

# OPERATION MANUAL

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## JENCO MODEL 3250M/3251M MICROCOMPUTER BASED Conductivity/TDS/Salinity & Temperature PORTABLE METER

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## **I. INITIAL INSPECTION**

Carefully unpack the instrument and accessories. Inspect for damages made in shipment. If any damage is found, notify your Jenco representative immediately. All packing materials should be saved until satisfactory operation is confirmed.

## **II. GENERAL INTRODUCTION**

The Jenco Model 3250M/3251M Handheld Conductivity, TDS (Total Dissolved Solids), Salinity, Temperature System is a rugged, microprocessor based instrument designed to use a four electrode cell to operate in field laboratories and process control applications.

The model 3250M/3251M microprocessor allows the user to easily recalibrate the parameters of the probe. A few keystrokes will adjust all the parameters for conductivity and TDS. The model 3250M/3251M system supports three popular base of cell constants (0.1, 1.0,10.0). The microprocessor also performs a self-diagnostic routine every time you turn on the unit providing you with basic information about the current cell constant, TDS factor and stability of the instrument.

The model 3250M/3251M is also equipped with a non-volatile memory allowing the user to store 50 different sets of readings. This model 3250M/3251M will also assign a site number for each set of readings The user will be able review the data directly in the instrument or download the data via RS232C for further analysis.

The system simultaneously displays temperature in °C along with Conductivity, TDS or Salinity. The user can switch back and forth from all these displays by just pushing a single key.

This instrument is powered by six AAA-size alkaline batteries or with a UL approved AC adapter. The instrument also displays a "LO BAT" message when the batteries are in need of replacement.

This instrument is also splash proof making it a versatile tool for conductivity/TDS/salinity /temperature applications.

### III. USING THE JENCO MODEL 3250M/3251M

#### PRECAUTIONS

The Model 3250M/3251M case is SPLASH PROOF, but the instrument should not be used under water since the instrument and the whole probe is not WATERPROOF. The SPLASH PROOF feature is to prevent permanent damage to the instrument when accidentally splashed with non-corrosive solutions.

Take the following measures immediately in the event that the instrument is dampened in any kind of solution.

1. Place all the rubber caps tightly in all the instrument's connector holes then wipe the instrument thoroughly with dry cloth. After wiping, the connectors should be inspected and cleaned to

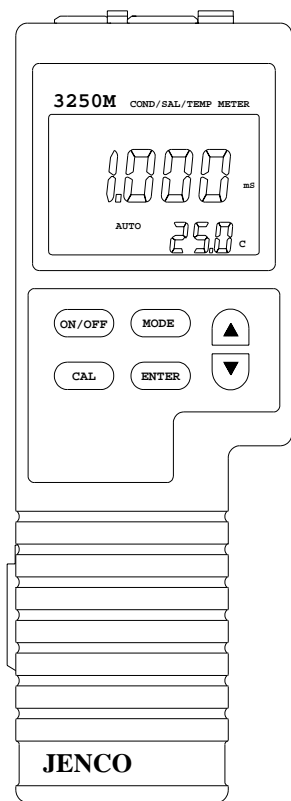


Figure 1

remove all contaminants that might affect the probe connections.

2.Wait for the instrument and probe connector to be completely dry before resuming operation.

3. If unsatisfactory results are gained after doing the above, notify your Jenco representative for possible repair or replacement (See WARRANTY).

### THE KEYPAD

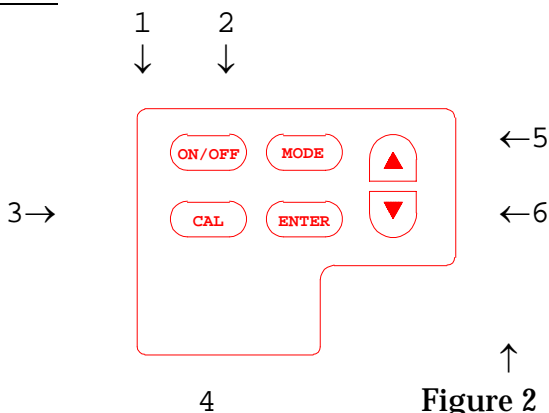


Figure 2

1. The [ON/OFF] key.

This key will turn on or turn off the instrument. The last display mode will be saved, except during Calibration/Setting, Recall and Erase mode where it will default to Conductivity mode.

2. The [MODE] key.

2a. In normal operation this key will select the display to Conductivity, TDS, Salinity, Recall and Erase mode.

2b. In Calibration/Setting mode this key will **exit** the current calibration/setting and go to the next calibration/setting parameter.

3. The [CAL] key.

During normal operation this key will change the mode from normal to Calibration/Setting mode. (See CALIBRATION/ SETTING SET-UP for more details.)

4. The [ENTER] key.

4a. During normal operation pressing this key for about 2 seconds will save all the readings in the next available site number.

4b. During RECALL mode this key will cycle the display to the saved data (conductivity/temperature, TDS/temperature & salinity/temperature) in the current site. A “RC” text will be displayed at the upper right corner to indicate you are in RECALL mode viewing the saved data.

4c. During CALIBRATION/SETTING mode this key will save the current value of the displayed parameter.

5. The [ Δ ] key.

5a. This key is used during Calibration/Setting mode to increment the value/option of the display.

5b. During Conductivity and TDS mode this key will cycle the display from auto ranging to manual ranging. (see AUTO/MANUAL RANGING IN CONDUCTIVITY/TDS)

5c. In Recall mode this will move to a lower (older) site number. Moving the site number will in no way change in which site the next data will be saved. It will always save in the next open site number.

6. The [ ∇ ] key.

6a. This key is used during Calibration to decrement the value/option of the display.

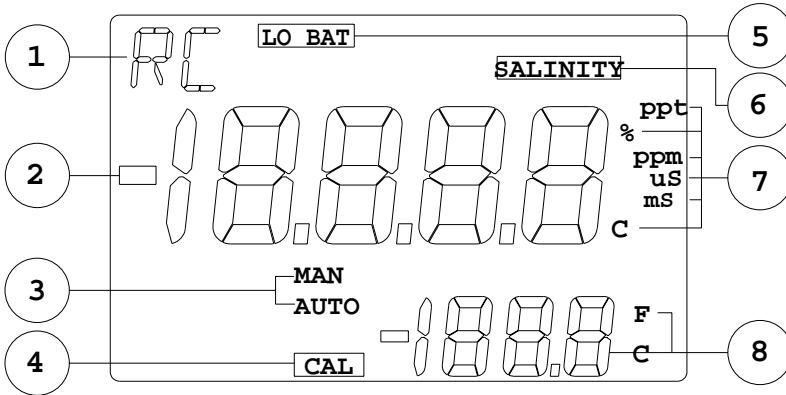
6b. In Recall mode this will move to higher (newer) site number. Moving the site number will in no way change in which site the next data will be saved. It will always save in the next open site number.

7. [∇] and [ENTER] keys.

Pressing this combination during ERASE mode for about 5 seconds will erase **ALL** data in the non-volatile memory. Data in all 50 sites will be erased completely. Do not use the erase function until all recorded data has been reviewed or

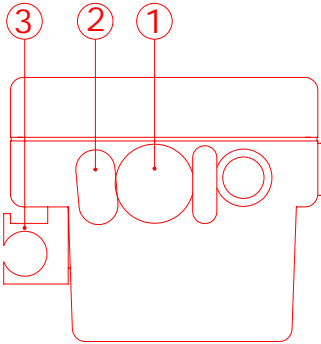
transcribed/downloaded outside the model 3250M3251M.  
(SEE SAVING AND RECALLING DATA.)

## THE DISPLAY



1. “RC” – this will show-up if the user is viewing the saved data.
2. MAJOR LCD DISPLAY
3. “MAN” / “AUTO” – “AUTO” will indicate that the unit is auto ranging, while “MAN” will indicate manual range.
4. “CAL” – this will indicate that the user is in CALIBRATION/ SETTING mode.
5. “LOBAT” – low battery voltage indicator.
6. “SALINITY” – this will show-up if the user is in SALINITY mode.
7.
  - a. “uS”(microsiemens), “mS”(millisiemens)– units for conductivity.
  - b. “ppm”(parts per million) – unit for TDS.
  - c. “ppt”(parts per thousand) – unit for TDS and salinity.
  - d. “°C”(degree centigrade) – temperature reference unit.
  - e. “%”(percent) – temperature coefficient unit.
8. MINOR LCD DISPLAY and Temperature units.

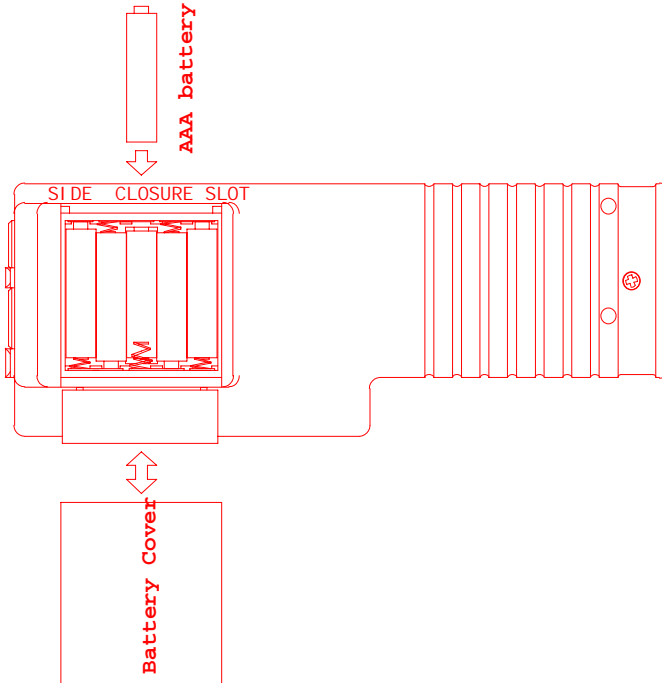
## CONNECTORS



1. PROBE connector
2. AC ADAPTOR connector
3. PROBE holder

Figure 4

## REPLACING THE BATTERIES



1. Position the meter so that the bottom part of the meter is facing up. (Refer to figure 5.)

Insert a coin in the side closure slot. Tilt the coin and thrust it upward to open the battery compartment and lift the closure up.

2. Remove all of the old batteries and insert a new

set of batteries ensuring the polarities are correct.



## **TURNING ON/OFF THE INSTRUMENT**

Once the batteries are installed correctly and/or an AC adapter is installed and plugged in the unit will turn ON at once. Pressing the [ON/OFF] key will turn on or turn off the instrument. When the unit is not in use the user should turn off the instrument to save battery life. By just unplugging the AC adapter will not turn off the instrument if batteries are present. It would automatically switch to battery power and will continue to operate.

After the unit is turned on the unit will display all segments for a few seconds then it will display the software version, current cell constant & TDS Factor. If the instrument detects a internal problem it will display an error message for a few seconds. You can learn about these error messages by consulting the **ERROR DISPLAYS** of this manual.

After the self-diagnostic is complete the temperature will be displayed in the lower right of the display and the instrument is ready to make a measurement. Just immerse the probe halfway to the liquid. If possible do not allow the probe to touch any solid object in the solution. There should be no air bubbles around the probe either. Shaking or moving the probe vigorously before recording any measurement will dislodge any bubbles formed in the probe.

**IF THE PROBE /INSTRUMENT IS NEW A CELL CONSTANT CALIBRATION MUST BE PERFORMED BEFORE USE, SINCE THE CELL CONSTANT IS SLIGHTLY DIFFERENT FOR EACH CONDUCTIVITY PROBE. REFER TO CALIBRATION/SETTING SET-UP FOR PROCEDURES.**

## **PROBE HANDLING AND MAINTENANCE**

### **Handling the probe**

To ensure accurate and repeatable results :

1. The probe (cell) must be clean before making any measurements. If measuring low conductivity solutions, extra ordinary cleanliness may be necessary.
2. The probe cell plates must totally submerged in the solution. The electrode chamber must be free of trapped air or particulates. You may need to tap the probe gently to dislodge any air bubbles.
3. Ideally, the probe should be at least 1/4 inch away from any object, including the sides and bottom of the container.
4. Stirring may be necessary for high accuracy readings.
5. If possible, isolate from ground potential the solution container.
6. Electrical fields and stray currents caused by stirrer motors, heaters, etc., can interfere with the measurements. The user should determine the effects of these and make the necessary corrections either by shielding or by disconnecting those units that cause trouble.
7. Always rinse the cell carefully before using it in another solution.
8. Never store a dirty or contaminated probe.

### **Storing the probe**

1. Always rinse the probe thoroughly with de-ionized or clean tap water to remove contaminants before storing it.
2. For short-term storage it recommended to immerse the probe in de-ionized water to keep the plates wet. For long-term storage, after rinsing the probe thoroughly the exterior body should be wiped dry before storing it.

## IV. MODEL 3250M/3251M MODES

**1. Conductivity** – The conductivity of solutions of ionic species is highly dependent on temperature, varying as much as 3% for each change of 1°C (Temperature Coefficient (TC) = 3%/°C). In addition, the temperature coefficient itself varies with the nature of the ionic species present.

Because the exact composition of a natural media is usually not known, it is best to report a conductivity at a particular temperature, e.g. 10.2 mS at 15°C. However in many cases, it is also useful to compensate for the temperature dependence in order to determine at a glance if gross changes are occurring in the ionic content of the medium over time. For this reason, the model 3250M/3251M allows the user to output conductivity in either raw or compensated form. If the user Temperature Coefficient ( $T_{\text{coeff}}$ ) is set to 0.00% then an **uncompensated Conductivity** is output to the screen. If the TC is not zero then the Model 3250M/3251M uses the temperature,  $T_{\text{coeff}}$ , **raw** Conductivity and the reference temperature ( $T_{\text{ref}}$ ) to display the **compensated Conductivity**.

The calculation is carried out as in the equation below:

$$\text{Conductivity}_{\text{Comp.}} = \text{Conductivity}_{\text{Uncomp.}} / (1 + T_{\text{coeff}} * (T_{\text{sol}} - T_{\text{ref}})).$$

Where:  $T_{\text{sol}}$  is the temperature of the solution.

Using the default  $T_{\text{ref}}$  &  $T_{\text{coeff}}$  values will be somewhat inaccurate, unless the solution being measured consists of pure KCl in water, but this will provide a close approximation for solutions of many common salts such as NaCl and  $\text{NH}_4\text{Cl}$  and for seawater.

Setting the temperature coefficient to 0.00% will yield a measurement of the conductive material in the solution with no regard to temperature (uncompensated conductivity).

**Note:**

The TDS is based on the specific conductance reading of the solution, setting the  $T_{\text{coeff}}$  to 0.00% will change the reading of conductivity to uncompensated conductivity.

2. **TDS** – The calculation is carried out as in the equation below:

$$\text{TDS} = \text{Compensated Conductivity} * (\text{TDS Factor})$$

**TDS** – is an approximation of the total weight of all solids that are dissolved in a volume of water. This is expressed in **ppt** (parts per thousand also referred as g/L(gram per liter) or **ppm** (parts per million) also referred as mg/L (milligram per liter).

In general, the total dissolved solids concentration is the sum of the cations (+charged) and anions (-charged) ions in the solution. The TDS reading provides a qualitative measure of the amount of dissolved ions, but does not tell us the nature or ion relationships.

The TDS Factor is just a simple multiplier that must be determined by the user experimentally. The default factor of 0.5 is only useful for a coarse estimate of TDS.

3. **Salinity** - a calculation based on the Uncompensated Conductivity and Temperature. Even if the  $T_{\text{coeff}}$  is >0.00% the Salinity still uses the uncompensated conductivity value.

4. **Recall** [rcl] - this is a special mode where you can display the data you saved during normal operation.

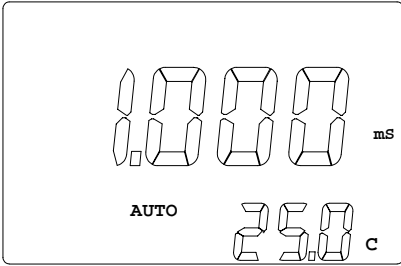
5. **Erase** [EraS]- this is a special mode where you can delete **all** the saved data.

The temperature of the solution is always displayed along side Conductivity, TDS or Salinity.

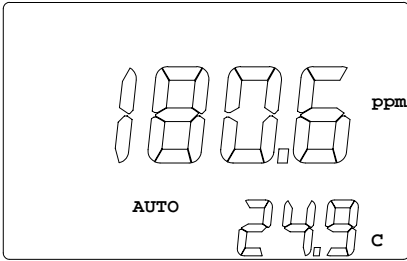
**Note:**

Every time the unit is turned OFF the last normal (Conductivity, TDS & Salinity only) mode is saved so that when you turn the instrument ON again it will return to this mode. Turning OFF at Recall or Erase mode will set the mode back to Conductivity mode.

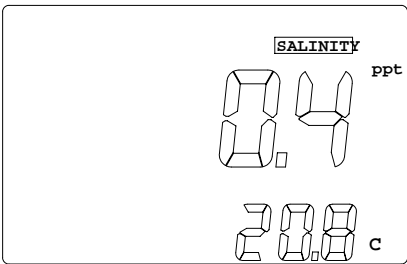
To choose any measurement mode (temperature is always included) simply press and release the [MODE] key. Carefully observe the annunciators units at the far side of the LCD.



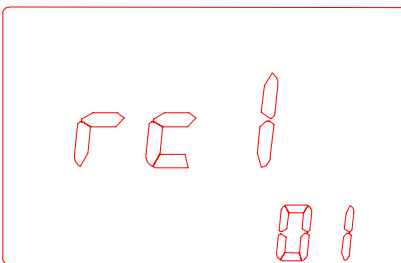
This is the Compensated Conductivity mode. The "AUTO" will also be displayed if the unit is auto ranging or "MAN" if the unit is in manual range.



This is the TDS mode. The "AUTO" will also be displayed if the unit is auto ranging or "MAN" if the unit is in manual range.



This is the Salinity mode, the "SALINITY" and "ppt" annunciators will be displayed at the same time.

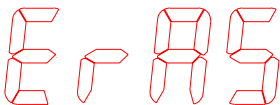


respectively.

This is the Recall mode the lower display is the site number.

User can press [ENTER] to view the saved data in this site number.

The user can also press the [▲] or [▼] key anytime to move to a lower site number or higher site number

The image shows a red-bordered rectangular area containing the text 'E-RAS' displayed in a red, hollow, blocky font. The 'E' is on the left, followed by a hyphen, then 'R', 'A', and 'S'.

This is the Erase mode.

User can press the [▽] and [ENTER] keys simultaneously for about 5 seconds to erase ALL saved data.

## AUTO RANGING

This model is an auto ranging instrument. This means whatever the Conductivity or TDS reading (with in the specifications of the instrument) of the solution; all you need to do is immerse the probe into the solution. The “**AUTO**” annunciator will be displayed if you are in Conductivity or TDS mode and the instrument is in auto ranging display.

After immersing the probe into the solution, the instrument will be place in a search routine to find the right range for the solution, this auto ranging will take as long as 5 seconds. During this search the instrument will display “**RANG**” on the LCD to indicate it is searching for the right range.

## MANUAL RANGING

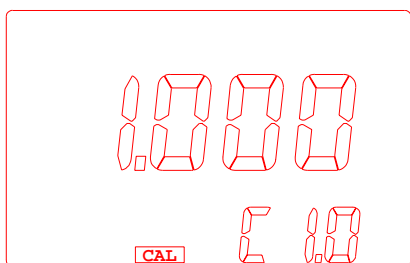
If you choose to disable the auto ranging feature and choose your own range, you can do this by pressing and releasing the [ Δ ] key while in any Conductivity or TDS mode. You will be switching to the four ranges of the model 3250M/3251M then back to auto ranging again. During **MANUAL RANGING** the “**MAN**” annunciator will be displayed to indicate you are in **MANUAL RANGING**. Every time you turn off the unit it will return to auto ranging again.

## V. CALIBRATION/SETTING MODE

### BASIC PROBE CELL CONSTANT

THIS PROCEDURE IS USUALLY NOT REQUIRED SINCE THIS OPTION IS SET AT THE FACTORY, BUT IF YOU WILL USE ANOTHER PROBE WHICH IS DIFFERENT FROM THE DEFAULT THEN YOU HAVE TO DO THIS PROCEDURE. EVERY TIME YOU SET A NEW CELL CONSTANT, YOU MUST ALSO CALIBRATE THE PROBE. REFER TO CELL CONSTANT CALIBRATION.

This is the basic probe cell constant. You can choose **0.1**, **1.0** or **10**. Be careful in changing this option since it will set the actual cell constant to this value and you must calibrate the cell constant before you can accurately use the unit.



To change the probe basic cell constant follow these steps:

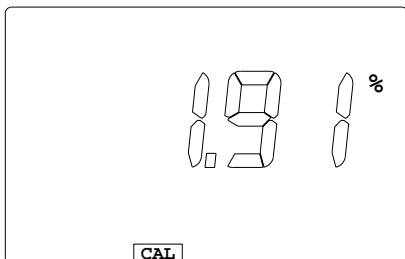
1. After the power-on diagnostics, press the [MODE] key to move to Conductivity mode if the display is not already there, press the [CAL] key, the CAL annunciator will appear on the lower left of the display. The instrument will display the actual (calibrated previously or default) cell constant while the lower part of the LCD will display the current selected BASIC PROBE CELL CONSTANT preceded with a capital "C".

2 Using the [  $\Delta$  ] and [  $\nabla$  ] keys you can now change the cell probe constant to the 3 available cell constants (0.1, 1.0 and 10.0).

3. To save the new value you can press the [ENTER] key or press the [MODE] key to exit (and return to normal operation). If you press the [ENTER] key the word "SAVE" will be displayed to indicate that a new basic probe cell constant is accepted. The instrument will switch to Temperature Coefficient setting.

## TEMPERATURE COEFFICIENT

This will be used by conductivity if you want your display to be compensated. Setting this option to 0.00% will disable compensation.



To change the temperature coefficient follow these steps:

1. After the power-on diagnostics, press the [MODE] key to move to Conductivity or TDS mode if the display is not already there,

press

the [CAL] key, The unit will switch to BASIC PROBE CELL CONSTANT if the unit is coming from Conductivity display, otherwise it will switch directly to Temperature coefficient if coming from TDS display. Press the [MODE] key again if the unit is in BASIC PROBE CELL CONSTANT. The large portion will display **1.91 %** or a value set previously using this procedure.

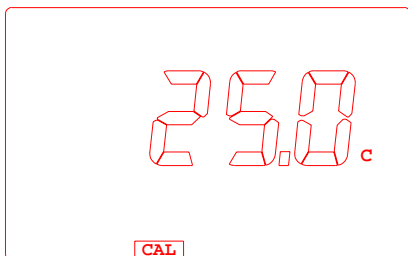
2. Using the [▲] and [▼] keys you can now change the coefficient to the desired value.
3. To save the new value you can press the [ENTER] key or press [MODE] to exit (and go to the next calibration parameter). If you press the [ENTER] key, the word "SAVE" will be displayed to indicate that a new temperature coefficient is accepted and then will switch to Temperature Reference setting.



## TEMPERATURE REFERENCE

If the Temperature Coefficient is not zero then the model 3250M/3251M will use the Temperature reference to calculate and display the compensated conductivity. The display will be the value as if the temperature is the Reference Temperature.

To change the temperature reference, follow these steps:

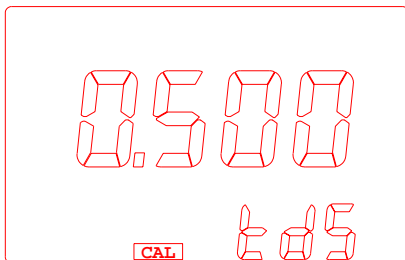


1. After the power-on diagnostics, press the [MODE] key to move to Conductivity or TDS mode if the display is not already there, press the [CAL] key, The unit switch to BASIC PROBE CELL CONSTANT if the unit is coming from Conductivity

display, otherwise it will switch directly to Temperature coefficient if coming from TDS display. Press the [MODE] key again if the unit is in BASIC PROBE CELL CONSTANT. Press the [MODE] key again if the unit is in Temperature Coefficient. The large portion will display **25.0** °C or a value set previously using this procedure.

3. Using the [▲] and [▼] keys you can now change the Temperature Reference to the desired value.
4. To save the new value you can press the [ENTER] key or press to [MODE] exit (and go to the next calibration parameter). If you press [ENTER] key the word "SAVE" will be displayed to indicate that a new temperature reference is accepted and will switch to Cell Constant Calibration.

## TDS FACTOR SETTING



The TDS factor is multiplied with the conductivity to get the TDS value. The user can directly adjust this value from 0.300 to 1.000. The user must experimentally determine this factor. Even if this

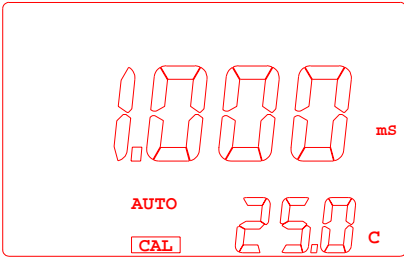
**Figure 6** factor is determined any change in the ionic species in the sample will affect the TDS reading. Unless the ionic species in the sample remain constant, the TDS can't be determined accurately. The default value of 0.5 is only useful for a coarse estimate of TDS.

To change the TDS factor follow these steps:

1. After the power-on, press the [MODE] key to go to TDS display.
2. Press the [CAL] key, the CAL annunciator will appear on the lower left of the display.
3. Press the [MODE] key until you reach the TDS FACTOR SETTING (figure 6).
4. The large portion of the LCD will display the current TDS factor.
5. Using the [  $\Delta$  ] and [  $\nabla$  ] keys you can now change the display to the desired value.
6. To save the new value, press the [ENTER] key or the [MODE] key to exit. If you press [ENTER] the word "SAVE" will be displayed to indicate that a new TDS factor is accepted and will switch back to normal operation.

## CELL CONSTANT CALIBRATION

To calibrate the Cell Constant follow these steps:



**Figure 7** [MODE] key to go to Conductivity display (if you are calibrating conductivity).

1. After the power-on diagnostics, immerse the probe to a known standard conductivity (Refer to **PREPARING STANDARD SOLUTIONS.**) which is chosen to calibrate your probe. Wait for the temperature to stabilize for a few seconds. Press the [MODE] key to go to Conductivity display (if you are calibrating conductivity).
2. Press the [CAL] key, the CAL annunciator will appear on the lower left of the display.
3. Press the [MODE] key until reach the CELL CONSTANT CALIBRATION (figure 7).
4. The large portion of the LCD will display the rough conductivity value of the standard solution, depending how far the current Cell Constant the true Cell Constant of the probe.
5. Using the [ $\wedge$ ] or [ $\vee$ ] keys you can now change the display to reflect the known standard Conductivity at the set Temperature Reference.
6. To save the new value you can press [ENTER] to save or the [MODE] key to exit. If you press [ENTER] the word "SAVE" will be displayed to indicate that a new probe cell constant is accepted and will switch normal operation.

If you encounter any errors during calibration check the chapter on ERROR DISPLAYS for the possible cause of the error.

**Before Cell Constant Calibration remember to do the following:**

1. Use properly stored standard solutions and a clean calibration container.

2. Rinse the probe with de-ionized or distilled water (wipe dry) before using in standard solutions.
3. After immersing into the solution let the reading stabilize for about 1 minute and shake the probe lightly to remove any air bubbles.
4. If possible and to minimize errors perform the calibration as close as possible to the selected reference temperature.

### **Step by step Cell Constant Calibration for the Model 3250M/3251M.**

1. Clean the probe thoroughly.
2. Wait for about 30 minutes after you turned on the instrument to stabilize the circuitry before calibrating the probe.
3. Choose a calibration solution which most similar to the sample being measured.
  - a. For seawater select 50 mS conductivity standard.
  - b. For fresh water select 1 mS conductivity standard.
  - c. For brackish water select 10 mS conductivity standard.
4. Select the correct base cell constant for the probe
5. Input the temperature coefficient of the standard solution. Most standard salt calibration solution has a  $T_{\text{coeff}}$  between 1.91% to 2.00%. If the  $T_{\text{coeff}}$  of standard solution is not available use the default of 2.00%.
6. You must set the Reference Temperature to 25°C as this is the standard temperature for commercial solutions, in any case you can still use another reference temperature.
7. Immerse the probe into the solution. Do not let the probe touch any part of the container and allow at least 1 minute so the temperature reading will stabilize.
8. Shake the probe lightly to remove air bubbles from the probe.
9. Wait for the conductivity reading to be stable.
10. Input the standard solution value by using the [ $\blacktriangle$ ] or [ $\blacktriangledown$ ] keys.

11. Press the [ENTER] key to save the standard solution value. The unit will display "SAVE" to indicate the new cell constant is accepted.
12. The model 3250M/3251M is now ready for conductivity measurements.

**Before reading the sample (unknown solution):**

1. Clean the probe thoroughly.
2. Switch to Conductivity mode.
3. If you want a compensated reading, input the most similar Temperature Coefficient of the sample or use the default of 2.00%. Set the Temperature coefficient to 0.00% if you want just the raw uncompensated conductivity.
4. If the  $T_{\text{coeff}}$  is not 0.00% you need to select a reference temperature or set it to the default of 25°C.
5. Immerse the probe into the solution. Do not let the probe touch any part of the container and allow at least 1 minute so the temperature reading will stabilize.
6. Shake the probe lightly to remove air bubbles from the probe.
7. Read the display.

## **VI. SAVING AND RECALLING DATA**

The Model 3250M/3251M is equipped with a non-volatile memory that can store up to 50 different sets of readings. Non-volatile memory will be retained even if power is lost.

### **A. SAVING READINGS TO MEMORY**

1. While in Conductivity, TDS or Salinity mode press the [ENTER] key for about 2 seconds. To indicate a successful save, the unit will display "SAVE" and the site number for a brief moment.
2. When all 50 sites are used up, the LCD will display "FULL". This message will remain on the LCD (even after power down) until a key (except for the [ON/OFF] key) is pressed.

3. Once you have acknowledged that the memory is full, any subsequent saving of data will begin overwriting the existing data starting at site #1.

## **B. RECALLING READINGS FROM MEMORY**

1. Press the [MODE] key repeatedly until Recall mode ("rcl" see MODEL 3250M/3251M modes) is displayed on the screen along with the site number on lower right corner.
2. Press the [ENTER] key to display the last set of data that was saved. The model 3250M/3251M will display Conductivity and temperature and the letters "RC" on the upper left corner to indicate you are in Recall mode. Press the [ENTER] key again to display the TDS and temperature. The [ENTER] key will cycle the reading from Conductivity/ Temperature, TDS/ Temperature and Salinity/ Temperature.
3. The user can also press the [▲] or [▼] key anytime to move to a lower site number or higher site number respectively.

Here is an example of the model 3250M/3251M memory.

Site #1 (oldest data)

Site #2

Site #3 ← for example if you are displaying site #3, then if you press the [▲] key the model 3250M/3251M will move to site #2.

Site #4

Site #5 (newest data)

Once the memory is full and the user acknowledges the FULL display by pressing any key, the instrument will start saving the newest data starting in site #1.

## **C. ERASING DATA**


- 1 To erase ALL the data stored in memory, press the [MODE] key repeatedly until the unit displays Erase mode ("Erase" see MODEL 3250M/3251M modes).

2. Press the [∇] and [ENTER] keys simultaneously for about 5 seconds. A countdown timer will be displayed at the lower part of the LCD. The LCD will display "dONE" after 5 seconds to indicate successful erasure and return to Conductivity mode.

**CAUTION:** All data will be erased, so be sure you have reviewed the saved data thoroughly or transcribed/downloaded to an archive before using this function.

## **VII. RS232C INTERFACE OPERATION(ONLY 3250M)**

### **A. INTRODUCTION**

This section assumes you are familiar with the basics of data communication, the RS232 interface, a rudimentary knowledge and a copy of the more popular Windows®  98+ computer languages capable of using an RS232 port.

A simple program must be written in order to send your command and receive data from the meter.

### **B. PREPARING THE METER**

This meter comes equipped with an RS232C interface. This meter communicates with a PC computer (100% IBM PC/AT compatibles) through a DB-9 interface connector. A standard RS232C cable used for interconnecting two IBM PC/ATs can also be used for this operation.

After you have connected the cable and turned on both the meter and the computer, you are now ready for the software preparation.

### **C. SOFTWARE**

A demo program written in Visual Basic® 6.0 and the source are included in the accompanying disk. Read the "Model 3250M RS232 protocol.doc" to understand the procedure used inside the demo program.

## VIII. ERROR DISPLAYS AND TROUBLESHOOTING

MAIN display	SECONDARY display	MODE	Possible cause(s) [Action(s)]
"OVer"	"ovr"	a. Conductivity b. TDS c. Salinity d. Cond-Cal	a. Temperature > 120.0°C. [Bring solution to a lower temp.] b. No temperature sensor.. [Use a temperature probe.]
"Over"	"udr"	a. Conductivity b. TDS c. Salinity d. Cond-Cal	a. Temperature < -10.0°C [Bring solution to a higher ttmp.] b. No temperature sensor. [Use a temperature probe.]
"Over"	-10.0~ 120.0°C	a. Conductivity b. TDS c. Salinity d. Cond-Cal	Reading > Specification. [Check calibration.] [Check temp. reference, and temp.] [Check Probe.]
"Over"	-10.0~ 120.0°C	Cond-Cal-after pressing [ENTER]	a.New cell constant > 30% of basic probe cell constant. [Use a new standard solution.] [Clean/replace probe.]
"Undr"	-10.0~ 120.0°C	a.Cond-Cal-after pressing [ENTER]	a.New cell constant <30% of basic probe cell constant.. [Use a new standard solution.] [Clean/replace probe.]
"rErr"	-10.0~ 120.0°C	a.Conductivity b.TDS	Reading exceeds user selected manual range. [Use auto-ranging or select a higher range.]
"Perr"	-10.0~ 120.0°C	a.Cond-Cal- after pressing [ENTER]	Standard solution reading = 0 uS. [Replace the standard solution.] [Clean/replace the probe.]
"Lerr"	-10.0~ 120.0°C	a.Conductivity b. Cond-Cal c.TDS	Temperature exceeds the values computed using user defined temperature coefficient and/or reference temperature. [Adjust temperature reference and/or temperature coefficient.] [Bring temperature to a suitable range.]



"Lerr"	-10.0~ 120.0°C	a. Conductivity b. Cond-Cal c. TDS	Temperature exceeds the values computed using user defined temperature coefficient and/or reference temperature. [Adjust temperature reference and/or temperature coefficient.] [Bring temperature to a suitable range.]
"Err"	a. "ra_" b. "ro_"	Power-on	a. Unit has failed its RAM test. b. Unit has failed its ROM test. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]
"FAIL"	"EEP"	Any Reading mode	Saving to EEPROM has failed. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]
"FULL"	blank	Any Reading mode	EEPROM is full. [See Saving and Recalling data.]

## IX. SPECIFICATIONS

### **Conductivity with cell constant probe**

Cell Constant	Range	Resolution	Accuracy
<b>K= 0.1 cm<sup>-1</sup></b>	0.000 to 9.999 $\mu\text{S}/\text{cm}$	0.001 $\mu\text{S}/\text{cm}$	$\pm 0.5\%$ FS
	10.00 to 99.99 $\mu\text{S}/\text{cm}$	0.01 $\mu\text{S}/\text{cm}$	$\pm 0.5\%$ FS
	100.0 to 999.9 $\mu\text{S}/\text{cm}$	0.1 $\mu\text{S}/\text{cm}$	$\pm 0.5\%$ FS
	1.000 to 3.000 $\text{mS}/\text{cm}$	0.001 $\text{mS}/\text{cm}$	$\pm 0.5\%$ FS
<b>K= 1 cm<sup>-1</sup></b>	0.00 to 99.99 $\mu\text{S}/\text{cm}$	0.01 $\mu\text{S}/\text{cm}$	$\pm 0.5\%$ FS
	100.0 to 999.9 $\mu\text{S}/\text{cm}$	0.1 $\mu\text{S}/\text{cm}$	$\pm 0.5\%$ FS
	1.000 to 9.999 $\text{mS}/\text{cm}$	0.001 $\text{mS}/\text{cm}$	$\pm 0.5\%$ FS
	10.00 to 30.00 $\text{mS}/\text{cm}$	0.01 $\text{mS}/\text{cm}$	$\pm 0.5\%$ FS
<b>K= 10 cm<sup>-1</sup></b>	0.0 to 999.9 $\mu\text{S}/\text{cm}$	0.1 $\mu\text{S}/\text{cm}$	$\pm 0.5\%$ FS
	1.000 to 9.999 $\text{mS}/\text{cm}$	0.001 $\text{mS}/\text{cm}$	$\pm 0.5\%$ FS
	10.00 to 99.99 $\text{mS}/\text{cm}$	0.01 $\text{mS}/\text{cm}$	$\pm 0.5\%$ FS
	100.0 to 300.0 $\text{mS}/\text{cm}$	0.1 $\text{mS}/\text{cm}$	$\pm 0.5\%$ FS

## **TDS**

The RANGE of TDS is the same as the conductivity but once the conductivity displays any kind of error (except range “rerr” error) the TDS display will display the same error too.

MODE	Range	Resolution	Accuracy
<b>Salinity</b>	0.0 to 80.0 ppt	0.1 ppt	± 1% FS
<b>Temperature</b>	-10.0 to 120.0 °C	0.1 °C	±0.2 °C

Reference temperature	: 15.0 to 25.0°C, keypad selectable at 0.1°C increment
Temperature coefficient	: 0.00 to 4.00%, keypad selectable at 0.01% increment
Basic probe cell number	: 0.1, 1.0 & 10.0, (user selectable)
Cell constant calibration	: Use known standard solution to calibrate conductivity.
TDS Factor	: 0.300 to 1.000 ( user selectable)
Display(Conductivity/Temp)	: 15mm/8.7mm High LCD
Power supply	: 6 AAA batteries/ 9V AC adapter
Battery Life (Alkaline)	: ~ 25 Hours (typical)
Dimensions	: 222mm(L) x 71mm(H) x 83mm(W)
Weight	: 470g (batteries included)

## **X. PREPARING STANDARD SOLUTIONS**

Suitable conductivity standards are available commercially or the user can prepare them using research grade reagents.

Here are some standard solutions the user can prepare to calibrate the probe of the model 3250M/3251M.

1. Standard solution of 1413  $\mu\text{S}$  at 25°C : accurately weight out 0.746 grams of research grade dried Potassium Chloride (KCl). Dissolve in 1000ml of deionized water

2. Standard solution of 12.90 mS at 25°C : accurately weight out 7.4365 grams of research grade dried Potassium Chloride (KCl). Dissolve in 1000ml of deionized water
3. Standard solution of 111.0 mS at 25°C : accurately weight out 74.2640 grams of research grade dried Potassium Chloride (KCl). Dissolve in 1000ml of deionized water

## **STORAGE**

You can store the remaining solution in a plastic container for one week but the air space between the cap and the solution must be kept to an absolute minimum. Storing the excess solution below 4°C can increase the storage life. If you have any doubt of the accuracy of the stored solution, a fresh batch should be prepared.

## **XI. WARRANTY**

Jenco Instruments, Ltd. warrants this product to be free from significant deviations in material and workmanship for a period of 3 years from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse, within the year period, please return-freight-prepaid and the correction of the defect will be made free of charge. If you purchased the item from our Jenco distributors and it is under warranty, please contact them to notify us of the situation. Jenco Service Department alone will determine if the product problem is due to deviations or customer misuse.

Out-of-warranty products will be repaired on a charge basis.

### **RETURN OF ITEMS**

Authorization must be obtained from one of our representatives before returning items for any reason. When applying for authorization, have the model and serial number handy, including data regarding the reason for return. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Jenco will not be responsible for damage resulting from careless or insufficient packing. A fee will be charged on all authorized returns.

**NOTE:** Jenco reserves the right to make improvements in design, construction and appearance of our products without notice.