Palintest

Micro 600

Conductivity/TDS Meters

ZI INST 1220

Palintest

Preface

This manual serves to explain the use of the Micro 600 Conductivity and Micro 600 TDS meters.

This manual functions in two ways: first as a step by step guide to help you operate the meter; second, as a handy reference guide.

This manual is written to cover as many anticipated applications of the Conductivity and TDS handheld meters as possible. If there are doubts in the use of these meters, please contact us. Our contact details are on the last page of this manual.

Palintest will not accept any responsibility for damage or malfunction to the meter caused by improper use of the instrument.

The information presented in this manual is subject to change without notice as improvements are made. Please refer to our website for the latest version.

Contents

1.0 Introduction

Thank you for purchasing the Micro 600 COND or Micro 600 TDS meter. These microprocessor-based handheld meters are economical and easy to use with a large custom LCD (Liquid Crystal Display) for clear and easy reading.

The Micro 600 COND measures conductivity (µS/cm or mS/cm) and temperature (°C) while the Micro 600 TDS measures total dissolved solids (TDS) in parts per million (ppm) or parts per thousand (ppt) and temperature (°C). Each measures up to 5 different ranges and can automatically switch to appropriate measuring range.

Your meter includes an electrode (cell constant K = 1.0) with built-in temperature sensor, rubber armour, 4 alkaline "AAA" batteries, instruction manual and warranty card.

The Micro 600 COND includes low (74µS), mid (1413µS) and high (12.88mS) range conductivity solutions and deionised water.

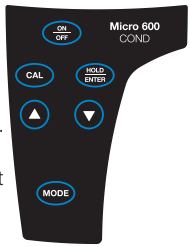
The Micro 600 TDS includes 50ppm, 300ppm and 3000ppm conductivity solutions and deionised water.

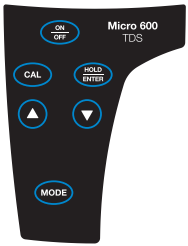
Please read this manual thoroughly before operating your meter.

To order other accessories and standards solutions, please refer to the accessories section for more information.

2.1 Description of Keypad Functions

Your meter has 6 keys on its splash-proof keypad. Some buttons have multiple functions depending on the mode of operation.





ON/OFF Powers meter on and off. Meter starts up in the measurement mode that you last switched off from.

CAL Enters into calibration mode. Pressing while in calibration mode will abort calibration without confirming value.

MODE Selects desired measurement mode. When pressed simultaneously with ON/OFF, it will take you into the SETUP mode. See ADVANCED SETUP section for more information.

HOLD Freezes measured reading. Press again to resume live reading.

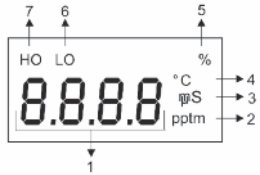
ENTER Confirms calibration value in calibration mode and confirm selections in SETUP mode.

▲ Increment values during calibration mode or scroll through SETUP. Activates manual ranging function during conductivity/TDS measurement.

▼ Decrement values during calibration mode.

2.2 Description of LCD Annunciators

Your meter has a large custom LCD that consists of 4-digit segments plus annunciators for uS/mS (Cond) or, ppm/ppt (TDS), and °C (temperature).



1 Primary display
2 Parts per million (ppm) (Micro 600 TDS). Parts per thousand (ppt) (Micro 600 TDS).
3 Milli-Siemens/cm (mS) or micro-Siemens/cm (µS) indicator (Micro 600 COND only).
4 Temperature indicator.
5 "LO" = low battery condition.
6 "HO" = HOLD function is activated and reading is frozen.

2.3 Inserting & removing the rubber armour/stand

1 To remove meter from rubber armour, push out from the bottom edges of meter until it is completely out of boot. Ensure that your electrode cables are not connected. See **Figure 1**.

2 To insert meter into armour, slide in from the top of meter before pushing the bottom edges of meter down to set it into position. Lift up the stand at the back of meter for bench top applications if necessary. See **Figure 2**.

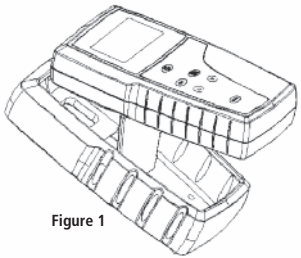


Figure 1

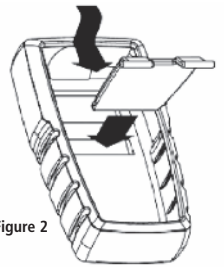
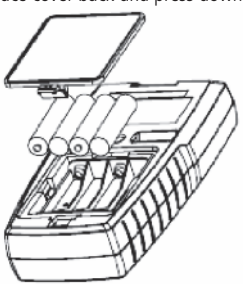
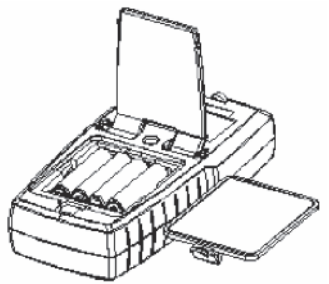


Figure 2

2.4 Inserting New Batteries

The battery compartment is found at the back of instrument. To open the battery compartment, push in the direction of arrow and lift up the cover. Note the polarity of battery before inserting into position. After replacement, place cover back and press down until it locks.





2.5 Battery Replacement

A "LO" annunciator in the LCD alerts you when battery power is running low. **Caution: Power off the meter before replacing battery**.

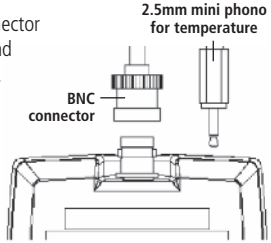
"LO" Battery Condition

2.6 Connecting the Electrode

1 To connect the electrode, align the connector slots with the posts of meter's socket and rotate connector clockwise until it locks.

2 To remove, rotate the connector in anti-clockwise direction until it unlocks, and slide the connector off the socket.

3 Insert the mini phono jack of temperature sensor into the socket on the meter as shown opposite.



2.7 Electrode Information

Your meter includes an electrode with a BNC connector having a nominal cell constant of k = 1.0, and a built-in temperature sensor. The Ultem-body housing has good chemical resistant properties. The electrode design offers fast temperature response and reduces air entrapment, ensuring accurate, repeatable, and stable readings.

The wettable materials of the probe include:

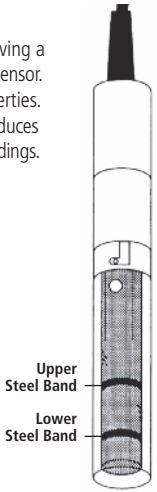
1 Polyetherimide (Ultem) - protective probe guard

2 Polybutylterphalate (Valox) - sensor housing

3 Stainless Steel (SS 304) - 2 steel bands

The protective probe guard can be removed temporarily for maintenance but must be re-attached during measurement and calibration. **Erroneous results will occur while the probe guard is removed**.

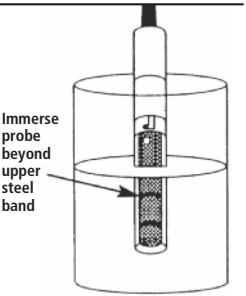
Always immerse the probe beyond upper steel band or best results. Use the fill line on the outside of the probe guard for reference.



1 DO NOT measure or calibrate without the protective probe guard in place.

2 Immersion above the protective guard is not recommended. The cable can be submerged briefly but is not designed for continuous immersion.

See **"Probe Care and Maintenance"** for more information.



2.8 Switching the Meter On

Press **ON/OFF** to power up your meter. Your meter will cycle through various setup parameters when switched on.

1 The first screen shows the model **[Cond] [tds6]**.

2 The second screen shows the nominal cell constant value. The Micro 600 COND and TDS meters can accept electrodes with k = 0.1, 1.0 or 10.0 nominal cell constants. Default value is k = 1.0 **[C 1.0]**. See **Section 5.2 Advanced Setup** to modify.

3 The third screen shows the Normalisation Temperature which can be set to 25°C or 20°C. Default value is 25°C **[t 25.0°C]**. See **Section 5.6 Advanced Setup** to modify.

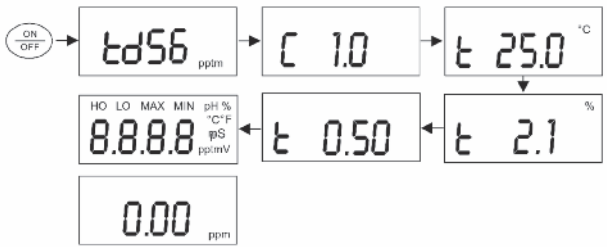
4 The fourth screen shows the Temperature Coefficient which can be set from 0.0 to 3.0% per °C. Default value is 2.1%/°C **[t 2.1%]**. See **Section 5.5 Advanced Setup** to modify.

5 All LCD segments light for 2 seconds before entering measurement mode. **Note: the meter will use the measurement mode that was in use when it was previously powered off.**

Micro 600 COND

Measurement Mode

Micro 600 TDS

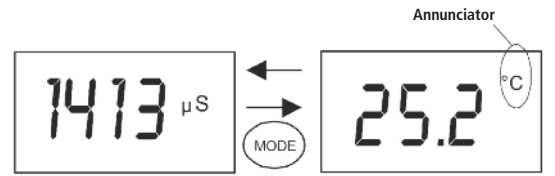


Measurement Mode

2.9 Changing Mode

To switch between conductivity and TDS measurement mode and temperature measurement mode, simply press the **MODE** key.

The annunciator will indicate the measurement mode you are in.



3.1 Important Information on Meter Calibration

The Micro 600 COND and Micro 600 TDS have five measuring ranges listed below. Each range can be calibrated to one point per range (five total points if each range is calibrated). Calibration is recommended for each range that will be used.

Micro 600 COND

Conductivity Range	Recommended Calibration Solution Range
0.00 → 20.00 µS/cm	6.00 to 17.00 µS/cm
0.0 → 200.0 µS/cm	60.0 to 170.0 µS/cm
0 → 2000 µS/cm	600 to 1700 µS/cm
0.00 → 20.00 mS/cm	6.00 to 17.00 mS/cm
0.0 → 200.0 mS/cm	60.0 to 170.0 mS/cm

Micro 600 TDS

TDS Range	Recommended Calibration Solution Range
0.00 → 10.00 ppm	3.00 to 8.50 ppm
10.0 → 100.0 ppm	30.0 to 85.0 ppm
100 → 1000 ppm	300 to 850 ppm
1.00 → 10.00 ppt	3.00 to 8.50 ppt
10.0 → 200 ppt	30.0 to 170 ppt

New calibrations replace old calibrations on a per range basis. For example, if the meter has been calibrated with 1413 µS/cm (0 to 2000 µS/cm range) and a calibration is performed with 1500 µS/cm (also 0 to 2000 µS/cm range), the meter will replace the 1413 µS/cm calibration in that range. The meter will retain all calibration data in other ranges.

When the electrode is replaced, it is best to clear all calibration data. To erase all calibration data completely, see **Section 5.8 Restore Factory Default Values**.

3.2 Preparing the Meter for Calibration

For best results, select a standard value close to the sample value you are measuring. Alternatively, use a calibration solution value that is approximately 2/3 the full-scale value of the measurement range you plan to use. For example, in the 0 to 2000 µS/cm conductivity range, use a 1413 µS/cm solution for calibration.

Use fresh calibration standard solutions. Reuse of standard solutions may impair calibration and accuracy of measurements. Store solutions in a dry, dark, and cool environment when possible while limiting exposure to air.

Rinse or immerse the probe before calibration and between samples with clean water (deionised water is ideal).

3.3 Selection of Auto or Manual Calibration (Micro 600 COND)

The Micro 600 COND is capable of automatic or manual calibration. The factory default setting is automatic.

In the automatic calibration mode, the Micro 600 COND will automatically select one of (4) calibration standard values (see below) depending on the range and normalisation temperature being used.

Automatic calibration is useful when all your calibration standards fall into one of the groups listed below. For example, if your 1413 µS/cm standard reads as 1400 µS/cm during calibration, you would simply press "ENTER" to accept this value using automatic mode. In manual mode, you would have needed to press the increment button 13 times before pressing "ENTER".

Note: If you will use a calibration standard that is not listed below, select manual calibration instead.

Normalisation Temperature	Calibration Standards (Range)
25°C	1. **84 µS/cm** (for 0 - 200 µS/cm)
	2. **1413 µS/cm** (for 0 - 2000 µS/cm)
	3. **12.88 mS/cm** (for 0.00 - 20.00 mS/cm)
	4. **84 µS/cm** (for 0 - 200 µS/cm)
20°C	1. **76 µS/cm** (for 0 - 200 µS/cm)
	2. **1278 µS/cm** (for 0 - 2000 µS/cm)
	3. **11.67 mS/cm** (for 0.00 - 20.00 mS/cm)
	4. **102.1 mS/cm** (for 0.0 - 200.0 mS/cm)

Table 1: Conductivity Calibration Standards for Auto Calibrations

Manual calibration is only useful when you wish to use one or more standard values that are not listed in table 1.

See **Section 5.3 Advanced Setup** to modify automatic or manual calibration.

3.4 Using Automatic Calibration (Micro 600 COND)

In Automatic Calibration mode, the COND can accept up to 4 calibration points with maximum of 1 point per measurement range. **Note: values in the 0.00 to 20.00 µS/cm range cannot be calibrated in Auto Calibration mode.**

1 If necessary, press **MODE** key to select conductivity mode.

2 Rinse the probe with deionised water or a rinse solution, then rinse with a small amount of calibration standard.

NOTE: For Automatic Calibration you must use one of the calibration standards listed in Table 1.

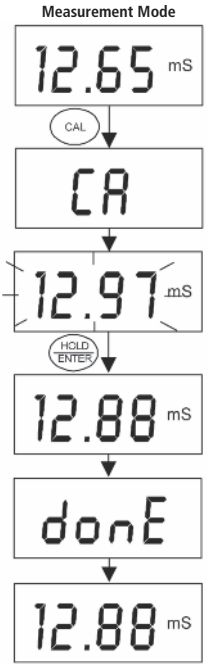
3 Dip the probe into the calibration standard. Stir the probe gently to create a homogeneous sample. Allow time for the reading to stabilise.

4 Press **CAL** key to enter conductivity calibration mode. The **[CA]** indicator will appear briefly, then a value will appear flashing.

NOTE: To exit calibration without confirmation, press CAL to return to measurement mode.

5 When the value is stable, press **ENTER**. The calibration standard value will appear for 3 seconds. If the calibration is successfully performed, **[donE]** will be displayed briefly before meter returns to measurement mode.

6 Repeat steps 1-5 as needed with additional calibration standards.



NOTES:

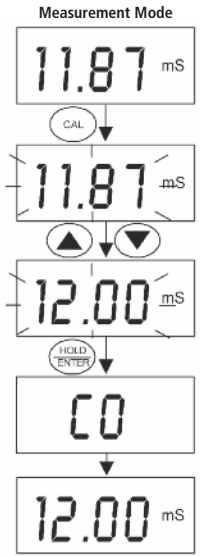
1. To protect from erroneous calibrations, the allowable tolerance is ±40% of the factory default value. If calibration is attempted with standards that fall outside this tolerance range, the error message **"Err 1"** is indicated and meter will return to measurement mode. For example, a 40% tolerance of a 1413 µS/cm standard, is 848 µS/cm to 1978 µS/cm.
2. If the measured temperature (°C) of the calibration solution is below 0°C or above 50°C, the error message **"Err 2"** is indicated and meter will return to measurement mode.
3. Low conductivity standard solutions (less than 20 µS/cm) are unstable and are very temperature dependent. As a result, reproducible calibration results are challenging in lowest measurement range (0.00 to 20.0 µS/cm).

3.5 Manual Calibration

In Manual Calibration mode you are not limited to the conductivity calibration standards listed previously in Table 1. This example shows a manual calibration sequence using a 12.00 mS/cm conductivity calibration standard.

1. If necessary, press **MODE** key to select conductivity mode.
2. Rinse the probe thoroughly with de-ionised water or a rinse solution, then rinse with a small amount of calibration standard.
3. Dip the probe into the calibration standard. Stir the probe gently to create a homogeneous sample. Allow time for the reading to stabilise.
4. Press **CAL** to enter conductivity calibration mode. The **[CAL]** indicator will appear briefly, then a value will appear flashing.

   NOTE: To exit calibration without confirmation, press CAL to return to measurement mode.



5 When the value is stable, press ▲ or ▼ as needed to adjust the value to match your calibration standard.

6 Press **ENTER** to confirm the adjusted value. **[CO]** will appear briefly indicating that the calibration was successful. The meter returns to measurement mode.

7 Repeat steps 1-6 as needed with additional calibration standards.

3.6 Temperature Calibration

The electrode includes a built-in temperature sensor that is factory calibrated with the meter. Perform temperature calibration only if you suspect temperature errors may have occurred over time or when the probe is replaced.

You can offset the temperature reading up to ±5°C from the original (default) reading.

1 Connect the mini phono plug of the electrode to the meter. See **Section 3.7**.

2 If necessary, press **MODE** to select temperature measurement mode.

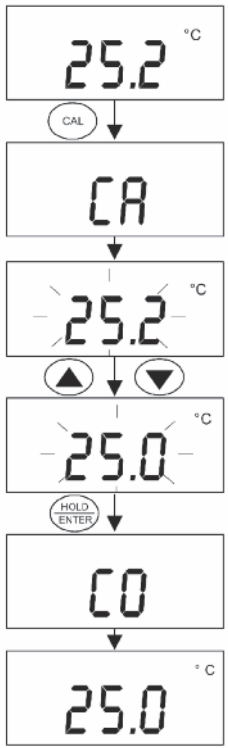
3 Press **CAL** to initiate temperature calibration. **"CA"** will appear briefly then a temperature value will start flashing.

4 Dip the probe into a solution with known temperature (for example, a temperature bath). Allow time for the temperature to stabilise.

5 When the value is stable, press ▲ or ▼ as needed to adjust the value to the solution temperature.

6 Press **ENTER** to confirm the adjusted value. **[CO]** will appear briefly indicating that the calibration was successful. The meter returns to measurement mode.

NOTE: To exit calibration without confirmation, press CAL to return to measurement mode.



4.0 Measurement

Your meter is capable of taking measurements that incorporate temperature measurements automatically (most common) or using a temperature which you input manually (rare).

4.1 With Automatic Temperature Compensation (ATC)

To compensate your reading using temperature values as measured by your electrode, simply attach the phono plug of the electrode to the meter. The measured reading is automatically compensated to the specified normalisation temperature (either 20°C or 25°C). The rate of compensation which is applied is the Temperature Coefficient.

See **Section 5.5 - Temperature Coefficient**
See **Section 5.6 - Normalisation Temperature**

4.2 Without ATC (Manual Temperature Compensation)

You can use manual temperature compensation after manually entering the temperature value of your process into the meter. The meter will then compensate from this fixed value to the normalisation temperature. Any temperature can be used between 0 and 50°C. The default value is 25°C.

To activate manual temperature compensation, simply unplug the temperature sensor from the meter (mini phono plug) and follow the steps 2 thru 6 of Temperature Calibration.

See **Section 3.6 - Temperature Calibration**

4.3 Taking Measurements

1. Rinse the electrode with de-ionised or distilled water before use to remove any impurities. Shake or air dry. To avoid contamination or sample dilution, rinse probe with a small volume of your sample.
2. Dip the probe into the sample.
3. Allow time for the reading to stabilise. Note the reading on the display.

NOTE: The protective probe guard must be attached during measurement. Erroneous results will occur while the probe guard is removed. Always immerse the probe beyond upper steel band for best results. Use the fill line on the outside of the probe guard for reference.

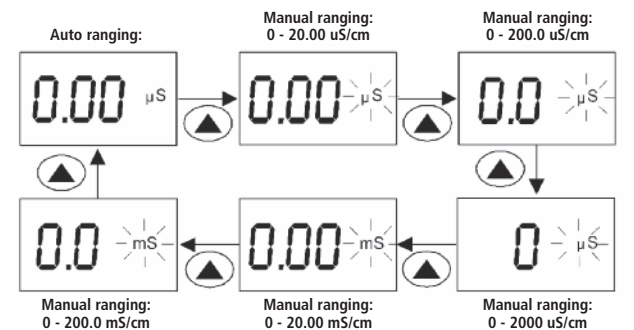
4.4 Using Manual Ranging Function

By default your meter has auto-ranging ability and automatically selects the range in which your readings appear.

Alternatively, to override auto-ranging you can manually select a specific range by pressing ▲ successively for each measurement range. The five ranges are:

Micro 600 COND **Micro 600 TDS**

Conductivity Range	TDS Range (using 0.5 TDS factor)
0 - 20.00 µS/cm	0 - 10.00 ppm
0 - 200.0 µS/cm	0 - 100.0 ppm
0 - 2000 µS/cm	0 - 1000 ppm
0 - 20.00 mS/cm	0 - 10.00 ppt
0 - 200.0 mS/cm	0 - 100 ppt



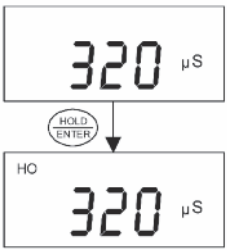
NOTE: If the value of the solution you are measuring is higher than the range selected **[Or]** (over range) will appear. Press ▲ to select a measurable range. The meter resets to Auto-ranging function once it is turned off. You will have reset the manual ranging function each time you turn the meter off.

4.5 HOLD Function

For prolonged observation of a reading, press **HOLD** while in measurement mode to freeze the display.

1 To hold a measurement, press **HOLD** while in measurement mode. **[HO]** will appear on the display.

2 To release the held value, press the **HOLD** again. **[HO]** will disappear and measure is resumed.



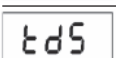
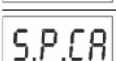
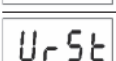
NOTE: The meter will shut off automatically after 20 minutes of the last key press. If the meter is shut off either automatically or manually, the HOLD value will be lost.

5.1 Advanced Setup Overview

Advanced setup allows customisation settings such as; selecting electrode's cell constant, normalisation temperature, temperature coefficient, TDS factor (Micro 600 TDS), automatic or manual calibration (Micro 600 COND), single-point or multi-point calibrations (COND and TDS), and to reset meter to factory default.

To enter advanced setup mode:

1. Switch off the meter.
2. Press **MODE** and then **ON**, holding both keys for 2 seconds. Release the **ON** key before releasing the **MODE** key.
3. If successful, **[SEUP]** will appear briefly followed by **[CELC]**.
4. Press ▲ or ▼ to select the desired advanced setup function.

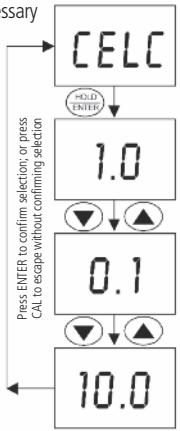
	Entering Advanced Setup Mode
	Cell Constant. Select k = 0.1, 1.0, or 10.0. Default value is 1.0.
	Select Automatic Calibration. "Yes" for auto calibration and "No" for manual calibration. Default value is "Yes". **(COND only)**
	Adjust Temperature Coefficient from 0.0 to 3.0% per °C. Default value is 2.1% per °C.
	Normalisation Temperature. Select "20°C" or "25°C". Default value is 25 °C.
	Adjust TDS factor from 0.4 to 1.0. Default value is 0.5. **(TDS only)**
	Select Single Point Calibration. Select "Yes" or "No". Default value is "Yes".
	User reset to factory defaults. Select "Yes" or "No". Default value is "no".

Overview of Advanced Setup

5.2 Select Cell Constant

Your meter includes a probe with a nominal cell constant (k) of 1.0. Use probes with k = 0.1 and 10 (sold separately) for improved performance in extreme samples. Use this setup function to change the cell constant if necessary Meter default is 1.0 to match the included probe.

k = 0.1 ideal for low measurements <20 µS/cm (<10 ppm).
k = 1.0 ideal for mid-range measurements
k = 10 ideal for high measurements >20 mS/cm (>10 ppt).



1 Enter advanced setup as described in Section 5.1.

2 Press ▲ or ▼ until **[CELC]** appears. Press **ENTER**.

3 Press ▲ or ▼ to select "1.0", "0.1" or "10.0". Ensure that the cell constant corresponds with the electrode you are using.

4 Press **ENTER** to select and return to **[CELC]** setup function.

5 Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to measurement mode.

5.3 Automatic Calibration (Micro 600 COND only)

Select automatic calibration "YES" for easy calibration of (4) factory pre-set conductivity calibration standards (see **Section 3.3 Table 1**). To use other standards or to calibrate any standard manually select "no". Default value is "YES".

1 Enter advanced setup as described in Section 5.1.

2 Press ▲ or ▼ until **[ACAL]** appears. Press **ENTER**.

3 Press ▲ or ▼ to select **[YES]** or **[no]**.

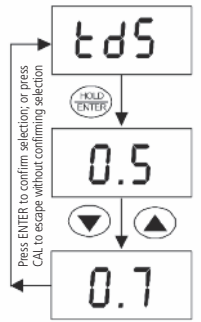
4 Press **ENTER** to select and return to **[ACAL]** setup function.

5 Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to measurement mode.

5.4 Setting the TDS Factor (Micro 600 TDS only)

The concentration of salts dissolved in solution increases the conductivity. This relationship varies from salt to salt and is roughly linear over a given range for a given salt. The TDS conversion factor is the number used by the meter to convert from conductivity to TDS. The TDS conversion factor can be set from 0.4 to 1.0. Default value is 0.5.

See **Section 13 - Calculating TDS Conversion Factor**.



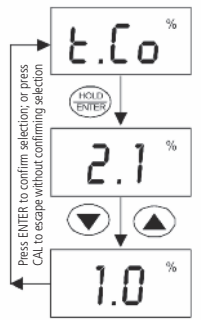
1 Enter advanced setup as described in Section 5.1.
2 Press ▲ or ▼ until **[tdS]** appears. Press **ENTER**.
3 Press ▲ or ▼ to select the desired TDS factor.
4 Press **ENTER** to select and return to the **[tdS]** setup function.
5 Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to measurement mode.

5.5 Temperature Coefficient

The temperature coefficient is the amount of change in conductivity per degree temperature (% per °C). For best results, determine and enter the exact temperature coefficient of your solution. The meter allows adjustment from 0.0 to 3.0% per °C. Default value is 2.1% per °C.

Note: Select 0.0% for uncompensated measurements. Temperature can be measured by probe and displayed.

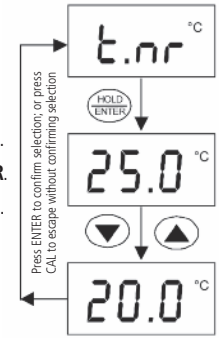
See **Section 14 - Calculating Temperature Coefficients**.



1 Enter advanced setup as described in Section 5.1.
2 Press ▲ or ▼ until **[t Co %]** appears. Press **ENTER**.
3 Press ▲ or ▼ to select a value between 0.0 to 3.0%.
4 Press **ENTER** key to select and return to the **[t Co %]** setup function.
5 Press ▲ or ▼ to move to the next setup

5.6 Normalisation Temperature

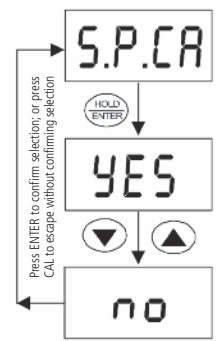
You can set the meter to normalise its measurements to a temperature of either 25°C or 20°C. Default value is 25°C.



1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [t nr °C] appears. Press **ENTER**.
3. Press ▲ or ▼ to select [25 .0°C] or [20 .0°C].
4. Press **ENTER** to select and return to the [t nr °C] setup function.
5. Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to measurement mode.

5.7 Single-Point Calibration

Select "YES" to apply a single calibration value across all ranges. Select "no" to allow separate calibrations for each range, or to restrict an individual calibration so that it is applied to one range only. Default value is "Yes".



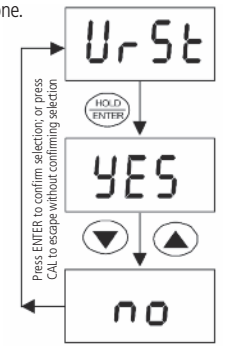
1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [S P CA] appears. Press **ENTER**.
3. Press ▲ or ▼ to select [YES] or [no].
4. Press **ENTER** to select and return to the [S P CA] setup function.
5. Press ▲ or ▼ to move to the next setup function menu or press **CAL** to exit to measurement mode.

5.8 Restore Factory Default Values

Use this function to reset all parameters to factory default settings. This clears all calibration data and any other setup functions you might have changed.

IMPORTANT: Once activated the settings and calibration data will be erased and can not be undone.

1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ key until **[UrSt]** appears. Press **ENTER**.
3. Press ▲ or ▼ to select **[YES]** or **[no]**.
4. Press **ENTER** to confirm.
5. If reset **[YES]** confirmed, the meter will return to measurement mode after initialisation.

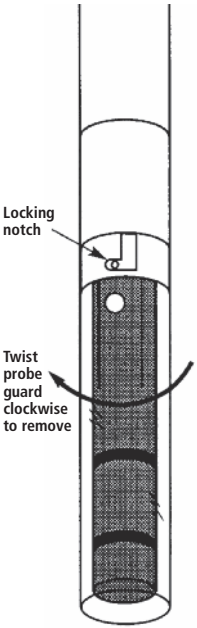


6.0 Probe Care and Maintenance

Keep the probe clean. Rinse the probe twice, and gently swirl it while you take readings. For best results, soak a dry probe for at least 5-10 minutes before calibration. Rinse the probe with clean water before storing. Never scratch the bands with an abrasive or hard substance. Do not strike against hard surfaces or submerge the cable for extended periods.

Do not immerse the probe in oily solutions, aggressive solvents, or strong acids. Clean with a mild detergent or isopropyl alcohol then rinse thoroughly. Dry storage is acceptable. Recalibrate after cleaning.

The included conductivity probe features a removable probe guard for easy cleaning. To remove - grip yellow probe guard and twist clockwise to release locking notch, then slide off.



NOTE: Remember to re-attach the probe guard - failure to do so will result in erroneous readings!

7 Troubleshooting

Problem	Cause	Solution
No display	Batteries are not installed, were improperly installed, or are too weak	Install batteries with correct +/- polarity. Replace with new batteries
"**LO**" displays in the LCD	Low battery	Replace batteries
Unstable readings	a) Air bubbles in probe b) Dirty probe c) Probe not immersed enough d) External noise pickup or induction caused by nearby electric motor e) Broken probe	a) Tap probe to remove bubbles b) Clean probe & recalibrate c) Make sure sample entirely covers the probe sensors d) Move or switch off interfering motor e) Replace probe
Slow response	Dirty / Oily probe	Clean & recondition probe
Inaccurate readings / can't calibrate	Probe guard not installed or calibration solution incorrect	Install probe guard & replace calibration solutions
"**Er1**" COND / TDS	Attempted calibration value was not within the ±40% auto calibration window	Check the value of the conductivity calibration solution. Switch to manual calibration mode and re-calibrate
"**Er2**" Temperature calibration error	Auto calibration was not within (0 - 50°C) temperature range	Ensure that the temperature is within the acceptable range

		COND	TDS
Conductivity Ranges (Resolution)	0 to 20.00 (0.01) µS/cm 20.0 to 200.0 (0.1) µS/cm 200 to 2000 (1) µS/cm 2.01 to 20.00 (0.01) mS/cm 20.1 to 200.0 (0.1) mS/cm	✓	
TDS Ranges (Resolution)	0 to 10.00 (0.01) ppm 10.0 to 100.0 (0.1) ppm 100 to 1000 (1) ppm 1.01 to 20.00 (0.01) ppt 20.1 up to 200.0* (0.1) ppt *depending on TDS factor used		✓
Salinity % Resolution	0.10 to 5.00% 0.01%		
Salinity ppt Resolution	1.0 to 50.0 ppt 0.1 ppt		
Accuracy	±1% full scale	✓	✓
Temperature Resolution Accuracy	-10.0 to 110.0ºC 0.1ºC ±0.5ºC	✓	✓
Cell Constant	Selectable	0.1, 1, 10	0.1, 1, 10
Temperature Compensation	Automatic / Manual (from 0 to 50 °C)	✓	✓
Temperature Coefficient	0.0 to 3.0% per °C	✓	✓
Normalisation Temperature	25.0 , 20.0 °C (selectable)	✓	✓
TDS Factor	0.4 to 1.0	✓	✓
Calibration points	Maximum 1 per range	5	5
Auto - or Manual-ranging	Selectable	✓	✓
Auto standard recognition	Selectable	✓	

Features	
Auto-Buffer Recognition	Yes
Hold Function	Yes "HO"
Low Battery Indicator	Yes "LO"
Auto Shut Off	20 minutes after last key operation
Display	Custom LCD
Operating Temperature	0 to 50ºC
Power Requirements	(4) AAA alkaline batteries (included)
Battery Life	>100 hours
Meter Dimensions / Weight	15.7 x 8.5 x 4.2 cm / 255 g

Conductance is a quantity associated with the ability of primarily aqueous solutions to carry an electrical current, I, between two metallic electrodes when a voltage V is connected to them. Though water itself is a rather poor conductor of electricity, the presence of ions in the water increases its conductance considerably, the current being carried by the migration of the dissolved ions. This is a clear distinction from the conduction of current through metal, which results from electron transport.

The conductance of a solution is proportional to and a good, though non-specific indicator of the concentration of ionic species present, as well as their charge and mobility. It is intuitive that higher concentrations of ions in a liquid will conduct more current. Conductance derives from Ohms law, V = IR, and is defined as the reciprocal of the electrical resistance of a solution.

C = 1 / R where C is conductance (siemens), R is resistance (ohms)

One can combine Ohms law with the definition of conductance, and the resulting relationship is:

C = I / V where I is current (amps), V is potential (volts)

In practice, conductivity measurements involve determining the current through a small portion of solution between two parallel electrode plates when an AC voltage is applied. Conductivity values are related to the conductance (and thus the resistance) of a solution by the physical dimensions - area and length - or the cell constant of the measuring electrode. If the dimensions of the electrodes are such that the area of the parallel plates is very large, it is reasonable that more ions can reside between the plates, and more current can be measured. The physical distance between the plates is also critical, as it effects the strength of the electric field between the plates. If the plates are close and the electric field is strong, ions will reach the plates more quickly than if the plates are far apart and the electric field is weak. By using cells with defined plate areas and separation distances, it is possible to standardise or specify conductance measurements.

Thus derives the term specific conductance or conductivity.

The relationship between conductance and specific conductivity is:

Specific Conductivity, S.C. = (Conductance) (cell constant, k)
= siemens * cm/cm^2
= siemens/cm

where C is the conductance (siemens), k is the cell constant, length/area or cm/cm^2

Since the basic unit of electrical resistance is the ohm, and conductance is the reciprocal of resistance, the basic unit of conductance was originally designated a "mho" - ohm spelled backwards - however, this term has been replace by the term "Siemens". Conductivity measurements are reported as Siemens/cm, since the value is measured between opposite faces of a cell of a known cubic configuration. With most aqueous solutions, conductivity quantities are most frequently measured in microSiemens per cm (µS/cm) or milliSiemens per cm (mS/cm).

The total dissolved solids scale approximate the ppm TDS in surface waters by multiplying the conductivity of a sample by a factor, 0.66.

Some users prefer the use of resistivity units to describe their water, particularly where high purity water is involved. The unit most often used to describe resistivity is megohmcm, which are simply the reciprocal of conductivity (µS/cm). The chart below shows the relationship between these units.

Conductivity (µS/cm)	Resistivity (Mega ohm-cm)
0.056	18
0.1	10
1.0	1.0
2.5	0.4
10.0	0.1

Conductivity and Temperature

Conductivity in aqueous solutions reflects the concentration, mobility, and charge of the ions in solution. The conductivity of a solution will increase with increasing temperature, as many phenomena influencing conductivity such as solution viscosity are affected by temperature.

The relationship between conductivity and temperature is predictable and usually expressed as relative % change per degree centigrade. This temperature coefficient (% change per degree) depends on the composition of the solution being measured. Extremely pure water exhibits a temperature coefficient of 5.2%, and concentrated salt solutions about 1.5%.

Since temperature affects the conductivity measurement so profoundly, usual practice is to reference the conductivity to a standard temperature - typically 25°C. Select 20°C or 25°C as the normalisation temperature in advanced setup.

Enter the temperature coefficient which best suits your sample and use an ATC probe to automatically temperature compensate back to the chosen reference temperature.

10 Calibration Tips

You only need one calibration for measurement throughout the entire range of the meter. If a range was not calibrated, the meter automatically detects the closest range calibrated and uses that calibration information. However, only the ranges that were calibrated have maximum accuracy.

If you are measuring in ranges near to or greater than 20 mS/cm (10 ppt), or near to or lower than 100 µS/cm (50 ppm), suggested calibration frequency is at least weekly.

If you are measuring in the mid-ranges and you wash the probe in deionised water and store it dry, suggested calibration frequency is at least monthly.

Wet the probe for 10 minutes before calibrating or taking readings to saturate the probe surface and minimise drift. If you take measurements at extreme temperatures, calibrate the meter at least once a week.

You should only use the probe specified for these meters. These probes have a built-in temperature sensor. If you use a different probe without a temperature sensor, you must measure the solution temperature separately and manually enter the solution temperature.

You can calibrate your meter using TDS calibration standard solutions. The calibration standard only needs to give the TDS value at a standard temperature such as 25°C. To determine the conductivity-to-TDS conversion factor use the following formula:

Factor = Actual TDS ÷ Actual Conductivity @ 25°C

Actual TDS: Value from the solution bottle label or as a standard you make using high purity water and precisely weighed salts.

Tip: ppm = milligram of salt(s) per litre of water

Actual Conductivity: Value measured using a properly calibrated Conductivity/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 in ppm the conductivity value must be in µS/cm; if the TDS value is in ppt the conductivity value must be in mS/cm.

Check your factor by multiplying the conductivity reading by the factor in the above formula. The result should be in TDS value.

Tip: When the TDS factor is set to 1.0, Conductivity = TDS.

Calculating Temperature Coefficients

To determine the temperature coefficient of your sample solution use this formula:

$$t_c = 100 \times \frac{C_{T2} - C_{T1}}{C_{T1}(T_2 - 25) - C_{T2}(T_1 - 25)}$$

Where:

t_c	= Temperature coefficient	**25**	= 25°C
C_{T1}	= Conductivity at Temp 1	C_{T2}	= Conductivity at Temp 2
T_1	= Temp 1	T_2	= Temp 2

NOTE: A controlled temperature water bath is ideal for this procedure.

1. Immerse the probe into a sample of your solution and adjust the temperature coefficient to 0% (that is, no compensation) by following instructions as described in **Section 6.5 - Temperature Coefficient**.
2. Wait for 5 minutes. Note T_1 and C_{T1} (conductivity at T_1).
3. Condition the sample solution and probe to a temperature (T_2) that is about 5°C to 10°C different from T_1, and note the conductivity reading C_{T2}.

NOTE: Record your results for future reference. Ideally T_1 and T_2 should bracket your measurement temperature, and should not differ by more than 5°C.

4. Calculate the temperature coefficient of your solution according to the formula shown above.
5. Enter the calculated temperature coefficient into the meter.

   See **Section 5.5 - Temperature Coefficient**.

The calculated temperature coefficient will now be applied to all the meter readings.

Replacement Parts and Accessories

Description	Product Code
Replacement Conductivity/TDS Probe	PT 142/1
12.88mS KCl Conductivity Solution (500ml)	PT 142/2
1412µS KCl Conductivity Solution (500ml)	PT 142/3
74µS KCl Conductivity Solution (500ml)	PT 142/4
3000ppm (442) TDS Solution (500ml)	PT 142/8
300ppm (442) TDS Solution (500ml)	PT 142/9
50ppm (442) TDS Solution (500ml)	PT 142/10
Deionised Water Wash Solution (500ml)	PT 1250
Micro 600 COND Complete Kit	PT 1220
Micro 600 TDS Complete Kit	PT 1210

14.0 Warranty

The Palintest Micro 600 COND/TDS Meter is guaranteed for a period of **three years** from date of purchase - its associated Conductivity/TDS electrode is guaranteed for a period of **six months** from date of purchase. This guarantee excludes accidental damage, or damage caused by unauthorised repair or misuse.

Should repair be necessary, please contact Palintest or your local distributor quoting the serial number on the base of the instrument. This guarantee does not affect your statutory rights.

14.1 Certificate of Conformity

Palintest Ltd certify this instrument, PT1210 and PT1220 has been tested and calibrated to meet all performance specifications.

It is recommended that regular calibration of the probe is carried out in accordance with the instruction manual to ensure correct operation.

The process used to verify this product is carried out in accordance with procedures contained within Palintest's certified ISO 9001 Business Management System.

For more information on Palintest products, contact your nearest Palintest office or visit our website

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V1-05/19
ZI INST 1220