Head is more than 6 months old or has been exposed to elevated N<sub>2</sub>O over long time.</li><li>2. N<sub>2</sub>O Wastewater Sensor has been used at high temperature (&lt;35°C)</li></ol>
<b>Solution</b>	<ol style="list-style-type: none"><li>1. Replace sensor head.</li><li>2. Consider a High Temperature version of the sensor head.</li></ol>
<b>Problem</b>	Slow response time: e.g. after 10 min waiting the measurement value is still increasing in the high concentration calibration liquid.
<b>Possible cause</b>	<ol style="list-style-type: none"><li>1. Sensor head is more than 6 months old.</li><li>2. Presence of an air bubble in the sensor tip.</li></ol>

<b>Solution</b>	<ol style="list-style-type: none"> <li>1. Replace sensor head.</li> <li>2. Perform air bubble procedure from top of this list.</li> </ol>
<b>Problem</b>	High slope after calibration (> 75%).
<b>Possible cause</b>	<ol style="list-style-type: none"> <li>1. Faulty calibration.</li> <li>2. Sensor head is more than 6 months old.</li> </ol>
<b>Solution</b>	<ol style="list-style-type: none"> <li>1. Perform another two-point calibration.</li> <li>2. Replace sensor head</li> </ol>
<b>Problem</b>	Sensor Body and Sensor Cap have started to corrode.
<b>Possible cause</b>	The corrosion protective layer on the aluminium sensor body (the anodization) has deteriorated and/or the sensor is in direct contact with another metal which will cause galvanic corrosion.
<b>Solution</b>	Replace the corroded parts and make sure that the sensor is not in direct contact with any other metal when it is in water.
<b>Problem</b>	The N <sub>2</sub> O Wastewater Sensor can be calibrated, but the calibrated nitrous oxide concentration does not appear in the overview window. The temperature value is fluctuating.
<b>Possible cause</b>	There is a fault in the temperature sensor, located in the sensor body.
<b>Solution</b>	Test if the problem is with the sensor body by switching it to the other channel on the console. If issue can be located to sensor body, return it to Unisense Environment for repair*.
<b>Problem</b>	No temperature reading is given on controller (---).
<b>Possible cause</b>	There is a fault in the temperature sensor, located in the sensor body.
<b>Solution</b>	Test if the problem is with the sensor body by switching it to the other channel on the controller. If issue can be located to sensor body, return it to Unisense Environment for repair*.
<b>Problem</b>	The touchpad reacts in an imprecise way.
<b>Possible cause</b>	The calibration of the touchpad is off.
<b>Solution</b>	Run a screen calibration by going to the menu: /Calibrate touchscreen and follow the prompts. This may need to be repeated several times.

\*Always contact Unisense Environment before returning equipment.

If you experience other errors or problems and you need technical assistance, please contact us at [sales@unisense.com](mailto:sales@unisense.com) (we strive to respond within one working day).

## 11. SPECIFICATIONS

### N<sub>2</sub>O Wastewater Sensor Body

Material	Anodized aluminium alloy. Robust design in aluminium alloy casing (6063-T6) and black POMacetyl copolymer
Dimensions & weight	60mm x 390mm (D x L), 1,2 kg
Mounting	Chain Loop and stainless steel chain kit
Power Supply	24V DC from N <sub>2</sub> O Wastewater Connector Unit
Communication	ModbusRTU (Slave)
N2O signal	1 x temp. compensated N <sub>2</sub> O value (N <sub>2</sub> O-N [mg/L] or ppm)
Temperature	1 x temperature (°C or °F)
Emission Rates	1 x Emission calculations (N <sub>2</sub> O-N [mg/m <sup>3</sup> /d]) with dynamic input parameters Emissions from anaerobic, anoxic and aerobic zones
Emission Parameters	$k_L \alpha_{N_2O}$ , $V_{gas}$
Aeration Metrics	Based on digital input of DO <sub>liq</sub> , DO <sub>air</sub> and air flux, these are calculated: OTR, OTE, OUR, $k_L \alpha_{O_2}$ , $\alpha F$ , SOTR, SOTE, AE, SAE
Datalogger	Sensor and emission data (+2 years days data) Calibration and sensor logbook (+ 1 year logbook)
Sensor Health	Sensor & calibration status: needs calibration, needs replacement, warnings & errors Diagnostic data: Raw and calibration signals

### N<sub>2</sub>O Wastewater Sensor Head

Material	Alloy connector, glass sensor Black POM acetyl copolymer
Measurement method	Electrochemical, clark type
Measuring range	Standard Range: 0-1.5 N <sub>2</sub> O-N mg/L    Auto setup Medium Range: 0-9 N <sub>2</sub> O-N mg/L    Auto setup High Range: 0-110 N <sub>2</sub> O-N mg/L    Auto setup
Detection limit	Standard Range: 0.005 N <sub>2</sub> O-N mg/L Medium Range: 0.03 N <sub>2</sub> O-N mg/L High Range: 0.4 N <sub>2</sub> O-N mg/L
Response time	< 65 sec
Expected lifetime	> 6 months
Calibration	2-point calibration, every second month
Temperature Working Range	Replaceable N <sub>2</sub> O Sensor head for either 0-27°C or 27-40°C
Digital E <sup>2</sup> PROM Enabled	Storage of sensor specific data, factory and calibrations, remaining lifetime

## N<sub>2</sub>O Wastewater Operator Console

Material	Stainless steel cabinet (IP67)
Dimensions & weight	300mm x 300mm x 150mm (LxWxD), 6.5 kg
Mounting	Panel mounted
Power supply	AC 100 to 240 V ±10%; 50..60Hz, 60W
Cable requirements	2×2×0.5 mm <sup>2</sup> twisted pair cable with overall shield (OS) for distances up to 100 m 2×2×0.75 mm <sup>2</sup> twisted pair cable with overall shield (OS) for distances up to 200 m
Communication	ModbusRTU (Master to Connector Unit and N <sub>2</sub> O Sensors)
Sensor Input Digital	Full digital support & communication from up to 16 sensors  PLC/SCADA. Full data access via Modbus TCP/IP Optional: ProfiBusDP or ModbusRTU (Slave)
N <sub>2</sub> O sensor support	Up to 16 N <sub>2</sub> O sensors and 8 Connector units per console

## N<sub>2</sub>O Wastewater Connector Unit

Material	Surface-mounted case made of plastic (ABC) IP67
Dimensions & weight	150mm x 100mm x 60mm (L x W x D), 0.5kg
Mounting	Multiple holes for surface or pipe mounting
Power Supply	24V DC, 2.5A from N <sub>2</sub> O Wastewater Operator Console
Communication	ModbusRTU (Master & Slave) with Console and Sensor
Sensor Output Analog	1 (optional 3) x configurable and user scaled output signals (Analog 4-20mA)
Sensor Input Digital	Optional: 1 x MODBUS RTU Slave (DO sensors), tank and aeration dimension
Sensor Input Analog	Air flow (Nm <sup>3</sup> /h, m <sup>3</sup> /h), User scaled input signal, (Analog 4-20mA)

## System Certifications

Certificates	CE, FCC, CB certificate, certificates pending for CSA & UKCA
Safety	IEC 61010-1:2010 + AMD1:2016, EN 61010-1:2010 + A1:2019, UL 61010-1:2012/R:2024, CSA C22.2 No. 61010-1/UPD4:2024
Electrically	EMC/Immunity (EU) EN 55011 and EN 61326-1 EMC/Immunity (USA/CAN) Issue 01 - FCC 47 CFR Part 15B and ICES-003
Environmental	Directive 2011/65/EU (RoHS 2) and 2015/863(EU)

# N<sub>2</sub>O Wastewater Sensor Head replacement

A Step-by-Step Guide to changing the Sensor Head

## Step 1 – Unscrew Sensor Cap

1. Hold the Sensor downwards.
2. Hold the Sensor Body with one hand and turn the Sensor Cap counterclockwise.
3. Lift up the Sensor Body. The Sensor Head sits in the Sensor Cap.



## Step 2 – Remove the Sensor Head

4. Place the Sensor Cap with the Sensor Head on a stable surface.
5. Hold down the Sensor Cap with one hand while carefully pulling out the Sensor Head.
6. Slowly pull out the Sensor Head. Be careful not to hit the Sensor Head.



## Step 3 – Insert new Sensor Head

7. Together with the Sensor Head you find a small pack of lubricant for the O-rings.
8. Apply grease to the two O-rings. One on the Sensor Head and one inside the Sensor Cap.
9. Hold onto the Sensor Cap with one hand and gently push the Sensor Head into the Sensor Cap.
10. Press it all the way down.



## Step 4 – Assemble Sensor

11. Bring the Sensor Body over the Sensor Head and Cap.
12. While still pointing the sensor downwards screw the Sensor Cap back onto the Sensor Body.



## Step 5 – Let it stabilize

13. When the Sensor Head is connected to the Sensor Body let it stabilize overnight before proceeding with the calibration procedure.

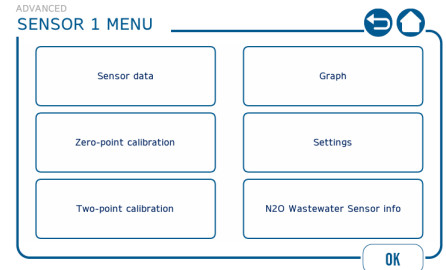
Version: May 2026

# Zero-point Calibration

A Step-by-Step Guide Using the Operator Panel

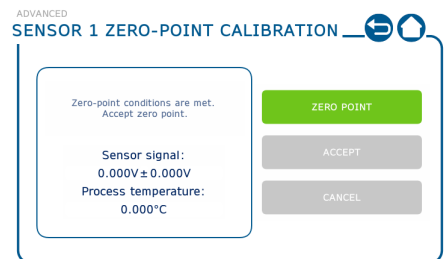
## Step 1 – Start Zero-point Calibration

1. Go to the menu of the N<sub>2</sub>O Wastewater Sensor you want to calibrate. Click the 'Manage button'  to go to the menu.
2. Click on the **Zero-point Calibration** button to start the calibration.



## Step 2 – Zero Point

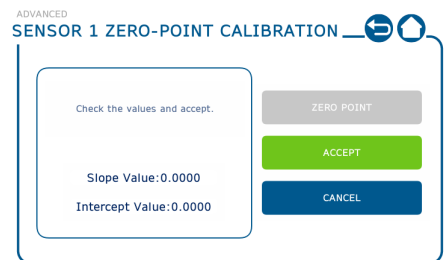
3. Place the N<sub>2</sub>O Wastewater Sensor in tap water *without* N<sub>2</sub>O in it.
4. The sensor is measuring the concentration in the water to set the zero point. This may take a few minutes.
5. When the **Zero Point** button goes from *orange* to *green* the Zero point conditions are met.
6. Accept the Zero point values by clicking the green **Zero Point** button.



## Step 4 – Accept Calibration

7. Confirm the Slope Value and the Intercept Value and click **Accept** to accept the calibration.

The calibration is completed and you can now place the N<sub>2</sub>O Wastewater Sensor in the wastewater tank.




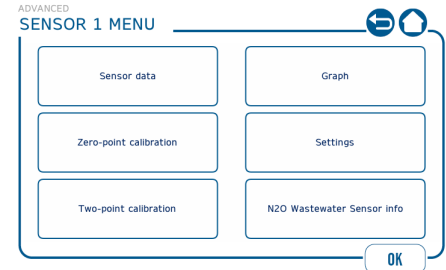
Version: May 2026

# Two-point Calibration

A Step-by-Step Guide Using the Operator Console

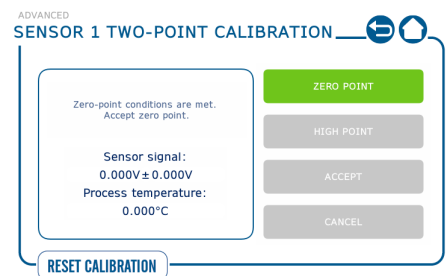
## Step 1 – Start Two-point Calibration

1. Go to the menu of the N<sub>2</sub>O Wastewater Sensor you want to calibrate. Click the 'Manage button'  to go to the menu.
2. Click on the **Two-point Calibration** button to start the calibration.



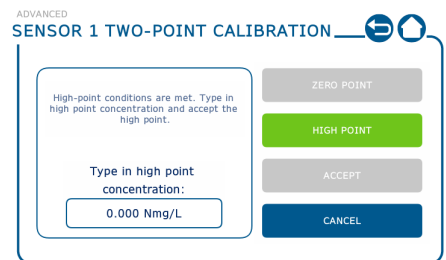
## Step 2 – Zero Point

3. Place the N<sub>2</sub>O Wastewater Sensor in tap water *without* N<sub>2</sub>O in it.
4. The sensor is measuring the concentration in the water to set the zero point. This may take a few minutes.
5. When the **Zero Point** button goes from *orange* to *green* the Zero point conditions are met.
6. Accept the Zero point values by clicking the green **Zero Point** button.



## Step 3 – High Point

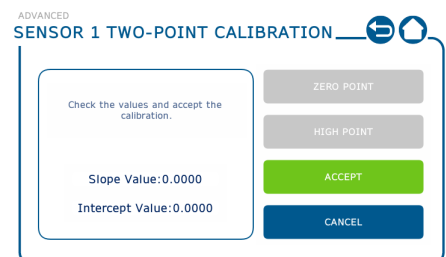
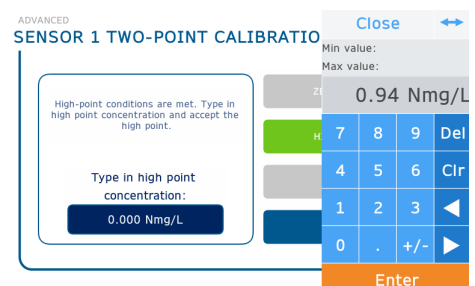
7. Place the N<sub>2</sub>O Wastewater Sensor in a stable bucket with 4 liters of tap water. Add 5 ml of the calibration solution to achieve a **0.94 mgN/L N<sub>2</sub>O** concentration and stir for 10 seconds!
8. The sensor is measuring the concentration to find the concentration value. This may take a few minutes.
9. When the **High Point** button goes from *orange* to *green* the high-point conditions are met.
10. Click the button with the concentration to type **0.94 Nmg/L**. Press **Enter**.
11. Click the green **High Point** button to accept.



## Step 4 – Accept Calibration

12. Confirm the Slope Value and the Intercept Value and click **Accept** to accept the calibration.

The calibration is completed and you can now place the N<sub>2</sub>O Wastewater Sensor in the wastewater tank.



Version: May 2026

# Screenless Two-point Calibration

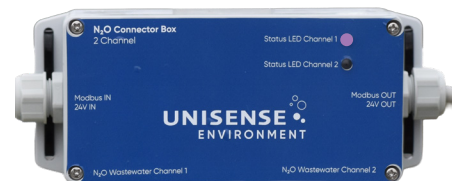
## A Step-by-Step Calibration Guide

Perform a screenless calibration by following these instructions and the corresponding status LED on the N<sub>2</sub>O Connector Unit.

### Step 1 – Initiate calibration

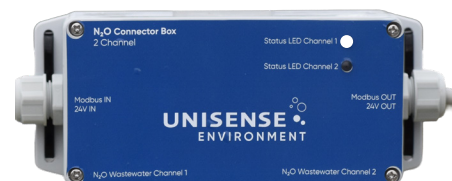
1. **Blinking blue:** The sensor is in measurement mode.
2. Hold the N<sub>2</sub>O Wastewater Sensor vertically (sensor tip upward) for 10 seconds.
3. **Steady violet:** The calibration has started.

*Note: Tilting the N<sub>2</sub>O Wastewater Sensor up again for 10 seconds at any time cancels the calibration.*



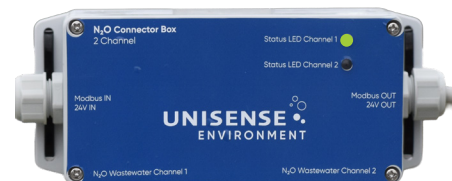
### Step 2 – Zero Point

4. Place the N<sub>2</sub>O Wastewater Sensor in tap water without N<sub>2</sub>O in it.
5. **Blinking violet:** The sensor is measuring the concentration in the water to set the zero point. This may take a few minutes.
6. **Turning white:** The zero point has been set.



### Step 3 – High Point

7. Place the N<sub>2</sub>O Wastewater Sensor in a stable bucket with 4 liters of tap water. Add 5 ml of the calibration solution to achieve a **0.94 Nmg/L N<sub>2</sub>O** concentration and stir for 10 seconds!
8. **Blinking white:** The sensor is measuring the concentration to find the High point value. This may take a few minutes.
9. **Steady green:** The High point conditions have been met.
10. The calibration is completed and you can now place the N<sub>2</sub>O Wastewater Sensor in the wastewater tank. The LED will be blinking blue to confirm the sensor is in measurement mode.



### Cancel calibration

You can cancel the calibration by:

- hold the N<sub>2</sub>O Wastewater Sensor vertically (sensor tip upward) for 10 seconds.
- hanging the N<sub>2</sub>O Wastewater Sensor vertically (tip down) for 30 min, e.g. placing it back into the wastewater.

In both cases, you will cancel the calibration, and the N<sub>2</sub>O Wastewater Sensor returns to measurement mode (blinking blue).

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