

User's Guide

EXTECH[®] INSTRUMENTS

A FLIR COMPANY

pH/Conductivity / TDS / Salinity / Temperature Meter

ExStik[®] EC500



CE

Introduction

Congratulations on your purchase of the ExStik® EC500 pH/Conductivity/Total Dissolved Solids (TDS) / Salinity meter. With the EC500's dynamic cell-constant technology it is possible to measure a wide range of Conductivity, TDS, and Salinity with the same electrode. Careful use and maintenance will provide years of reliable service.

Powering the ExStik™

The ExStik® uses four (4) CR2032 Lithium Ion Batteries (included). If the batteries are weak, the 'BAT' indicator appears on the LCD. Press the ON/OFF key to turn the ExStik® on or off. The auto power off feature shuts the ExStik® off automatically after 10 minutes of inactivity to preserve battery life.

Getting Started

- For new meters, remove the battery cap and then remove the battery insulating strip.
 - Remove the cap from the bottom of the ExStik to expose the pH electrode, reference junction and conductivity electrodes.
 - Before the first use or after storage, soak the electrode in tap water or pH 4 buffer solution for about 10 minutes.
 - White KCL crystals may be present in the cap or on the electrode. This is to be expected depending on the length of time in storage. These crystals will dissolve while soaking the electrode or they can be rinsed away with tap water.
 - For best results calibrate with pH 7 buffer solution first, then calibrate with the buffer solution closest to the expected pH value of the solution or material to be tested.
 - To preserve the pH electrode life keep the sponge in the protective cap soaked with tap water or pH 4 buffer solution.
 - For best results, calibrate for conductivity with a standard in the expected range of the sample. For maximum accuracy calibrate from low conductivity value standards to high value standards.
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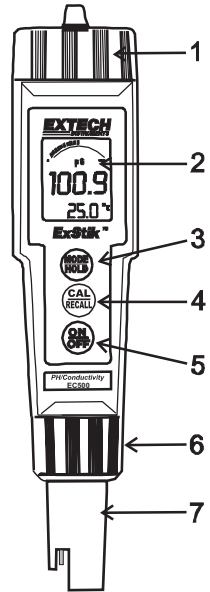
Specifications

Display	2000 count LCD with Bargraph
pH Range	0.00 to 14.00
pH Accuracy	±0.01 pH typical
pH ATC Range	0°C to 90°C (32°F to 194°F)
pH Reference Junction	Permanent gel, non-refillable
Conductivity ranges	0 to 199.9µS/cm 200 to 1999µS/cm 2.00 to 19.99mS/cm
TDS ranges (Variable ratio)	0 to 99.9ppm or mg/L 100 to 999ppm or mg/L 1.00 to 9.99ppt or g/L
Salinity range (Fixed ratio of 0.5)	0 to 99.9ppm 100 to 999ppm 1.00 to 9.99ppt
TDS Ratio	0.4 to 1.0 adjustable
Salinity Ratio	0.5 Fixed
Conductivity ATC	2.0% per °C
Temperature Range	-5.0°C to 90.0°C (23.0°F to 194°F)
Temperature Resolution	0.1 up to 99.9, 1 >100
Temperature Accuracy	±1 °C; 1.8°F (from -5 to 50°C; 23 to 122°F) ±3°C; 5.4°F (from 50 to 90°C; 122 to 194°F)
Conductivity ATC Range	0.0°C to 60.0°C (32.0°F to 140°F)
Accuracy	Conductivity: ±2% full scale TDS: ±2% full scale Salinity: ±2% full scale
Measurement Storage	25 tagged (numbered) readings
Low battery indication	'BAT' appears on the LCD
Power	Four (4) CR2032 Lithium Ion Batteries
Auto power off	After 10 minutes (override available)
Operating conditions	-5°C to 50°C (23°F to 122°F)
Dimensions	40 x 200 x 40 mm (1.6 x 7.9 x 1.6")
Weight	93 g (3.3 oz)

Meter Description

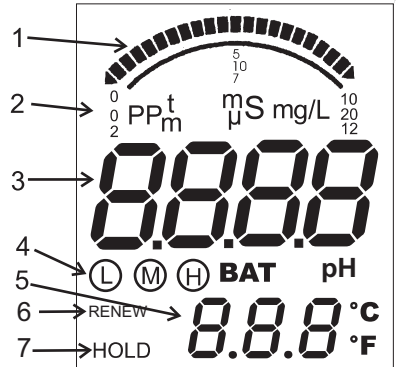
Front Panel Description

1. Battery compartment cover
 2. LCD Display
 3. MODE/HOLD button
 4. CAL/RECALL button
 5. ON/OFF button
 6. Electrode Collar
 7. pH/Conductivity Electrode
- (Note: The Electrode cap is not shown)



LCD Display

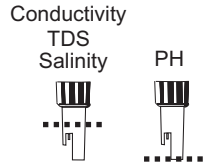
1. Bargraph display
2. Measurement units
3. Main display
4. Range calibration and low battery indicators
5. Temperature display
6. Renew indicator
7. Reading hold indicator



Measurement Procedure

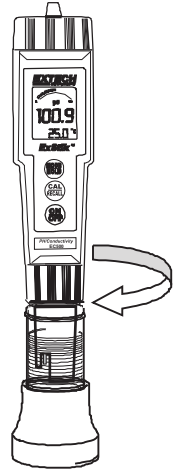
Sample Preparation:

1. For Conductivity, TDS or Salinity place the test sample in a sample cup with enough depth (2.5cm minimum) to cover the electrode. Stir the solution to remove any air bubbles.
2. For pH, place the tip of the electrode in the sample or make contact with a wet surface.

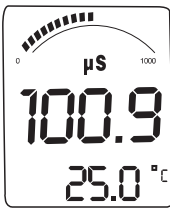


Measurement:

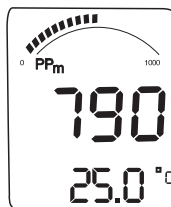
1. Press the **ON** button. (8888 and then "SELF CAL" will appear in the display during the turn-on diagnostics)
2. Depress and hold the **MODE/HOLD** key to scroll to the desired measurement mode.
3. Insert the electrode into the sample making sure that the electrodes are completely submersed.
4. Slowly stir the solution with the electrode to remove air bubbles if in the Conductivity, TDS or Salinity mode.
5. If in the Conductivity, TDS or Salinity modes, the meter will auto-range to the proper range and then display the reading.



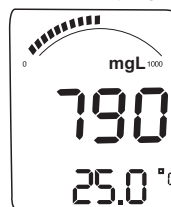
Conductivity



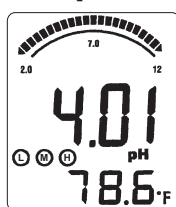
TDS (ppm)



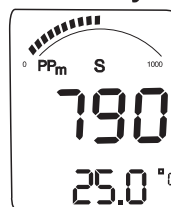
TDS (mg/l)



pH



Salinity



Changing Measurement Function

The meter can be set to measure pH, Conductivity, TDS or Salinity.

To change the mode:

1. Press and Hold the **MODE/HOLD** button for 2 seconds and the display will begin to scroll through the units.

μS (Conductivity); **pH**; **ppm S** (Salinity); **ppm** (TDS); **mg/l** (TDS);

Note: The “HOLD” function cannot be on when changing the measurement function. If “HOLD” is displayed in the lower left corner of the display, briefly press the **MODE/HOLD** button to turn it off.

2. When the desired units are displayed, release the **MODE/HOLD** button.

TDS Compensation Ratio

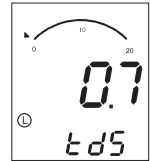
The TDS value is determined by multiplying a conductivity reading by a known ratio factor. The meter allows for selecting a conversion ratio in the range of 0.4 to 1.0. The ratio varies with the application, but is typically set between 0.5 and 0.7.

Note: The stored ratio will briefly appear in the lower temperature display when the meter is first turned on, or when changing measurement function to TDS.

Note: In the Salinity mode the ratio is fixed at 0.5.

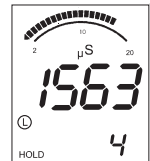
To change the ratio, while in the TDS measurement mode (ppm or mg/l):

1. Press and release the **CAL/RECALL** button twice in succession. The stored ratio will appear in the display.
2. Press the **MODE/HOLD** button to increase the ratio value in steps of 0.1.
3. When the desired ratio is displayed, press and release the **CAL/RECALL** button to store the value and return to the normal mode.
4. If no buttons are pressed for 5 seconds, the meter returns to measure mode.



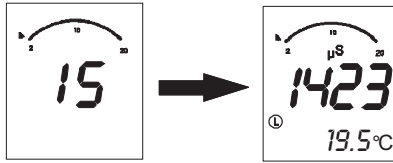
Storing Readings

1. Press the **MODE/HOLD** button to store a reading. The storage location number will be displayed on the lower display, while the main display shows the stored reading. The meter will enter the HOLD mode and the “HOLD” indicator will appear.
2. Press the **MODE/HOLD** button again to exit the HOLD mode and return to normal operation.
3. If more than 25 readings are stored, previously stored readings (starting with number 1) will be overwritten.



Recalling Stored Readings

1. Press the **CAL/RECALL** button and then press the **MODE/HOLD** button. A location number (1 through 25) will briefly appear and then the value stored in that location will appear. The displayed units will flash, indicating that the storage recall mode is active.



2. The last stored reading will be displayed first. Pressing and releasing the **MODE/HOLD** button will scroll through the stored readings one at a time. The location number is displayed first, followed by the reading stored in that location.
3. To exit the storage mode, press the **CAL/RECALL** button and the meter will return to normal operation, after displaying "End".

Clear Stored Memory

With the unit on, press and hold ON/OFF for 4 seconds. "clr" will be briefly displayed when the memory is cleared.

Changing Temperature Units

To change the displayed temperature units (°C or °F):

1. With the unit OFF, press and hold down the **CAL/RECALL** button.
2. With the **CAL/RECALL** button depressed momentarily press the **ON/OFF** button. When "SELF CAL" appears in the display release the **CAL/RECALL** button. The unit will power on with temperature displayed in the new units.

Data Hold Mode

Press the **MODE/HOLD** button to hold (freeze) a reading in the display. The meter will enter the HOLD mode and the "HOLD" indicator will appear.

Note: This also stores the reading.

Press the **MODE/HOLD** button again to return to normal operation.

Auto Power OFF

The auto power off feature automatically shuts the meter off 10 minutes after the most recent button press.

Auto Power OFF Disengage Feature

To disable the Auto Power Off feature:

1. Turn the unit on
2. Press **CAL/RECALL** once (**Quickly**)
3. Immediately and simultaneously press the **MODE/HOLD** and **ON/OFF** buttons for approximately 2 seconds, until "oFF" is briefly displayed

To disengage this feature, turn the unit off with the **ON/OFF** button. The next time the unit is powered up, Auto Power OFF mode will be engaged again.

Low Battery Indication

When the batteries become weak the "BAT" icon will appear in the display. Refer to the Maintenance section for battery replacement information.

Calibration - pH (1, 2, or 3 points)

1. Place the electrode into a buffer solution (4, 7, or 10). Press and hold the **CAL/RECALL** key until "CAL" appears in the lower (temp.) display. When doing a 2 or 3 point calibration, calibrate with pH 7 buffer first, then follow with pH 4 then the pH 10 buffer.
2. The ExStik[®] automatically recognizes the solution and calibrates itself to that value (the circled number on the LCD will match the solution). Note that if the solution is more than 1 pH unit off from the L (4), M (7), or H (10) pH buffer, or if the electrode slope is low, the ExStik[®] will assume an error and abort the calibration (End will be displayed, and the unit will return to measure mode.)
3. During calibration, the pH reading flashes on the main display.
4. When calibration is complete, the ExStik[®] automatically displays "SA", then "End" and returns to normal operation mode.
5. The appropriate circled indicator (L, M, or H) appears on the LCD when a particular calibration or series of calibrations has been completed within one power on cycle. When the ExStik[®] is turned off, the circled indicator configuration and the calibration data will be retained.
6. For a two or three point calibration, repeat steps 1-4.

CAL Reminder Display

When in pH measurement mode, a "CAL" icon will appear after 15 on/off cycles of the meter without performing a calibration. The CAL display is simply a reminder to calibrate pH, and will turn off when the pH electrode is recalibrated. The reminder does not affect function in any way.

RENEW Display

A flashing 'RENEW' warning indicates that the probe is not performing to expected specifications. If cleaning and recalibration does not cause the RENEW icon to disappear, replace the probe (see optional accessories on the last page of this manual). The RENEW display appears as a result of the pH electrode slope falling below 70% of a nominal slope.

Measurement and Display Considerations

- If the unit appears to be locked (display frozen). It is possible that the Data Hold mode has been inadvertently accessed by pressing the **MODE/HOLD** button. ("HOLD" will be displayed in the bottom left of the LCD.) Simply press the **MODE/HOLD** button again or turn the meter off and then on.
- For maximum accuracy, allow sufficient time for the temperature of the probe to reach the temperature of the sample before calibrating. This will be indicated by a stable temperature reading on the display.

Calibration - Conductivity

Meter accuracy verification should be performed on a periodic basis. Once per month is the recommended cycle for normal use. If calibration is required, a conductivity standardizing solution must be obtained. The meter can be calibrated in any or all of the three ranges. Standardizing solutions of 84 μ S/cm, 1413 μ S/cm or 12.88mS/cm (12,880 μ S/cm) are used for the automatic calibration recognition procedure. No other calibration values are permitted.

Calibration is always done in conductivity mode. Since salinity and TDS values are calculated from conductivity values, this procedure also calibrates the salinity and TDS ranges.

1. Fill a sample cup with the standardizing solution.
2. Turn the meter ON and insert the electrode into the solution. Tap or move the electrode in the sample to dislodge any air bubbles.
3. Press and hold the **CAL/RECALL** button (approximately 2 seconds) until "CAL" appears in the lower (temp) display. The main display will start flashing.
4. The meter will automatically recognize and calibrate to the standardizing solution. The display will briefly indicate "SA", End and then return to the measurement mode after a calibration.
Note: The "SA" will not appear if the calibration fails.
5. The "range calibrated" symbol will appear in the display for each range that is calibrated during that power on cycle.

(L) Low range, 84 μ S/cm

(M) Medium range, 1413 μ S/cm

(H) High range, 12.88mS/cm (12,880 μ S/cm)

Note: Each time the calibration mode is entered all calibration symbols on the display are cleared, but only the calibration data for the currently calibrated range is replaced. The other two ranges keep the existing calibration data, just the symbols are removed. Calibration of all three ranges must be performed during one power on period for all three range calibration symbols to appear.

Note: The meter allows for a 1, 2 or 3 point calibration. If calibration is done for more than one point the lowest value standard should be done first to obtain the best accuracy.

Considerations and Techniques

- Do not touch the inner surfaces of the conductivity electrodes. Touching the surface of the platinumized electrodes may damage and reduce the life of the probe.
- Store the electrode in the wetting cap with the sponge moistened with pH 4.01 buffer solution.
- Always rinse the electrode in de-ionized water between measurements to avoid cross contamination of the sample. Double rinsing is recommended when high accuracy is required.
- Periodically, accumulated salt deposits from the reference electrode may build up in the storage cap, and should be rinsed away. These deposits could affect measured values of low conductivity samples.
- When measuring low conductivity samples, extra care is recommended in rinsing the probe to avoid contamination of the sample with electrolyte from the pH reference electrode. This will only be a factor when measuring in the low range, and can be further minimized by increasing the volume of the sample. (Example: Try a 200 to 500 mL sample.)
- If the 200mL sample cup is to be used, then the electrode should not be allowed to sit in the sample for any longer than necessary, to avoid electrolyte leakage into the sample, raising the conductivity value.

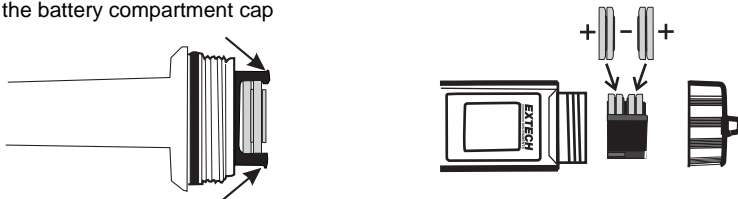
Operational Matrix

Function / Resulting Action	Power Status	Mode Setting	Required Key Press Sequence
On/Off	On or Off	Any	Momentary press of the ON/OFF key
Calibration	On	pH or Conductivity	Press & hold CAL/RECALL key for 2 seconds, until it enters CAL function
Store Reading	On	Any measure mode	Momentary press of the MODE/HOLD key
Hold Release	On	While In Hold Mode	Momentary press of the MODE/HOLD key
Enter Memory Retrieval	On	Any measure mode	Momentary press of the CAL/RECALL key followed by a momentary press of the MODE/HOLD key (Within 4 seconds)
Scroll Stored Readings	On	Memory Recall	Momentary press of the MODE/HOLD key (Displays "last in first out")
Exit Memory Retrieval	On	Memory Recall	Momentary press of the CAL/RECALL key
Clear Stored Memory	On	Any Measure Mode	Press and hold the ON/OFF key for 4 seconds, until "clr" is displayed.
Change Measurement Mode	On	Any	Press and hold the MODE/HOLD key for at least 2 seconds (the modes will scroll by until the key is released)
Enter Cond/TDS Ratio	On	TDS (ppm or mg/l)	Press and release the CAL/RECALL key twice in quick succession
Change Cond/TDS Ratio	On	TDS ratio	Momentary press of the MODE/HOLD key (each key press increases the ratio by 0.1, the value cycles from 0.4 - 1.0)
Exit Cond/TDS Ratio	On	TDS ratio	Momentary press of the CAL/RECALL key
Change Temperature Units	Off	n/a (off mode)	Press and hold the CAL/RECALL key then momentarily press the On/Off key. Release the CAL/RECALL key after the "SELF CAL" lights
Override Auto Power Off	On	Any measure mode	Momentarily press the CAL/RECALL key then simultaneously press and hold the ON/OFF & MODE/HOLD key for approximately 2 seconds, until "oFF" is displayed
Default Reset	OFF	n/a	Simultaneously press ON/OFF, CAL/RECALL and MODE/HOLD momentarily. "dFLt" will be displayed.

Maintenance

Battery Replacement

1. Twist off the battery compartment cap
2. Holding the battery housing in place with a finger, pull out the battery carrier using the two small tabs.
3. Replace the four (4) CR2032 batteries observing polarity.
4. Replace the battery compartment cap



Electrode Replacement

1. To remove an electrode, unscrew and completely remove the electrode collar (turn the collar counter-clockwise to remove).
2. Gently rock the electrode from side to side, pulling it downwards, until it disconnects from the meter.
3. To attach an electrode, carefully plug the electrode into the meter socket (note that the electrode connector is keyed, ensuring proper connection).
4. Tighten the electrode collar firmly enough to make a good seal (a rubber gasket seals the electrode with the meter).

Cleaning Recommendations

When cleaning the probe, take care not to scratch or damage the sensing surface or the platinized electrode surfaces.

Contaminant	Cleaning Solution	Instructions
Water soluble substances	Deionized water	Soak or scrub with a soft brush. Recondition in 4 or 7 buffer for 1 hour.
Grease & Oil	Warm water and household detergent	Soak or scrub with a soft brush, maximum of 10 minutes. Rinse thoroughly with DI water, recondition in 4 or 7 buffer for 1 hour.
Heavy grease & Oil	Alcohol	Maximum of 5 minute soak, scrub with a soft brush. Rinse thoroughly with DI water, recondition in 4 or 7 buffer for 1 hour.
Lime and hydroxide coatings	10% acetic acid	Soak until coating dissolved, maximum of 5 minutes. . Rinse thoroughly with DI water, recondition in 4 or 7 buffer for 1 hour.

Please Note: Since the EC500 does not have a refillable reference electrolyte chamber, it is important not to soak the electrode in the above solutions for more than the recommended times. To do so may cause a reference potential shift, which will cause degradation in performance or failure.

Troubleshooting

Problem	Possible Cause	Action
Reading is frozen	Unit is in "HOLD" mode	Press MODE/HOLD key to exit "HOLD" mode
"BAT" message	Batteries are low	Replace batteries
Unit will not calibrate in pH	Low pH slope	Replace electrode, see reorder information
Unit will not calibrate in pH	Clogged or contaminated reference junction	Clean junction (see cleaning instructions)
Unit will not calibrate in pH	Damaged or worn out sensing membrane	Replace electrode, see reorder information
Unit will not calibrate in pH	Contaminated pH buffers	Use fresh buffers
Unit will not calibrate in conductivity mode	Contaminated conductivity standards	Use fresh standards
Unit will not calibrate in conductivity mode	Dirty probe	Clean conductivity probe (See cleaning instructions)
Unit will not calibrate in conductivity mode	Damaged conductivity probe	Replace electrode, see reorder information
Unit will not calibrate in conductivity mode	Trapped air bubbles	Tap or stir to release air bubbles
Unit will not turn on	Batteries are low or dead	Replace batteries
Unit will not turn on	Batteries installed with incorrect polarity	Replace batteries, observe polarity
"RENEW" message	pH sensor needs recalibration	Recalibrate unit Use fresh buffers
"RENEW" message	pH sensor slope has fallen below acceptable limits	Replace electrode, see reorder information
Unit will not respond to any key presses	Internal fault	Perform hard reboot: Remove batteries, hold ON/OFF switch down for 5 seconds, replace batteries



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