Manual

Sensors

PS
EPS
O2S
pH XR1
ORP XT1
CON
TMP

Version 1.00

From FW Version 1.90 - 27.04.2022

Manufacturer:

SENECT GmbH & Co. KG
An 44 – Nr. 11
76829 Landau / Deutschland

Important note:

Please read this manual carefully and store it so that you can use it later. Read the warning and safety notes attentive.

Further information and latest software releases or documents can be downloaded from:

www.senect.de

www.produkte.senect.de

EU Declaration of Conformity

according to the EU Low Voltage Directive 2014/35/EU as per Annex IV;
dated 26 February 2014 (L 96/357)

We, the manufacturer, hereby declare that the product described below complies with the basic safety and health requirements of the EU Low Voltage Directive in its design and construction as well as in the version placed on the market by us. The manufacturer hereby assumes sole responsibility for issuing this declaration of conformity. In the event of a modification of the product not agreed with us, this declaration loses its validity.

Manufacturer: Senect GmbH & Co. KG
An 44 – No. 11
D-76829 Landau in der Pfalz / Germany
Email: info@senect.de

Description of the electrical operation:

Function: Measurement of dissolved oxygen and temperature in aquaculture systems
Type / Model:

- SENECT Level Sensor PS, PS-300-MA
- SENECT Level Sensor EPS, EPS-250-MA
- SENECT Pressure Sensor, EDS-2500-MA, EDS-6000-MA, EDS-250B-MA
- SENECT O2S Sensor, O2S-20-SC, O2S-20-SC-PP
- SENECT ORP Sensor XT-1, ORP-1-XT1-SC
- SENECT pH Sensor XR-1, PH-410-XT1-SC
- SENECT CON Sensor, CON-2-SC, CON-10-SC, CON-50-SC, CON-500-SC
- SENECT TMP Sensor, TMP-50-SC, TMP-50-SC-IT
- SENECT TMP-DUO, DUO-50-SC

Compliance with other directives/regulations also applicable to the product is declared:

- Electromagnetic Compatiblitity 2004/108/EG
- Low Voltage Directive 2006/95/EG
- RoHS 2011/65/EG
- WEEE 2012/19/EU

The following harmonized standards were applied:

- DIN EN 61326-1: 2013
- DIN EN 50581: 2013
- DIN EN 61010-1: 2010 + A1: 2015/04

Year of CE-marking: 2016

Signed for and on behalf of: Senect GmbH & Co. KG

Place and date: Landau in der Pfalz, 1. Juni 2016

Signature:

B.Eng. Florian Mäck (CTO)

Index

Type description

Art.-No.:	Name:	Type:
2000	Sensor - Water level sensor EPS	EPS-250-MA
2001	Sensor - Water level probe PS	PS-300-MA
2002	Pressure sensor EDS 6 bar	EDS-6000-MA
2003	Pressure sensor EDS 2.5 bar	EDS-2500-MA
2004	Pressure sensor EDS 250 bar	EDS-250B-MA
2100	Sensor - Oxygen O2S	O2S-20-SC
2100-PP	Sensor - Oxygen O2S PP housing	O2S-20-SC-PP
2200	Sensor - pH XR1	PH-410-XR1-SC
2300	Sensor - ORP XT1	ORP-1-XT1-SC
2400	Sensor - Conductivity CON 50 mS/cm	CON-50-SC
2410	Sensor - Conductivity CON 2 mS/cm	CON-2-SC
2420	Sensor - Conductivity CON 10 mS/cm	CON-10-SC
2450	Sensor - Conductivity CON 500 mS/cm	CON-500-SC
2500	Sensor - Temperature TMP PT1000	TMP-50-SC
2501	Sensor - Temperature TMP-DUO	DUO-50-SC
2502	Sensor - Temperature TMP int. transducer	TMP-50-SC-IT

General safety instructions

The SENECT pressure sensor EDS is an electronic sensor unit for measuring the pressure in pipelines, hoses or vessels.

As this is an electronic product, the usual requirements, as with all electrical appliances, must be met. The device may only be operated with compatible control units or control units approved by SENECT. The device and all connected lines must be installed and operated protected from moisture and wetness. When laying all cables, care must be taken that no safety-relevant impairments such as tripping hazards occur. For many applications, fuse protection by a residual current circuit breaker with a tripping current < 30 mA is mandatory. Find out more about this.

The device must be installed protected from overheating by direct sunlight and must only be operated at an ambient temperature between 0°C and +40°C. The device must not be modified, except for extensions or software updates of SENECT®. It is forbidden to open the device or to penetrate the inside of the housing in any way.

The pressure sensor EDS is not intended to be used by persons (including children) with limited physical, sensory or mental abilities or for lack of experience and/or knowledge, unless they are supervised or instructed by a person responsible for their safety on how to operate the device. Please keep these instructions for use as a reference. Technical and optical changes as well as printing errors reserved.

Symbols and signal words

	DANGER! Warning of life-threatening dangers. WARNING! Warning of possible life threatening and / or severe irreversible injuries. ATTENTION! Warning of possible medium or slight injury.
	ATTENTION! Follow the notes to avoid damage of equipment
	NOTE! Further information for the use of the device!
	ATTENTION! Warning of electrical shock.

Intended use

The SENECT® sensor is designed to measure the respective parameter in water. The measuring range, resolution and accuracy can be found in the following table.

All SENECT® sensors are designed for the use in industrial aquaculture applications.

Type:	Measured value / Remark	Measuring range	Resolution
EPS-250-MA	Water level in tanks, sensor screwed in	0 – 250 mbar / 0 – 250 cm	0,1 mbar 0,1 cm
PS-300-MA	Water level, sensor submerged	0 – 300 mbar / 0 – 300 cm	0,1 mbar / 0,1 cm
EDS-6000-MA	Pressure of gaseous media (air, oxygen) or liquid media (water) in pipelines or containers	0 – 6000 mbar	1 mbar
EDS-2500-MA		0 – 2500 mbar	1 mbar
EDS-250B-MA		0 – 250 bar	1 bar
O2S-20-SC O2S-20-SS	Concentration of dissolved oxygen, Water temperature	0 – 400 % a.s. 0 – 40°C	0,1 % a.s. 0,1 °C
PH-410-XR1-SC	pH-value in water	pH 4 – pH 10	0,01 pH
ORP-1-XT1-SC	Oxidation-reduction potential (ORP or redox potential)	-2000 – +2000 mV	1 mV
CON-50-SC	Electrical conductivity in water, temperature. An integrated temperature sensor provides temperature compensation so that the displayed values refer to the temperature-corrected conductivity at 25°C.	0 – 50 mS/cm 0 – 40 °C	0,01 mS/cm 0,1°C
CON-2-SC		0 – 2 mS/cm 0 – 40 °C	1 µS/cm 0,1°C
CON-10-SC		0 – 10 mS/cm 0 – 40 °C	0,01 mS/cm 0,1°C
CON-500-SC		0 – 500 mS/cm 0 – 40 °C	0,1 mS/cm 0,1°C
TMP-50-SC TMP-50-SC-IT	Temperature in water	0 – 50 °C	0,1 °C
DUO-50-SC	Temperature in water Temperature in air	0 – 50 °C -10°C – 50 °C	0,1 °C 0,1 °C

Scope of delivery

Sensor type	Delivered Items
Conductivity Sensor CON	1 x Conductivity Sensor CON 1 x Manual
Pressure Sensor EDS	1 x Pressure Sensor EDS incl. connection cable 1 x Manual
Water level Sensor EPS	1 x Water level Sensor EPS 1 x Manual
Oxygen Sensor O2S	1 x Oxygen Sensor O2S 1 x Manual
ORP Sensor XT1	1 x ORP Sensor XT1 electronic interface 1 x ORP Sensor XT1 electrode 1 x ORP Calibration-Solution (+475 mV) 1 x Calibration-BNC-plug (0 mV) 1 x Manual
pH Sensor XR1	1 x pH Sensor XR1 electronic interface 1 x pH Sensor XR1 electrode 1 x pH Calibration-set (pH 4 and pH 10) 1 x Manual
Water level probe PS	1 x Water level probe PS 1 x Manual
Temperature Sensor TMP	1 x Temperature Sensor TMP (incl. electronic interface) 1 x Manual
Temperature Sensor DUO	1 x Double Temperature Sensor DUO (incl. electronic interface) 1 x Manual

Please check directly after delivery, that the package is not destroyed or damaged or was opened before. Please check also, that all parts as listed above are included. If anything is missing or broken, please contact us as soon as possible within 14 days. Unfortunately, we cannot accept later information of damage, which happened during the transport.

Installation

Choose a place for the electronic interface (electronic unit protected by black silicone casing) which is clean, dry and protected from direct sunlight. Ensure that all cables are placed safely and all regulations are fulfilled.

Mount the sensor so that the sensor head is permanently submerged. This can be achieved, for example, by attaching it using suction cups or, if the water level fluctuates greatly, by attaching it to a float. Alternatively, the sensors can also be installed in the pipe system (e.g. within a measuring chamber).

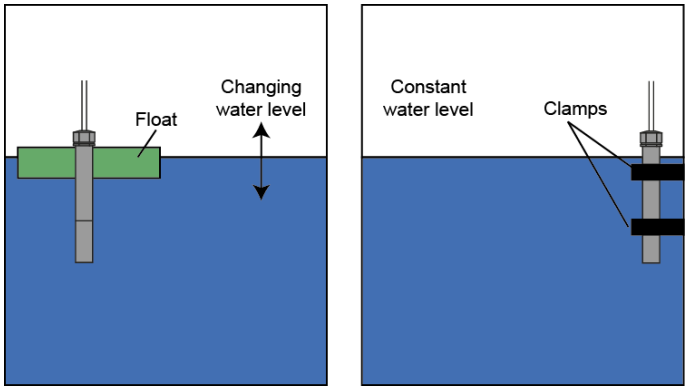


Figure 1: Example of the installation of the oxygen sensor

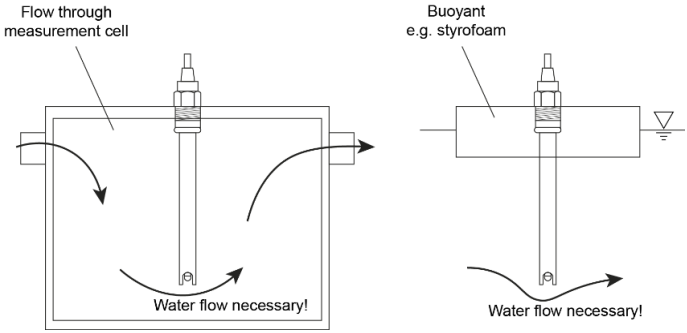


Figure 2: Example of mounting an electrode in a flow chamber or float

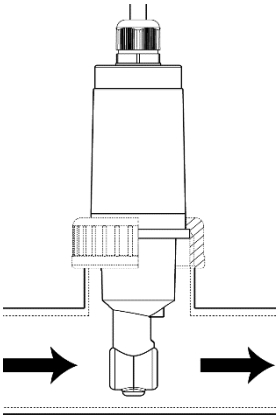


Figure 3: Mounting sensor CON in a pipeline

To increase the service life, the sensor can be mounted so that the upper part of the sensor and the cable are not submerged. This can be achieved either by mounting using brackets or suction cups, or by mounting on a float if the water level fluctuates greatly.

Important Note: Sensor EPS

The Water level sensor EPS must not be submerged. Use the submersible water level probe PS for this purpose.

Getting started

Short version

1. Attach the probe to the measuring point.
2. Mount the electronic interface at a protected location.
3. Connect the sensor cable with a control unit (plug „SENSOR“).
4. The control unit recognizes the sensor and starts the measurements.

The menu may differ depending on the software version used. Updates to these operating instructions can be found at www.senect.de.

Sensor – Water level PS & EPS

EPS:

Mount the water level sensor screwed in (either with seal and lock nut or with sealing tape and matching thread in the container wall) in a container or in a filter chamber (when used to control drum or belt filters).

PS:

Attach the water level probe submerged at the desired location in the filter (if the water level probe is to be used to control a drum or belt filter) or in the pond / basin. The probe must be firmly anchored in a location with low currents to avoid interference.

It is important to ensure that the connector is kept permanently dry, as this is where the pressure equalization with the atmosphere takes place. Please note that there is a capillary in the cable for pressure equalization and therefore **a minimum bend radius of 15 cm** is required.

Connect the connection cable to your control unit at one of the sensor slots marked in blue. The SENECT control units automatically detect the water level sensor and start operation.

1. Assign the type of sensor in the menu under **Sensors / Plug X / Sensor Type** (EPS-250-MA or PS-300-MA).
2. To assign a function to the water level sensor, select the place of use under **Sensors / Plug X / Position**. This is linked to a respective function:
    - Pre-chamber: The water level sensor is used to control filters in pumped version and is installed in the filter pre-chamber.
    - Filter: The water level sensor is installed behind the drum or belt in filters and is used to control the filter in gravity mode.
    - Refill sensor: The water level sensor is used to refill water in the pond or basin.
    - Other: The water level sensor is not assigned to any of these functions and can be assigned a function via the Outputs menu.
3. To set the measured value to 0cm (reference the sensor), select **Sensors / Plug / Sensor referencing**.

Water level probe – Controlling particle filters

The optimal location for the PS level probe for filter control is where the level of pollution of the filter mesh is "measured" and where it is also possible to check the function of the circulation pump. **In gravity systems** this is usually behind the filter or in the filter chamber, while **in pumped systems** it is in front of the drum filter or in the pre-chamber of the filter.

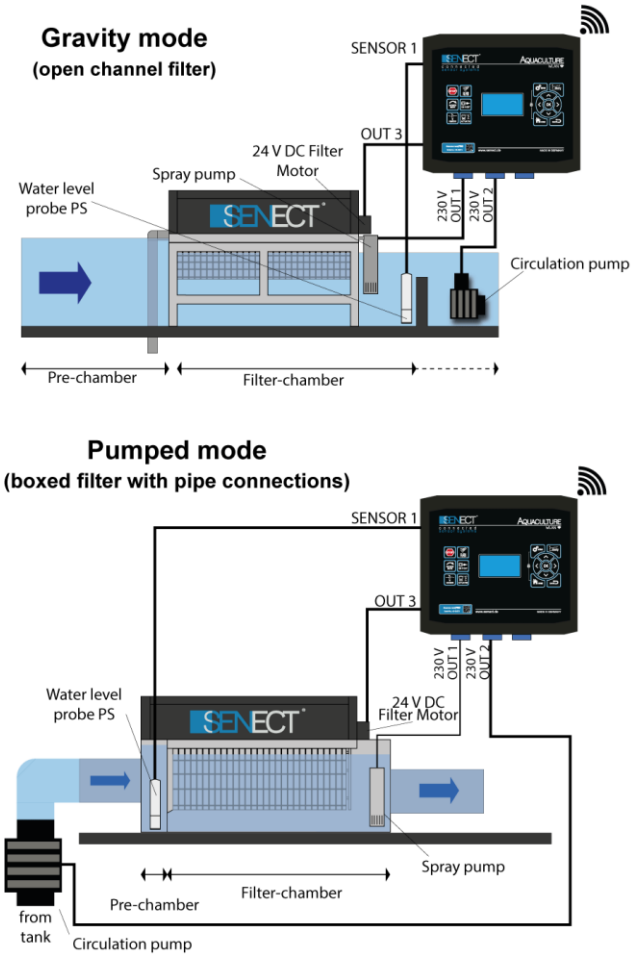


Figure 4: The locations of the water level probe when a drum filter is to be controlled. Please note, that in the gravity mode, the PS is in the filter chamber, while in pumped mode, the PS is installed in the pre-chamber.

The cleaning of drum or belt filters can be triggered depending on the contamination by measuring the water level. A distinction must be made here as to whether a rise or fall in water level should trigger cleaning. In gravity mode (see Figure 4), the probe is mounted in the **filter chamber** and a drop in the water level triggers cleaning.

In pumped mode, the probe is installed in the **pre-chamber** and a rising water level triggers the cleaning.

Therefore, select one of both variants for your filter control.

Differential operation: Use two water level probes to control the filter operation via the water level difference between the pre-chamber and filter chamber, assign the water level probes to the position where the probes are located. If the pre-chamber and filter chamber are selected, cleaning triggering takes place automatically according to the water level difference.

After selecting the position(s), trigger a filter cleaning with the **CLEAN FILTER** key and then set the water level to "0 cm" with the "Reference sensor" menu item. Now the ***relative*** water level is set to "0 cm" (the absolute water level always refers to the actual installation depth of the probe).

Now you can adjust further filter settings.

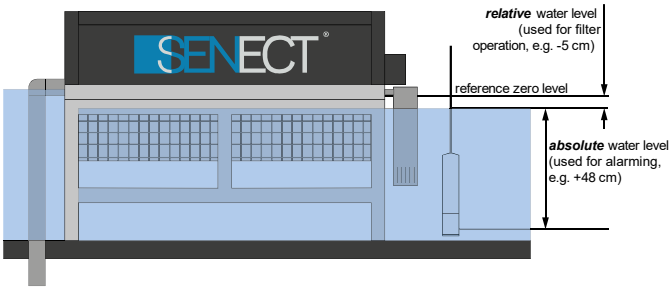


Figure 5: Difference between relative and absolute water level. The relative water level is used for control purposes (e.g. control filter, refill water) while the absolute water level is used for alarming.

Water level probe – Refilling water level

Select "**Refill sensor**" as the position and place the probe in your pond or basin. Set the water level to "0 cm" with "**Reference sensor**". With the position "Refill sensor" the sensor value is additionally displayed in the app as "Pond" in the filter sensor values field.

You can move the "0 cm" line in the menu under "**Change zero-point**". Positive values (e.g. +5 mm) move this line upwards while negative values (e.g. -2 mm) move this line downwards.

Now you can set the other water refill settings. For the FILTER|CONTROL unit you will find them in the **water refill menu** while for the other controllers you must use the "**Sensor control**" function.

Water level probe – Other position

If you want to use the water level only for monitoring or to do a sensor contro select as the position "Other". You can then set the **alarm thresholds**. Please note that these thresholds refer to the ***absolute*** water level. You can change to the referenced water level in the alarm threshold menu.

Sensor – Pressure EDS

The sensor is screwed into a suitable thread using the pressure sensor-side G1/4" threaded nipple.

Seal the thread with sealing tape or a suitable and approved sealing compound (e.g. Loxeal 58-11, BAM-approved Teflon tape). Make sure never to touch the sensor membrane (not even for cleaning purposes) and that the cable connection side must be kept permanently dry, as this is where the pressure equalization to the atmosphere takes place.

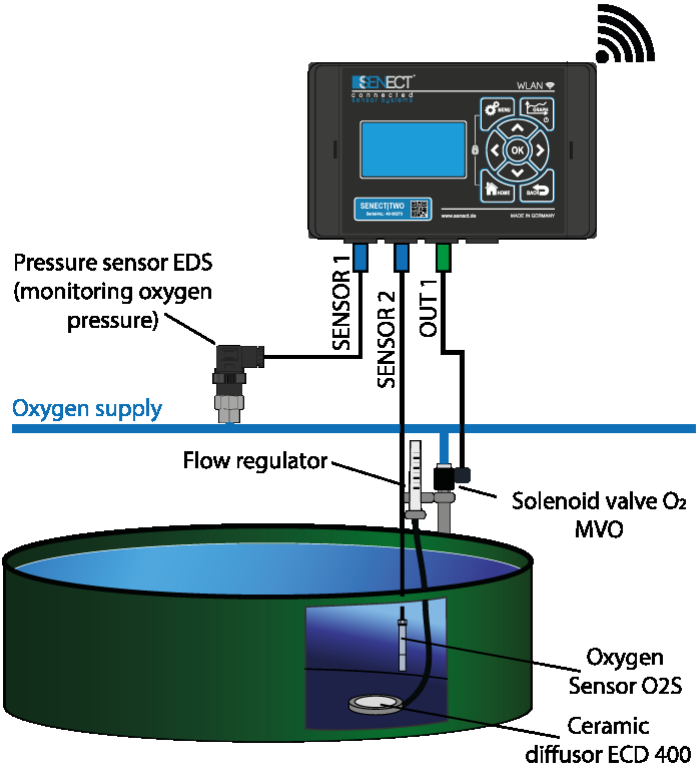
Connect the supplied connection cable to the sensor and your control unit at one of the sensor slots marked in blue. The SENECT control units automatically detect the sensor and start operation.

1. Select the correct sensor type under **Sensors / Plug X / Sensor type** (EDS-2500-MA).
2. Enter the measuring range of your sensor in mbar (e.g. 2500 mbar) in the submenu **Sensors / Plug X: EDS / Measuring range**.

The sensor is now ready for use and you can make further settings. For further information, please refer to the manual of your SENECT controller.

Application example

The pressure sensor EDS can be used to monitor the line pressure of the ventilation line (oxygen or compressed air). If there is a fault in this supply line (tank empty, generator defective, leakage), the EDS can trigger an alarm if the pressure falls below the set lower threshold value.



Apply the following settings:

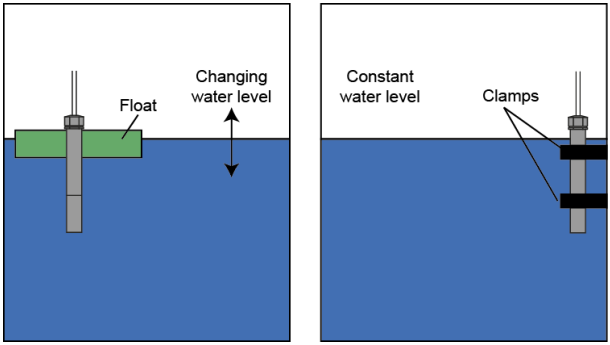
- Sensor / Plug X: EDS / Alarm / Lower Threshold: e.g. 1500 mbar
- Sensor / Plug X: EDS / Alarm / Upper Threshold: e.g. 2000 mbar
- Sensor / Plug X: EDS / Alarm / Hysteresis: e.g. 10 mbar

These settings trigger an alarm when the pressure drops below 1500 mbar or exceeds 2000 mbar.

Sensor – Oxygen O2S

Remove the blue protective cap of the sensor and attach the sensor. The probe itself must be suspended in the water so that the membrane is permanently submerged.

To increase the service life, the sensor can be mounted so that the upper part of the sensor and the cable are not submerged. This can be achieved either by mounting using brackets or suction cups, or by mounting on a float if the water level fluctuates greatly.



Please consider when selecting the mounting location that in surface waters like fish ponds the solar radiation can lead to a thermal stratification of the water body, associated with strong gradients in dissolved oxygen

Protect your sensor from fish biting on the sensor membrane! SENECT offers protection cages.

The oxygen sensor O2S-20-SC-PP already has a protection cap.

Connect the blue marked plug of the sensor with a sensor input port (also blue marked) of your control unit. The SENECT control units recognize the sensor itself and start automatically the measurements. Take into account that the measurement interval is set to 30 s to elongate the lifetime of the sensing cap.

The oxygen sensor O2S is factory calibrated and need to be recalibrated – under for aquaculture typical environmental conditions – earliest 6 months.

Recalibration intervals

Recalibration of the sensor is regularly recommended every 6 months. To determine if a calibration is necessary, hold the sensor in air (preferably with 100% humidity) for a few minutes. If the sensor shows about 100% oxygen saturation (usually this value is just below 100% due to insufficient humidity), no calibration of the upper calibration point is necessary. Repeat this procedure for the lower calibration point, keeping the sensor in 0% O2 solution. If the sensor indicates approx. 0%, no recalibration is necessary for this point either.

Membrane wear

Since the fluorescent membrane fades due to the measurement, we recommend replacing the sensor cap (Art. No.: 2101, Type: O2S-ATK), which contains the photoreactive membrane, at intervals of three years. To do this, simply unscrew the cap and replace it. The sensor **must always be recalibrated** after replacing the cap!

Cleaning

If algae or microorganisms grow up, the sensor membrane must be cleaned regularly. It is best to remove soiling or growth carefully with a cotton swab and water. If the membrane is more heavily soiled, you can also use diluted acetic acid.

Avoid contact with organic solvents such as toluene, acetone or chloroform at all costs. These solvents can cause damage to the membrane! Steam sterilization can also damage the sensor.

Disinfection

The sensor can be disinfected with peracetic acid (max. 5 mg / l), methanol, ethanol, isopropanol or 3% H2O2 solution. Rinse the sensor afterwards with tap water.

Salinity / Conductivity correction:

If no conductivity sensor is connected, fresh water with a salinity of 0 PSU is assumed as the medium and no correction takes place with regard to electrical conductivity or salinity. However, you can specify an electrical conductivity (which is used as a measure of salinity) in the menu under "**Sensor / O2S / Salinity correction**" for which the oxygen value is to be corrected (**mode: correct by fixed value**). To do this, enter the electrical conductivity in µS / cm (referred to 20°C) in the submenu "**Correction value**".

By connecting a conductivity sensor, you can automatically make the correction for salinity in this menu based on the measured conductivity (**mode: corrected by sensor**).

Salinity [ppt or ‰]	Electric conductivity[1] [µS cm^{-1}]	Salinity [ppt or ‰]	Electric conductivity[1] [µS cm^{-1}]
1	2000	21	30300
2	3700	22	31600
3	5300	23	32900
4	6900	24	34200
5	8400	25	35400
6	9900	26	36700
7	11300	27	37900
8	12800	28	39200
9	14200	29	40400
10	15600	30	41700
11	17000	31	43000
12	18900	32	44200
13	19700	33	45400
14	21100	34	46700
15	22400	35	47900
16	23800	36	49100
17	25100	37	50300
18	26400	38	51500
19	27700	39	52700
20	29000	40	53900

[1]Electrical conductivity at 20°C. Values according to Weyl, Limnology and Oceanography; 9,75, 1964.

The SENECT control units measure the air pressure and use it to correct the calibration and the measured values.

Sensor error

If the sensor or the membrane is damaged and it is no longer possible to read out reliably measured values, an error code is given. You can send this information as well as further background information regarding the sensor behavior directly by email to SENECT GmbH & Co. KG to get support as soon as possible. To do this, select "Sensors / O2S / Calibrate sensor / Info to SENECT" in the menu.

Sensor pH XR1 & Redox XT1

The pH or redox electrode is a highly sensitive measuring instrument. It is essential to avoid impacts and shocks. The pH electrode must not dry out during use, but also during storage. A rubber cap with 3 M KCl solution is already included in the scope of delivery for storage. If you do not use the electrode, please put the electrode back into the filled cap.

1. Connect the cable of the electrode with the electronic sensor interface (BNC-plug).
2. Connect the blue marked plug of the cable with your control unit at one of the sensor input ports. Your SENECT control unit will automatically recognize the sensor and starts the measurement. Please refer to the instructions in the operating manual of the control unit.
3. Now remove the protective cap of the electrode and briefly rinse the electrode with tap water. Immerse the sensor in one of the two pH buffer solutions or redox test solution to check the functionality.

   If the pH value displayed with your control unit is close to the value of the calibration solution (±0,1 pH-units), you can directly install the electrode. If the deviation is larger, please calibrate the sensor (see chapter calibration)
4. Mount the electrode at the measurement location. The electrode shaft including the active glass tip must be **permanently submerged** and **placed into the water flow**. The electrode must be mounted **vertical** (angle > 80°).

We recommend the initial calibration after 1 week of air conditioning of the electrode in water.

To increase the service life, the sensor can be mounted so that the upper part of the sensor and the cable are not submerged. This can be achieved either by attaching it by means of suction cups or, in the case of highly fluctuating water levels, by mounting it on a float. Alternatively, the electrode can also be installed in the pipe system (e.g. inside a measuring chamber). For this purpose, the electrode can be screwed into suitable holders with its PG13.5 thread (see **Figure 2**).

It is also recommended to install the electrode in the clean water area, e.g. behind an existing particle filter.

Maintenance

Under normal conditions (clean water, stable and not extreme pH values), a check every 14 days and calibration every month is recommended.

Since the electrode loses its salts with usage, the signal may drift with time so that you should clean the electrode and calibrate it again.

Cleaning

Under no circumstances may the membrane glass be treated with aggressive or abrasive cleaning agents (such as scouring agents). The membrane glass must not be scratched.

Impurities deposited on the surface of the membrane glass and diaphragm must be removed.

However, dirt on the glass must be removed. Use therefore a water-dipped soft paper towel and rinse the electrode with clean water. If the contamination cannot be removed, you can use the following cleaning agents:

For limescale or metalhydroxide coatings:	Diluted hypochloric acid (1-3%)
For fatty or oily contamination:	Organic solvents (e.g. ethanol) or tenside containing solvents (e.g. dishwashing agents)
For protein contamination:	Pepsin in diluted hypochlorid acid

Lifetime

All pH electrodes have a limited lifetime. A specific lifetime cannot be determined since it depends on the environmental conditions during the use e.g. temperature, pH, etc. This may range from days to years. Therefore, we cannot publish respectable lifetime estimates.

Storage should be in dry rooms at -5 to +30°C and should not last longer than 6 months. The electrode must be stored in 3 M KCl solution. If the electrode has nevertheless been stored dry for a longer period of time, the electrode can be conditioned by immersing it in 3 M KCl solution for 24 hours.

Avoid the contact to organic cleaning agents like acetone or chloroform. This may damage the membrane. Steam disinfection can also damage the sensor

Calculating CO_2

The concentration of dissolved carbon dioxide can be determined indirectly via the parameters alkalinity, temperature and the pH value.

The SENECT control units can automatically calculate the CO2 concentration if the alkalinity is entered manually (e.g. determined via photometric measurement) and the temperature is known. If the temperature is measured via a sensor, you can select the sensor input in the menu under "**with plug**" to which a sensor with temperature measurement is plugged. Alternatively, you can also specify a fixed temperature ("**fixed value cor.**").

The calculation of the carbon dioxide is based on the following publication:

Wurts, W. A. and Durborow, R. M.: „*Interactions of pH, Carbon Dioxide, Alkalinity and Hardness in Fish Ponds*“, SRAC Publication No. 464, 1992.

Notes regarding the measurement of the oxidation-reduction potential

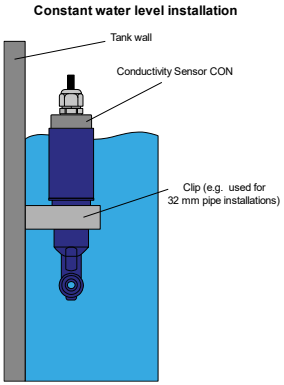
Each SENECT ORP sensor delivered has been tested and calibrated for proper functioning by our quality assurance staff. Despite the high quality requirements, the measured value may be influenced by the measuring principle and the properties of the medium.

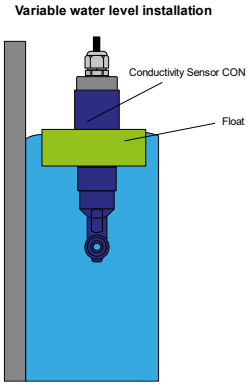
- **Drift**: Usually, a drift can be observed in electro-chemical measurements. Therefore, the sensors must be calibrated regularly in order to obtain reliable measurements. Due to polarization effects, there is often a drift in the first few days during initial commissioning. Therefore, the resulting measurement inaccuracy must be taken into account.
- **Interference currents**: So-called leakage currents are often observed in pond systems. These usually result from 230 V devices such as pumps. Make sure that all electrical devices in the water comply with the latest directives and do not have any damaged parts, e.g. porous cables.
- The measurement of the redox potential is influenced by the **concentration of substances** that determine redox potential. In exceptional cases, i.e. when the concentration of such substances is too low, meaning that the medium is insufficiently "weighted", no meaningful measured values can be obtained.

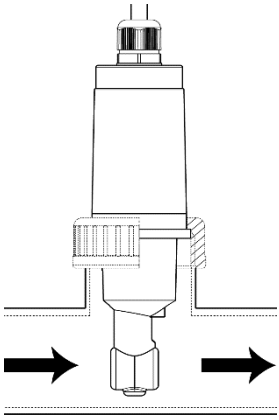
Sensor - Conductivity CON

Connect the blue marked plug of the cable with your control unit at one of the blue outlined sensor input ports. Your SENECT control unit will automatically recognize the sensor and start the measurement. Please refer to the instructions in the operating manual of the control unit.

Attention: Based on the inductive measurement principle, magnetic field can cause interference with the sensor. Ensure that there are no electrical cables, no motors or other magnetic fileds in the vicinity of the sensor.







Maintenance and cleaning

Cleaning and maintenance intervals depend strongly on the environment in which the sensor is measuring. Use soft towels to clean the sensor. Typical hand dish washing soaps can also be used.

Additional information about the unit of salinity

The term salinity refers to the salt content of liquids, mostly water. Its typical unit is „mass of salt per kg of water“ (g / kg). The unit ppt (parts per thousands) is also used and refers to the mass, which makes it interchangeable with g / kg (e.g. 1 ppt = 1 g / kg).

Since the measurement of the electrical conductivity („how good the water allows electric currents to flow“) can be used to determine the salt concentration of sea water, the Practical Salinity Unit (PSU) was created, which defines the salinity by the electrical conductivity. Please note, that the calculation of the salinity by measurements of the conductivity are only valid, if the ion composition is equal to the composition of sea water. The PSU therefore can be used to measure the salt content in g (salt) per kg (water).

Application notes e.g. for creating artificial seawater often refer to the salinity in % or ‰. That allows the user to calculate the amount of salt which must be added. The units % or ‰ also refer to the mass:

$$1\frac{g}{kg} = 1\ ppt \approx 1\ PSU \approx 0{,}1\% \approx 1{,}97\ \frac{mS}{cm}$$

This relationship shows, that dissolving 1 g salt per kg of water (approx. 1 liter) will result in a conductivity of app. 1,97 ms / cm.

The used equations are drawn from:

UNESCO – Technical papers in marine science – 44: *Algorithms for computation of fundamental properties of seawater*, 1983

Sensor – Temperature TMP & DUO

Attention: Due to the measuring principle of the sensor, induced voltages can falsify the measuring signal. Therefore, make sure that the sensor and the sensor cable are not installed near current-carrying lines, motors or other magnetic fields.

1. Connect the blue marked plug of the cable with your control unit at one of the blue outlined sensor input ports. Your SENECT control unit will automatically recognize the sensor and start the measurement. Please refer to the instructions in the operating manual of the control unit.
2. Install the temperature sensor so that it is permanently submerged.
3. If possible, install the temperature sensor (Sensor DUO) for the air in a place with drafts.

Calibration of sensors

In general, the calibration should always be carried out at the temperature at which the measurement takes place.

Recalibration intervals

Depending on the sensor type, a more or less frequent or no calibration is necessary.

Sensor type	Calibration intervals
Conductivity Sensor CON	Free of calibration, Check every 4 weeks in test solution
Pressure Sensor EDS	Free of calibration
Water level Sensor EPS	Free of calibration
Oxygen Sensor O2S	Every 6 months, Check every 4 weeks exposed to air
ORP Sensor XT1	Every 4 weeks
pH Sensor XR1	Every 4 weeks
Water level probe PS	Free of calibration
Temperature Sensor TMP	Free of calibration
Temperature Sensor DUO	Free of calibration

pH Sensor XR1

1. Rinse the electrode briefly under running tap water and immerse it in the buffer solution (pH 4.0 calibration solution).

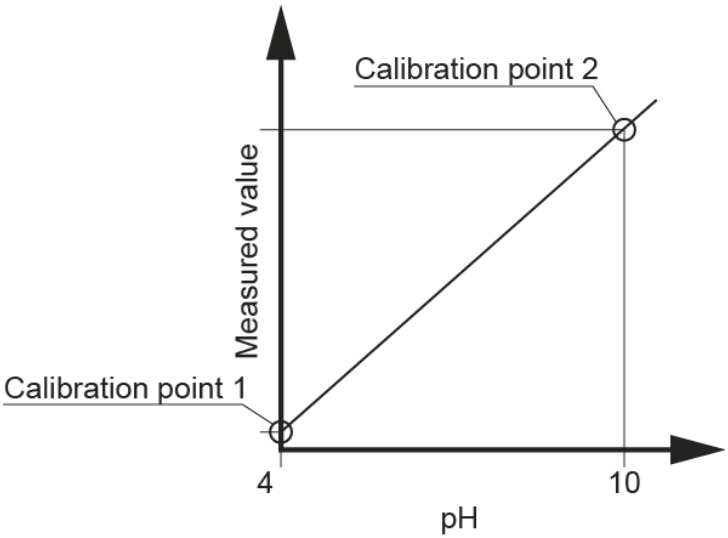
2. Choose in the menu of your control unit the pH sensor (**Sensors / Sx: pH**) and select "**Sensor Calibration / pH / Calibration Point 1**".

3. Select the pH value of your calibration solution (here: pH = 4.00) and move the electrode gently until the displayed raw signal value (in digits) is nearly constant. If it is constant validate this calibration point by pressing **OK**. Alternatively, the control unit confirms this calibration point automatically after 120 s.

Tip: In case you work with another calibration solution, you can change the pH value by using the cursor keys.

4. Rinse the electrode with tab water again and dip it into the vessel containing the pH 10 calibration solution. Select in the menu „**Sensor calibration / pH / Calibration Point 2**" and wait until the displayed value is stabilized. Then press **OK** or wait 120 s.

5. If the calibration worked select „Save calibration".

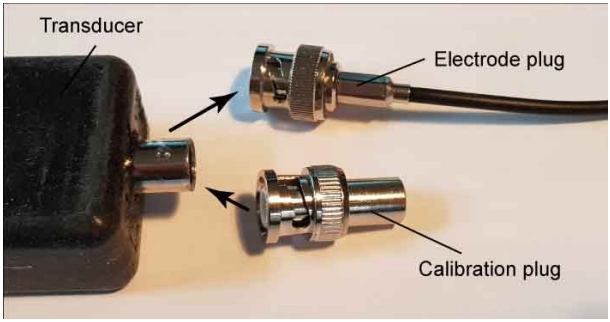


Tip: It is also possible to load old calibrations. There you can also see the calibration coefficients.

Redox Sensor XT1

The calibration of the ORP sensor is a 2-point calibration, where the first calibration point (0 mV) is determined with the supplied BNC calibration plug and the second calibration point is determined with the +475 mV test solution. The calibration is only performed initially and after an electrode exchange. Afterwards the sensor is checked with the test solution. If the measured value deviates too far, either cleaning or replacement of the electrode is necessary.

1. Unplug the electrode and plug in the BNC calibration plug.



2. In the **Sensors** menu of your controller, select the Plug where the ORP sensor is plugged in and then "**Sensor Calibration / ORP / Calibration Point 1**".
3. Select 0 mV as the reference voltage and confirm this calibration point with **OK**.
4. Remove the BNC calibration connector and reinsert the electrode.
5. Go back one level in the menu and select "**Sensor calibration / Measuring channel 1 / Calibration point 2**".
6. Rinse the electrode briefly under running tap water and immerse it in the +475 mV calibration solution.
7. Move the electrode gently in the buffer solution and wait until the displayed value has stabilized. If this is the case, confirm the calibration point with **OK**.
8. If the calibration is correct, save it in the menu under "Save calibration".

Tip: It is also possible to load old calibrations. There you can also see the calibration coefficients

As an alternative to calibration with the BNC calibration plug, you can also perform a **two-point calibration** with a second ORP calibration solution.

1. Briefly rinse the electrode under running tap water and immerse it in the calibration solution with the lower redox potential (e.g. +271 mV).
2. In the **Sensors** menu of your controller, select the plug where the ORP sensor is plugged in and then "**Sensor Calibration / ORP / Calibration Point 1**".
3. Use the arrow keys to set the correct value of the redox potential.
4. Move the electrode gently in the buffer solution and wait until the displayed value has stabilized. If this is the case, confirm the calibration point with **OK**.
5. Rinse the electrode again and immerse it in the second (higher) calibration solution and repeat steps 2 to 4.
6. If the calibration is correct, save it in the menu under "Save calibration".

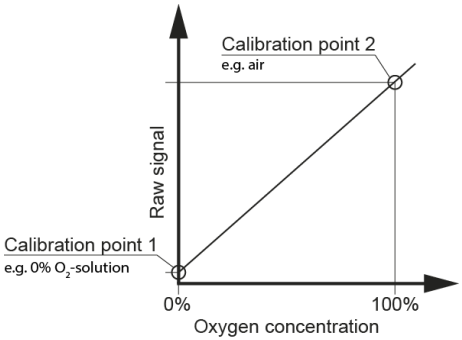
Your SENECT ORP Sensor XT1 is now ready to be used.

Oxygen-Sensor O2S

Place the sensor for several minutes at humid (100% water vapour saturated) air and ensure, that there are no water drops on the membrane.

Select in the menu „**Sensors**“ the oxygen sensor (O2S) and choose „**Sensor calibration/ O2 % a.s.**“.

Select **100% a.s. (Calibration Point 2)** to take up the 100% a.s. calibration point. Wait the displayed 120 s and save this point with **OK**.



Alternatively, you can use air saturated water to create a 100% a.s. oxygen solution. Aerate therefore water with an air pump and diffusor stone. After several minutes, the water should be equilibrated with the air. This equilibrated water has by definition an oxygen concentration of 100% air saturation.

Attention! By using this method, inaccuracies can be created by:

- The air is injected with a pressure exceeding atmospheric pressure. Therefore, the partial pressure of O2 can also be slightly increased.
- The exact timing, when 100% saturation is achieved is hard to determine, since oversaturation due to the injection with overpressure can occur.
- Oxygen depleting substances in the water can be present so that 100% a.s. may not be achieved.

Due to these risks, we recommend the calibration in water-saturated air.

Short-version: Oxygen signal: 1-Point-calibration

1. Expose the senor to air for a few minutes.
2. **Menu / Sensors / O2S / Sensor calibration / O2 % a.s. / 100% a.s.**
3. Wait for the displayed 300 seconds to pass.
4. Press **OK**. Finished!

Oxygen signal: 2-Point-calibration

For the 2-Point-Calibration perform at first the previous step (calibration of calibration point 2, e.g. in air). Additionally, perform the same procedure when the sensor is submerged in oxygen-free water.

You can create an oxygen-free solution by adding 1 tea spoon of sodium sulphite in 100 ml water (concentration 2 mol / l). Please wait 15 minutes until all oxygen is reduced.

Immerse the sensor and wait a few minutes. Now select **0% a.s. (calibration point 1)** in the calibration menu to record this (lower) value (no oxygen). Wait for the displayed 300 s and save the calibration with **OK**.

More background information about the calibration of oxygen sensors can be found in DIN EN 25814.

Temperature: 2-Point-Calibration

To calibrate the temperature signal of the sensor O2S, two calibration points are necessary. The calibration point 1 must have a lower temperature (e.g. 0°C) than calibration point 2. This temperature (point 1) must be lower than 20°C.

The calibration point 2 (higher temperature) must be between 30°C and 50°C.

Submerge the sensor in a water bath with the lower temperature (calibration point 1) and wait, until the sensor has the same temperature as the water. Select in the menu "**Sensors / TMP / Sensor Calibration / Temperature / Calibration point 1**". Measure the water temperature with a reference thermometer and enter this temperature with the cursor keypad. Confirm the calibration point with **OK**.

Repeat this procedure for the upper calibration point 2 with a temperature between 30°C and 50°C.

The temperature measurement of the O2S is now recalibrated!

Tip: In the menu under **Info** you can see the serial number of the sensor (SN), the measuring signal at the lower calibration point (C0), the signal at the upper calibration point (C1), the temperature of the lower calibration point of the temperature (T0) and that of the upper calibration point (T1) as well as the operating mode used (e.g. the control unit used).

The SENECT control units measure the air pressure and use it to correct the calibration and the measured values.

Menu – Sensors in SENECT® OS

The menu for the sensors depends on the respective sensor type. Please observe the notes in the operating manual of the respective sensor.

The Sensors menu consists of the following submenus:

- **Sensors**
  - **Sensor Referencing**
  - **Sensor Calibration**
  - **Position**
  - **Alarm Threshold**
  - **Sensor Type**
  - **Plug Name**
  - **Change zero-point**
  - **Salinity Correction**
  - **CO2 Calculation**
  - **Measuring Range**

To change the settings of the connected sensors or to calibrate / reference the sensors, select the respective sensor in this menu item.

The sensor plug, sensor type and, if available, the sensor name assigned by the user are displayed here per line.

Example:

`S1: PS 3m Tank2:` Level probe PS-300-MA on plug 1 (S1) with the plug name "Tank 2".

Submenu: Reference Sensor (only for water level sensors):

If all water levels in your system are correct, you can set the water level measurement of the selected sensor to "zero" in this menu option.

Submenu: Sensor Calibration

pH and ORP sensors should be calibrated regularly to obtain correct measured values. In this menu item you can calibrate the sensors (also other sensors such as oxygen sensor O2S).

- **Sensor Calibration**
  - **Measuring Channel 1**
    - **Calibration Point 1**
    - **Calibration Point 2**
    - **Factory Settings**
    - **Save Calibration**
    - **Load Calibration**
  - **Measuring Channel 2**
    - **Calibration Point 1**
    - **Calibration Point 2**
    - **Save Calibration**
    - **Load Calibration**
  - **Information**
  - **Info to SENECT**

To do this, select which parameter you want to calibrate: Measuring channel 1 is the actual sensor, measuring channel 2 is for the integrated temperature measurement of the sensor (e.g. oxygen or conductivity sensor). Now you can carry out a two-point calibration, e.g. at pH 4 (calibration point 1) and pH 10 (calibration point 2) for the pH sensor. In the editor you can adjust the value of the calibration point, e.g. if you calibrate with a pH 7 solution instead of a pH 4 solution.

Save Calibration: After a successful calibration, the calibration must be saved so that it is also available after a restart.

Load Calibration: Old calibrations can be loaded here in case a calibration cannot be completed successfully (e.g. because the calibration solution was spilled).

Factory settings (only with O2 Sensor): Calibration points for 0 and 100% can be entered here to restore the calibration points.

Info: In the **Info** menu, you can view information regarding the calibration. Keep this data at hand in case of malfunctions and queries to Senect.

Info to Senect: If your sensor has an error, you can send the error data directly from the controller to SENECT for troubleshooting. To do this, select **Info to SENECT** in the calibration menu.

Submenu Position (only with water level sensors):

The position of the sensor determines its function. Select "Filter-chamber" if you want to use the water level sensor to clean the filter behind the filter (or in the filter chamber). Select "Pre-chamber" if the sensor is positioned in the prechamber and should also be used to control the filter. Select "Refill Sensor" if the sensor is to be used for water level control (refilling). Or select "Other" if none of these functions should be linked to the sensor.

Submenu Alarm Thresholds

In this menu, the desired values for a sensor alarm are set:

- **Alarm Threshold**
  - **Lower Threshold**
  - **Upper Threshold**
  - **Hysteresis**
  - **Lower Threshold °C**
  - **Upper Threshold °C**
  - **Hysteresis °C**
  - **Alarm On/Off**
  - **Unit**
  - **Temp. Thershold**

If you want an alarm to be triggered when the measured value falls below or exceeds a sensor value, you can enter the thresholds in this menu item. The **hysteresis** indicates the tolerance value within which no new alarm is to be sent if the measured value fluctuates. If a sensor also has a temperature signal, the parameters for this can be entered in the menu items with °C.

Example:
You want to receive an alarm when the temperature exceeds 25°C or falls below 10°C. Set the **Lower Threshold** to 10°C and the **Upper Threshold** to 25°C. As hysteresis e.g. 0.5°C. You will then receive an all-clear signal when the temperature is above 10.5°C again.

If you want to switch off the alarm, you can set this under "**Alarm On / Off**".

In the "**Unit**" menu you can select the unit to be considered for the alarm, e.g. referenced or absolute level for level sensors or e.g. % a.s. or mg/l for oxygen sensors.

In the "**Temp. Thresholds**" menu, you can set temporary alarm thresholds for a specific time. The actual alarm threshold then becomes effective again after this time. This is useful if an alarm is present but for a certain period of time the alarm should only be activated if the temperature falls below / exceeds another threshold, e.g. during maintenance work.

Submenue Sensor Unit

In the submenu Sensor Unit the unit of the sensor can be set.

- **Flow Sensor: cumulative or absolute**
  - **cumulative**
  - **absolute**
- **Pressure Sensor: mbar or bar**
  - **mbar**
  - **bar**

Submenu Sensor Type

Select the type of your sensor here, e.g. the level sensor PS-300-MA or the screw-in level sensor EPS-250-MA.

- **Sensor type**
  - **EPS-250-MA (Level probe 2.5m)**
  - **PS-300-MA (Level probe 3.0m)**
  - **EDS**
  - **Flow**
  - **CO2**

If a pressure sensor EDS or a flow sensor is connected, select it here. The measuring range of the sensor must then be stored in the Measuring range menu, e.g. 6000 mbar for an EDS with a measuring range up to 6 bar.

Submenu Plug Name

You can also assign the sensor a name with a maximum of 8 characters, which appears in the SENECT Control App, for example.

Submenu Change zero-point (for level sensors)

If, for example, the sensor is used for refilling, but the basin or pond is not yet full and therefore the reference water level (zero) has not yet been reached, you can change it manually here.

Submenu Salinity Correction (only with O2 Sensors)

As the oxygen saturation concentration is dependent on the salt content, the SENECT control offer the possibility of correction.

- **Salinity Correction**
  - **Modu**
    - **From fix Value cor.**
    - **From Sensor cor.**
  - **Correction Value**
  - **With Plug**

If a conductivity sensor (CON2, CON10 or CON50) is also connected to the control unit, the measured value of this sensor can be used for correction (**Mode**: corrected by the sensor.) In the menu "With Plug" the sensor slot of the CONxx is specified which is to be used for correction. Alternatively, a fixed correction value for salinity can be entered (**Mode**: corrected by the fixed value). This value is entered as electrical conductivity (µS / cm) under **Correction Value**.

Submenu CO2 calculation (only for pH sensor)

Based on the pH value, temperature and alkalinity, the CO2 content can be calculated.

- **CO2 Calculation**
  - **Mode**
    - **From fix Value cor.**
    - **From Sensor cor.**
  - **Correction Value**
  - **With Plug**
  - **Alkalinity**

Since the CO2 calculation is dependent on temperature, the SENECT controllers offer the possibility of calculation with temperature. If a sensor with temperature measurement (e.g. TMP, CON, O2S) is connected to the controller, the measured value of this sensor can be used for calculation (**Mode:** from sensor cor.). In the menu "With Plug" the sensor plug of the sensor with temperature signal which is to be used for calculation is specified. Alternatively, a fixed temperature value can be entered (**Mode:** from fix value cor.). This value is entered as temperature in °C under **Correction Value**. Under alkalinity the alkalinity must be entered in mg/l. The display shows a conversion to °dH.

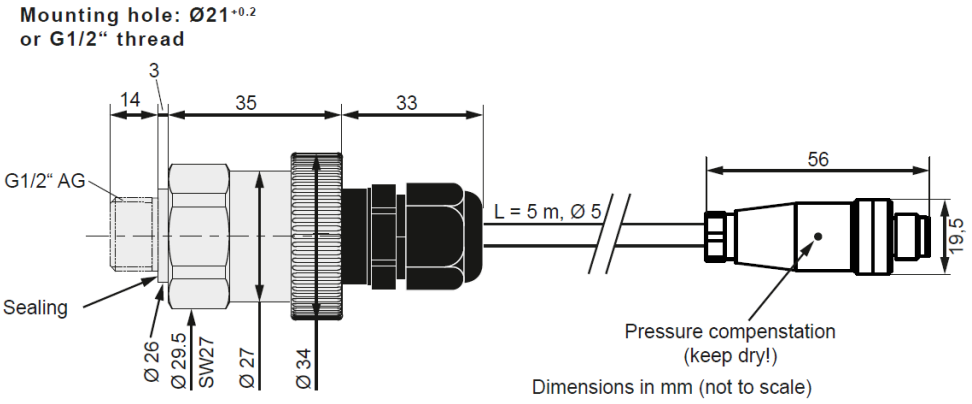
Measuring Range Submenu (for pressure sensor)

In this menu the measuring range of pressure sensors can be set, e.g. 2500 mbar for an EDS2.5 or 6000 mbar for an EDS6.0 with 6 bar pressure range.

Technical data

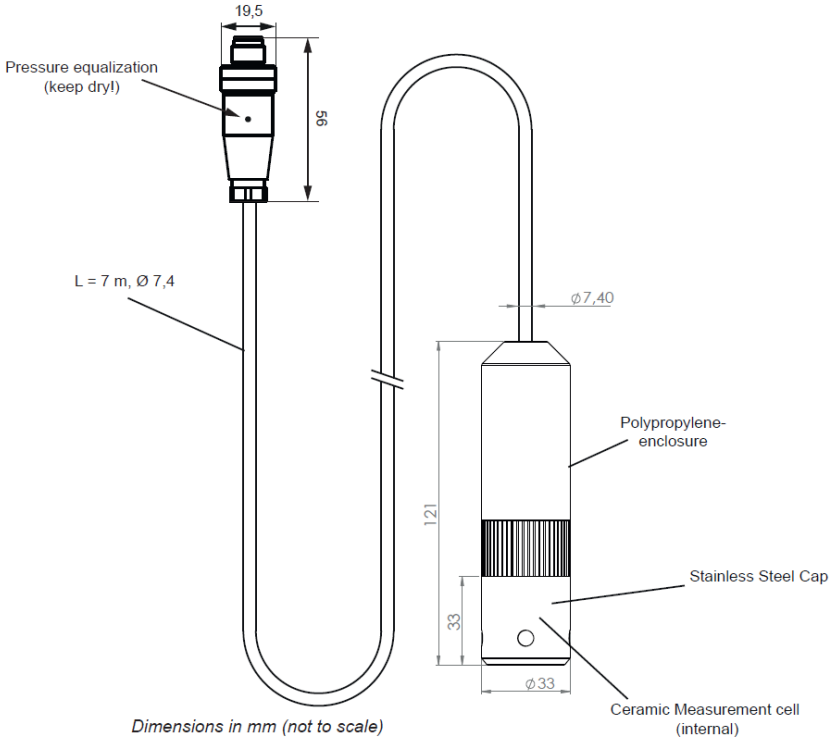
Water level sensor EPS

Dimensions Sensor:	Ø 34 mm, Length: 85 mm
Material (medium-side.):	Stainless steel 316L, ceramic
Cable length:	5 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° bis 40 °C
Burst pressure:	2,5 bar (2,5 m water column)
Measuring range:	0 – 250 mbar or 0 – 2,5 m water column
Accuracy:	< 1% FS
Response time:	T_{90} < 3 s
Ingress Protection:	IP54 (exterior sensor part)



Water level probe PS

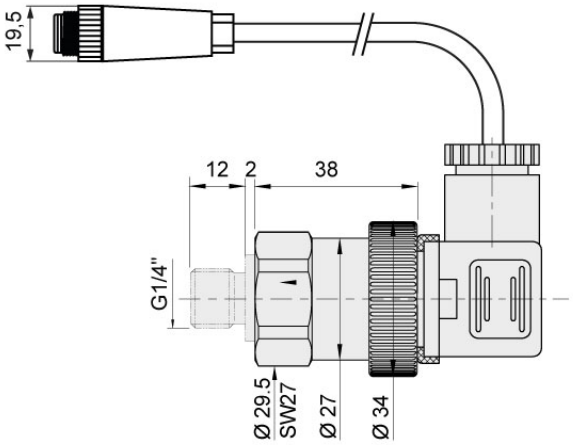
Dimensions Probe:	Ø 33 mm, Length: 168 mm
Weight probe	ca. 460 g
Cable length:	7,5 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° to 40 °C
Burst pressure:	1,5 bar
Measuring range:	0 – 300 mbar or 0 – 3 m water column
Accuracy:	< 1% FS
Response time:	T_{90} < 3 s
Ingress Protection:	IP68 (Sensor)



Dimensions in mm (not to scale)

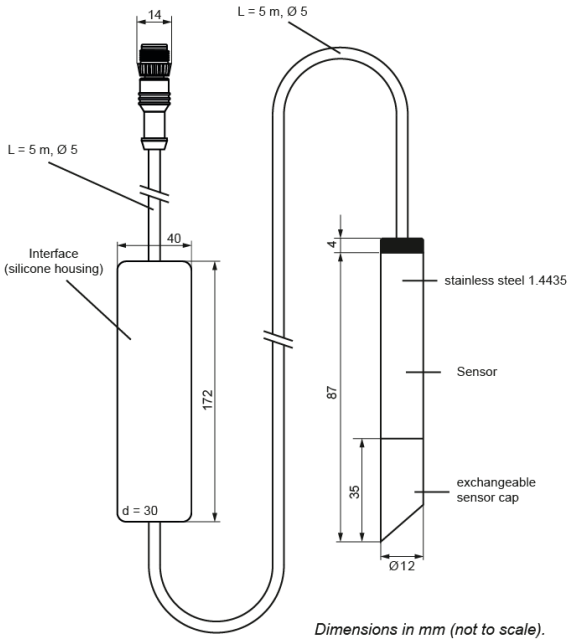
Pressure sensor EDS

Dimensions Sensor:	Ø 21-34 mm Width: max. 34 mm Length: 80 mm
Material (medium-side.):	Stainless steel (1.4542)
Cable length:	5 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° to 40 °C (medium up to +125°C)
Burst pressure:	EDS-2500-MA: 3,0 bar EDS-6000-MA: 7,5 bar
Measuring range:	EDS-2500-MA: 2,5 bar EDS-6000-MA: 6,0 bar
Accuracy:	< 0,5% FS
Response time:	T_{90} < 3 s
Ingress Protection:	IP54 (exterior sensor part)



Oxygen sensor O2S

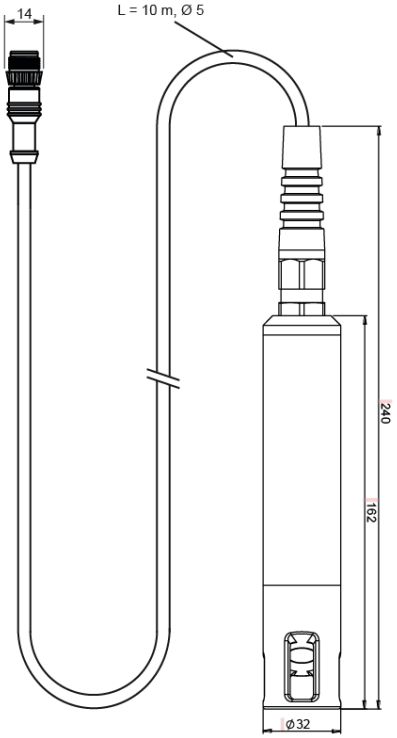
Dimensions Sensor	Ø 12 mm, Length: 85 mm
Weight probe	ca. 100 g
Cable length:	10 m total
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° to 40 °C
Burst pressure:	3 bar
Measuring range:	0 - 200% / 0 - 20 mg O2 l-1
Accuracy Oxygen:	< 1% FS
Accuracy Temperature:	< ± 1°C FS
Response time:	T90 < 30s
Ingress Protection	IP68 (Sensor) IP40 (Electronic interface)



Dimensions in mm (not to scale).

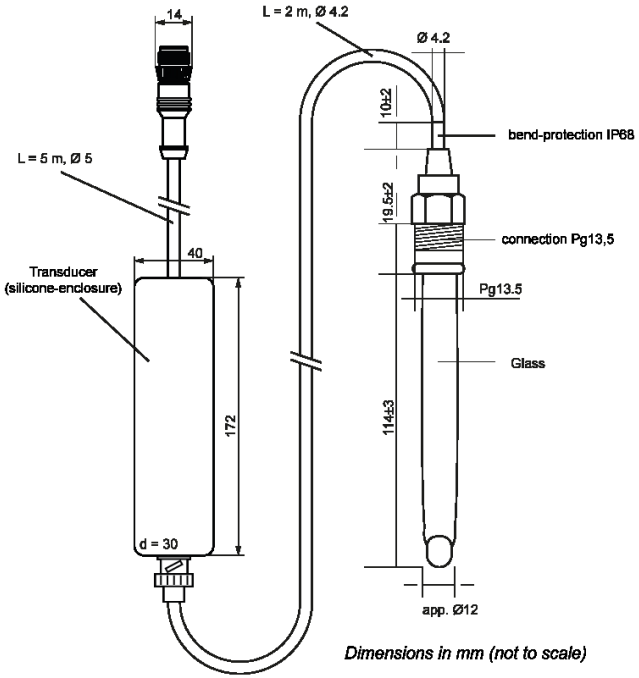
Oxygen sensor O2S PP Housing

Dimensions Sensor	Ø 32 mm, Length: 240 mm
Weight probe	ca. 400 g
Cable length:	10 m total
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° to 40 °C
Burst pressure:	3 bar
Measuring range:	0 - 200% / 0 - 20 mg O2 l-1
Accuracy Oxygen:	< 1% FS
Accuracy Temperature:	< ± 1°C FS
Response time:	T90 < 30s
Ingress Protection	IP68 (Sensor)



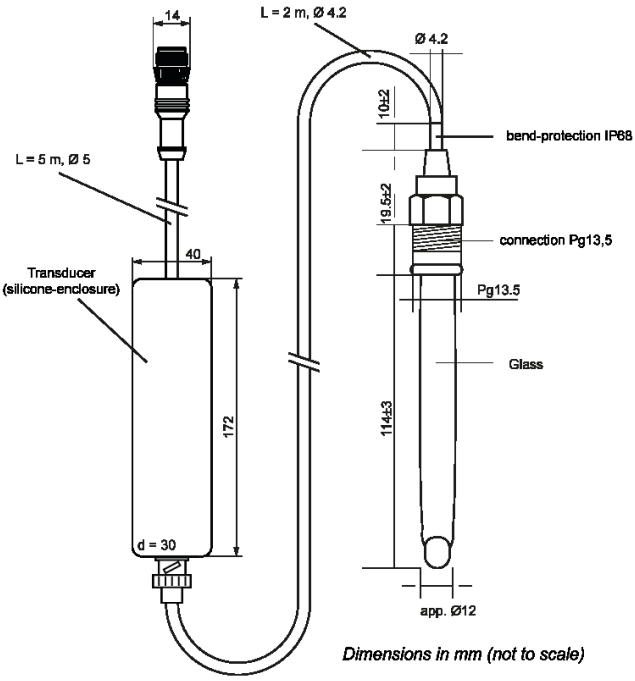
Sensor – pH XR1

Dimensions Sensor:	Ø 12 mm, Length: 120 mm
Cable length: electronic interface	5 m
Cable length: electrode	2 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° bis 40 °C
Burst pressure:	6 bar
Measuring range:	pH 4 to pH 10
Accuracy:	< 2% FS
Response time:	T_{90} < 30s
Ingress Protection:	IP68 (electrode) IP40 (electronic interface)



Sensor – ORP XT1

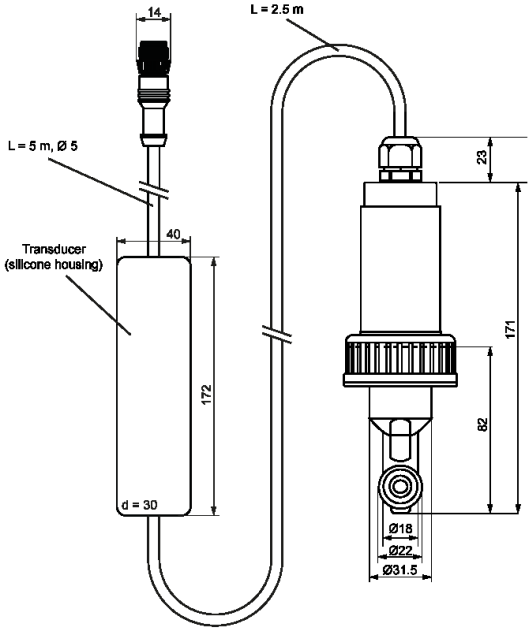
Dimensions Sensor:	Ø 12 mm, Length: 120 mm
Cable length: electronic interface	5 m
Cable length: electrode	2 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range:	0° to 40 °C
Burst pressure:	6 bar
Measuring range:	-1000 mV to +1000 mV
Accuracy:	< ±2,5% FS
Response time:	T_{90} < 30s
Ingress Protection:	IP68 (electrode) IP40 (electronic interface)



Dimensions in mm (not to scale)

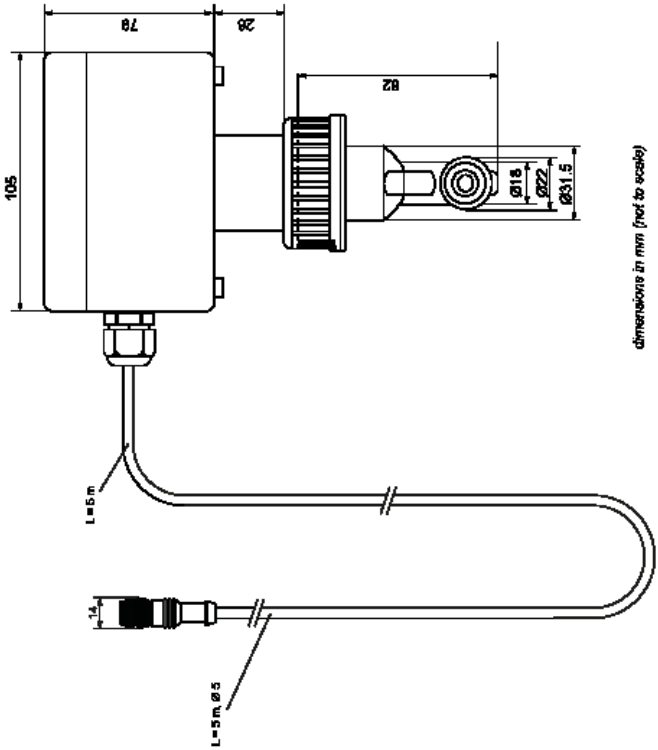
Conductivity sensor CON

Dimensions Probe:	Ø 44 mm Length: 200 mm / 189 mm (CON500)
Housing material	Polypropylene
Process connection	G 1 ½“ PVC-Thread
Cable length total	5 m (CON500) 10m (CON2, CON10, CON50)
Voltage:	24 V DC
Power consumption:	<< 1 W
Temperature range	0° to 40 °C
Accuracy:	< ±1,5% FS
Response time:	T_{90} < 60s
Ingress Protection:	IP67 (Sensor) IP40 (electronic interface)



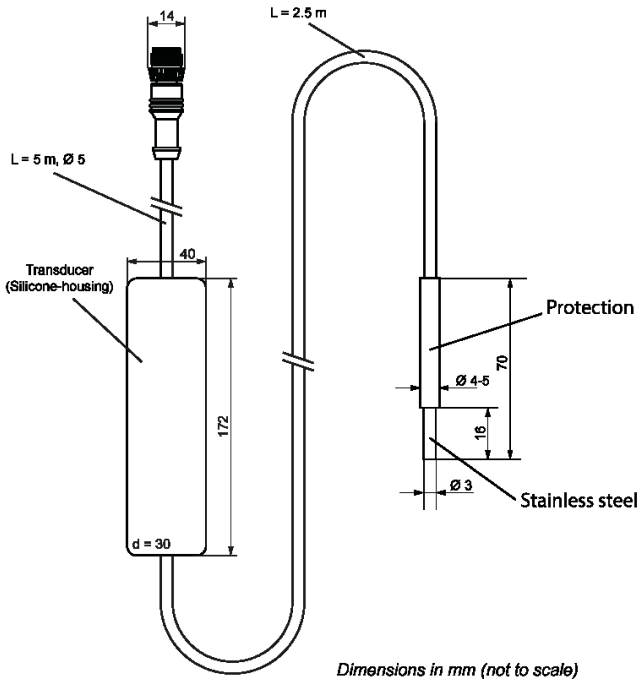
dimensions in mm (not to scale)

CON 100 & CON 500



Temperature sensor TMP & Duo

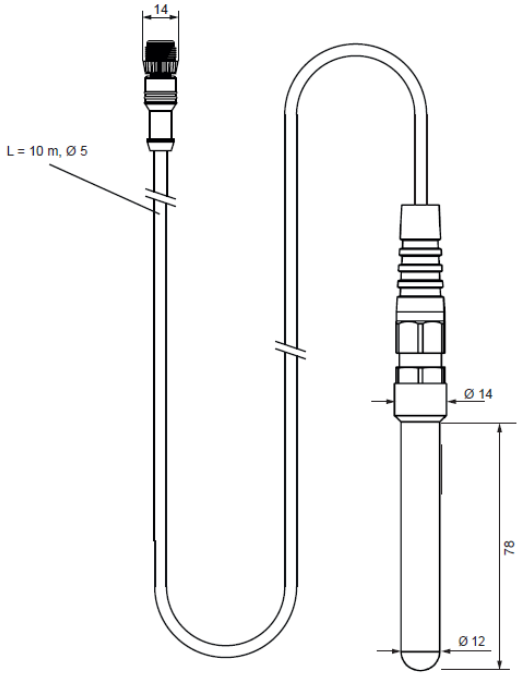
Dimensions Probe:	Ø 3 mm, Length: 85 mm
Cable length: electronic interface	5 m
Cable length: sensor	5 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Measuring range:	0° to 50 °C
Accuracy:	< ±0,5°C
Response time:	T_{90} < 60s
Ingress Protection:	IP68 IP40 (electronic interface)



Dimensions in mm (not to scale)

Temperature sensor TMP with integrated transducer

Dimensions Probe:	Ø 3 mm, Length: 85 mm
Cable length: sensor	10 m
Voltage:	24 V DC
Power consumption:	<< 1 W
Measuring range:	0° to 50 °C
Accuracy:	< ±0,5°C
Response time:	T_{90} < 60s
Ingress Protection:	IP68



Information about the correct disposal

Your device is well packed at delivery. Please dispose the packaging material accordingly to the regulations in your country.

Do not throw the product in the casual litter bin. Make sure you are informed about the local disposal regulations and dispose your product accordingly. Alternatively, you can also send the product back to the producer.

The SENECT GmbH & Co. KG is member of the “Stiftung Elektro-Altgeräte Register” and the products are registered (WEEE-Reg.-Nr.: DE37193510).

Guarantee

Upon receipt of your sensor, please check both the completeness and the function of all parts supplied. If you still have any complaints, please contact us immediately, preferably by email (info@senect.de) or by phone (+49 6341 9595210). Please describe your claim as precisely as possible so that we can offer you a solution as quickly as possible.

The following information is essential for proper processing:

1. Date of purchase and distributor
2. Exact description of the error or defect
3. Your contact information

The General Terms and Conditions apply, which can be viewed on the website https://produkte.senect.de/General-Terms-And-Conditions. Each SENECT® sensor is covered by a 1-year manufacturer's guarantee and a 2-year warranty. Excluded are pH and redox electrodes, see note in chapter pH & redox sensor.

Notes