# Conductivity, TDS, Salinity Meter

# 850038

# Instruction Manual

SPER
SCIENTIFIC

# INDEX

## INTRODUCTION

This meter measures conductivity value in uS and mS, as well as total dissolved solids (TDS) and Salinity. Simultaneously displays readings, time, date, and temperature in °C or °F.

Features a detachable probe, ATC, 99 memory points, min-max-average, hold, RS232 port, large LCD, auto shut off, and indicators for low battery and over range.

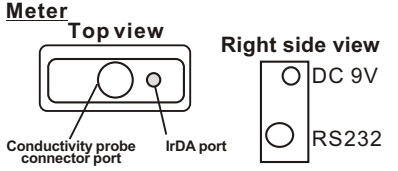
## MATERIAL SUPPLIED

This package contains:

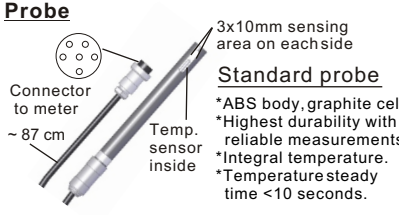
- ✓Meter
- ✓Probe
- ✓Batteries AAA x 4pcs
- ✓Instruction manual
- ✓Hard carrying case

## PORTS & PROBE

**Meter**



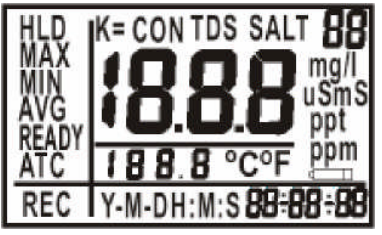

**Probe**




Standard probe

*ABS body, graphite cell.
*Highest durability with reliable measurements.
*Integral temperature.
*Temperature steady time <10 seconds.

## DISPLAY




The meter will briefly display all LCD segments when it is first turned on.

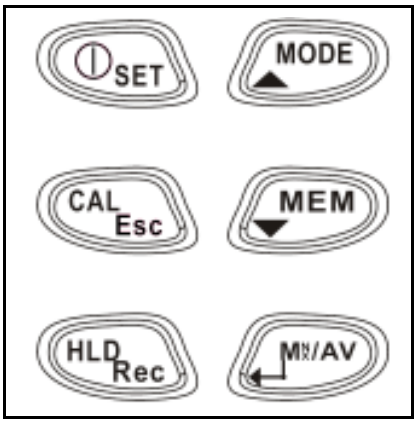
**The primary display shows: The measured conductivity value (CON) in uS or mS per cm.**

- TDS in ppm or ppt
- Salinity in ppt

**The secondary display below the primary display shows:**
The temperature of the reading.

- Year/Month/Date and Hour/Min/Sec (displayed at the bottom of the screen).
- HLD(Hold), Max, Min, Avg, Ready and ATC are shown on the left side of the screen.
- REC (Recall) is shown at the left bottom left.
- The top right number ("88") indicates the records in memory.

## KEYPAD OPERATION




1. ⏻ SET (Power) key:
Turn on the meter by pressing the SET key. The entire display flashes. Once the meter is on, press this key for more than 2 seconds to enter the settings mode. Manually turn the meter off by pressing and releasing this key.

2. ▲ MODE key:
Press the Mode key to switch between the displayed measurements for conductivity (CON), TDS, or Salinity (SALT).

3. **CAL/Esc** key:

In normal mode, press this key > 2 seconds to enter calibration mode. While the meter is in calibration, setting or recall mode, press this key (Esc) to return to previous mode.

4. **MEM ▼:**

In normal mode, press this key to store the current reading with RTC (real time clock), the primary display will flash 3 times. The occupied memory number (88 on the top right corner) changes from xx to yy, eg: 00 to 01 .(Fig. A& B)

In setting mode, press this key to change the setting content. Under recall mode, press this key to read memories.

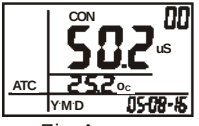



Fig.A

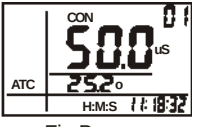



Fig.B

5-1.HLD/REC :

In normal mode, press the key < 1 sec. To hold the current reading, then quickly press the key again to unlock it. In normal mode, press the key more than 2 seconds to enter recall mode. (Fig. C, page 6)

Press **HLD+ENTER** for the backlight. The backlight will turn off automatically after 10 seconds.

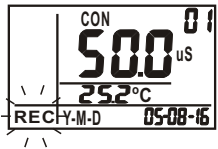



Fig. C

6-1. **MI/MX/AV** key:
In normal and recall mode, press this key to view Max./Min./Avg. readings.

In normal mode, press key > 2 sec. to clear the value. The entire LCD will flash for 2 seconds.

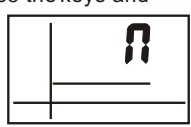
In setting mode, press this key to enter content setting.

7. ⏻ **SET +** ▲ :
When the meter is off, pressing these two keys simultaneously for more than one second disables auto-off mode.

## AUTO POWER OFF

The meter will auto-powered off in 20 minutes after last key press.
This function saves battery power.

To override this function, press **POWER** and **UP** keys at the same time until **"n"** is displayed. Release the keys and meter will enter normal mode.



## RECALL MODE

In the normal mode, press HLD/Rec more than 2 seconds to enter **RECALL (REC)** mode. Press **MIN/MAX/AV** to view Maximum, Minimum and Average of the memorized data (Fig. D). You could also press MODE ▲ or MEM ▼ to review the memories one by one.

**"REC"** is flashing in recall mode. To exit recall mode, press HLD/Rec more than 2 sec. Quickly press CAL/Esc to return to normal mode. LCD will show the last memory count saved before you entered recall mode.

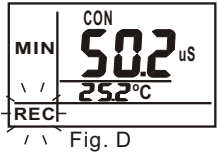


Fig. D

Press **MX/MN/AV** key when **REC** is flashing, so that the **MAX** value of the all memories will diaplay. Press **MX/MN/AV** key again to view **MIN.** Press again to view **Average.** The top right corner record number will not be displayed while viewing **MX/MN/AV.**

## REVIEW MODE

In normal mode, press MN/AV ↵ key < 1sec. to view MAX, MIN, AVG. These values are cleared when the meter is turned off. You can press the MN/AV ↵ key > 2 second to clear these values (LCD will flash for 2 seconds). Note: Clear the values when the measurement is stable.

## PREPARATION FOR CALIBRATION

Two issues should be considered before operation:

**What is the right calibration standard?**
**When should you calibrate?**

### Selecting a calibration standard

For best results, select a conductivity, TDS or NaCl standard near the sample value you are measuring. Alternatively, use a calibration solution value which is approximately 2/3 of the full scale of the measurement range you plan to use.

For example, in the 0 to 1999 uS range, use 1413 uS solution for calibration.

DO NOT reuse the calibration solution. Contaminants in the solution will affect the calibration and the accuracy. Be sure to use fresh solution each time.

Refer to below table.
Use the recommended solution for different conductivity and TDS ranges for best results.

| Conductivity measuring range | | Recommended cal. solution range |
|---|---|---|
| 1 | 0~19.99uS | 6.00~17.00uS |
| 2 | 0~199.9uS | 60.0~170.0uS |
| 3 | 0~1999uS | 600~1700uS |
| 4 | 0~19.99mS | 6.00~17.00mS |
| 5 | 0~199.9mS | 60.0~170.0mS |

| TDS measuring range (factor=0.5) | | Recommended cal. solution range |
|---|---|---|
| 1 | 0.00~9.99ppm | 3.00~8.50ppm |
| 2 | 0.0~99.9ppm | 30.0~85.0ppm |
| 3 | 0~999ppm | 300~850ppm |
| 4 | 0.00~9.99ppt | 3.00~8.50ppt |
| 5 | 0.0~199.9ppt | 30.0~85.0ppt |

This meter has a built-in algorithm to linearize the measurement of Sodium Chloride concentration. For SALT calibration, you only need to perform one-point calibration.

The previous calibration data will be replaced after re-calibrating. For example, if you previously calibrated the conductivity meter at 1413 uS in the 0 to 1999 uS range, when you re-calibrate it at 1500 uS again (also in the 0 to 1999uS range), the previous 1413uS will be replaced in this range (0~1999uS). However, the meter will retain the calibration data for other ranges which are not yet re-calibrated.

If you use solution to calibrate **one** range and then manually input the cell constant (**P5.2)**, the cell constant of range 1 to 5 will be changed simultaneously.

**NOTE**:
The temperature coefficient of the meter defaults to 2.1% per °C (Fig. E) and provides good results for most applications. See Program **P4.1** on page 27 to reset the coefficient.

Alternatively, refer to **Appendix D** to calculate the temperature coefficient and determine the appropriate temperature coefficient for solution.

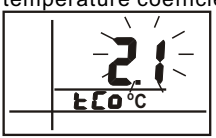


Fig. E

**NOTE:**
The default normalization temperature value is 25°C.

To normalize to another value, see **P4.2** on page 28 (Fig. F). Before resetting this value, the calibration standard value of the normalized temp. must be known. (Refer to the datasheet enclosed with your solution.)

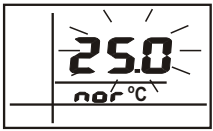



Fig .F

## When should you do the calibration?

**For first use and for best results, use solution to calibrate or manually input the cell constant if solution is not readily available.** (refer to the label on the probe).
**NOTE**: The cell constant has been programmed into meter. To completely calibrate the meter, clear all previous calibration data, (to erase all calibration data, see **P7.1** on page 32 (Fig. G)).

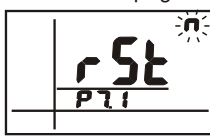



Fig .G (8306)

Cell Constant

If the conductivity of measured solutions are < 100$\mu$S, or TDS are < 50 ppm, calibrate the meter at least once a week for accuracy.

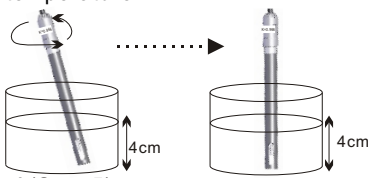
If the meter is used in the mid ranges, it is needed to do calibration at least once a month.

If the measurement is performed at extreme temperatures, calibrate at least once a week.

## CONDUCTIVITY CALIBRATION

Follow the below steps for conductivity calibration:

1. Insert the probe into demineralized water or distilled water for about 30 minutes to rinse the probe.
2. Select the conductivity standard for calibration. ( See page 8)
3. Pour 4 cm (deep) of the solution into two separate clean containers(A&B).
4. Turn on the meter, the entire display flashes three times and then returns to the normal measurement mode.
5. Rinse the probe in one of the containers. Gently stir the probe.
6. Dip the rinsed probe into the other container. Tap the probe on the bottom of container to remove air bubbles. Let the probe stabilize to the solution temperature.




A(Step 5) B( Step 6)

7. Press **CAL** key more than 2 seconds to enter calibration mode. The probe auomatically detects the conductivity value of solution and blinks the value on the LCD (Fig. H)

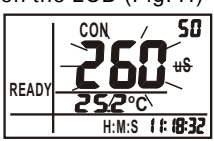



Fig .H

8. Press the **UP/DOWN** keys to change the value on the primary display to match the value to the standard (normalization temp. is 25°C). Adjust the conductivity reading up to +20% from the detected value. However, if the detected value and standard value differ by more than ±20%, clean or replace the probe.
   Example:
   Standard: 10uS; Detected value: 19uS
   Adjustable range: ±3.8us (19*20%)
   However, under above situation, the values already differed over 20%.

**NOTE:**

* When the calibration is stable, "Ready" will display. If not, check that the calibration solutions aand the input value (step 8) are correct.

* Cell constant may degrade with time and usage. Use this feature as a reminder for changing to a new probe.

* The meter will automatically detect the solution, If the standard value is over the measuring limit or less than 10% of measuring limit, the displayed value will equal the range limit or 10% of range limit. Under this situation, go to parameter settings first to manually select a suitable range. (**P1.0**, see page 23).

  Example 1:
  Standard: 22uS; Detected value: 19uS
  Adjustable range: ±3.8us (19*20%)
  Although the values differ less than

20% but the 22uS is already over range limit so the maximum value could be input is 19.99uS only. To exactly adjust the value to 22uS, please manual select the range as 0~199.9 in **P1.3**

Example 2:
Standard: 1.6uS; Detected value: 2.1uS
Adjustable range: ±0.42us (2.1*20%)
Although the values differ less than 20% but the 1.6uS is already less than 10% range limit (1.99) so the max. value that could be input is 1.99uS.

9. After "Ready" is displayed, press "**ENTER**" to confirm the calibration. The LCD will stop flashing and the meter will switch back to normal measurement mode.
10. Repeat 1~9 for other ranges.

**NOTE:**

* When switching the meter from measurment to calibration mode, the meter will auto defect the solution value based on the previously selected cell constant (0.1, 1.0 or 10), so, sometimes the primary display may seem to jump to the auto defected value after entering calibration. This means that even in the same solution, it is normal for the displayed values in measurment and calibration modes to be different.

* To exit conductivity calibration mode without confirming calibration, **DO NOT** press the ENTER key in step 9. Press **Esc** to retain the meter's previous calibration data for the current range.

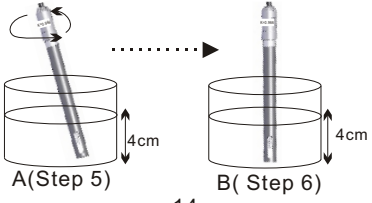
## TDS CALIBRATION

There are 2 options for TDS calibration

**Option1: Using TDS standards**

Follow these calibration steps:

1. Insert the probe into demineralized or distilled water for about 30 minutes in order to rinse the probe.
2. Select the TDS standard for calibration. The factory default setting of the TDS conversion factor is 0.50. If your solution has a different TDS factor, you can improve the calibration accuracy by setting the TDS factor before starting the calibration.
   To change the TDS factors to the correct value, see Appendix B or refer to the value provided by standard solution manufacturer.
3. Pour 4 cm (deep) of the solution into two separate & clean containers.(A&B)
4. Turn on the meter. The full LCD will flash three times. Press the **MODE** key to select TDS mode.
5. Rinse the probe in one of the containers. Gently stir the probe.
6. Dip the rinsed probe into the other container. Tap the probe on the bottom of container to remove air bubbles. Let the probe stabilize to the solution temperature.



7. Press **CAL** key for more than 2 sec. To begin the calibration. The TDS value blink on the display. (Fig. I)
8. Press the **UP/DOWN** keys to match the value on the primary display to the value of the standard solution. Refer to the solution normalization temperature. The meter is defaults to 25°C.

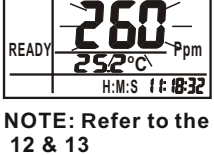


Fig .I

**NOTE: Refer to the notes on pages 12 & 13**

9. After " Ready" displays, press "**ENTER**" to confirm the calibration. The LCD will stop flashing and the meter will switch back to TDS measurement mode.
10. Repeat 1~9 for other ranges as needed.

**Option2: Using Conversion Factors**

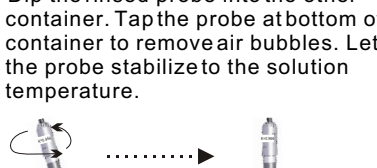
TDS values are related to conductivity. You can calibrate the meter by using conductivity standards as described above and then program the meter with a given conversion factor. Refer to below steps:

1. Perform the conductivity calibration procedure on page 11~13.
2. Select the correct Conductivity-to-TDS conversion factor. Refer to Appendix B or calculate the TDS conversion factor for other solutions using the formula show in Appendix C
3. Refer to **P2.1** (in page 25) to check the settings procedures.

## SALT CALIBRATION

Follow the below steps for salinity calibration:

1. Insert the probe into demineralized or distilled water for about 30 minutes to rinse the probe.
2. Select the Sodium Chloride standard for calibration. 10~40ppt is suggested.
3. Pour 4 cm (deep) of the standard into two separate & clean containers.(A&B)
4. Turn on the meter. The full LCD will flash three times. Press the **MODE** key to switch to SALT mode.
5. Rinse the probe in one of the containers. Gently stir the probe. Rinsing removes contaminants that affect the calibration.
6. Dip the rinsed probe into the other container. Tap the probe at bottom of container to remove air bubbles. Let the probe stabilize to the solution temperature.




A(Step 5) B( Step 6)

7. Press **CAL** >2 sec. to begin the calibration. The SALT value will blink on the LCD.( Fig. J)

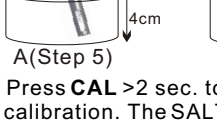



Fig .J

8. Press the **UP/DOWN** keys to match the value on the primary display to the value of the calibration standard.

   Adjust the SALT reading up to ±20% from the detected value. If the detected value and standard values differs by more than ±20%, clean or replace probe

   The maximum input value is 50 ppt and the minimum input value is 1ppt.

9. When "Ready displays, press "ENTER" to confirm the calibration. The meter switches to SALT measurement mode. Note: For high accuracy in Conductivity &TDS modes, perform the calibration again before measuring Conductivity or TDS if ou have performed a salt calibration.

## CONDUCTIVITY MEASUREMENT

### Range Selection (For COND. & TDS)

The meter defaults to "auto-ranging" mode. Auto-ranging selects the range that gives you the greatest resolution and accuracy.
Alternatively, you can manually select one of the five ranges in setup mode **P1.0** (see page 23).
Example: If you prefer the meter to display a reading as 0.50 mS rather than 500 uS, you could select the "0 to 19.99 mS" range by the manual ranging function.

The meter will reset to auto-ranging mode once it is turned off.

**NOTE:**
Accuracy is a percent of full-scale, so using your meter in the lowest range will provide the greatest accuracy.

### Automatic Temperature Compensation (For COND. & TDS)

To measure with automatic temperature compensation, follow the below steps:

1. Turn on the meter. "ATC" should be displayed on the left-bottom corner of the LCD. If the ATC indicator doesn't appear, the manual temperature compensation is selected.
   See **P2.4** on page 26 for instructions on selecting Automatic Temperature Compensation.

2. Set the temperature coefficient to the correct value.

The meter defaults to 2.1% per °C (temperature coefficient). This provides good results for most applications. You may see **P4.1** on page 27 to set the temperature coefficient to a different value.

3. Select the normalization temperature. The meter defaults to 25°C (normalization temperature). To reset the value, see **P4.2** on page 28.

4. Press **Esc** to switch back to normal mode. Rinse the probe with deionized or distilled water before using to remove any impurities adhering to the electrode body. If the electrode isn't used for a long time, soak the probe for at least 30 mins.

5. Dip the probe into the sample. Make sure there are no air bubbles trapped on the slot of the probe. To remove air bubbles, stir the probe mildly and make sure the electrode tip is submerged.

6. Stir the probe gently in the sample to create a homogenous sample. Allow a few seconds for the temperature reading to reach the solution temperature.

7. Take readings. When the reading is stable, "READY" will be displayed on the left-middle LCD.

**Manual Temperature Compensation (For COND. & TDS)**

To measure with manual temperature compensation, follow the below steps:

1. Turn on the meter. Press the set key more than one second to enter setting mode. Refer to **P2.4** (page 26) to disable the ATC function.

2. To set a manual temperature compensation value. See **P4.3** on page 29.

3. To switch the meter back to normal mode. The middle region of LCD will display a fixed temperature that you input, "ATC" is not displayed. To start the measurement follow steps 4-6 on page 19.
   **NOTE:**
   Manual Temperature Compensation only available when the ATC is off. For non-compensated measurements, change the temp. coefficient to 0.0%.( Fig. K)

Fig. K

## TDS MEASUREMENT

Follow the below steps for TDS measurement.

1. Turn on the meter.
2. Set the TDS conversion factor to a correct value. The factory default value is 0.50. Refer to P2.1 on page 25.

To chang the TDS factor to another value, see Appendix B &C on page 41.

3. Select Range, automatic temperature compensation or manual temperature compensation per your application by following steps on page18~20.

4. Start to take readings. Press "**MODE**" to switch the meter to TDS mode. (Fig. L)

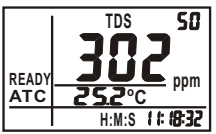


Fig. L

## SALINITY MEASUREMENT

In SALT mode, the following fixed conditions apply:

*Built-in NaCL conductivity to TDS conversion factor.
*Temp. Coefficient.
*Normalization Temp. (fixed at 25°C)

**1. Taking measurements with READY indicator activated:**

If the READY indicator is activated, "READY" is displayed when the reading is stable. (Fig. M).

To turn the READY indicator on or off See **P 2.2**, page 25.

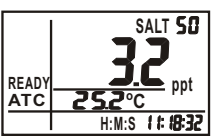


Fig.M

**2. Taking measurements with the auto endpoint feature activated:**

When a reading is stable for more than 5 seconds, this feature will automatically hold the reading in the display. "HLD" appears on the top-left of the LCD. Press the HOLD key to unfreeze the reading (Fig. N)

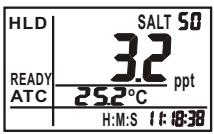


Fig.N

To turn the Auto endpoint feature on or off see **P 2.3** on page 26.

## PARAMETER SETTING

1. When the meter is in the normal mode, press **SET** for more than two seconds to enter to setup mode.
2. Press ▲or▼ to switch the setting parameter one by one.
3. Press **ESC** key to return to the previous status.
4. Press **ENTER** to enter each parameter setting as follows:

**a) P0.0: Print (Prn)**

At P0.0, press **ENTER** to reach P0.1. "Prn" will flash to indicate that the meter is transmitting the memories through its IrDA port to another device. ( Fig. O)

IrDA port to port should be at less than 30 degree angle

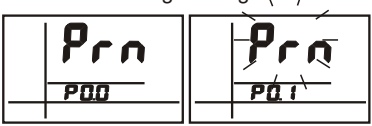



Fig. O

**b) P1.0: manual range setting (rAn)**

Normally, the meter will automatically select a range when readings appear. The manual ranging function allows you to select a specific range and and corresponding resolution. This function is for COND and TDS measurement. The Salinity range is fixed. There are 5 ranges.

Press the UP or KEYS to select the ranging function, rAn. (Fig.P ). When you see P1.0, press ENTER.

The digits flash on the display.

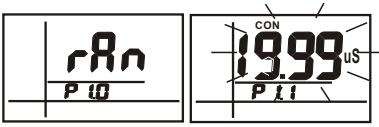



Fig. P

Press the **UP** or **DOWN** key to select from P1.1 to P1.5 and then press **ENTER** to save.

**NOTE:** Press **ENTER** to select P1.1 or other ranges, LCD will flash the limit value (Fig. P). Press the ENTER key to confirm. The meter will return to normal measure mode.

The LCD will display E03 if the measured conductivity/TDS values are beyond the limit value. Select a range within limits.

The meter will reset to the Auto-ranging function when it is turned off. The manual ranging function must be set each time the meter is turned on.

| Type | | Range | | |
|---|---|---|---|---|
| | | Cell Constant =0.1 | Cell Constant =1.0 | Cell Constant =10 |
| P1.1 | Ist Range | 0~1.99uS/ppm | 0~19.99uS/ppm | 0~199.9uS/ppm |
| P1.2 | 2nd Range | 0~19.99uS/ppm | 0~199.9uS/ppm | 0~1999uS/ppm |
| P1.3 | 3rd Range | 0~199.9uS/ppm | 0~1999uS/ppm | 0~19.99mS/ppt |
| P1.4 | 4th Range | 0~1999uS/ppm | 0~19.99mS/ppt | 0~199.9mS/ppt |
| P1.5 | 5th Range | 0~19.99mS/ppt | 0~199.9mS/ppt | 0~1999mS/ppt |

**c)P2.0: Meter configuration: (CoF)**

**P2.1: TDS factor: (tdS)**

The concentration of dissolved salts in solution increases the conductivity. This effect varies from salt to salt and is roughly linear in a given range for a given salt. The TDS conversion factor is a value used by the meter to convert from conductivity to TDS.

After selecting P2.0, press **ENTER** to select P2.1. Press again to enter P2.1. TDS factor flashes on the LCD (Fig. Q). You can press **UP/DOWN** to change the value from 0.40 to 1.00. The default value is 0.50. Press **ENTER** to confirm the TDS factor and select P2.2 automatically.

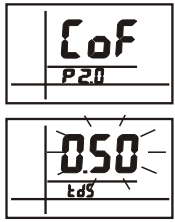



Fig. Q

**P2.2: READY indicator:(rdy)**

Turn the **READY** indicator "on" to alert you that the measurement is stable.
Select "off" for faster response.
Press **UP/DOWN** to switch the ready function to "on" or "off". (Fig. R)
Press **ENTER** to confirm the last state and select P2.3 automatically.

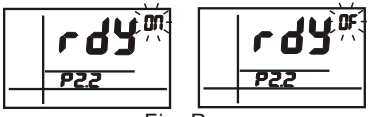



Fig. R

**P2.3: Auto endpoint function:(AEP)**
P2.3 lets you switch on or off the "Auto endpoint function". Select auto endpoint "on" to **HOLD** your measurement when it is stable for more than 5 seconds. The display value will freeze and the **HLD** indicator will appear on the LCD. Press the **HLD** key again to release the display.

Select the auto endpoint "off" to deactivate this feature. Press **UP/DOWN** to switch auto endpoint function on or off (Fig. S). Press **ENTER** to confirm the last state and select P2.4 automatically.

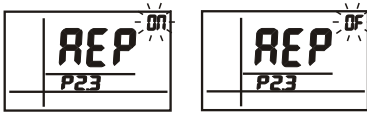



Fig. S

**P2.4: ATC or non-ATC: (Atc)**
P2.4 allows you to select Automatic or Manual Temperature Compensation. The default is ATC.
Press **UP/DOWN** to switch automatic temperature compensation on or off (Fig. T).
Press **ENTER** to confirm the last state and return to P2.0.

**NOTE:**
The default is **"Ready Indicator on", "auto endpoint function off" & "ATC on"**

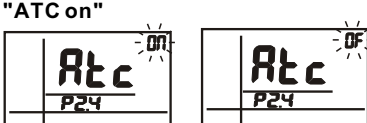



Fig. T

**d) P3.0:Unit :(Unt)**

**P3.1 selecting°C or°F:(t)**

Select P3.0 and press **ENTER** to advance to P3.1.

Press **UP** or **DOWN** key to switch °C or °F. Press **ENTER** again to confirm the last unit and advance to P3.2 automatically. (Fig. U)

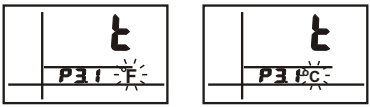



Fig U

**P3.2 selecting ppm or mg/L: (tdS)**

After entering P3.2 from P3.1, the TDS unit(mg/l or ppm) will flash on the LCD. The default unit is ppm.

Press **UP** or **DOWN** key to switch ppm or mg/l, Press **ENTER** again to confirm the last unit and return to P3.0.(Fig. V)

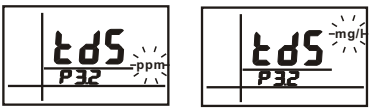



Fig V

**e)P4.0: temperature parameters: (t)**

**P4.1: Temperature coefficient:(tCo)**

The temp. coefficient (expressed as percent per °C) is the changed ratio of conductivity per degree of temp. By using a suitable temp. coefficient the meter will accurately compensate the temperature for most solutions. The adjustable range is 0.0 per °C to 10.0 % per °C. The default is 2.1% per°C. Note: 0.0% has no effect on temperature and the displayed value is the same as actual temperature.

Select P4.0 and press **ENTER** to advance to P4.1. Press **ENTER** again and the Temperature Coefficient will flash. Press **UP/DOWN** to change the value from 0.0 to 10.0, the unit is %/°C (Fig. W). Press **ENTER** to confirm the last value and advance to P4.2 automatically.

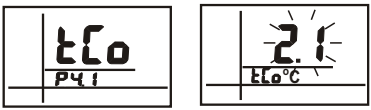



Fig W

**P4.2: Normalization temperature:(nor)**

The meter will normalize its cond. measurement to a standard temp. which you preset.

Adjust the normalization temperature from 15 to 30 °C (59 to 86 °F).
The meter default is 25 °C (77 °F).
After pressing **ENTER**, the normalization temperature will flash on the LCD. Press **UP/DOWN** to change the value from 15.0 to 30.0 °C (59.0~86.0°F). (Fig. X)
Press **ENTER** to confirm the last value and advance to P4.3.

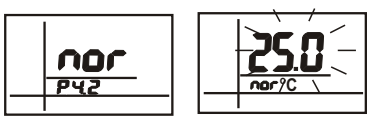



Fig X

**NOTE**: To know more about the temperature effect on on measurement, refer to Appendix D on page 43

**P4.3: Manual temp. Compensation:(Int)**

When you disable the ATC and select manual temperature compensation, you need to manually enter the temp. value of solution into the meter. You can select any temperature between 0°and 50°C (32 to 212°F). The default is 25°C (77°F).

Press **ENTER** to move to P4.3 from P4.2 the default manual input temperature will flash on the LCD.
Press **UP** to select the flashing value from 0~9.( Fig. Y)
Press **DOWN** to select the digit.
Adjustable range is from 0.0~50.0°C (32.0~122.0°F). The default is 25.0°C (77.0°F).
Press **ENTER** to confirm the last input and return to P4.0.

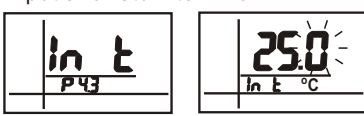



Fig Y

**f)P5.0: CELL setting: (CEL)**

**P5.1: Cell Constant:(SEL)**

. The cell constant, K, 1.0, 10, or 0.1.
Use Cell Constant 1.0 for midrange measurements.
Use Cell Constant 10 for high range measurements (above 20 mS or 10 ppt)
Use Cell Constant 0.1 for low range measurements (below 20 μS or 10 ppm)

Using the correct cell constant is important to obtain the optimal reading in various ranges of measurement. Refer to following table ranges.

| Ranges available<br>COND./TDS (Factor=0.5) | K=0.1 | K=1.0 | K=10 |
|---|---|---|---|
| 0.00~19.99uS/0~9.99ppm | * | * | |
| 0.0~199.9uS/0~99.9ppm | * | * | |
| 0~1999uS/0~999ppm | | * | |
| 0.00~19.99mS/0~9.99ppt | | * | * |
| 0.0~199.9mS/0.0~99.9ppt | | * | * |

**NOTE:** The cell constant of the probe sold with this meter is near K=1.0.

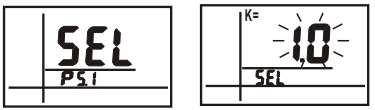



Fig Z

Select P5.0 and press **ENTER** to advance to P5.1. Press **ENTER** again and the cell constant value will flash. Press **UP/DOWN** to switch the value from 0.1,1.0,10.0, one by one. The default value is 1.0. (Fig. Z) Press **ENTER** to confirm the last input and select P5.2 automatically.

**NOTE:**

When using a cell constant K= 0.1, the measured range will be only 1/10 of the range measured by K=1. So, the lowest range will be 0~1.99us (0~0.99ppm). Since only 5 ranges are available, the highest range will only be 0~19.99mS (0~9.99ppt).

When using a cell constant K= 10, the measured range will be 10 times the range measured by K=1. So, the highest range will be: 0 to 1999 mS (0.0 to 999 ppt). Since only 5 ranges are available, the lowest range will be 0 to 199.9uS (10.0 to 99.9 ppm)

**P5.2: Input the cell constant:(InPt)**

If constant K=0.1/1/10 does not completely meet your needs, input the cell constant after selecting the K=0.1, 1 or 10.

For example: K=0.992

After saving P5.1, P5.2 will be selected. Press **ENTER** again to advance to P5.2.The cell constantr (0.1, 1 or 10) will flash on the LCD. Press **UP** to select the flashing value from 0~9. (Fig. AA)

Press **DOWN** to change the flashing digit.

The selectable range is ±20% of cell constant which is selected in P5.1.

Press **ENTER** to confirm the last value and return to P5.0.

**NOTE**: After inputting cell constant, all calibration information in P8.0 will be cleared. Manual input of the Cell Constant will change all the constants in ranges 1~5 at the same time.

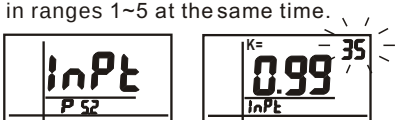



Fig. AA

**g).<u>P6.0: Memory Clear:</u> (Clr)**

**P6.1: Memory clear(CLr)**

Use this function to clear all stored memory when you need to store a new series of values. This function lets you avoid confusing the old values with the new ones.

In P6.0, press **ENTER** to enter P6.1.

Press **UP/DOWN** to select "n"-NO or "y"-YES, then press **ENTER** to confirm and the meter will return to P6.0. (Fig. AB)

If the memory is full, you must clear all values to continue recording. If not, when you record the 100th value, "FuL" will flash 3 times.

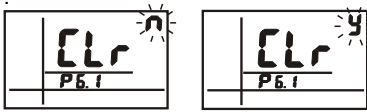



Fig. AB

**h)P7.0:Reset to factory default setting(rSt)**

P7.1: Reset (rSt) restores the factory default settings. This function clears all calibration data and other user defined parameters except the clock settings and memory.

In P7.0, press **ENTER** to advance to P7.1. Press **UP/DOWN** to select "**n**"-NOr or "**y**"-YES. (Fig. AC)
Press **ENTER** to confirm and then return to P7.0.

**NOTE:** Refer to **Appendix A** to review the default parameters or recalibrate. When replacing a probe, clear all calibration data in memory.

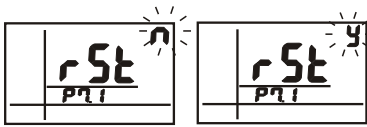



Fig. AC

**i)P8.0:View calibration data (CAL)**

This function lets you recall previous calibration data and may help you know when its time to re-calibrate the meter. This function is for "Review" purpose only.

In P8.0, press **ENTER** to advance to P8.11. Press the **UP/DOWN** key to change to P8.X. Ex: **UP** key to enter P8.2 or **DOWN** key to return P8.0. P8.1 is calibration data for range 1 P8.2 is for range 2, ..... P8.5 is for range 5. (Fig. AD)

Calibration data and date (Y-M-D HH:MM:SS) are displayed. If there is no prior calibration data at a particular range, the primary display will show "---"

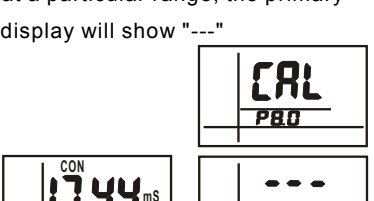



Fig. AD

**J)P9.0:Electrode data:(ELE)**

This mode has 5 parameters, P9.1 to P9.5 which display the probe cell constant value for diagnostic purposes. Without calibration solution, the cell constant value will be equal to the value in P5.2 for 5 ranges. Otherwise, the cell constant value will be equal to the value set during your calibration procedure.

In P9.0, press **ENTER** to advance to P9.1. Press **UP/DOWN** key to change to P9.X (P9.1~P9.5). Ex: **UP** key to enter P9.2 or **DOWN** key to enter P9.0 (Fig. AE). P9.1 is the cell constant value for range 1. P9.2 is for range 2, etc.

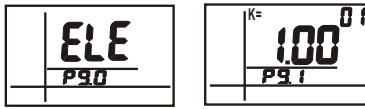



Fig. AE

**k)PA.0:RTC Setting:(rtc)**

Press ↵ to PA.1,press ▲or▼ to set Year.
Press ↵ to PA.2,press ▲or▼ to set Month.
Press ↵ to PA.3,press ▲or▼ to set Day.
Press ↵ to PA.4,press ▲or▼ to set Hour.
Press ↵ to PA.5, press ▲or▼ to set Minute.
Press ↵ to PA.6,press ▲or▼ to set Second.

This procedure lets you set Y-M-D first after every selection, press ↵ to confirm the values. Next, digits will be flashing until you press ↵ to save. After setting Y-M-D,set the H:M:S. The first digits will flash until you press ↵ to confirm (Fig.AF).

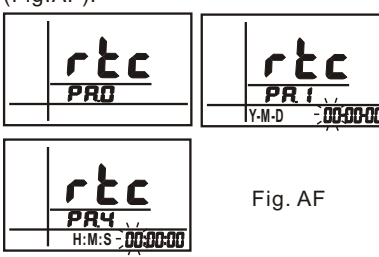



Fig. AF

| Specs | Range | Resolution | Accuracy |
|---|---|---|---|
| Conductivity | µS/cm: 0~19.9, 0~199.9, 0~1999<br>mS/cm: 0~19.99, 0~199.9 | ±0.05% full scale | ±1% of full scale, ±1 digit |
| TDS | ppm: 0.00~19.99, 0.0~199.9, 0~1999<br>ppt: 0.00~19.99, 0.0~199.9 | ppm: 0.01, 0.1, 1<br>ppt: 1.01, 0.1 | |
| Salt | ppt: 2~42 (KCL) | | |
| Temperature | 0~80.0°C | 0.1°C / 0.1°F | 0.6°C <50°C,<br>1°C >50°C |

## MAINTENANCE & STORAGE

**a) Make sure the electrode is clean**

Between measurements, rinse the electrode with de-ionised water. If the electrode has been exposed to a solvent that is immiscible with water, clean it with a solvent miscible with water, e.g. Ethanol or acetone and rinse carefully with water.

**b) Store the conductivity cell carefully**

Before storing the electrode, rinse it carefully in de-ionised water.
Short-term storage: In de-ionised water.
Long-term storage: In de-ionised water or store dry.
After long-term storage, leave the electrode in de-ionised water for 8 hours before use.

**c) Handle platinised cells carefully**

Do not touch the black platinum layer of the platinized cells.
To rinse the platinized cells, dip the cell several times in a beaker with demineralised water.

Be careful when rinsing platinized cells with deionised water from a water bottle. The force of the water can remove some of the platinum layer and consequently change the cell constant.

# TROUBLESHOOTING

**a) Power on but no display:**

1) Make sure to press the power key long enough to turn the meter on.
2) Check that the batteries are in place and make sure ther is good contact and matching polarity.
3) Replace all batteries.
4) Remove the batteries for one minute and then reinstall them.

**b) Display disappears:**

Check whether the low battery indicator is being displayed before the LCD disappears, if so, replace the batteries.

**c) E01:**

The probe is disconnected or damaged.

**d) E02:**

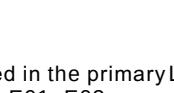
The measured value is below the range limit.

**e) E03:**

The measured value is over the range limit.

**f) E04:**

The value displayed in the primary LCD is not correct. See E01~E03.




**g) E32:**

IC memory error.

**h) E41:**

Meter configuration error. For example: the temperature coefficient is over the setting limit.

# WARRANTY

Sper Scientific warrants this product against defects in materials and workmanship for a period of five (5) years from the date of purchase, and agrees to repair or replace any defective unit without charge. If your model has since been discontinued, an equivalent Sper Scientific product will be substituted if available. This warranty does not cover probes, batteries, or damage resulting from accident, misuse, or abuse of the product. To obtain warranty service, ship the unit postage prepaid to:

SPER
SCIENTIFIC

7720 E. Redfield, Suite 7
Scottsdale, AZ 85260 USA

The defective unit must be accompanied by a description of the problem and your return address. Return your warranty registration card within ten (10) days of purchase or register online at:

www.sperscientific.com.

## IrDA TRANSMISSION

A maximum of 99 memories may be transmitted via IrDA to an IrDA receiver.

1. IR Protocol: Compatible with SIR, 19200 bps, 8 data bits, no parity.

2. The data format transmits every second.

   C***. **uS(mS):t***.*C(F):D***. **ppm(ppt): S***. * ppt @****-**-** **:**:**LRCCRLF

   The error message format is:

   ExxNul - "xx" is the error code

3. The format of the description transmits every 15 records.

$CON:TEMP:TDS:SALTLRCCRLF

## RS232 OUTPUT: (9600 bps )

The meter can link with a PC to capture on-line data and display COND/TDS/SALT readings with real-time output. You can retrieve files, save the data for data analysis, record statistics and more.

**Connection procedures:**

- Plug the optional RS232 cable into the RS232 jack port (on the right side of the meter)
- Insert the D-sub 9P type connector into computer's Com. Port - OR-
- Set up RS232 software by inserting the CD-ROM.
- When installing the RS232 software follow the procedures in the operation manual.
- The RS232 protocol is: 9600 bps, 8data bits, noparity.
- The data format is:
  Tx.ASCII code sent each second while meter is on:
  C***. **uS(mS):t***.*C(F):
  D***. **ppm(ppt): S***.*ppt
  @****-**-** **:**:**LRCCRLF
  The error message format is: ExxNul (xx is the error code).
- Memory data is not available via RS232.

## Appendix A: Meter Factory Default Setting

| Type | Parameters | Default | Remark |
|---|---|---|---|
| P0.1 | IRDA Output | | |
| P1.1<br>P1.2<br>P1.3<br>P1.4<br>P1.5 | Manual range setting | OFF<br>OFF<br>OFF<br>OFF<br>OFF | The meter resets to the Auto-ranging function once it's turned off |
| P3.1<br>P3.2 | Select℃/℉<br>Select ppm or mg/L | ℃<br>ppm | Temp unit<br>TDS unit (only 8302, 8305,8306) |
| P4.1<br>P4.2<br>P4.3 | Temp. coefficient<br>Nor. Temp<br>Manual compensation temp. | 2.1%/℃<br>25℃<br>25℃ | Adjustable from 0.0 to 10%<br>Adjustable from 15 to 30℃<br>Adjustable from 0~50.0℃ |
| P5.1<br>P5.2 | Cell const. Select<br>Cell const. Input | 1.0<br>1.0 | Select K=1.0, 0.1 or 10<br>The input cell constant offset is ±20% of select cell constant in P5.1 |
| P6.1 | Clear Memory | NO | Retain Memory |
| P7.1 | Factory default | NO | Retain your current settings |
| P8.1<br>P8.2<br>P8.3<br>P8.4<br>P8.5 | Viewing previous calibration data | ---<br>---<br>---<br>---<br>--- | No calibration data for 1st range<br>No calibration data for 2nd range<br>No calibration data for 3rd range<br>No calibration data for 4th range<br>No calibration data for 5th range |
| P9.1<br>P9.2<br>P9.3<br>P9.4<br>P9.5 | Viewing probe data | ---<br>---<br>---<br>---<br>--- | No offset for effective cell constant (1st range)<br>No offset for effective cell constant (2nd range)<br>No offset for effective cell constant (3rd range)<br>No offset for effective cell constant (4th range)<br>No offset for effective cell constant (5th range) |
| PA.1<br>PA.2<br>PA.3<br>PA.4<br>PA.5<br>PA.6 | Real time clock. Only 8303, 8306 | NO | Retain year of current RTC.<br>Retain month of current RTC.<br>Retain day of current RTC.<br>Retain hour of current RTC.<br>Retain minute of current RTC.<br>Retain second of current RTC. |

## Appendix B: Conductivity to TDS Conversion Factors

| Conductivity at 25℃ | TDS KCl | | TDS NaCl | | TDS 442 | |
|---|---|---|---|---|---|---|
| | ppm value | Factor | ppm value | Factor | ppm value | Factor |
| 23 μS | 11.6 | 0.5043 | 10.7 | 0.4652 | 14.74 | 0.6409 |
| 84 μS | 40.38 | 0.4807 | 38.04 | 0.4529 | 50.5 | 0.6012 |
| 447 μS | 225.6 | 0.5047 | 215.5 | 0.4822 | 300 | 0.6712 |
| 1413 μS | 744.7 | 0.527 | 702.1 | 0.4969 | 1000 | 0.7078 |
| 1500 μS | 757.1 | 0.5047 | 737.1 | 0.4914 | 1050 | 0.7 |
| 2070 μS | 1045 | 0.5048 | 1041 | 0.5029 | 1500 | 0.7246 |
| 2764 μS | 1382 | 0.5 | 1414.8 | 0.5119 | 2062.7 | 0.7463 |
| 8974 μS | 5101 | 0.5685 | 4487 | 0.5 | 7608 | 0.8478 |
| 12,880 μS | 7447 | 0.5782 | 7230 | 0.5613 | 11,367 | 0.8825 |
| 15,000 μS | 8759 | 0.5839 | 8532 | 0.5688 | 13,455 | 0.897 |
| 80mS | 52,168 | 0.6521 | 48,384 | 0.6048 | 79,688 | 0.9961 |

442: 40% sodium sulfate, 40% sodium bicarbonate and 20% sodium chloride.

## Appendix C: Calculating TDS conversion factors

The meter can be calibrated by using TDS calibration standard solutions. The calibration standard requires the TDS value at a standard temperature such as 25°C. To determine the Conductivity-to-TDS conversion factor, please use the following formula:

Factor = Actual TDS ÷ Actual Conductivity @ 25°C

**Definitions:**
Actual TDS: Value from the solution bottle label or from a standard buffer which made by using high purity water and precisely weighed salts.
Actual Conductivity: Value measured using a properly calibrated Conductivity/TDS/Temperature meter.

Both the actual TDS and the actual conductivity values must be in the same magnitude of units. For example, if the TDS value is ppm, the conductivity value must be in uS; if the TDS value is in ppt, the conductivity value must be in mS.

Check this number by multiplying the conductivity reading by the factor in the above formula and the result is the TDS in ppm.

## Appendix D: Temperature Effect

Conductivity measurements are temperature dependent, if the temperature increases, conductivity increases. eg: the conductivity measured in a 0.01 M KCl solution at 20° C is 1.273 mS/cm, whereas, at 25 °C, it is 1.409 mS/cm.

The concept of reference temperature (Normalization temperature) was introduced to allow the comparison of conductivity results obtained at different temperature. The reference temperature is usually 20°C or 25° C. The conductivity meter measures the actual COND. and temperature and then converts it to the reference temperature using a temperature correction function and displays the conductivity at the reference temp.. It is mandatory to always associate the temperature together with a conductivity result. If no temperature correction is applied, the conductivity is the value taken at measurement temperature. The 830x meter used linear temperature correction.

**Linear temperature correction:**
In moderately and highly conductive solutions, temperature correction can be based on a linear equation involving a temperature coefficient (θ). The coefficient is usually expressed as a conductivity variation in %/° C.
Linear temperature correction is used, e.g. for saline, acids and leaching solutions.

$$K_{Tref} = \frac{100}{100 + \theta \cdot (T - T_{ref})} \cdot K_T$$

where:
$K_{Tref}$ = Conductivity at Tref
$K_T$ = Conductivity at T
$T_{ref}$ = Reference temperature
T = Sample temperature
θ = Temperature coefficient
**Note:** the correction is accurate only within a limited temperature range around T1 and T2. The greater the difference between T and Tref, the higher the risk of error.

**Calculating Temperature Coefficients (θ )**
By measuring the conductivity of a sample at temperature T1 close to Tref and another temperature T2, you can calculate the temperature coefficient by using the following equation:

$$\theta = \frac{(K_{T2} - K_{T1}) \cdot 100}{(T_2 - T_1) \cdot K_{T1}}$$

T2 should be selected as a typical sample temperature and should be approximately 10°C different from T1. The temperature coefficients of the following electrolytes generally fall into the ranges shown below:
Acids: 1.0 - 1.6%/°C
Bases: 1.8 - 2.2%/°C
Salts: 2.2 - 3.0%/°C
Drinking water: 2.0%/°C
Ultrapure water: 5.2%/°C

Average temperature coefficients of standard electrolyte solutions expressed as %/°C of the conductivity value at 25°C

| Temp. Range °C | KCl 1 M | KCl 0.1 M | KCl 0.01 M | Saturated NaCl |
|---|---|---|---|---|
| 15 - 25 | 1.725 | 1.863 | 1.882 | 1.981 |
| 15 - 25 -35 | 1.730 (15 - 27°C) | 1.906 | 1.937 (15 - 34°C) | 2.041 |
| 25 - 35 | 1.762 (25 - 27°C) | 1.978 | 1.997 (25 - 34°C) | 2.101 |