# OPERATING MANUAL

## PRO 595

Multifunction meter / logger for water analysis


P-000107-10-EN 11/2025

senseca

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# 1 General information

Read this document carefully and familiarize yourself with the operation of the device before using it. Keep this document ready to hand and in the immediate vicinity of the device so that it is always available to the personnel/user in case of doubt.

Only technically qualified persons are permitted to carry out commissioning, operation, maintenance and decommissioning. The personnel must have carefully read and understood the operating manual before starting any activity.

**Legal notices**

- For your safety, use only the manufacturer's original spare parts and accessories. We assume no responsibility for the use of other products and any resulting damage.
- The user must have adequate knowledge of the measuring process and use of the measurements. The user is liable in case of damage/danger due to misinterpretation of the measurements as a result of inadequate knowledge.
- The liability and warranty of the manufacturer for product damages and consequential damages are voided in the event of misuse, failure to comply with these operating instructions, failure to observe safety warnings, assignment to inadequately qualified technical personnel and arbitrary modifications of the device.
- No part of this document may be reproduced, modified or translated without prior written permission of the product manufacturer. In case of ambiguity between different language versions of this document, the English version applies.
- This document does not create any legally binding obligations for the product manufacturer. All legally binding obligations are included only in the General Terms and Conditions of Sale.

**Correctness of content**

- This document was checked for corrected contents and is subject to a continuous updating process. This does not rule out potential errors. In the event that errors are discovered or in case of suggestions to make this document more user-friendly, please inform us via the contact information given in this document.
- We reserve the right to change the product specifications and the contents of this document without prior notice.

**Explanation of symbols used**

**Danger!**
Warning of danger that could result in death, serious bodily injury, or serious property damage if not observed.

**Caution!**
Warning of potential danger or harmful situation that may cause damage to the device or the environment if not observed.

**Attention!**
Action that may have a direct effect on operation or may cause an unexpected behavior.

[▶ p.4] Reference to the indicated page number.

## 1.1 Product identification

Exact product name can be found on device rear plate. The firmware version is displayed at startup. The info in this manual applies to devices with **firmware version 1.4.1.0 or later**.

## 1.2 Safety information

Fault-free operation and operational safety of the device can only be guaranteed if the general safety requirements and the specific safety requirements in this document are observed.

Do not use the device in climatic conditions other than those specified in this document.

Do not use the device in places with:

- Rapid ambient temperature variations that may cause condensation.
- Direct vibrations / shocks to the device.
- High-intensity electromagnetic fields or static electricity.

**Intended use**

The device is a multi-parameter portable meter for measuring, in combination with pH/ORP electrodes and DX series digital probes, pH, ORP, dissolved oxygen, temperature, pressure, ambient humidity, photo-radiometric quantities, and Indoor Air Quality (IAQ).

**Foreseeable misuse**

If the following notices are disregarded, personal injury or death, as well as property damage can occur.

**Danger!**

- Do not use in safety / emergency stop devices!
- Not suitable for use in hazardous areas (Ex-environments)!
- Not suitable for diagnostic or other medical purposes on patients!
- Not suitable for SIL (Safety Integrity Level)!
- The device is not suitable for contact with food (use only appropriate probes)!
- Not suitable for children!
- Do not use as PPE (Personal Protection Equipment).

**Danger!**

pH/ORP electrodes contain glass parts that can cause injuries when broken! Inspect the electrode before and after measurement. Measure in samples when measuring food and discard the sample after measurement.

**Caution**!

Do not use if:

- There is visible damage to the device.
- The device is not working as expected.
- The device has been stored under unsuitable conditions for an extended period.

On suspicion that the device can no longer be operated without danger, it must be decommissioned and prevented from recommissioning with appropriate labelling.

In case of doubt, send the device to the manufacturer for repair or maintenance.

**Caution**!

Penetration probes entail the risk of **stab injuries** due to the pointed probe. Handle penetration probes with care and fit a protective cap on the probe tip when not in use!

**Caution**!

Risk of burns when measuring high or very low temperatures: use gloves if necessary!

**Attention!**

Remove batteries to prevent leakage if the device is stored at a temperature above 50 °C or not used for an extended period of time.

# 2 Overview

**PRO 595** is a professional multifunction handheld meter with data logging capabilities. It has a BNC input for standard pH/ORP electrodes, a banana socket for a possible temperature sensor integrated into the electrode and two inputs for DX series digital probes.

The meters communicate digitally with the probes of the DX series, allowing long probe cables. The probes are fully interchangeable without the need of readjusting the meter. DX series of digital probes consists of a wide range of models for the measurement of dissolved oxygen, temperature, pressure (absolute, relative and differential), humidity (relative, absolute, dew point and various calculated humidity quantities), photo-radiometric quantities, indoor air quality ($CO_2$ and VOC index) and soil moisture (Volumetric Water Content).

The high-impedance pH/ORP BNC input allows connecting inexpensive electrodes, which is particularly useful in harsh applications where electrodes are frequently replaced. The temperature banana socket can be used for pH measurement compensation when using electrodes with built-in temperature sensor.

For each displayed variable, minimum, average and maximum values can be detected. The user can reset the statistical info to start a new statistical calculation.

Alarm thresholds can be set, to warn the user when the set values are exceeded.

The HOLD feature allows freezing the measurements on display, while the REL feature allows showing the measurement against a value determined by the user.

The meter can be connected to a PC via the USB-C port, for data acquisition in COM interface mode or, in mass storage mode, for viewing or downloading the files stored in the internal memory or connecting to the **ProXware** application software.

Powered by 4 rechargeable NiMH AA size batteries. For permanent operation, the instrument can also be powered via the USB-C port by a 5 Vdc standard power adapter or suitable power bank.

The configurable auto-off feature and LCD backlight level allows for more energy saving options.

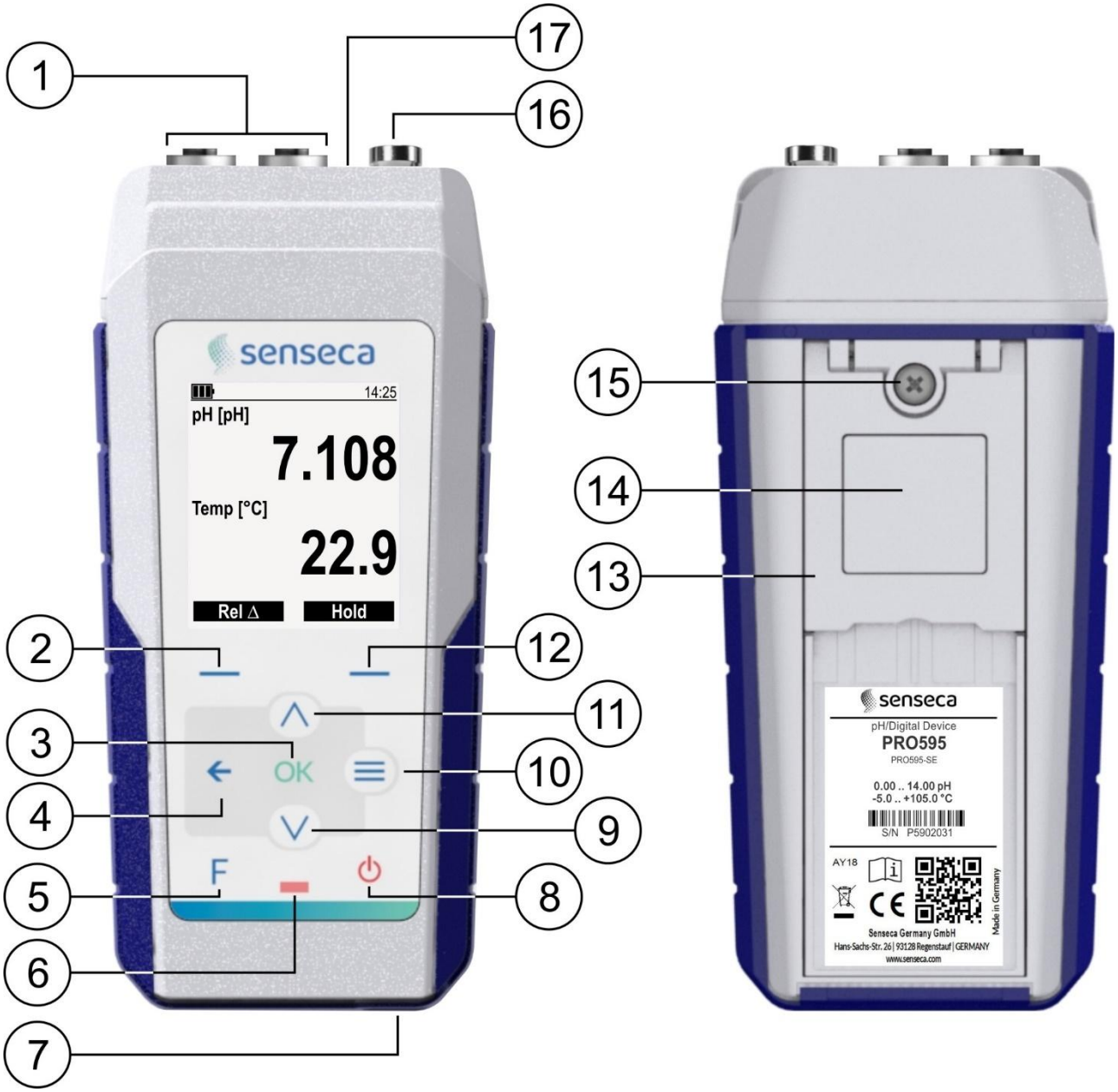
## 2.1 Scope of delivery

**PRO 595** is supplied with:

- Quick start guide
- Sheet with Master PIN
- 4 rechargeable NiMH batteries, AA size
- USB cable
- Test report

The **ProXware** application software is downloadable from Senseca website.

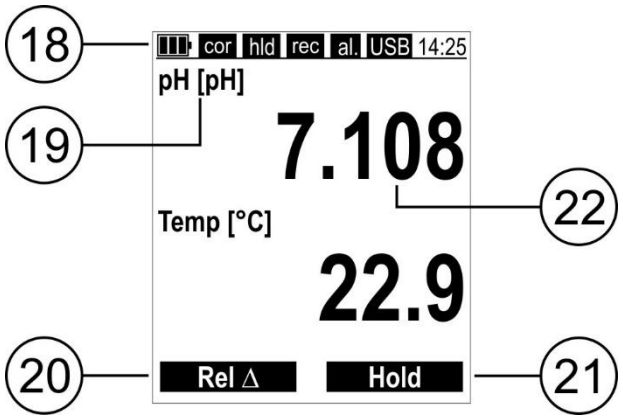
# 3 Description




1. Inputs with M12 connector for DX series digital probes.
2. Left function key: runs the command shown at the bottom left on display.
3. **OK** key: confirms the selection.
4. ← key: in measurement display cycles through the various available visualization modes; in the menu goes up one level, cancelling any unconfirmed changes.
5. **F** key: favorite functions (menu shortcuts).
6. Status LED.
7. USB-C port for connecting the PC or the external power supply.
8. **ON/OFF** key: turns the instrument on/off.
9. **Down arrow** key: scrolls down in a list or decreases the value of a parameter.

10. **MENU** key: enters the configuration menu.
11. **Up arrow** key: scrolls up in a list or increases the value of a parameter.
12. Right function key: runs the command shown at the bottom right on display.
13. Foldable stand: pull to open the stand.
14. Magnet, for attachment to metal surfaces.
15. Battery compartment fixing screw.
16. Input with BNC connector for pH/ORP electrodes.
17. Input with banana socket for electrode built-in temperature sensor.

## DISPLAY




Symbols in the status bar:

| | |
|---|---|
|  | Battery charge level |
|  | External power supply connected |
| cor | Measurement correction applied |
| lck | Protected mode active (*) |
| hld | Hold function active |
| rec | Logging in progress |
| al. | Measurement in alarm |
| USB | USB port connected to PC |
| 14:25 | Current time |

18. Status bar.
19. Measured parameter and unit of measurement.
20. Function corresponding to the left function key.
21. Function corresponding to the right function key.
22. Measured value.

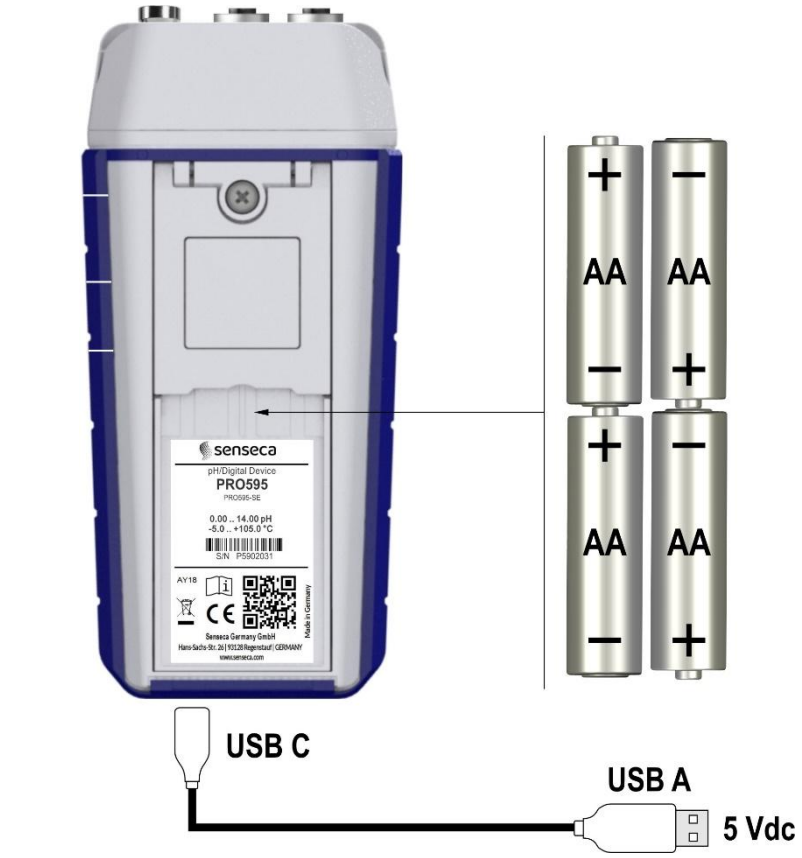
(*) lck *and* cor *symbols share the same position;* cor *has priority over* lck*, which is not displayed if* cor *is on. The* cor *symbol only lights up after a correction of the temperature sensor connected to the banana socket input.*

# 4 Preparing the instrument

**Power supply**

The instrument is powered by 4 AA size rechargeable NiMH batteries, already assembled in the device as standard.

If for some reason (e.g., shipping rules) the batteries are not already assembled, unscrew the battery cover fixing screw and remove the cover, then insert the batteries as shown below.




The instrument can also be powered via the USB-C port by a 5 Vdc standard power adapter or power bank. If a power bank is used, make sure it is of appropriate capacity and does not have the auto-shutdown function when the current draw is very low (for example, suitable power banks are those in the Varta Power Bank Energy series).

**Probes connection**

Connect the probes to the inputs at the top of the instrument. For digital probes, screw the shell of the probe M12 connector to the instrument M12 connector. The digital input number is indicated next to the connector.

**Caution**!

Before connecting a digital probe, check the presence and condition of all pins on the M12 connector, which must not be bent.
The M12 connector has a reference key that prevents incorrect insertion: ensure that the key on the female connector is aligned with the key on the male connector.
The connector must be inserted and secured manually, without the use of tools. Grasp the rotating ring nut of the female connector with one hand, insert the probe connector into the instrument connector without excessive force and respecting the insertion key, then screw the ring nut of the probe connector onto the instrument connector.

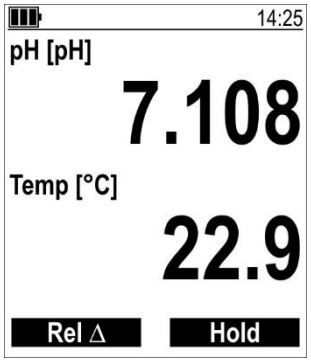
# 5 Measurement mode

To switch on the instrument, press the ON/OFF key. After a few seconds, the instrument displays the measured values.

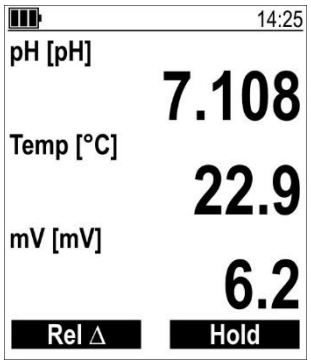
*Note: when the instrument is turned on for the first time, it automatically enters the menu displaying some factory settings (language, date/time, etc.); press repeatedly OK to accept the proposed settings or change them as indicated in the Configuration chapter [▶ p.14].*

The parameters of the digital probes are preceded by the input number: "**1:**" or "**2:**".

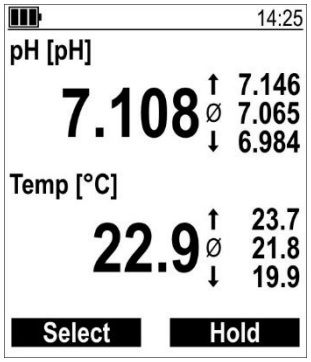
Use the **down/up arrow** keys to scroll through the measured parameters. By repeatedly pressing the ← key, measurements can be displayed in different formats:



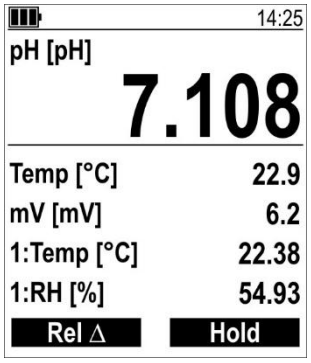

Parameters displayed in large format.



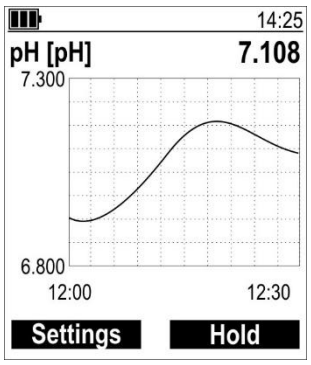

Parameters displayed in medium format.




Parameters displayed in medium format with indication of maximum (↑), average (∅) and minimum (↓) values for each parameter.




One parameter displayed in large format and the remaining in small format.




One parameter displayed numerically and graphically.

Up to 3 parameters can be displayed graphically, selectable in the **Chart setup → Channel select** menu. The left function key **Settings** is a shortcut to the **Chart setup** menu.

A graph for each of the chosen parameters is displayed. Use the **down/up arrow** keys to scroll through the various graphs.

To enable/disable the display of a parameter, change the units of measurement or the order in which parameters are displayed, see the Configuration chapter [▶ p.14].

## 5.1 Hold function

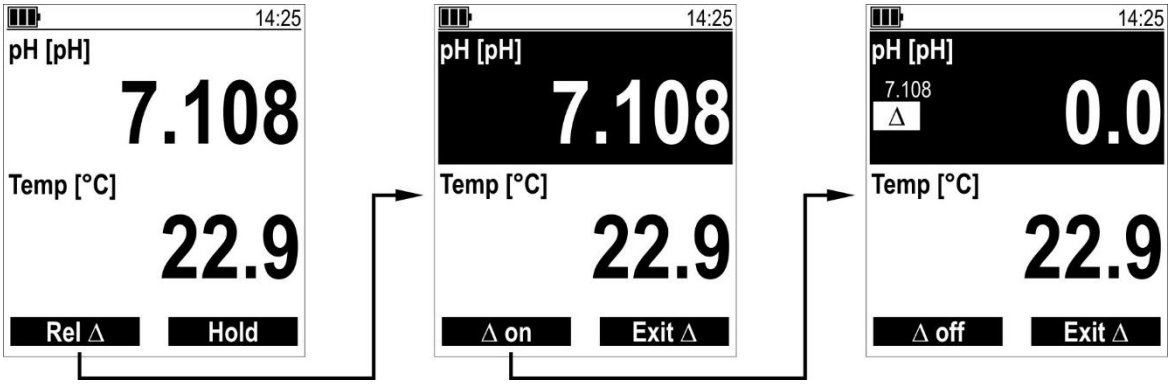
The **Hold** function, which can be activated/deactivated by pressing the right function key, freezes the current measurement values on the display.

The function activation is highlighted by the hld symbol in the status bar of the display.

## 5.2 Rel function

The **Rel** function displays the relative measurement against a reference value, consisting of the measurement value at the time the function is activated.

To activate the relative measurement, press the left function key (**Rel Δ**), select with the **down/up arrow** keys the measurement for which the function should be activated (the selected measurement is highlighted in negative), then press the left function key (**Δ on**). The symbol **Δ** and the reference value appear on display.




To disable the relative measurement, press the left function key (**Δ off**) again.

By pressing the right function key (**Exit Δ**), the instrument exits the relative measurement enable/disable (**Δ on/off**) mode.

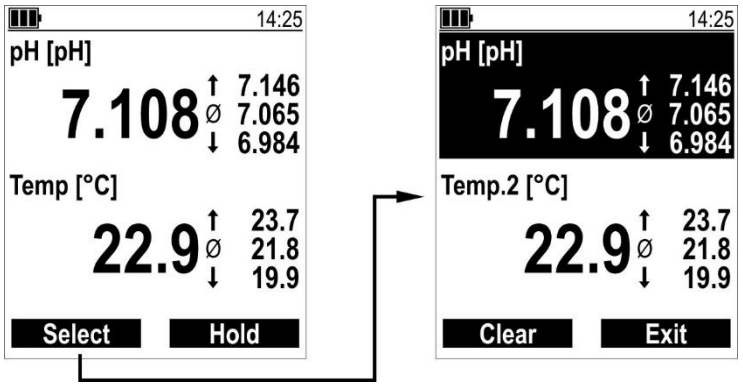
The **Rel Δ** command is not available:

- in the screen with the statistical values;
- in the screen with the graph;
- while logging.

## 5.3 Reset of the statistical values

To reset the statistical values, press the left function key (**Select**) in the measurement screen with the maximum/medium/minimum values, select with the **down/up arrow** keys the measurement whose statistical values should be reset (the selected measurement is highlighted in negative), then press the left function key (**Clear**).

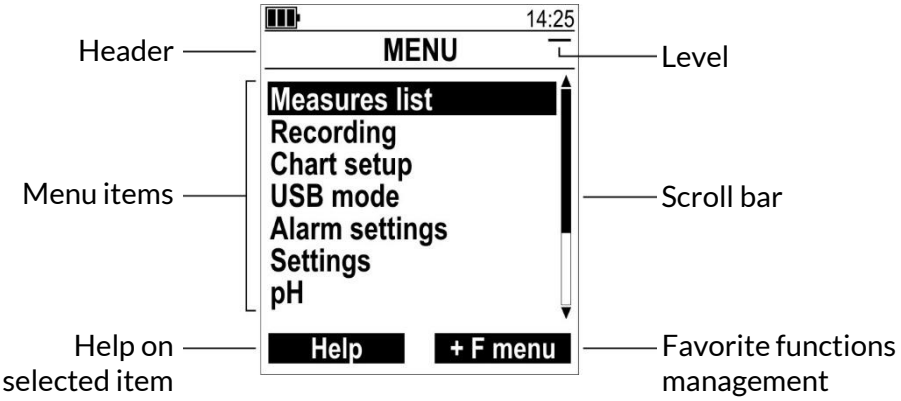
To exit the statistical values reset mode, press the right function key (**Exit**).



# 6 Configuration

Press the **MENU** key to enter the configuration menu.

The menu is structured in levels. The current level is indicated by the number of overlapping bars in the menu header:




Use the **down/up arrow** keys to select an item, press **OK** to confirm.

The presence of the scroll bar indicates that there are additional items available beyond those displayed.

The left function key (**Help**) provides a description of the selected item. If the help function is entered, press the left function key (**Help off**) again to exit.

The right function key (**+ F menu** or **– F menu**) adds or remove the selected item to or from the list of favorite functions [▶ p.18].

**Attention!**

It is not possible to access the menu if the instrument is logging.

## 6.1 Menu structure

The menu structure is shown below; each item is preceded by the level according to the bar symbology shown on the display.

| MENU | DESCRIPTION |
|---|---|
| **– Measures list** | Selection of the quantities to display and log |
| **– Recording** | |
| **=** Start recording | Automatic logging start |
| **=** Set interval | Setting of logging interval: 1/2/5/10/15/30 s, 1/2/5/10/15/30 min, 1 h |
| **=** Mode | Setting of single recording mode |
| **=** Single recording | Manual storing of the current measurements (single sample) |
| **– Chart setup** | Setting of the measurement graphical display |
| **=** Channel select | Selection of parameters to be displayed graphically (up to 3 parameters, selectable from those enabled in the "Measures list" menu) |
| **=** Chart interval | Chart measurement interval: 1/2/5/10/15/30 s, 1/2/5/10 min |
| **– USB mode** | Configurable between COM interface (for logging and serial communication) or Mass storage (for viewing logging files from PC) |

| MENU | DESCRIPTION |
|---|---|
| **– Alarm settings** | Type of alarm signaling: Off, acoustical (buzzer) and/or optical (flashing backlight and red flashing status LED) |
| **– Settings** | |
| **=** Device info | Displaying of instrument info (model, S/N, FW revision, …) |
| **=** Backlight | Backlight configuration |
| **≡** BL activation | Backlight duration: Off, 5 s, 30 s, 1 min, always On |
| **≡** BL intensity | Backlight intensity: Low, Medium, High |
| **=** Auto-off | Auto-off setting: Off, 30 min, 1/2/4/6/12 h |
| **=** Date & time | Setting of date and time (yyyy-mm-dd hh:mm:ss) |
| **=** Time zone | UTC or CET time zone setting |
| **=** Language | Selection of the menu language |
| **=** PIN configuration | Protected mode configuration |
| **≡** Activate PIN code | Protected mode enabling/disabling |
| **≡** Set PIN | Setting of access code |
| **=** Dark mode | Black background enabling/disabling |
| **=** Factory reset | Reset to factory settings |
| **– pH** | pH measurement settings |
| **=** Probe info | Information on the probe |
| **=** Calibration | pH measurement adjustment |
| **≡** Acid range | Calibration at a point of choice between 1 and 6 pH<br>*The item appears only if "Buffer detection" is set to "No buffer detection"* |
| **≡** Neutral range | Calibration at a point of choice between 6 and 8 pH<br>*The item appears only if "Buffer detection" is set to "No buffer detection"* |
| **≡** Basic range | Calibration at a point of choice between 8 and 14 pH<br>*The item appears only if "Buffer detection" is set to "No buffer detection"* |
| **≡** New calibration | Calibration at 1, 2 or 3 points with GPH or DIN pH buffers<br>*The item appears only if "Buffer detection" is set to "GPH" or "DIN"* |
| **≡** Asymmetry | pH electrode offset in mV after a pH 7 (or neutral range) calibration<br>*The item does not appear if the offset calibration has not been performed* |
| **≡** Slope | pH electrode slope in mV/pH after a 2-point calibration (one of the points must be pH 7 or a point in the neutral range)<br>*The item does not appear if a 2-point calibration has not been performed* |
| **≡** Basic slope | pH electrode slope in mV/pH in the basic range after a 3-point calibration<br>*The item does not appear if a 3-point calibration has not been performed* |
| **≡** Acid slope | pH electrode slope in mV/pH in the acid range after a 3-point calibration<br>*The item does not appear if a 3-point calibration has not been performed* |
| **≡** Calibration history | Info on calibrations performed (date/time, type, offset, slope, electrode rating) |
| **≡** Factory defaults | Restoring factory calibration |
| **=** Buffer detection | Selection of automatic detection of buffer solution with GPH (4/7/10) or DIN (4.01/6.87/9.18) standards or manual setting of calibration value (No buffer detection) |
| **=** Temperature | Manual setting of solution temperature<br>*The item appears only if "ATC" is set to "Manual"* |
| **=** Alerting | Selection of the measure/channel with which to associate the alarm |

| MENU | DESCRIPTION |
|---|---|
| = Alarm settings (*) | Setting of the alarm thresholds |
| ≡ Min. alarm | Lower alarm threshold (alarm if measure < threshold) |
| ≡ Max. alarm | Upper alarm threshold (alarm if measure > threshold) |
| ≡ Hysteresis | Thresholds hysteresis |
| = ATC | Selection of manual temperature setting or input to which the temperature probe is connected (Banana socket, DX Port 1, or DX Port 2).<br>If ATC = "Manual", the instrument considers the temperature:<br>o set in "pH → Temperature" menu, with 1 °C resolution, if no sensor is connected to the banana socket;<br>o measured by the sensor integrated in the electrode, with decimal resolution, if connected to the banana socket, even if "Banana socket" is not expressly selected.<br>If ATC = "Banana socket" and the temperature sensor is not connected, the instrument does not consider the manually set temperature but displays an error message. |
| = Sensor type | Selection of the type of temperature sensor connected to the banana plug: Pt1000, NTC 10k, or NTC 30k |
| = Temp. units | Setting of the temperature unit of measurement: °C, °F, K |
| = T. compensation | Temperature measurement adjustment |
| ≡ Zero point | Offset adjustment |
| ≡ Gradient | Slope adjustment |
| = Resolution pH | Selection of the pH measurement resolution: 0.0, 0.00 or 0.000 |
| **– DX Port x** | Digital input number "x" measurement settings<br>*The items actually listed may depend on the type of probe* |
| = Probe info | Information on the connected probe |
| = Measuring units | Setting of the unit(s) of measurement<br>The availability of the item depends on the probe connected |
| = Alarm settings | Setting of the alarm thresholds |
| ≡ Alerting | Selection of the quantity with which to associate the alarm |
| ≡ Min. alarm (*) | Lower alarm threshold (alarm if measure < threshold) |
| ≡ Max. alarm (*) | Upper alarm threshold (alarm if measure > threshold) |
| ≡ Hysteresis (*) | Thresholds hysteresis |
| = Correction | Measurement adjustment.<br>The item is available only if the probe allows user calibration, and the items available in this submenu depend on the type of probe connected [▶ p.26]. |
| = Calibration type | Selection of factory or user calibration<br>The item is available only if the probe allows user calibration |
| = Salinity | *Only **DX 53x** probes*. Setting of the salinity of the measured liquid. |
| = Measuring rate | *Only **DX 210/240** probes*. Selection of Low or High rate. |

(*) The item does not appear if "Alerting" is set to "Off"; to display the item, first select a measure/channel to associate the alarm with.

To go back up one level within the menu, press the ← key. The **MENU** key allows exiting the menu directly and return to measurement mode from any level (except from parameter setting screens, from which you can exit only with ←).

## 6.2 Configuring a parameter

Configuring a parameter may require choosing an option from those proposed, or setting a numerical value.

**Configuring a parameter by choosing an option from those proposed:**

The current setting is marked by the check mark. To change it, choose an option with the **down/up arrow** keys, then press **OK** to confirm.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

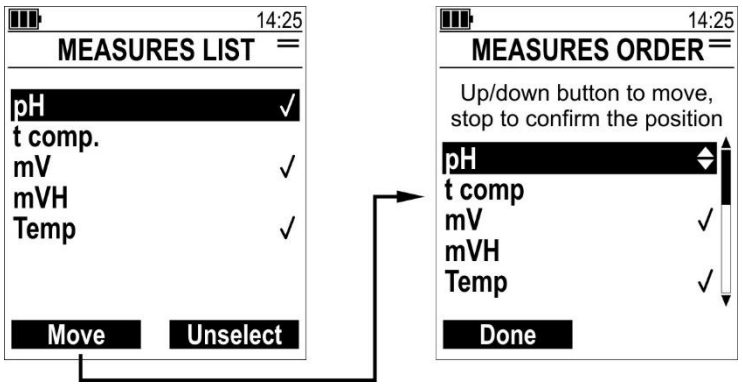

**Configuring a parameter by setting a numerical value:**

Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

## 6.3 Selecting and sorting the quantities to be displayed

The **Measures list** menu item allows choosing which quantities to display and in which order.




Enabled quantities are marked by the check mark. To enable or disable a quantity, select it with the **down/up arrow** keys, then press the right function key (**Select** or **Unselect** depending on whether the quantity is disabled or enabled).

The quantities are displayed in the measurement screens in the order in which they appear in this menu. To change the position of a quantity, select it with the **down/up arrow** keys, press the left function key (**Move**), move the quantity with the **down/up arrow** keys, and press the left function key (**Done**).

The symbols used for the variables are listed below:

- **Quantities relating to pH/ORP measurement**:

  **pH** pH measurement
  **t comp.** Temperature value used for compensation
  **mV** mV signal of the pH/ORP electrode
  **mVH** Temperature compensated mV signal referred to standard hydrogen electrode
  **Temp** Temperature measurement of the connected sensor

- **Quantities relating to DO (dissolved oxygen) measurement**:

  **Conc.** Dissolved oxygen concentration in mg/l
  **Sat.** Percentage of dissolved oxygen relative to saturation value
  **Sal.** Salinity value set in the instrument
  **Temp** Temperature measurement of the sensor integrated in the probe

- **Humidity quantities** (the quantities actually available depend on the probe type):

  **RH** Relative humidity
  **Td** Dew point
  **Twet** Wet bulb temperature
  **AHum** Absolute humidity
  **MixR** Mixing ratio
  **Enth** Specific enthalpy
  **PVP** Partial vapor pressure
  **SHum** Specific humidity
  **Tf** Frost point temperature
  **SVPW** Saturation vapor pressure above water
  **SVPI** Saturation vapor pressure above ice

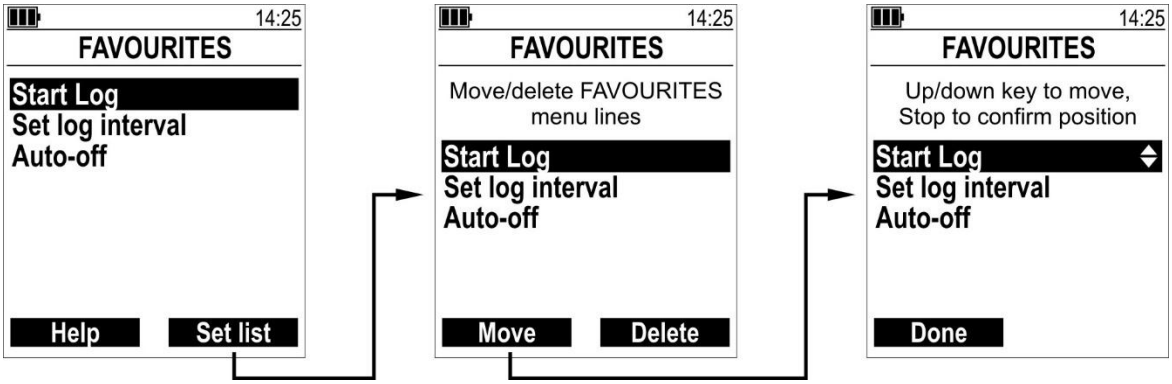
## 6.4 Favorite functions (menu shortcuts)

Frequently used menu items can be added to a list of favorite functions so that they are easily accessible without the need to navigate the menu structure.

To add a menu item to the list of favorite functions, select it in the menu and press the right function key (**+ F menu**). Items added to the list of favorite functions are marked with the symbol ★.


The favorite functions can be accessed from the measurement screens by pressing the **F** key. To execute a favorite function, select it with the **down/up arrow** keys, then press **OK** to confirm.

The list of the favorite functions can be edited by pressing the right function key (**Edit**).




The left function key (**Clear all**) deletes the entire list.

To change the position of a function, select it with the **down/up arrow** keys, press the right function key (**Move**), move the quantity with the **down/up arrow** keys, and press the right function key (**Done**).

Press the ← key to exit from the function list editing mode.

To delete a single menu item from the list of favorite functions, select it in the menu and press the right function key (**- F menu**): the symbol ★ disappears.

**Attention!**

For security reasons, It is not possible to add the menu items “Activate PIN code”, “Set PIN”, and “Factory reset” to the list of favorite functions.

## 6.5 Protected mode

The configuration of the instrument can be protected with a numeric code (PIN) that is required to access the menu or send serial commands.

By default, the protected mode is disabled. To enable the protected mode, select **Settings → PIN configuration → Activate PIN code → Yes** and press **OK**. You are prompted to enter the PIN, which is **0** by default. Set the PIN, if different from the default, using the **down/up arrow** keys and function keys (**< >**), then press **OK**, the instrument returns to the setting screen with protected mode enabled.

The protected mode activation is highlighted by the lck symbol in the status bar of the display.

**Attention!**

lck is not displayed if cor is on, because the two symbols share the same position and cor has priority over lck.

Upon exiting the menu after activating the protected mode, the mode is immediately active. If the menu is entered when the mode is already active (thus entering the access PIN), upon exiting the menu the PIN request to re-enter the menu is reactivated 2 minutes after the last key press (in the meantime, it is possible to re-enter the menu without entering the PIN), unless the 2 minutes without pressing keys have already elapsed within the menu, in which case the PIN request to re-enter the menu is reactivated immediately upon exiting the menu.

In protected mode, accessing the menu by entering the PIN does not automatically unlock serial communication, and sending the PIN via the appropriate serial command [▶ p.34] does not automatically unlock menu access.

**Attention!**

Menu items added to the list of favorite functions are not protected if accessed via the **F** key.

**Changing the PIN:**

The code can be set from 0 to 9999 (default = 0).

To change PIN, select **Settings → PIN configuration → Set PIN**, set PIN using **down/up arrow** keys and function keys (**< >**), then press **OK**, a message appears to remind you to activate protected mode, press **Help Off** to close the screen.

**Attention!**

Changing the PIN automatically disables the protected mode if it is active. After changing the PIN, it is necessary to reactivate the protected mode again.

**Attention!**

In the package of the instrument there is a sheet with a Master PIN, different for each instrument, which allows access to the protected features in case the user forgets the PIN after changing it.
If you lose your Master PIN sheet, you can request a copy by indicating the serial number of your device.

# 7 Measurement basics

**Attention!**

Before immersing a pH/ORP electrode in a solution, remove the protective cap from the electrode and rinse the electrode shaft and membrane with distilled or deionized water.

The type of digital probe connected is automatically recognized by the instrument. The probe is factory calibrated and the calibration data are stored in the probe, which sends the measured value directly to the instrument.

## 7.1 pH measurement

The response of a pH electrode depends on temperature (Nernst's law), assuming the pH of the solution remains constant. The pH of a solution itself is also generally slightly dependent on temperature. To take accurate measurements, it is therefore essential to measure not only the pH of the solution, but also its temperature.

The temperature can be measured using electrodes with an integrated temperature sensor, a separate digital temperature probe connected to the instrument, or with a thermometer not connected to the instrument, setting the temperature value manually.

There are electrodes for general applications and electrodes for specific applications. Always check that the electrode used is appropriate for your field of application.

The lifespan of a pH electrode can typically vary from 6 months to 2 years, depending on frequency of use, field of application, regular maintenance, and proper storage.

**Attention!**

- The pH electrode has high impedance and is therefore very sensitive to disturbances; avoid interference and electrostatic discharge.
- Keep the connector contacts clean and dry.
- Unless the electrode is completely watertight, do not immerse the electrode above the shaft.
- After use, protect the electrode tip with its protective cap.
- Always keep the electrode tip moist when not in use. If the tip remains dry for a long time, the electrode may be permanently damaged. Use KCl 3M in the protective cap to keep the tip moist; do not use distilled or deionized water.
- Calibrate the electrode frequently.
- Crystallization of the KCL 3M solution on the protective cap and shaft is unavoidable. Crystallization can be easily removed with a cloth and does not constitute a defect.
- Clogging of the electrode diaphragm, which connects the internal electrolyte to the solution being measured, is a frequent cause of malfunction; use the appropriate cleaning solutions if the electrode does not perform as expected.
- Replace the electrode if cleaning solutions do not sufficiently regenerate the electrode.

## 7.2 ORP measurement

When measuring oxidation-reduction potential (ORP), the instrument directly displays the signal in mV generated by the electrode.

The measurement is performed using standard Ag/AgCl electrodes (3M KCl solution reference system). The mV signal can be directly displayed or automatically converted to the “standard

hydrogen electrode" with temperature compensation (mVH).

The ORP electrode does not require calibration. However, verification solutions are available to check the functionality of the electrode.

## 7.3 Temperature measurement

The sensor is located at the end of the probe.

**Immersion or penetration measurement**: immerse the probe stem for at least 60 mm; when measuring in liquids, stir the liquid if possible.

**Attention!**

The measurement may be inaccurate if the probe stem is not sufficiently immersed, due to heat loss from the metal stem.

**Measurement in air/gases**: immerse the stem as much as possible in the fluid to be measured. The response time is shorter in the presence of flow; in the absence of flow, you can speed up the measurement by moving the probe, if possible.

**Attention!**

The probe stem must be dry, otherwise a temperature lower than the actual temperature will be detected.

**Measurement of solid materials by contact**: the measuring surface should be flat and smooth; the probe should be perpendicular to the measuring plane. Probes with tip specially designed for contact measurements must be used. The ambient temperature and heat dissipation of the probe metal stem can affect the accuracy of the measurement.

**Attention!**

For a more accurate and faster contact measurement, interpose thermally conductive paste between the measuring surface and the probe tip. Measurement on non-metallic surfaces takes longer because of the poor thermal conductivity.

## 7.4 Humidity measurement

Place the probe in the environment to be measured and, for a more accurate measurement, wait for the probe housing to reach thermal equilibrium with the environment.

Keep the probe away from heat or cold sources, walls, drafts, etc., so as to avoid temperature changes that can cause condensation, as well as slow down reaching measurement stability.

In case of a thermal jump, to accelerate reaching thermal equilibrium move the probe in a fan-like manner so that it is subjected to a slight air flow.

The sensitive end of the probe is protected by a filter that must be cleaned regularly. For best measurement results, use a probe with a filter type suitable for your application.

**Attention!**

Do not expose the probe to direct sunlight, use appropriate shielding when using the probe outdoor.

## 7.5 Pressure measurement

Depending on the probe connected, the instrument measures absolute, relative or differential pressure.

Before detecting relative or differential pressures, verify the need to perform zeroing of the pressure measurement by leaving the probe inputs open.

**Attention!**

Use hoses with a diameter compatible with the probe pressure ports. The inner diameter of the hose should not be too large to avoid pressure loss and should not be too small to avoid mechanically forcing the ports when inserting the hose.

**Caution**!

- Use hoses suitable for the pressure to be measured.
- Do not exceed the maximum overpressure specified for the probe, the measuring sensor may be damaged.
- It is recommended that the hoses are not under pressure during connection.
- It is recommended to secure the hoses to the pressure ports with hose clamps when measuring pressures above 1 bar.

## 7.6 $CO_2$ measurement

During the measurement, it is recommended to stay not too close to the sensor, to avoid altering the $CO_2$ values.

## 7.7 VOC index (Volatile Organic Compounds) measurement

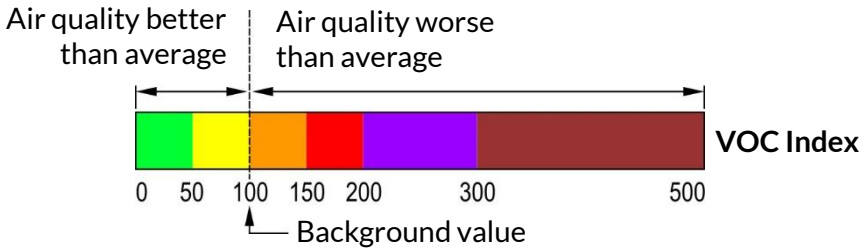
Volatile organic compounds are polluting chemicals that evaporate easily at ambient temperature and pressure. An excessive concentration of these substances in indoor environments reduces the air quality, causing discomfort or alterations in the health status of the occupants.

The VOC index measurement provided by the instrument is not an absolute concentration, but it is a measurement:

- relative (compared to the average situation of the monitored environment);
- qualitative (index of better or worse than the average situation).

The sensor must therefore "adapt" to the environment to be monitored, so that the average pollution state (background value) of the environment can be determined. For this to happen, **it is necessary to leave the instrument operating in the environment to be monitored for at least 12 hours**.

After the time of adaptation to the environment, the state of VOC pollution is expressed as an index variable from 1 to 500 (dimensionless). The value 100 corresponds to the background value of the environment. Values below 100 indicate that VOC pollution is improving; values above 100 indicate that VOC pollution is worsening compared to the determined background value.




| VOC Index | Air quality |
|---|---|
| VOC Index < 50 | Much better than average |
| 50 < VOC Index < 100 | Slightly better than average |
| 100 < VOC Index < 150 | Slightly worse than average |
| 150 < VOC Index < 200 | Somewhat worse than average |
| 200 < VOC Index < 300 | Much worse than average |
| 300 < VOC Index < 500 | Bad compared to average |

The VOC index value is an average referring to the last 24 hours of monitoring.

Not being an absolute indication, the VOC measurement is not suitable for comparing different environments, because environments with a very different degree of pollution could generate similar values of the VOC index, being the index based on the background value of the environment.

## 7.8 Soil moisture (Volumetric Water Content) and temperature measurement

Insert the probe **completely** into the soil so that the entire handle is covered by the ground. The probe integrates a temperature sensor located inside the handle; therefore, it is necessary that the handle is immersed in the soil for a correct detection of the temperature.

After the introduction of the probe, fill in the empty spaces between the soil and the probe with some soil made powder. To obtain accurate measurements, the soil should be in contact with the electrodes and the probe handle.

The probe can be oriented in any direction, but it is advisable to place it vertically into the ground, so to not hinder the flow of water downward and to minimize the influence of the probe in the soil behavior.

**Attention!**

- Do not use excessive force when introducing the probe, so to avoid irreparable damage to the electrodes. By means of an accessory, perform a hole into the soil deep enough to accommodate the probe. Never use the probe to make the hole in the soil.
- Indicate the presence of the probe during the soil maintenance operations (e.g. lawn mowing, ploughing, mechanized harvesting, etc.).
- To remove the probe from the soil, grab the handle and pull it upwards. **During the extraction, remove the probe vertically, by avoiding tilt that would damage the electrodes. Do not remove the probe by pulling the cable.**

## 7.9 Dissolved oxygen (DO) measurement

The DX53x digital probes use an optical measurement principle, eliminating the need for chemicals, a minimum flow of solution in contact with the membrane, and frequent maintenance.

The probe must be positioned vertically in the solution. A slight angle of inclination does not compromise the measurement.

As the salinity of the liquid increases, the solubility of oxygen in water decreases, meaning that at the same partial pressure of oxygen, fewer milligrams of oxygen dissolve per liter of water. To correctly determine the DO measurement as a percentage of saturation, it is therefore necessary to set the salinity of the liquid in the instrument menu.

**Attention!**

- Calibrate the probe before taking a measurement, preferably at a temperature close to that of the liquid to be measured.
- After immersing the probe in a liquid, wait for thermal equilibrium between the probe and the liquid (at least 15 min), and for the measurement to stabilize before taking the measurement.

## 7.10 General warnings on probes usage

For temperature or other measurements that are automatically temperature compensated, wait for thermal equilibrium between the sensitive part of the probe and the area to be measured before taking the measurement.

Thoroughly clean the probe after use.

**Danger!**

If the probe has a metal stem or other metal parts, be careful not to come into contact with live parts.

**Caution**!

- Do not expose the probe to corrosive gases or liquids!
- Do not expose the probe to temperatures exceeding the operating limit specified for the probe, the measuring sensor may be damaged.
- Avoid performing measurements in the presence of high-frequency sources, microwaves or strong magnetic fields.
- Connect the probe to the instrument without forcing or bending the connectors or contacts!
- Do not deform or drop the probe!
- Bending within moderate radius is only allowed for mineral insulated probes.

## 7.11 Warning on USB port isolation

The instrument USB port is not galvanically isolated, and its connection, either to the PC or to an external power supply that is not isolated from ground, may affect the measurement when using a probe that is in contact with the measured medium. Under such conditions, always check the measurement with and without USB connected: if a difference in the detected value is noticed, disconnect USB, or use an external suitable USB isolator (for example, DFRobot FIT0860) to detect reliable measurements.

# 8 Measurement adjustment

For some quantities it is possible to apply a correction to the measurement or calibrate the probe at one or multiple points.

**Notes on measurement adjustment of digial probes:**

Correction/calibration of digital probes is possible only if the user calibration type is set in the instrument (**Port x → Calibration type → User** menu item).

If the factory calibration type is set in the instrument (**Port x → Calibration type → Factory** menu item), the parameters in **Port x → Correction →** ***quantity*** menu will be visible in read-only mode.

In case of erroneous correction/calibration, it is always possible to reset the user calibration parameters to the factory values by selecting **Port x → Correction →** ***quantity*** **→ Factory defaults → Yes**. Restoring factory values does not change the type of calibration in use, which remains user.

## 8.1 pH

Calibration can be performed by manually setting the buffer solution values, or with automatic recognition of solutions according to GPH (4/7/10) or DIN (4.01/6.87/9.18) standards. Set the desired method in the **pH → Buffer detection** menu.

If an electrode with an integrated temperature sensor or an external temperature probe is used to temperature-compensate the pH measurement, select the temperature input in the **pH → ATC** menu. If the temperature probe is not connected to the instrument, select **pH → ATC → Manual** and set the temperature in the **pH → Temperature** menu.

**Attention!**

- Rinse the electrode with distilled or deionized water before immersing it in a buffer solution.
- After immersing the electrode in a buffer solution, wait for thermal equilibrium between the electrode and the solution, and for the measurement to stabilize before calibrating the point.
- It is advisable to perform calibration at a temperature between 10 and 40 °C, and preferably at a temperature close to that of the solution to be measured.
- If calibration is performed without automatic recognition of the buffer solution, check the temperature variation table for the solution used to find the exact calibration value to be set.
- Use fresh buffer solutions.

In case of erroneous calibration, it is always possible to reset the user calibration parameters to the factory values by selecting **pH → Calibration → Factory defaults → Yes**.

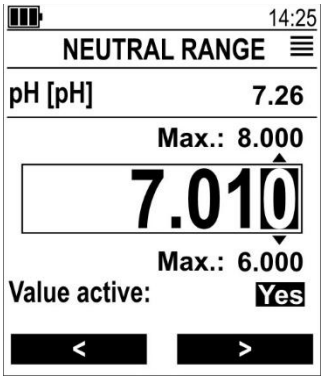
- **pH calibration with manual setting of buffer solution values:**

Select **pH → Buffer detection → No buffer detection**.

Select **pH → Calibration**. Available options are:

  - **Acid range**: calibration at a point between 1 and 6 pH.
  - **Neutral range**: calibration at a point between 6 and 8 pH.
  - **Basic range**: calibration at a point between 8 and 14 pH.

Select the range to be calibrated. In the upper part of the display, the current pH measurement is shown. In the center of the display, the exact calibration value should be set.




Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

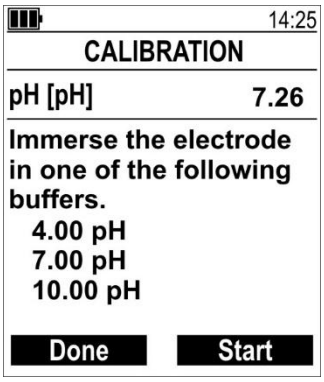
The "Value active" parameter indicates whether or not the calibration point is used in the pH measurement. The " Value active " setting is changed by pressing the **F** key. The parameter is automatically set to "Yes" if a digit of the calibration value is changed.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

- **pH calibration with automatic recognition of buffer solution:**

Select **pH → Buffer detection → GPH** or **DIN**.

Select **pH → Calibration → New calibration**.




Dip the electrode into one of the proposed buffers and press the right function key (**Start**): the instrument will begin recognizing the buffer and will automatically select the point to be calibrated. When the instrument has completed calibration of the point, a check mark will appear next to the calibrated point.

Calibration can be exited after the first point by pressing the left function key (**Done**), or continued with the calibration of the other points by immersing the electrode in the other solutions (rinse the electrode before immersing it in a different buffer) and pressing the right function key (**Start**) for each point. In the case of multi-point calibration, the left function key (**Done**) should only be pressed after calibrating all the desired points.

In multi-point calibration with manual temperature setting, before calibrating the next point (i.e., before pressing **Start**), you can temporarily exit the calibration screen with the ← key (do not press **Done**) to set the solution temperature. After setting the temperature, select **New Calibration** to return to the calibration screen.

## 8.2 Temperature

**Sensor connected to the banana socket input:**

The measurement can be adjusted by setting the following parameters, available in the **pH → T. compensation** menu:

- **Zero point**: adds an offset ($t_{offs}$) to the measurement.

  $$\text{Displayed value} = \text{Measured value} + t_{offs}$$

- **Gradient**: applies a percentage correction ($C_{slope}$%) to the measurement. Zero indicates no correction.

  $$\text{Displayed value} = (\text{Measured value} + t_{offs}) * (1 + C_{slope}\% / 100)$$

If a measurement correction is applied by setting a value other than zero for the “Zero point" and/or "Gradient” parameters, the cor symbol appears on the display.

**Digital probes:**

Select **Port x → Correction → Temperature**. The options available depend on the type of probe connected.

- **DX 115 / DX 310 / DX 311** probes
  It is possible to calibrate the temperature in 1, 2 or 3 points, or to characterize the Pt100 sensor by entering the parameter $R_0$ (resistance at 0 °C) and the coefficients A, B and C of the Callendar-Van Dusen equation. Available options are:
  - **R0**: parameter $R_0$ (resistance at 0 °C) of the Callendar-Van Dusen equation.
  - **A**: coefficient A of the Callendar-Van Dusen equation.
  - **B**: coefficient B of the Callendar-Van Dusen equation.
  - **C**: coefficient C of the Callendar-Van Dusen equation.
  - **Point 0 °C**: first calibration point (settable -10…40 °C).
  - **Point 100 °C**: second calibration point (settable 60…140 °C).
  - **Point 400 °C**: third calibration point (settable 200…500 °C).

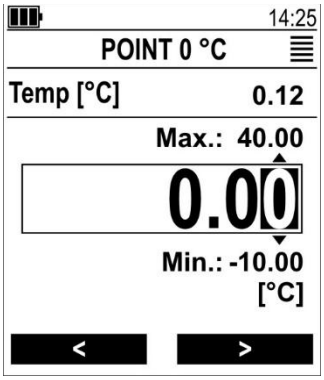
  When calibrating the probe at one of the available points, the R0, A, B and C values of the Callendar-Van Dusen equation are automatically updated.

- **DX 330** probe
  It is possible to calibrate the temperature in 1 or 2 points, or to add an offset to the measurement. Available options are:
  - **Point 0 °C**: first calibration point (settable -10…30 °C).
  - **Point 60 °C**: second calibration point (settable 30…105 °C).
  - **Offset**: correction of the measurement by adding an offset (settable -45…140 °C).

**Calibration in one of the available points:**

Immerse the probe in a reference bath (if the probe can be immersed) or place it in an

environment of known temperature (e.g., a climatic chamber); then, select the point to be calibrated in the menu.



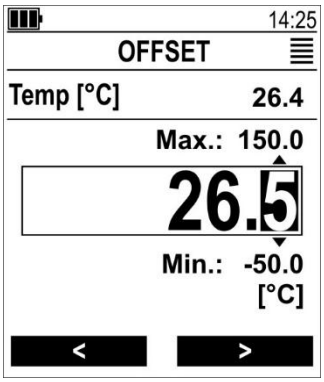

In the upper part of the display, the current temperature measurement is shown. In the center of the display, the exact calibration value should be set.

Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

**Offset in DX 330 probe:**

Correcting the temperature with the **Offset** option in the DX 330 probe is absolutely similar to calibration in a point: the current measurement is shown in the upper part of the display, and the correct measurement value should be set in the center.




## 8.3 Relative humidity

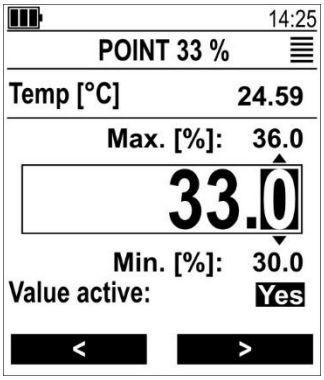
Select **Port x → Correction → Rel. Humidity**. The options available depend on the type of probe connected.

- **DX 310 / DX 311** probes
  It is possible to calibrate the relative humidity in multiple points (up to 5). Available options are:
  - **Point 11 %**: first calibration point (settable 0…25%).
  - **Point 33 %**: second calibration point (settable 30…36%).
  - **Point 50 %**: third calibration point (settable 38…70%).
  - **Point 75 %**: fourth calibration point (settable 72…78%).
  - **Point 85 %**: fifth calibration point (settable 80…95%).

- **DX 330** probe
  It is possible to calibrate the relative humidity in 1 or 2 points. Available options are:
  - **Point 33 %**: second calibration point (settable 20…50%).
  - **Point 75 %**: fourth calibration point (settable 50.1…90%).

**Calibration in one of the available points:**

Place the probe in an environment of known relative humidity (e.g., a climatic chamber or a container with salt saturated solution); then, select the point to be calibrated in the menu.




In the upper part of the display, the current temperature measurement is shown, useful in case a salt saturated solution, whose relative humidity value depends on the temperature, is used for calibration. In the middle part of the display, the exact relative humidity calibration value should be set.

Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

The "Value active" parameter, displayed in DX 310 and DX 311 probes, indicates whether or not the calibration point is used in the relative humidity measurement. The " Value active " setting is changed by pressing the **F** key. The parameter is automatically set to "Yes" if a digit of the calibration value is changed.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

**Attention!**

- For an accurate calibration, wait until the probe housing reaches thermal equilibrium and the measurement is stable before calibrating a point.
- If a saturated salt solution is used, check the value of the solution at the calibration temperature.

## 8.4 Differential pressure

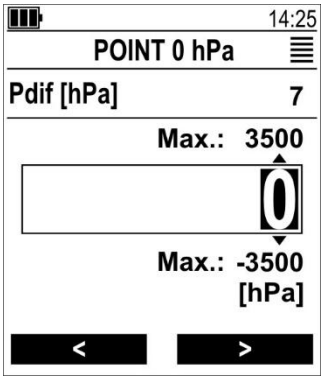
Select **Port x → Correction → Diff pressure**. Available options are:

- **Point "*-p*"**: calibration at a negative value "-p".
- **Point 0 hPa**: zero calibration.
- **Point "*+p*"**: calibration at a positive value "+p".
- **Offset**: correction of the measurement by adding an offset.

The calibration points "±p" and the settable calibration ranges depend on the probe range.

**Calibration in one of the available points:**

For zero calibration leave the inputs open. For calibration at "±p" points, apply the pressure indicated by the menu items to the inputs. Wait for the measurement to stabilize; then, select the point to be calibrated in the menu.



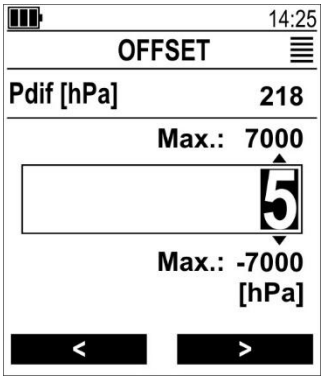

In the upper part of the display, the current differential pressure measurement is shown. In the center of the display, the exact calibration value should be set.

Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

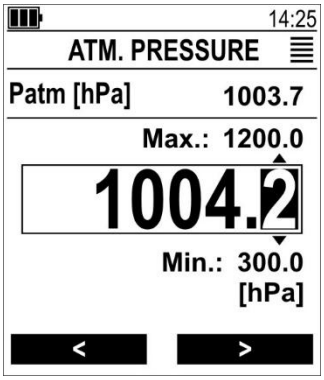
**Offset:**

Correcting the measurement with the **Offset** option is absolutely similar to calibration in a point: the current measurement is shown in the upper part of the display, and the correct measurement value should be set in the center.



## 8.5 Atmospheric pressure

In the DX 330 probe, an offset can be added to the atmospheric pressure measurement by selecting **Port x → Correction → Atm. Pressure → Offset**.




In the upper part of the display, the current atmospheric pressure measurement is shown. In the center of the display, the exact calibration value should be set (0…1200 hPa).

Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

## 8.6 $CO_2$

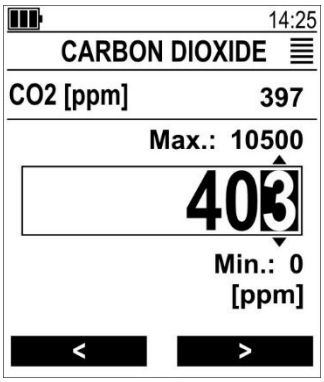
In the DX 330 probe, it is possible to calibrate the $CO_2$ measurement in 1 or 2 points, or to add an offset to the measurement.

Select **Port x → Correction → Carbon Dioxide**. Available options are:

- **Point 400 ppm**: first calibration point (settable 0…2000 ppm).
- **Point 5000 ppm**: second calibration point (settable 2001…10500 ppm).
- **Offset**: correction of the measurement by adding an offset (settable 0…10500 ppm).

**Calibration in one of the available points:**

Place the probe in an environment of known $CO_2$ and wait for the measurement to stabilize; then, select the point to be calibrated in the menu.




In the upper part of the display, the current $CO_2$ measurement is shown. In the center of the display, the exact calibration value should be set.

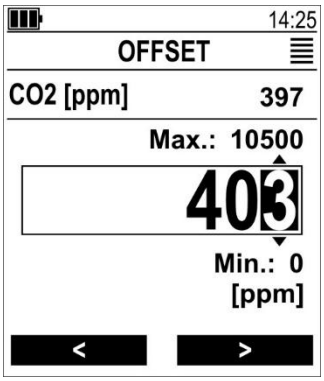
Select the various digits using the function keys (**< >**). To change a digit, use the **down/up arrow** keys. When finished, press **OK** to confirm the value.

After pressing OK, the instrument performs a procedure to verify the stability of the measurement: wait for the completion of the procedure, avoiding standing too close to the probe so as not to alter the measurement.

Pressing the ← key it is possible to exit by canceling changes not yet confirmed.

**Offset:**

Correcting the measurement with the **Offset** option is absolutely similar to calibration in a point: the current measurement is shown in the upper part of the display, and the correct measurement value should be set in the center.




## 8.7 Dissolved oxygen (DO)

Calibration can be performed at 1 point (100% $O_2$) or at 2 points (100% and 0% $O_2$).

**Attention!**

- Wait for thermal equilibrium between the probe and the air/liquid (at least 15 min), and for the measurement to stabilize before calibrating.

For 100% $O_2$ calibration, wrap the probe head with the cap in a damp cloth to create an atmosphere saturated with water vapor. Ensure that there are no water droplets on the membrane and that the cloth does not touch the membrane. This is the simplest method of calibration and is suitable for most applications. With DX 532 and DX 535 sensors, the sponge in the protective cap can be moistened instead of a cloth to create the necessary environment. The maximum possible accuracy is achieved when calibrating in air-saturated water.

For 0% $O_2$ calibration, immerse the probe in the 0% calibration solution.

Select **Port x → Calibration**.

To calibrate a point, press the right function key (**Start**): the instrument will automatically select the point to be calibrated. When the instrument has completed calibration of the point, a check mark will appear next to the calibrated point.

Calibration can be exited after the first point by pressing the left function key (**Done**), or continued with the calibration of the second point by pressing the right function key (**Start**). In the case of multi-point calibration, the left function key (**Done**) should only be pressed after calibrating all the points.

In case of erroneous calibration, it is always possible to reset the user calibration parameters to the factory values by selecting **pH → Calibration → Factory defaults → Yes**.

After calibration at 0%, rinse the probe with clean water.

# 9 Logging

The logging function stores in the memory of the instrument the detected measurements, along with the date and time of each sample. Data recording can be automatic, according to the set interval, or single (manual).

**Attention!**

- To use the logging function, the **USB mode** menu item must be set to **COM interface**.
- The Logging function records only the quantities enabled in the measurement screens. Before starting logging, make sure that all quantities of interest are enabled.

## 9.1 Automatic logging

The automatic logging data are stored in **CSV** format.

To start automatic logging, select the **Start recording** item from the **Recording** menu.

By selecting "Start recording," the instrument automatically exits the menu. It is not possible to access the menu during logging.

The logging activation is highlighted by the rec symbol in the status bar of the display. During logging, the status LED briefly flashes green every 5 seconds.

With logging active, in the measurement screens the left function key assumes the function of **Stop** logging.

During logging, the instrument auto-off is disabled.

## 9.2 Single recording

The single recordings data are stored in a single file in **JSON** format (history.json). The new recordings are added to existing recordings, which are not deleted.

Three modes are available for single recording, which can be selected in the **Recording → Mode** menu:

- **Standard**
- **Multiselect**
- **On hold**

**Standard mode:**

To make a single recording, select the **Single recording** item of the **Recording** menu, then select with the **down/up arrow** keys one of the available labels (Location xx) and press **OK** to confirm and save the measurement data.

During data saving, the rec symbol lights up in the status bar of the display.

The selected label is marked with the check mark. The label associated with the recording is useful for distinguishing the various recordings in the data file, which is unique for all single recordings. The label may, for example, represent the location where the recording takes place; recordings made in different locations may be associated with different labels. There are 20 distinct labels available (Location 1...20).

**Multiselect mode:**

Operation is similar to standard mode, except that the check mark always remains visible next to all labels that are selected (in standard mode only the last label selected is marked with the check mark).

The left function key **Clear**, which appears on the label list screen, removes all checkmarks from the list (but does not clear the data). The function key appears only if there is at least one check mark.

**On hold mode:**

Operation is similar to the standard mode, with the added option of directly accessing the label list when the Hold function key, which becomes **Hold/rec**, is pressed.

If, after pressing the **Hold/rec** function key, a label is selected and **OK** is pressed, the data is saved and the instrument returns to measurement mode, exiting the Hold function. If instead OK is not pressed to save the data, but the menu is exited to return to measurement mode, the instrument remains in Hold.

**Changing the labels name:**

The label names can be customized with the following serial command:

**updateLocation: n, name**

where n is the label index (1...20). The name has a maximum length of 16 characters.

## 9.3 Viewing the logged data

The instrument can be connected to the PC via a standard USB-C cable. The instrument is viewed by the PC as a mass storage device containing the various data files.

**Attention!**

With the instrument turned on, to view the device disk drive, logging must be off and the **USB mode** menu item must be set to **Mass storage**.

Regardless of the USB mode setting, the instrument disk drive is always visible when the instrument is turned off, if it is connected to a PC and protected mode is not enabled [▶ p.20].

The **ProXware** application software can be used to read the CSV files.

JSON files can be imported into Microsoft Excel® (Data → Get data → From file → From JSON menu). See the Microsoft Excel® help for details on the data import procedure.

## 9.4 Deleting the logged data

The log files can be erased from the PC using a file manager.

# 10 Serial communication

Serial commands can be sent to the instrument, to read the instrument information and the measurements.

To send serial commands to the instrument, the **USB mode** menu item must be set to **COM interface**.

In the serial communication software used [1], the PC COM port number to which the instrument is connected has to be set.

Recommended communication parameters:

- Baud rate = 115200
- Data bits = 8
- Stop bits = 1
- Parity = None

The full list of commands supported by the model, with their description, is obtained by sending the following command:

**GetCommandList: 0***<CR><LF>*

<CR> = Carriage Return
<LF> = Line Feed

Between the characters ":" and "0" of the command there is a space.

All command strings sent to the instrument must be terminated by the *<CR><LF>* control characters.

**Serial communication in protected mode:**

If the protected mode is active [▶ p.20], the following command must be sent to activate serial communication:

**setPINCode: nnnn**

where nnnn is the PIN.

The default PIN is **0000**. The PIN must always be written with 4 digits (e.g., 0023 for 23).

After the PIN is sent, the serial communication is locked again if the instrument does not receive serial commands for 2 minutes.

**Attention!**

In the package of the instrument there is a sheet with a Master PIN, different for each instrument, which allows access to the protected features in case the user forgets the PIN after changing it.
If you lose your Master PIN sheet, you can request a copy by indicating the serial number of your device.

[1] *Any standard serial communication software, e.g., "HTerm", can be used.*

# 11 Battery management

If the external power supply is not connected, the battery symbol on the display indicates the battery charge level.

If the battery charge is insufficient to ensure a correct measurement, the instrument turns off. The data remains stored even with low batteries.

In case of discharged batteries it is necessary to recharge the batteries by connecting the external power supply to the USB port of the instrument.

**Attention!**

- For a fast charging of the batteries, the power supply must be able to provide at least **900 mA**.
- The actual battery autonomy depends on the number and type of probes connected. If you plan to use the instrument on battery power alone, make sure the charge is sufficient to complete the measurements.

If charging is in progress when the instrument is off, the empty, half-full and full battery symbols appear cyclically on the display; when charging is complete, the battery-full symbol remains.

**Tips:**

To increase the battery autonomy, it is possible to reduce the brightness of the backlight and/or enable the instrument auto-off (see Configuration chapter [▶ p.14]).

**Prolonging the life of the rechargeable batteries:**

- When first used, make a full charge.
- Do not leave the batteries discharged for a long time.
- Do not allow batteries to over-discharge, recharge them when the battery symbol on the display reaches the minimum level.

**Danger!**

- **Do not short-circuit the batteries, they may explode with serious risk to people!**
- Do not use charging devices different from those indicated!
- Do not overcharge the batteries by leaving them on charge for a long time after reaching the full charge status!
- Do not expose the batteries to high temperature!
- Do not throw the batteries into fire!

**Caution!**

**Disposal:** Dispose the exhausted batteries in the appropriate bins or deliver them to authorized collection centers. Comply with current regulations.

# 12 Maintenance

It is recommended to perform a calibration check of the instrument and connected probes annually at accredited laboratories.

## 12.1 Cleaning

Do not use aggressive cleaning agents or incompatible with the materials indicated in the technical specifications. For cleaning, use a soft dry cloth or slightly dampened with clean water.

## 12.2 Storage

It is advisable to remove the batteries if the product is stored for a long time.

**Caution**!

Do not store the product where:

- Humidity is high.
- The product is exposed to direct sunlight.
- The product is exposed to a source of high temperature.
- There are strong vibrations.
- There is vapor, salt and/or corrosive gas.

## 12.3 Disposal

Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

# 13 Technical specifications

**pH/ORP and electrode integrated sensor temperature measurement specifications**

| | |
|---|---|
| Measuring range | |
| pH | -2…+16 pH |
| ORP | -2000…+2000 mV |
| Temperature | -5…+150 °C (Pt1000) / -5…+105 °C (NTC 10k/30k) |
| Resolution | |
| pH | 0.1/0.01/0.001 (configurable) |
| ORP | 0.1 mV |
| Temperature | 0.1 °C / 0.1 °F (Pt1000) |
| Accuracy (@ 25 °C) | |
| pH | ±0.01 pH ± 1 digit |
| ORP | ±1 mV ± 1 digit |
| Temperature | ±0.2 °C ± 1 digit (Pt1000) |
| pH temperature compensation | Automatic or manual |
| Measurement rate | 1 meas./s |

**DX-series digital probes measurement specifications**

See the data sheets of the various probes.

**General specifications**

| | |
|---|---|
| Input channels | 1 BNC connector for pH/ORP electrodes<br>1 4 mm banana connector for temperature sensor integrated in pH/ORP electrode<br>2 M12 connectors for DX series digital probes |
| Storage capacity | Up to 1 million data sets, file system based. Each data set includes measurements of all channels and date/time stamp. |
| Logging type | Automatic with manual start/stop or manual single recording |
| Logging interval | 1, 2, 5, 10, 15, 30 s / 1, 2, 5, 10, 15, 30 min / 1 h |
| Clock | User settable RTC<br>Max. drift 1 min/month @ 25 °C |
| Display | 140 x 160 dot matrix backlit LCD<br>Visible area 42 x 50 mm |
| User interface | Multilingual (en, de, it, fr, es) |
| PC connection | USB-C, Mass Storage Device |
| Power supply | 4 x AA NiMH rechargeable batteries<br>External 5 Vdc via USB C |
| Power consumption | 18 mA typ. |

| | |
|---|---|
| Battery autonomy | > 150 h typ. continuous operation (backlight off) |
| Auto power off | Yes, user configurable |
| Operating conditions | -5…50 °C / 0…85 %RH non-condensing |
| Storage temperature | -25…65 °C (without batteries) |
| Protection degree | IP 67 (except probe connection) / IK 06 |
| Dimensions | 170 x 80 x 38 mm |
| Weight | 395 g approx. |
| Housing material | ABS, TPE (side protection), Polyester (front panel) |

# 14 Attachable probes and accessories

For the available pH/ORP electrodes and DX series digital probes, please see the instrument datasheet and/or visit Senseca website.

**Solutions and accessories for electrodes:**

**GPH-DOS-4** 4.01 pH @ 25 °C buffer solution, 250 ml.
**Art. No. 485556**

**GPH-DOS-7** 7.00 pH @ 25 °C buffer solution, 250 ml.
**Art. No. 485554**

**GPH-DOS-10** 10.01 pH @ 25 °C buffer solution, 250 ml.
**Art. No. 485557**

**GPH-DOS-10** 10.01 pH @ 25 °C buffer solution, 250 ml.
**Art. No. 485557**

**GPH-BAG-4-20** 4.01 pH @ 25 °C buffer solution, sachet 25 ml (20 pcs.).
**Art. No. 488912**

**GPH-BAG-7-20** 7.00 pH @ 25 °C buffer solution, sachet 25 ml (20 pcs.).
**Art. No. 488913**

**GAK 1400** Kit including 5 buffer capsules GPH 4.0, 5 buffer capsules GPH 7.0, 5 buffer capsules GPH 10.0, 3 100 ml plastic bottles GPF 100, 1 electrolyte solution KCL3M and 1 cleaning solution GRL 100.
**Art. No. 603523**

**GRL 100** Pepsin/HCl cleaning solution, 100 ml.
**Art. No. 601420**

**KCL 3M** KCl 3M electrolyte solution.
**Art. No. 602477**

**GSKA 3610** Metal protective cylinder for ∅12 mm electrodes, for depth measurements.
**Art. No. 607267**

**Other accessories:**

**CASE PRO-400**

Case for PRO Line.
Recess for one instrument, space for accessories, carrying handle, zipper.
Dimensions: 415 x 245 x 70 mm (W x H x D).
**Art. No. 486900**

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