EN

ROYAL Eijkelkamp
Meet the difference

1886

MADE IN ITALY

pH - Cond - PC

INSTRUCTIONS MANUAL

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Index

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1. Introduction

XS Instruments, globally recognized as a leading brand in the field of electrochemical measurements, has developed this new line of professional bench instruments, which is completely produced in Italy, finding the perfect balance between performance, attractive design and ease of use.

The perfect balance between the high performance of the instrument, a modern and attractive design and the user-friendliness make this series of instruments the ideal solution for electrochemical measurements in laboratory.

The innovative high definition colour LCD display shows all the necessary information, such as the measurement, the temperature, the buffers used for the last calibration (also custom), the condition of stability.

Everyone can use these tools thanks to the instructions that appear directly on the display. The calibration is guided step by step and the instrument configuration menu is easy to consult. In addition, a LED indicates the status of the system to the user.

Up to 3 pH calibration points can be made between 8 automatically recognized values and 5 points for Conductivity; in addition, buffers chosen by the operator can be used.

It is also possible to perform mV calibration for Redox sensors.

For an accurate measurement of Conductivity, it is possible to work with 3 different cell constants and modify the compensation coefficient and the reference temperature.

It is possible to consult the calibration data anytime and the representation makes the calibration process more efficient, through the icons of the buffers used.

The ideal solution for an accurate and precise measurement is using an *XS Sensor* electrochemical electrode with an *XS Instruments* device and perform the calibrations with *XS Solution* certified calibration solutions.

• Safety information

• *Details of the words and symbols of warning*

The safety information in this manual is very important to avoid personal injury, damage to the instrument, malfunctions or incorrect results due to failure to comply with them. Read this manual carefully in its entirety and make sure you familiarize yourself with the tool before putting it into operation and starting to work with it.

This manual must be kept in the vicinity of the instrument, so that the operator can consult it if necessary.

Safety provisions are indicated with warning terms or symbols.

• *Reporting terms:*

ATTENTION for a medium risk hazardous situation, which could lead to serious injury or death if not avoided.

ATTENTION for a dangerous situation with reduced risk which, if not avoided, can cause material damage, data loss or minor or medium-sized accidents.

ADVICE for important product informations.

NOTE for useful important informations.

Warning symbols:

Attention

This symbol indicates a potential risk and warns you to proceed with caution.

Attention

This symbol draws attention to a possible danger **from electric current**.

Attention

The instrument must be used following the indications of the reference manual. Read the instructions carefully.

Advice

This symbol draws attention to possible damage to the instrument or instrumental parts.

Note

This symbol highlights further information and tips.

- ***Additional documents that provide safety information***

The following documents can provide the operator with additional information to work safely with the measuring system:

- operating manual for electrochemical sensors;
- safety data sheets for buffer solutions and other maintenance solutions (ex storage..);
- specific notes on product safety.

- ***Use according to destination***

This instrument is designed exclusively for electrochemical measurements both in the laboratory and directly in the field.

Pay attention to the technical specifications shown in the INSTRUMENT FEATURES / TECHNICAL DATA table; any other use outside them is to be considered unauthorized.

This instrument has been manufactured and tested in compliance with EN 61010-1 safety standards for electronic instruments and has left the factory in perfect technical conditions (see test report in each package) and safety.

The regular functionality of the device and the operator's safety are guaranteed only if all the normal laboratory safety standards are respected and if all the specific safety measures described in this manual are observed.

- ***Basic requirements for safe use***

The regular functionality of the device and the operator's safety are guaranteed only if all the following indications are respected:

- the instrument can only be used in accordance with the specifications mentioned above;
- if using the instrument with the power supply, use only the model supplied. If you need to replace the power supply, contact your local distributor;
- the instrument must operate exclusively in the environmental conditions indicated in this manual;
- the only part of the instrument that can be opened by the user is the battery compartment. Carry out other operations only if explicitly authorized by the manufacturer.

- ***Unauthorized use***

The instrument must not be put into operation if:

- is visibly damaged (for example due to transportation);
- it has been stored for a long period of time in adverse conditions (exposure to direct light, heat sources or places saturated with gas or vapours) or in environments with conditions different from those mentioned in this manual.

- ***Device maintenance***

If used correctly and in a suitable environment, the instrument does not require maintenance procedure.

It is recommended to occasionally clean the instrument case with a damp cloth and a mild detergent. This operation must be performed with the instrument off and disconnected from the power supply and only by expert and authorized personnel.

The housing is in ABS / PC (acrylonitrile butadiene styrene / polycarbonate). This material is sensitive to some organic solvents, for example toluene, xylene and methyl ethyl ketone (MEK).

If liquids get into the housing, they could damage the instrument.

In case of prolonged non-use of the device, cover the BNC connectors with the special cap.

Do not open the instrument housing: it does not contain parts that can be maintained, repaired or replaced by the user. In case of problems with the instrument, contact your local distributor.

It is recommended to use only original spare parts. Contact your local distributor for information. The use of non-original spare parts can lead to malfunction or permanent damage to the instrument. Moreover, the use of spare parts not guaranteed by the supplier can be dangerous for the user himself.

For the maintenance of the electrochemical sensors, refer to the documentation present in their packaging or contact the supplier.

- ***Responsibility of the owner of the instrument***

The person who owns and uses the tool or authorizes its use by other people is the owner of the tool and as such is responsible for the safety of all users of the tool and third parties.

The owner of the instrument must inform users of the use of the same safely in their workplace and on the management of potential risks, also providing the required protective devices.

When using chemicals or solvents, follow the manufacturer's safety data sheets.

2. Instrumental features

- ***Parameters***

pH 7 Vio: pH, mV, ORP, Temp

COND 7 Vio: Cond, TDS, Temp

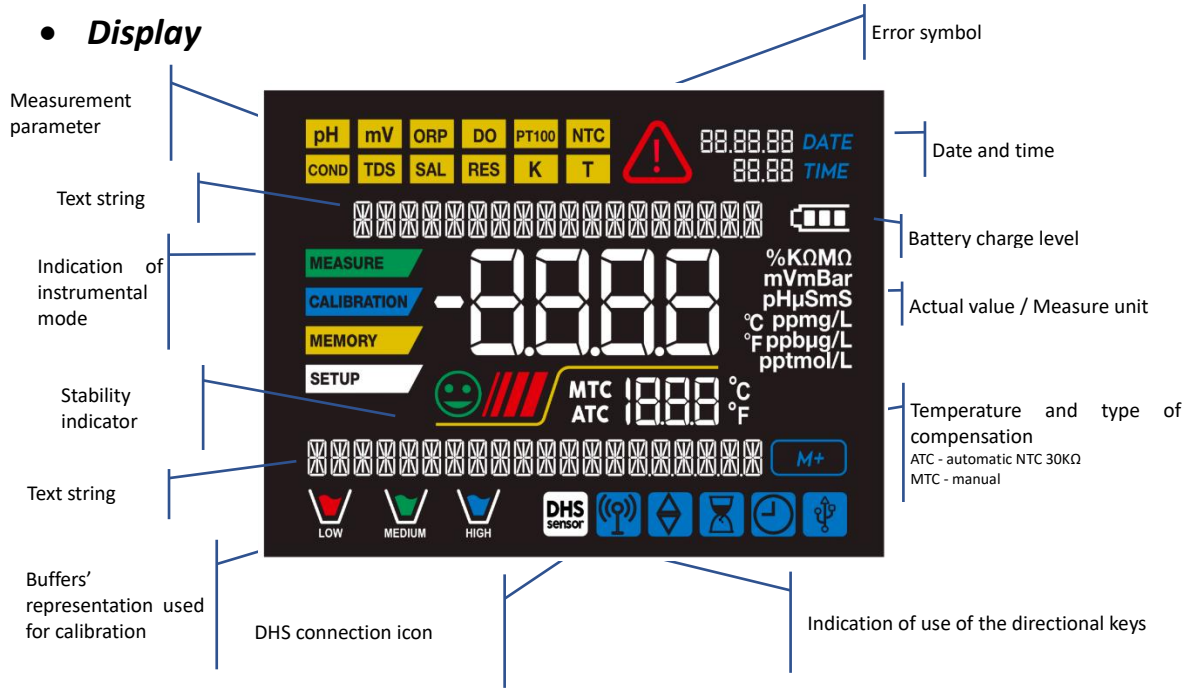
PC 7 Vio: pH, mV, ORP, Cond, TDS, Temp

- ***Datasheet***

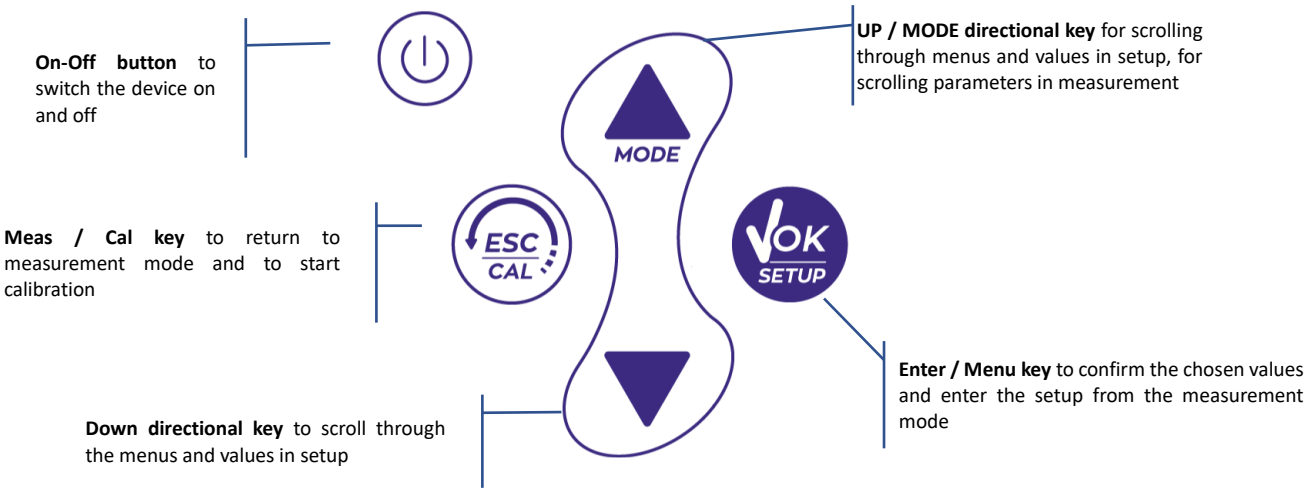
	Series 7 Vio
pH	**pH 7 Vio - PC 7 Vio**
Measuring range	0 … 14
Resolution / Accuracy	0.1, 0.01 / ±0.02
Recognized calibration points and buffers	**AUTO:** 1…3 / USA, NIST **CUS:** 2 user values
Buffers indication	Yes
Calibration report	Yes
Automatic DHS recognition	Yes
Stability filter	Low – Nor - High
mV	**pH 7 Vio - PC 7 Vio**
Range / Resolution	Range: -1000 … +1000 / Resolution: 1
ORP	**pH 7 Vio - PC 7 Vio**
Calibrations points	1 point / 475 mV
Conductivity	**COND 7 Vio - PC 7 Vio**
Range / Resolution	0,00 – 20,00 – 200,0 – 2000 µS / 2,00 – 20,00 – 200,0 mS Automatic scale
Recognized calibration points and buffers	1…5 / 84, 147, 1413 µS, 12.88, 111.8 mS, 1 user value
Reference temperature	15…30 °C
Temperature coefficient	0,00…10,00 %/°C
TDS	**COND 7 Vio - PC 7 Vio**
Temperature coefficient	0,1mg/l…200 gr/l / 0.40…1.00
Temperature	**pH 7 Vio - COND 7 Vio - PC 7 Vio**
Measuring range	0…100 °C
Resolution / Accuracy	0,1 / ± 0,5°C
Temperature compensation ATC (NTC30KΩ) and MTC	pH: 0…100 °C Cond: 0…80 °C
System	
Display	High definition colours LCD
Brightness and contrast management	Manual
Sleep mode	Yes
Auto-Off	Yes
IP protection	IP 57
Power supply	AA 1,5 V – 3 batteries
Sound level during standard operation	< 80 dB
Environmental operating conditions	0 … +60 °C
Maximum permissible humidity	< 95 % non-condensing
Maximum altitude of use	2000 m
System dimensions	185 x 85 x 45 mm
System weight	400 g
Reference regulations	EMC 2014/30/UE RoHS 2011/65/EU EN 61326-1 EN 61010-1

3. Description of the instrument

- ***Display***



- ***Keyboard***



- ***LED***

All the instruments are equipped with a two-colours LED (red and green) which provide the user with important information on the status of the system:

Function	LED	Description
Power on	🟩	*Fixed*
Power off	🟥	*Fixed*
Standby	🟩	*Flashing every 20 s*
Measure stable	🟩	*Flashing every 3 s*
Errors during calibration	🟥	*Flashing every 1 s*
Errors during measurement	🟥	*Flashing every 3 s*
Selection confirm	🟩	*Switched on for 1 s*
Timed screens	🟩	*Fixed*
DHS deactivation	🟥	*Fixed*

4. Installation

- ***Components supplied***

The instrument is always supplied inside the specific transport case; in the version without sensor it is always present:

Instrument with batteries, 1m S7 / BNC connection cable, NT55 temperature probe, buffer solutions in single-dose bottle and / or sachet, paper tissues, screwdriver, beaker, electrode holder support -only for multiparameter- multilingual user manual and test report.

Versions with the sensors(s) already included are also available. Contact your local distributor to be updated on the correct composition of the sales kit.

- ***Implementation***

- The device leaves the factory ready to be used by end-user.
- Batteries are included.

- ***Turning On and Off***

Turn on the system by pressing the button  . The display initially activates all segments and then appears:

- model and firmware of the instrument;
- settings relating to the most important parameters and any information on the DHS sensor, if connected;
- the instrument switches on to the last parameter that was used;
- to switch off the instrument, press the key  , while into measure mode.

- ***Replacement of batteries***

The instrument works with 3 AA 1.5V batteries.
To proceed with the replacement:

1. Turn Off the instrument.
   Turn the instrument over with the display facing down and place it on a stable surface.
   It is advisable to put a cloth to avoid any scratching on display.
2. Using the screwdriver supplied, completely unscrew the screw close to the battery symbol.
3. Remove the battery stopper cap with the help of the lanyard.
4. Remove the 3 exhausted batteries (one in the left compartment and two in the right compartment) and insert the new ones. Pay attention to the correct polarity. Follow the diagram above the battery symbol in the rear compartment of the instrument.
5. Reinsert the battery holder and tighten the screw.

- ***Instrument transport***

The instrument is always supplied with the appropriate transport case. Use only the original case to transport the instrument. If you need to buy a new one, contact your local distributor.
The inside of the case is shaped to be able to house the instrument and the sensor still connected.

- ***Key functions***

Button	Press	Function
	Short	Press to turn the device on or off
	Short	• In calibration mode and press to return to measurement mode • In measurement mode, press to start the calibration
	Short	In measurement mode, press to enter the setup In the setup menus, press to select the desired program and / or value During calibration, press to confirm the value
	Short	In the setup and sub-setup menus press to scroll In the setup submenus, press to change the value In MTC and customer calibration mode, press to change the value
	Long Press (3s)	In measurement mode, keep one of the two keys pressed to change the temperature in MTC mode (manual compensation, without probe). When the value starts to flash, the user can change the temperature value by entering the correct one. Then confirming with 
	Short	In measurement mode, press to scroll through the different parameters • **pH 7 Vio**: pH → mV → ORP • **COND 7 Vio**: Cond → TDS • **PC 7 Vio**: pH → mV → ORP → Cond → TDS

IMPORTANT:

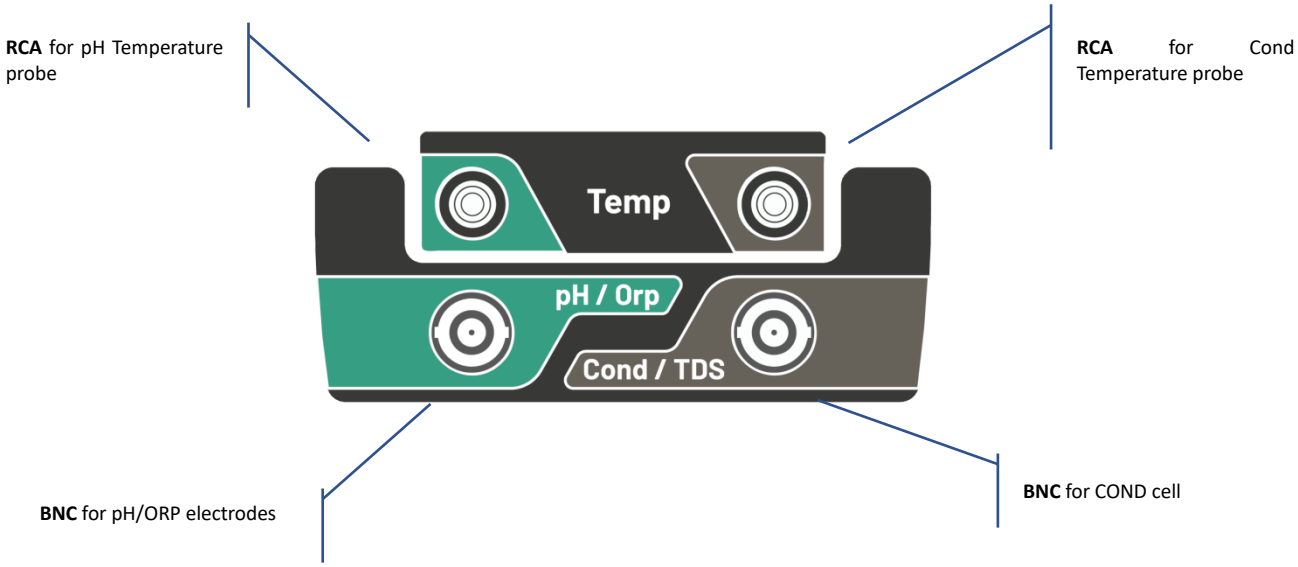
- **When the Sleep mode is active (by default after two minutes of inactivity of the instrument) press any key to reactivate the brightness of the display.**
- **Only at this point do the keys regain their function.**

• *Inputs / Outputs connections*

Use only original accessories guaranteed by the manufacturer.
If necessary, contact your local distributor.

The BNC connectors at the time of sale are protected by a plastic cap.
Remove the cap before connecting the probes.

PC 7 Vio upper panel



READ THE MANUAL BEFORE PROCEEDING TO CONNECT PROBES OR ANY OTHER ACCESSORY.

• *Symbols and icons on the display*

Symbol	Description	Symbol	Description
	Press the directional keys to change the parameter or value on the display		Error in measurement or calibration
DHS sensor	DHS digital sensor active		Battery level indication
	Measurement stability indicator		The bars scroll if the measurement is not stable

5. Operation of the device

- After switching on, the instrument enters measurement mode in the last parameter used.
- **To scroll through the different parameter screens, press the key**  , the current measurement parameter is shown in the display on the top left (ex: ).

Sequence of parameters in measurement mode:

pH 7 Vio	COND 7 Vio	PC 7 Vio
pH	Conductivity	pH
mV	TDS	mV
ORP		ORP
		Conductivity
		TDS

Note: *Pressing*  *after the last parameter the instrument automatically restarts from the first*

In the measurement screens for the pH, ORP and Conductivity parameters, press the key  to start the calibration of the active parameter. (Subsequent paragraphs).

On the left side of the display, through a string of different colours, it is always indicated how the instrument is located.

Note: To confirm the user switching from one mode to another, the string flashes

String	Meaning
MEASURE	The instrument is in measurement mode
CALIBRATION	The instrument is in calibration (**automatic or manual in relation to the user's choice**)
SETUP	The instrument is in the configuration menu. The configuration menu can concern the characteristics of the parameters or the general setting of the instrument

6. Setup Menu

SETUP

- In measurement mode, press the key  to enter SETUP mode, select the parameter you want to modify by moving with the directional keys and confirming with  .

pH 7 Vio

pH SETTINGS

ORP SETTINGS

SETTINGS

COND 7 Vio

COND SETTINGS

TDS SETTINGS

SETTINGS

PC 7 Vio

PH SETTINGS

ORP SETTINGS

COND SETTINGS

TDS SETTINGS

SETTINGS

- Within the selected menu, move between the different programs using the directional buttons and press the button  to access the submenu you want to edit.
- **Using**  **and**  **choose the desired option or change the numerical value and confirm with**  .

- The value or parameter being edited is recognizable as it flashes on the display.
- The icon  indicates that the value or parameter to be chosen can be modified using the directional keys.
- Press  to return to the previous menu.

- ***Setup Menu's Structure***

SETUP

P1.0	pH SETTINGS		P1.1 Buffer Selection P1.2 Resolution P1.3 Set Stability criteria P1.6 View pH Cal P1.8 Reset pH Setting P1.9 Temp Cal pH
P2.0	ORP SETTINGS		P2.6 View ORP Cal P2.8 Reset ORP Setting P2.9 Temp Cal ORP
P3.0	COND SETTINGS		P3.1 Cell Constant P3.2 Buffer Selection P3.3 Reference Temp P3.4 Temp. Compensation Factor P3.6 View Cond Cal P3.8 Reset Cond Setting P3.9 Temp. Cal Cond
P4.0	TDS SETTING		P4.1 TDS Factor
P9.0	SETTINGS		P9.1 Temperature U.M. P9.3 Backlight mode P9.4 Brightness P9.5 Sleep Mode P9.6 Setup Parameters P9.8 Reset P9.9 Auto Power-Off

7. Temperature measurement ATC – MTC

MEASURE

- **ATC**: The direct measurement of the sample temperature for all parameters is carried out through the NTC 30KΩ probe, which can be either integrated into the sensor (electrode and / or cell) or external.
- **MTC**: If no temperature probe is connected, the value must be changed manually:

  keep pressed  or  until the value starts to flash; then adjust it by continuing to use the directional keys; then press  to confirm.

8. pH Parameter

pH

pH 7 Vio; PC 7 Vio

On this series of devices, it is possible to use pH sensors with integrated temperature probe or to connect two different sensors. Connect the pH electrode to the BNC type connector marked in green. Instead, connect the temperature probe to the RCA / CINCH Temp connector always marked with a green background.

The instrument is also able to recognize the DHS sensor, an innovative electrode capable of storing calibration data and then being able to be used immediately on any enabled instrument.

• *pH parameter Setup*

SETUP

- In measurement mode press  to access the SETUP menu.
- By pressing the button  access the **pH SETTINGS P1.0** menu
- Move with the keys  and  to select the sub-menu you want to access.

The chart below shows the setup menu structure for the pH parameter, for each program the options that the user can choose, and the default value are shown:

• *Composition of the setup Menu for pH parameter*

Program	Description	Options	Factory Default Settings
P1.1	CAL BUFFER SELECT	**USA – NIST – Custom**	USA
P1.2	SELECT RESOLUTION	0.1 – 0.01	0.01
P1.3	STABILITY CRITERIA	**LOW – MEDIUM - HIGH**	MED (nor)
P1.6	CALIBRATION DATA	-	-
P1.8	RESET SETTINGS	YES – NO	NO
P1.9	TEMPERATURE CAL	YES – NO	-

P1.1 pH buffer selection

- Access this setup to select the buffer family with which to perform the electrode calibration. Calibration lines **from 1 to 3 points** can be made.

During calibration press ESC CAL to exit and save the points calibrated up to that moment (see calibration paragraph).

The instrument automatically recognizes 2 families of buffers (**USA and NIST**) also the user has the possibility to perform a manual calibration up to 2 points with customizable values.

USA Buffers: 1,68 - 4,01 - **7,00**** - 10,01 (Factory)

NIST Buffers: 1,68 - 4,00 - **6,86**** - 9,18

***Neutral point always requested as first*

Beaker	Buffer value
LOW	**Acid** < 6.5
MEDIUM	**Neutral** 6.5 ~ 7.5
HIGH	**Basic** > 6.5

In the measurement mode at the bottom left of the display, a series of beakers indicates the buffers with which the last automatic and manual calibration was carried out.

P1.2 Resolution

Access this menu to choose the resolution you want to have when reading the pH parameter:

- **0.1**
- **0.01** -default-

P1.3 Stability criteria in pH measurement

To consider the reading of a value truthful, we recommend to wait for a stable measurement, indicated by the icon . When the measurement is not stable, four red bands appear flowing on the display .

Access this menu to change the measurement stability criteria.

"LOW": choose this option to make the stability icon appear even in conditions of poor stability. Readings included within 1.2 mV.

"MEDIUM" (default value): readings included within 0.6 mV.

"HIGH": choose this option to display the stability icon only in conditions of high measurement stability, readings within 0.3 mV.

P1.6 pH Calibration data

Access this menu to get information on the last calibration performed. The following screens will automatically scroll on the display:

- first screen: beakers indicating the buffers used;
- second screen: OFFSET value of the electrode expressed in mV;
- third and possibly fourth screen: Slope% in the measuring range (one Slope% only if two calibration points are performed, two Slope% if three points are performed).

***Note**: The instrument only accepts calibrations with pH electrodes with Slope% between 80 - 120%.*

Outside this range of acceptability, the instrument does not allow to complete the calibration and displays the error message SLOPE OUT OF RANGE

P1.8 Reset of pH parameter

If the instrument does not work perfectly or incorrect settings have been made, confirm YES with to return all the parameters of the pH menu to the default settings.

IMPORTANT: *The factory reset of the parameters DOES NOT erase the stored data.*

P1.9 Temperature calibration

All the instruments in these series are pre-calibrated for a correct temperature reading. However, if there is a difference between the measured and the real one (usually due to a probe malfunction) it is possible to perform an offset adjustment of ± 5°C.

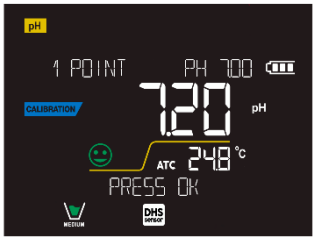
Use the buttons and to correct the temperature offset value and confirm with .

- ***Automatic pH calibration***

CALIBRATION

Example: three-point calibration with USA type buffer (7.00 / 4.01 / 10.01).

- In **pH** measurement mode pH press to enter calibration mode.
  The string "1ST POINT PH 7.00" appears on the display; the device requires the neutral value as the first calibration point.
  Rinse the electrode with distilled water and gently dab with absorbent paper. Dip the electrode in the pH 7.00 solution.
- When the signal is stable, the red bands are replaced by the stability icon .

  Press as indicated by "PRESS OK".
  The measured value flashes on the display and then the icon of the pH 7.00 beaker appears at the bottom left MEDIUM indicating that the instrument is calibrated on the neutral point.
- Remove the electrode, rinse with distilled water and dab gently with absorbent paper. Dip the sensor in the pH 4.01 buffer solution ("CHANGE BUFFER").
- The instrument is now ready to recognize the second calibration point.
  Alongside the string "2ND POINT pH" the different pads that the device can recognize automatically scroll.
- When the 4.01 value is recognized and the icon appears; press as indicated by the string "PRESS OK".
  The actual measured value and the Slope% flash on the display; subsequently the icon of the beaker pH 4.01 LOW appears next to the green beaker, indicating that the instrument is calibrated in the acid field.
- Remove the electrode, rinse with distilled water and dab gently with absorbent paper. Dip the sensor in the pH 10.01 buffer solution ("CHANGE BUFFER").
- The instrument is now ready to recognize the third calibration point.
  Alongside the string "3RD POINT PH" the different pads that the device can recognize automatically scroll.

  When the value 10.01 is recognized and the icon appears, press as indicated by the string "PRESS OK".

Switching from an acidic to a basic pH may take a few more seconds to achieve stability.

The actual measured value and the second Slope% flash on the display; subsequently the icon of the beaker pH 10.01 HIGH appears next to the green and red beakers, indicating that the instrument is calibrated in the basic field.

- At the end of the third calibration point, the instrument automatically returns to measuring mode.
- To perform a one- or two-point calibration, press the key ESC CAL once you have finished the first or second point.

***Note**: Electrode calibration is an important operation to obtain a trustable value of pH during measurement. Therefore, make sure that the buffers used are new, unpolluted and at similar temperature.*

***ATTENTION:** Before proceeding with the calibration operations, carefully consult the safety data sheets of the substances involved:*

- *Buffer solutions for calibration*
- *STORAGE solution for electrode maintenance*
- *Refill electrode solution*

• *Manual calibration*

Example: two- point calibration pH 6.79 e pH 4.65 (DIN19267)

- Access the Setup menu for **pH** and select in **P1.1→ Customer**, press twice ESC CAL to return to the measurement and position in pH mode pH.
- Press ESC CAL to enter the calibration mode.
- Rinse the electrode with distilled water and gently dab with absorbent paper.
  Immerse the electrode in the first pH buffer solution (ex pH 6.79).
- Wait for the pH value on the display to stabilize; when the icon appears and the value flashes, edit it using the directional keys by entering the correct one (ex pH 6.79), as suggested by the string "ADJUST THE VALUE" and by the icon .

***Note:** Check the buffer value according to the temperature*

- When the icon reappears, press to confirm the first point; the value measured actually flashes on the display and the beaker icon appears with the buffer identification color MEDIUM .
- Remove the electrode, rinse with distilled water, dab gently with absorbent paper and dip it in the next pad (ex pH 4.65).
- Wait for the pH value on the display to stabilize; when the icon appears and the value flashes, modify it using the directional keys by entering the correct one (ex pH 4.65), as suggested by the string "ADJUST THE VALUE" and by the icon .
- When the icon reappears, press OK SETUP to confirm the second point; the value measured flashes on the display, the Slope% and the icon appears next to the first beaker identifier of the second buffer

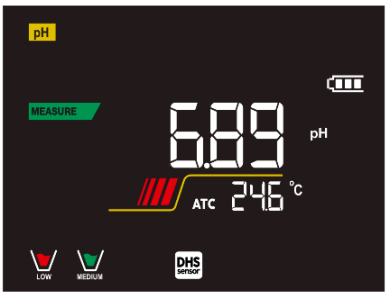
- At the end of the second calibration point, the instrument automatically returns to measuring mode.
- To perform a one-point calibration just press the key  after finishing the first point.

***Note**: If you are working with manual temperature compensation (MTC), update the value before calibrating the instrument*

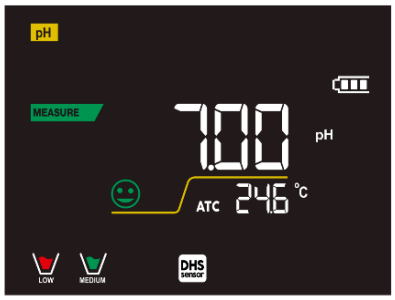
• *Performing a pH measurement*

- In measurement mode, press the key  and move to the pH parameter indicated by the icon  .

- Connect the electrode to the instrument's pH / ORP BNC (green).
- If the user does not use an electrode with a built-in temperature probe or an external probe, NTC 30KΩ, it is advisable to manually adjust the temperature value (MTC).
- Remove the electrode from its tube, rinse with distilled water and dab gently with absorbent paper.
- Check the presence and eliminate any air bubbles present in the membrane bulb by stirring vertically (as for the clinical thermometer). If present, open the side cap.
- Dip the electrode in the sample while keeping stirred.
- Scroll on the display with four red bands  means that the measurement is not yet stable.
- Consider the measurement truthful only when the stability icon appears  .



Example of an unstable measurement



Example of stable measurement

- **After the measurement, wash the electrode with distilled water and preserve it in the appropriate storage solution.**
- **Never store the sensors in ANY TYPE OF water OR DRY!**
- Always have on the display the indication of the buffers used for calibration and the possibility of being able to consult, at any time, the calibration data or to be able to enter the expiration date are useful tools for obtaining accurate measurements.

• *DHS Electrodes*

- **The electrodes equipped with DHS technology can save a calibration curve within their memory. The calibrated sensor is automatically recognized by any instrument enabled for DHS recognition and acquires its calibration.**
- Connect the DHS electrode to the BNC and RCA connectors of the instrument.
- The device automatically recognizes the probe and the following screens scroll on the display:
  - first screen: sensor identification name and production batch;

- second screen: CALIBRATION DATE and TIME (if a GLP instrument is used) and beakers indicating the buffers used;
- third screen: OFFSET value of the electrode expressed in mV;
- fourth and possibly fifth screen: Slope% in the measuring range (one Slope% only if two calibration points are performed, two Slope% if three points are performed).

- From the moment the DHS electrode is recognized, the device use the calibration stored on the probe.
- The icon on the display DHS sensor indicates that the connection was successful.
- If the calibration is satisfactory (see the calibration data in menu P.1.6) the electrode is ready to start the measurements. Otherwise recalibrate the electrode; the data will be updated automatically.
- The DHS electrode calibrated with a pH 7 Vio or PC 7 Vio device is ready to be used on any pH meter enabled for DHS recognition and vice versa.
- When the electrode is disconnected, a message on the display informs the user of the deactivation of the sensor; the device use its previous calibration stored in the device, no data is lost!
- The DHS electrode does not require batteries and if it is used on pH meters that are not enabled to recognize the chip, it works as a normal analog electrode.

- ***Errors during calibration*** CALIBRATION

- **NOT STABLE:** The button OK SETUP has been pressed with still unstable signal. Wait for the icon to appear to confirm the point.
- **WRONG BUFFER**: The buffer you are using is polluted or not part of the recognized families.
- **SLOPE OUT OF RANGE**: The slope of the sensor calibration line is out of the acceptable range 80 - 120%.
- **CALIBRATION TOO LONG**: the calibration has exceeded the time limit, only the points calibrated up to that moment will be kept.

9. mV Parameter

pH 7 Vio; PC 7 Vio

- In measurement mode press MODE and move to the mV parameter indicated by the icon mV
- The display shows the measurement in mV of the pH sensor.
- Scroll on the display of four red bands means that the measurement is not yet stable.
- Consider the measurement truthful only when the stability icon appears .

***Note**: This measurement is recommended to evaluate the sensor efficiency*

10. ORP Parameter (Redox Potential) ORP

pH 7 Vio; PC 7 Vio

ORP sensors can be used on this series of devices to measure the Oxide-Reduction Potential.

Connect the Redox electrode to the BNC type connector marked in green; instead, if necessary, connect the temperature probe to the RCA / CINCH Temp connector always marked with a green background.

It is possible to calibrate the sensor offset by going for automatic calibration to a predefined point. The instrument automatically recognizes the Redox solution 475 mV / 25 ° C; contact the local distributor to proceed with the purchase.

The instrument can correct the sensor offset by ± 75 mV.

SETUP

- ***ORP Parameter Setup***

- In measurement mode press to access the SETUP menu.
- Use the directional keys to move to **ORP SETTINGS P2.0** and access the menu by pressing the key .
- Move with and to select the program you want to access.

The table below shows the Setup menu structure for the ORP parameter; for each program there are the options that the user can choose and the default value:

- ***Composition of the setup Menu for ORP Parameter***

Program	Description	Options	Factory Default Settings
P2.6	CALIBRATION DATA	-	-
P2.8	RESET SETTINGS	YES – NO	NO
P2.9	TEMPERATURE CAL	YES – NO	-

P2.6 Calibration data

Access this menu to get information on the last calibration performed. The screens with the sensor offset value and the temperature at which the calibration was performed will scroll on the display.

P2.8 Reset of the ORP Parameter

If the instrument does not work perfectly or incorrect settings have been made, confirm YES with the key to return all the parameters of the ORP menu to the default settings.

P2.9 Temperature calibration

All the instruments in these series are pre-calibrated for a correct temperature reading. In case, however, a difference between the measured and the real one is evident (usually due to a probe malfunction) it is possible to perform an offset adjustment of ±5 °C.

Use the keys and to correct the temperature offset value and confirm with .

CALIBRATION

- ***ORP automatic calibration***

Automatic calibration with 475 mV

- In **ORP** measurement mode ORP press the key to enter calibration mode.
- On the display the string “POINT ORP 475” appears; the device requires 475 mV as the calibration point.
- Rinse the electrode with distilled water and gently dab it with absorbent paper. Dip the electrode in the 475 mV Redox buffer solution.
- When the solution is recognized and the signal is stable, the red stripes are replaced by the stability icon .
- Press the key as indicated by the string “PRESS OK”.

- The actual measured value flashes on the display and then the beaker icon MEDIUM appears at the bottom left, indicating that the instrument is calibrated. The instrument automatically returns to measuring mode.

ATTENTION: *Before proceeding with the sensor calibration operations, carefully consult the safety data sheets of the substances involved:*

- *Redox Standard solutions*
- *STORAGE solution for REDOX electrode maintenance*
- *Refill ORP electrode solution*

11. Conductivity Parameter

COND 7 Vio, PC 7 Vio

Connect the Conductivity probe to the BNC type connector marked by the grey color while the temperature probe must be connected to the RCA / CINCH Temp connector always on a grey background.

Conductivity is defined as the ability of the ions contained in a solution to conduct an electric current. This parameter provides a fast and reliable indication of the quantity of ions present in a solution.

• *…how to get the Conductivity?*

The first Ohm's law expresses the direct proportionality in a conductor between the current intensity (I) and the applied potential difference (V) while the resistance R represents the proportionality constant. Specifically: V = R x I, the resistance is consequently R = V / I
Where R=resistance (Ohm) V=voltage (Volt) I=current (Ampere)

The inverse of the resistance is defined as conductance (G) G = 1 / R and is expressed in Siemens (S)

Measuring resistance or conductance requires a measuring cell, which consists of two opposite charge poles. The reading depends on the geometry of the measuring cell, which is described through the constant cell parameter C = d / A expressed in cm^{-1} where d represents the distance between the two electrodes in cm and A their surface in cm^2. Conductance is transformed into specific Conductivity (k), which is independent of the cell configuration, multiplying it by the cell constant.

k = G x C is expressed in S / cm even if the units of measurement mS / cm are in common use

(1 S/cm -> 10^3 mS/cm) and µS/cm (1 S/cm -> 10^6 µS/cm)

• *Setup for Conductivity Parameter*

- In measurement mode press  to access the SETUP menu.
- Use the directional keys to move to **COND SETTINGS P3.0** and access the menu by pressing the key  .
- Move with the keys  and  to select the program you want to access.

The table below shows the setup menu structure for the COND parameter, for each program the options that the user can choose, and the default value are shown:

Program	Description	Options	Factory Default Settings
P3.1	CELL CONSTANT	0.1 - 1 - 10	1
P3.2	CALIBRATION METHOD	AUTOMATIC / CUSTOM	AUTOMATIC
P3.3	REFERENCE TEMPERATURE	15 … 30 °C	25 °C
P3.4	TEMP COMPENSATION FACTOR	0.00 … 10.00 %/°C	1.91 %/°C
P3.6	CALIBRATION DATA	-	-
P3.8	RESET SETTINGS	YES – NO	NO
P3.9	TEMPERATURE CAL	YES – NO	-

P3.1 Cell constant Selection

Choosing the right conductivity cell is a decisive factor for obtaining accurate and reproducible measurements.

One of the fundamental parameters to consider is to use a sensor with the right cell constant in relation to the solution under analysis.

The following table relates the cell constant of the sensor with the measurement range and the standard with which it is preferable to calibrate:

Costante di cella	**0.1**	**1**		**10**
Standard (25°)	84 - 147 µS	1413 µS	12.88 mS	111.8 mS
Range di Misura ideale	0 – 300 µS	300 – 3000µS	3 – 30 mS	30 – f.s. mS
Simbolo taratura a display	LOW	MEDIUM	MEDIUM HIGH	HIGH

Access this setup menu to select the cell constant related to the sensor you are using:

- **0.1**
- **1** -default-
- **10**

For each of the 3 selectable cell constants the instrument stores the calibrated points. By selecting the cell constant, the previously performed calibration points are automatically recalled.

P3.2 Calibration method

Access this setup menu to select automatic or manual recognition of the standards with which to perform the calibration:

- **Automatic:** -default- The device automatically recognizes up to 3 of the following standards
  84 µS/cm, **147** µS/cm, **1413** µS/cm, **12.88** mS/cm e **111.8** mS/cm;

- **Custom**: the device can be calibrated on a point with a manually entered value.

Note: *To obtain accurate results, it is advisable to calibrate the device with standards close to the theoretical value of the solution to be analysed*

P3.3 and P3.4

Temperature compensation in Conductivity measurement doesn't have to be confused with pH temperature compensation.

- **In a conductivity measurement the value shown on the display is the conductivity calculated at the reference temperature. Then the effect of temperature on the sample is corrected.**
  When measuring pH, on the other hand, the pH value at the displayed temperature is shown on the display. Here the temperature compensation involves adapting the slope and the electrode offset to the measured temperature.

P3.3 Reference Temperature

Conductivity measurement is strongly related to the temperature.

If the temperature of a sample increases, its viscosity decreases and this leads to an increase in the mobility of the ions and the measured conductivity, although the concentration remains constant.

For each conductivity measurement, the temperature to which it refers must be specified, otherwise value obtained is meaningless. Generally, as temperature we refer to 25 ° C or more rarely to 20 ° C.

This device measures Conductivity at real temperature (ATC or MTC) and then converts it to the reference temperature using the correction Factor chosen in program P3.4.

- Access this setup menu to set the temperature to which you want to refer the Conductivity measurement.

- The device can report Conductivity from **15°C to 30°C**. By default, it is 25°C which is correct for most analyses.

P3.4 Temperature compensation Factor

It is important to know the temperature dependence (% change in Conductivity per °C) of the sample being measured.

- Access this menu to change the temperature compensation Factor.

  By default, 1.91% / °C is set which is suitable for most analyses.

  Press the key  , the value flashes and as indicated by the icon  use the directional keys to enter the new coefficient. Confirm with  .

Compensation coefficients for special solutions and for groups of substances are shown in the following table:

Solution	(%/°C)	Solution	(%/°C)
NaCl Saline solution	2.12	1.5% Hydrofluoric acid	7.20
5% NaOH Solution	1.72	Acids	0.9 - 1.60
Diluted ammonia solution	1.88	Bases	1.7 – 2.2
10% Hydrochloric acid solution	1.32	Salts	2.2 - 3.0
5% Sulfuric acid solution	0.96	Drinking water	2.0

Compensation coefficients for calibration standards at different temperatures for T_{ref} 25 ° C are shown in the following table:

°C	0.001 mol/L KCl (147µS)	0.01 mol/L KCl (1413 µS)	0.1 mol/L KCl (12.88 mS)
0	1.81	1.81	1.78
15	1.92	1.91	1.88
35	2.04	2.02	2.03
45	2.08	2.06	2.02
100	2.27	2.22	2.14

To determine the calibration coefficient of a solution, the following formula is applied:

$$tc = 100x\frac{C_{T2} - C_{T1}}{C_{T1}\,(T_2 - 25) - C_{T2}\,(T_1 - 25)}$$

Where *tc* is the temperature coefficient to be calculated, C_{T1} and C_{T2} are Conductivity at **temperature** 1 *(T1)* and at **temperature** 2 *(T2).*

Any result with "correct" temperature is plagued by an error caused by the temperature coefficient. The better the temperature correction, the lower the error. The only way to eliminate this error is not to use the correction factor, acting directly on the temperature of the sample.

Select 0.00% / °C as the temperature coefficient to deactivate the compensation. The displayed Conductivity value refers to the temperature value measured by the probe and not related to a reference temperature.

P3.6 Conductivity Calibration Data

Access this menu to get information on the last calibration performed. The following screens will automatically scroll on the display.

- First screen: beakers indicating the buffers used for calibration.
- Second and possibly third, fourth and fifth screens: Value of the actual cell constant in the measurement range indicated by the beaker.

***Note**: The instrument only accepts calibrations with a maximum tolerance of 40% on the nominal value of the cell constant*

P3.8 Reset of the COND Parameter

If the instrument does not work perfectly or incorrect settings have been made, confirm **YES** with the key 

to return all the parameters of the pH menu to the default settings.

P3.9 Temperature calibration

All the instruments in these series are pre-calibrated for a correct temperature reading. If, however, there is a difference between the measured and the real one (usually due to a probe malfunction) it is possible to perform an offset adjustment of ± 5°C.

Use the keys and to correct the temperature offset value and confirm with .

- ***Automatic Cond calibration***

CALIBRATION

Example: One-point calibration (1413 µS/cm) using a K=1 cell constant

- In **COND** Measurement mode press to enter calibration mode.
- Rinse the cell with distilled water and dab gently with absorbent paper.
  Start with a few ml of standard solution. Immerse the sensor in the standard 1413 µS / cm, keeping it slightly stirred and making sure that there are no air bubbles in the cell.

- On the display next to the string "POINT COND", all the Conductivity values that the instrument can recognize will appear.
- The string "WAIT FOR STABILITY" and the flowing red bands indicate that the measurement is stable yet.

- When the value stops on 1413 and the icon appears, confirm the calibration pressing as indicated by the string "PRESS OK".

- The actual measured value flashes on the display and the updated cell constant is then shown.

- The icon appears which indicates that the instrument is calibrated in the medium conductivity range.
  Automatically the device returns to measurement mode.

  One-point calibration is enough if measurements are performed within the measurement range. For example, the standard solution 1413 µS / cm is suitable for measurements between about 200 - 2000 µS / cm.

- **To calibrate the instrument on several points, once returned to the measurement, repeat all the calibrations steps.**
  The beaker relating to the new calibrated point will join the previous one.
  It is advisable to start the calibration from the less concentrated standard solution and then continue in order of increasing concentration.

- **When a new calibration of a previously calibrated point is performed, it is overwritten on the previous one and the cell constant is updated.**
- For each cell constant (P3.1) the instrument stores the calibration, so as to allow the user who uses multiple sensors with different constants not to be forced to recalibrate each time.
- The instrument recalls the last calibration with respect to the parameters P3.1 (cell constant) and P3.2 (type of calibration solutions) selected.

Important: *Standard conductivity solutions are more vulnerable to contamination, dilution and direct influence of CO2 than pH buffers, which instead, thanks to their buffer capacity, tend to be more resistant. In addition, a slight change in temperature, if not adequately compensated, can have significant effects on accuracy.*

Therefore, pay attention in the calibration process of the Conductivity cell in order to obtain accurate

measurements.

***Important**: Always rinse the cell with distilled water before calibration and when switching from one standard solution to another to avoid contamination.*

Replace standard solutions frequently, especially low Conductivity ones.

Contaminated or expired solutions can affect the accuracy and precision of the measurement.

***ATTENTION:** Before proceeding with the calibration operations, carefully consult the safety data sheets of the substances involved:*

- *Calibration Buffer solutions*

• *Manual Conductivity calibration*

CALIBRATION

Example: Calibration at 5.00 µS/cm using a K=0.1 cell constant

- Access the Setup menu for COND SETTINGS and select in the **P3.1** → **0.1** and into the program **P3.2** → **Custom,** then go back to the measurement and go into **COND** mode COND.
- Press the key ESC CAL to enter the calibration mode.
- Rinse the cell with distilled water and dab gently with absorbent paper.
  Start with a few ml of standard solution and immerse the sensor in the conductivity standard 5.00 µS/cm.
- The string "WAIT FOR STABILITY" and the flowing red bands indicate that the measurement is not yet stable.
- Wait for the Conductivity value on the display to stabilize; when the icon appears, use the keys MODE and to adjust the value by entering that of the standard solution (ex: 5.00 µS/cm), as indicated by the string "ADJUST THE VALUE" and by the icon .
- When the icon reappears, confirm the calibration point by pressing the key OK SETUP .
- The actual measured value flashes on the display and the updated cell constant is then shown.
- The icon LOW appears, which indicates that the instrument is calibrated in the low Conductivity range.

Automatically the device returns to measurement mode.

- For each CELL CONSTANT (P3.1) the instrument stores the calibration in order to allow the user who uses multiple sensors with different constants not to be forced to recalibrate each time.
  The instrument recalls the last calibration with respect to parameter P3.1 (cell constant) and P3.2 (type of calibration solutions) selected.

***Note:** if you are not aware of the exact compensation coefficient, to obtain a calibration and an accurate measurement set in P3.4 → 0.00 %/°C and then work by bringing the solutions exactly to the reference temperature*

Another method for working without temperature compensation is to use the appropriate thermal tables

present on most Conductivity solutions.

***Important**: Always rinse the cell with distilled water before calibration and when switching from one standard solution to another to avoid contamination.*

Replace standard solutions frequently, especially low Conductivity ones.

Contaminated or expired solutions can affect the accuracy and precision of the measurement.

- ***Errors during calibration***  CALIBRATION

- **NOT STABLE:** The button  has been pressed with still unstable signal. Wait for the icon  to appear to confirm the first point.
- **WRONG BUFFER**: The buffer you are using is polluted or not part of the recognized families.
- **CALIBRATION TOO LONG**: The calibration has exceeded the time limit, only the points calibrated up to that moment will be kept.

- ***Making a Conductivity measurement*** MEASURE

- Access the Setup menu for Conductivity to check the calibration and check, and if necessary, update the reading parameters; press  to return to measurement mode.
- Press  to scroll through the different screens of parameters until activating the Conductivity parameter indicated by the icon COND .
- Connect the Conductivity cell to the instrument's BNC for Cond (grey).
  If the user does not use a cell with a built-in temperature probe or an external probe NTC 30KΩ it is advisable to manually update the temperature value (MTC).
  Remove the cell from its test tube, rinse with distilled water, dab gently **taking care not to scratch the probe**.
- Dip the sensor in the sample, the measuring cell and any vent holes must be completely immersed.
- Keep in slight agitation, eliminate any air bubbles that would distort the measurement by gently shaking the sensor.
- Scroll on the display with four red bands  means that the measurement is not yet stable.
- Consider the measurement truthful only when the stability icon appears  .
- **For a highly accurate measurement the instrument uses five different measurement scales and two units of measurement (µS / cm and mS / cm) depending on the value; the scale change is performed automatically by the device.**
- Once the measurement is finished, wash the cell with distilled water.
- The Conductivity sensor does not require much maintenance, the main aspect is to make sure that the cell is clean. The sensor must be rinsed with abundant distilled water after each analysis; if it has been used with water insoluble samples before carrying out this operation, clean it by immersing it in ethanol or acetone.

  Never clean it mechanically, this would damage conductivity cell, compromising their functionality.
  For short periods, store the cell in distilled water, while for long periods, keep it dry.

12. TDS Parameter

COND 7 Vio, PC 7 Vio

- The Conductivity measurement can be converted into the TDS Parameter

- This parameter uses the Conductivity calibration; therefore, refer to the previous paragraph to calibrate the sensor

Total Dissolved Solids (TDS) correspond to the total weight of the solids (cations, anions and non-dissociated substances) in a liter of water. Traditionally, TDS are determined using the gravimetric method, but a simpler and faster method is to measure Conductivity and convert it to TDS by multiplying it by the TDS conversion factor.

- In measurement mode press OK SETUP to access the SETUP menu. SETUP
- Use the directional keys to move to **TDS SETTINGS P4.0** and access the menu by pressing the key OK SETUP.
- Press again OK SETUP to enter the program **TDS FACTOR P4.1**
- When the value flashes, use the directional keys as indicated by the icon ▲▼ to enter the correct value and confirm with OK SETUP.

By default, the TDS factor set is 0.71; the user can change it between 0.40 ... 1.00.

Below are the TDS factors in relation to the Conductivity value:

Conductivity of the Solution	TDS Factor
1-100 µS/cm	0.60
100 – 1000 µS/cm	0.71
1 – 10 mS/cm	0.81
10 – 200 mS/cm	0.94

The TDS measurement is expressed in mg/l or g/l depending on the value.

13. Instrument's Settings

SETUP

- In measurement mode OK SETUP to access the SETUP menu.
- Use the directional keys to move to **SETTINGS P9.0** and access the menu by pressing the key OK SETUP.
- Move with the keys MODE and ▼ select the program you want to access.

The chart below shows the setup menu structure for the general settings of the instrument; for each program there are the options that the user can choose and the default value:

- ***Composition of the setup menu for Setting's Menu***

Program	Description	Options	Factory Default Settings
P9.1	TEMPERATURE U.M.	°C / °F	°C
P9.3	BACKLIGHT MODE	INDOOR – OUTDOOR	INDOOR
P9.4	BRIGHTNESS	LOW – NORMAL - HIGH	NORMAL
P9.5	SLEEP MODE	OFF – 2 MIN – 5 MIN	2 MIN
P9.6*	SELECT PARAMETER	YES – NO *for each parameter*	YES
P9.8	RESET	YES - NO	NO
P9.9	AUTO POWER-OFF	YES – NO	NO

** Function available only for PC 7 Vio*

P9.1 Temperature Unit
Access this setup menu to select which temperature unit to use.

- **°C** -default-
- **°F**

P9.3 Backlight Mode
Access this setup menu to select which contrast mode o use for the backlight display:

- **INDOOR (In)** – Default option - Recommended if you use the device indoor
- **OUTDOOR (Out)** – Recommended if you use the device outdoor

P9.4 Brightness
Access this setup menu to choose between three different levels of display brightness:

- **LOW**
- **NORMAL**
- **HIGH**

***Note**: Keeping the display bright always adversely affects battery life*

P9.5 Sleep Mode
Access this setup menu to select if and after how long to activate the device's Sleep mode:

- **OFF**: Sleep mode off
- **2 MIN**: The instrument enters Sleep mode if no key is pressed for 2 minutes
- **5 MIN**: The instrument enters Sleep mode if no key is pressed for 5 minutes

When the device is in Sleep mode, the display brightness is reduced to a minimum, saving significantly on battery consumption.
To exit Sleep mode and return the display to normal brightness, press ANY button. Once the display brightness is reactivated, the buttons reacquire their function (paragraph "Key function").

P9.6 Select Parameters

Function available only for PC 7 Vio

Through this setup menu it is possible to select which parameters do NOT display in measurement mode. Access menu P9.6. The icon pH flashes, with directional keys select:

- **YES**: in measurement mode the pH parameter is displayed
- **NO**: in measurement mode the pH parameter is not displayed

Confirm the selection with OK SETUP, now the icon mV flashes, then repeat the same operation for the mV parameter and then for all the parameters up to the TDS TDS.

Example: The user wishes to work only with the pH, Conductivity and TDS parameters.
In the P9.6 menu:
pH -> YES / mV -> NO / ORP -> NO / COND -> YES / TDS -> YES

Press twice ESC CAL to return to measurement mode. Scrolling with the key MODE only the parameters pH, COND and TDS are present.

Note: *At least one of all the parameters must be enabled with YES*

P9.8 Reset Settings
Access this setup menu to restore the instrument to factory conditions.

P9.9 Auto-Off
Access this setup menu to activate or deactivate the auto-shutdown of the instrument:

- **YES:** The instrument automatically turns off after **20 minutes** of inactivity
- **NO:** The instrument remains always on even if you are not using it

IMPORTANT*: The correct and systematic use of parameters P9.3 / P9.4 / P9.5 / P9.9 allows to significantly extend battery life*

14. Warranty

Warranty period and limitations

- The manufacturer of equipment provide five years of warranty from the date of purchasing only and exclusively on electronic parts of the device, only upon right maintenance and professional use.
- During the warranty period, the manufacturer will repair or replace defective components, if covered by warranty.
- This warranty does not apply if the product has been damaged, used incorrectly, exposed to radiation or corrosive substances, if foreign materials have penetrated inside the product or if unauthorized modifications have been made by the customer without approval from the manufacturer.

15. Disposal of electrical devices

This equipment is subjected to the regulations for electronic devices.

Dispose of in accordance with local regulations.

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