Congratulations !

You have purchased the latest in handheld instruments for pool and spa testing. The **Aqua-TP** provides readout of Salinity, TDS, pH, ORP and Temperature in a single waterproof unit. We trust that your new **Aqua-TP** will give you many years of reliable service.

The **Aqua-TP** is a breeze to operate. This manual has been designed to help you get started, and also contains some handy application tips. If at any stage you require assistance, please contact either your local TPS representative or the TPS factory in Brisbane.

The manual is divided into the following sections:

1. **Table of Contents**
   Each major section of the handbook is clearly listed. Sub-sections have also been included to enable you to find the information you need at a glance.

2. **Introduction**
   The introduction has a diagram and explanation of the display and controls of the **Aqua-TP**. It also contains a full listing of all of the items that you should have received with your **Aqua-TP**. Please take the time to read this section, as it explains some of items that are mentioned in subsequent sections.

3. **Main Section**
   The main section of the handbook provides complete details of the **Aqua-TP**, including operating modes, calibration, troubleshooting, specifications, and warranty terms.

4. **Appendices**
   Appendices containing background information and application notes are provided at the back of this manual.

Model Aqua-TP
TDS-Salinity-pH-ORP-
Temp. Meter
Version   : 1.0
Date   : 19/06/2002

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1. Introduction

1.1 Aqua-TP Display and Controls

① **Display**

24 character alpha-numeric display. Can show any of the following combinations readouts simultaneously (see section 2)…

- Salinity + pH + Temperature
- Salinity + Temperature
- pH + Temperature
- Temperature only
- TDS + pH + Temp
- TDS + Temperature
- ORP + Temperature

A unique "Large Digit" mode nearly doubles the size of the digits (section 2).

User-friendly prompts and error messages are also provided.

② (Cal)

Used to calibrate all parameters. See sections 3 to 7.

Also used to select buffers for automatic buffer recognition. See section 8.

③ (Mode)

Hold this key for 2 seconds to toggle between Salinity and TDS modes. See section 2.

④ (On/Off)

Switches the **Aqua-TP** on and off.

Hold this key for 3 seconds to invoke Battery Saver mode. See section 9.

⑤ (▲) and ⑥ (▼)

These keys toggle the **Aqua-TP** between Large Display mode and Dual Display mode. See section 2.

NOTE: The digits in Large Display mode are made by combining the two rows of the display. This results in a small gap approximately half way up the digits.

1.2 Unpacking Information

Before using your new **Aqua-TP**, please check that the following accessories have been included:

		Part No
1.	**Aqua-TP** Salinity-TDS-pH-ORP Temperature Instrument	121136
2.	Salinity/TDS/Temp Sensor, plastic body, 1m	122201
3.	pH Sensor, plastic body, 1m	121207
4.	0.8% Salinity Standard, 200mL	122308
5.	2.00 ppK TDS Standard, 200mL	122307
6.	pH6.88 Buffer, 200mL	121306
7.	pH4.00 Buffer, 200mL	121381
8.	9V Battery	130026
9.	**Aqua-TP** Handbook	130050

Options that may have been ordered with your **Aqua-TP**:

1.	ORP Sensor, plastic body, 1m	121262
2.	ZoBell ORP Standard, 200mL ea Part A and Part B, 231mV	121309
3.	Low volume, k=1/ATC/Temp sensor, glass body	122216
4.	Temperature sensor, 1m	121247
	(only required when Salinity/TDS sensor is not used)	
5.	Aluminium Carry Case	130057

1.3 Specifications

	Ranges	Resolution	Accuracy
Salinity	0 to 1.00 %	0.01 %	±0.01 %
TDS	0 to 2500 ppM	10 ppM	±10 ppM
pH	0 to 14.00 pH	0.01 pH	±0.01 pH
ORP	0 to ±1000 mV	1 mV	±1 mV
Temperature	-10.0 to 120.0 ^{O}C (Salinity/TDS sensor limited to 60 ^{O}C)	0.1 ^{O}C	±0.2 ^{O}C

Additional Salinity / TDS Specifications

Temperature Compensation .... Automatic, 0 to 50.0 ^{O}C

Calibration Span Range .... 75 to 133 %

Auto Standard Recognition .... 0.8% Salinity
2000 ppM TDS

Additional pH Specifications

Temperature Compensation .... Automatic, 0 to 50.0 ^{O}C

pH Input Impedance .... >3 x 10^{12} Ω

pH Asymmetry Range .... -1.00 to 1.00 pH

pH Slope Range .... 85.0 to 105.0%

Auto pH Buffer Recognition pH4.00, pH6.88, pH7.00 pH9.23,
pH10.06

Additional ORP Specifications

Temperature Compensation .... Not applicable to ORP

ORP Input Impedance .... >3 x 10^{12} Ω

Sensor Offset Range .... -60 to 60 mV

Auto Standard Recognition .... ZoBell Solution (+231mV)

Additional Temperature Specifications

Temperature Sensor Offset Range ....-10.0^{o}C to +10.0^{o}C

General Specifications

Display	24 Character alphanumeric LCD, with full text prompts and error messages.
Power	9V Alkaline Battery for 70 hours operation.
Battery Saver	On : Auto switch-off after 5 minutes Off : Continuous use
Dimensions	157 x 78 x 35 mm
Mass	Instrument only : Approx 200g Full Kit : Approx 2.5kg
Environment	Temperature : 0 to 45 ^{O}C Humidity : 0 to 90 % R.H.

2. __Operating Modes__

Press the 🔘 key to select the desired operating mode. The sequence is shown in the following table…

__Salinity/TDS, pH & Temperature Mode__	`1.00%` `7.00pH 25.0t`
Salinity or TDS data is shown on the top, pH data is shown on the bottom left and Temperature is shown on the bottom right. Press and hold 🔘 for 2 seconds to toggle between Salinity and TDS modes. Calibration is not available in this mode. Large digit readout is not available in this mode.	

↓ (Mode)

__Salinity or TDS Mode__	`1.00%` `25.0t`
Salinity or TDS data is shown on the top line and Temperature data is shown on the bottom line. Press and hold 🔘 for 2 seconds to toggle between Salinity and TDS modes. Select this mode to calibrate Salinity or TDS. Press ⊙ or ⊙ to toggle between dual readout or large digit readout.	

↓ (Mode)

__pH Mode__	`7.00pH` `25.0t`
pH data is shown on the top line and Temperature data is shown on the bottom line. Select this mode to calibrate pH. Press ⊙ or ⊙ to toggle between dual readout or large digit readout.	

↓ (Mode)

Continued over the page…

Mode selection, continued…

ORP Mode	`700.mV` `25.0t`
ORP data is shown on the top line and Temperature data is shown on the bottom line. Select this mode to calibrate ORP. Press ⊙ or ⊙ to toggle between dual readout or large digit readout.	

↓ (Mode)

Temperature Mode	`25.0t`
Temperature data only is shown on the top line. Select this mode to calibrate Temperature. Press ⊙ or ⊙ to toggle between regular readout or large digit readout.	

↓ (Mode)

Back to Salinity or TDS + pH + Temperature mode

Note: The decimal point is replaced by a " ∗ " if a Salinity , TDS, pH, ORP or Temperature calibration has failed (see sections 3 to 7), if the unit is initialised (see section 10), or if the unit has lost its factory calibration (see section 11.1).

3. <u>Salinity Calibration</u>

A " * " in place of the decimal point indicates that the Salinity readout is not calibrated, or a past calibration has failed. The " * " will be removed once a Salinity calibration has been successfully performed in Salinity standard.

3.1 Calibration

1. Switch the **Aqua-TP** on.

2. Select Salinity mode (see section 2).

3. Plug the Salinity/TDS sensor into the sensor socket.

4. Rinse the Salinity/TDS sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. DO NOT BLOT THE SENSOR WIRES.

5. **Zero Calibration**
   Let the sensor dry in air.

   When the reading has stabilised at or near zero, press and hold the Ⓒⁿ key for 2 seconds.

   A " * " will not be removed after a zero calibration.

6. **Standard Calibration**
   Place the sensor into a sample of 0.8% Salinity standard, so that it is immersed at least to the vent hole in the white plastic cover. The white plastic cover MUST be in place for correct readings.

   Glass sensors must be immersed to the hole in the glass body. See the diagrams below.
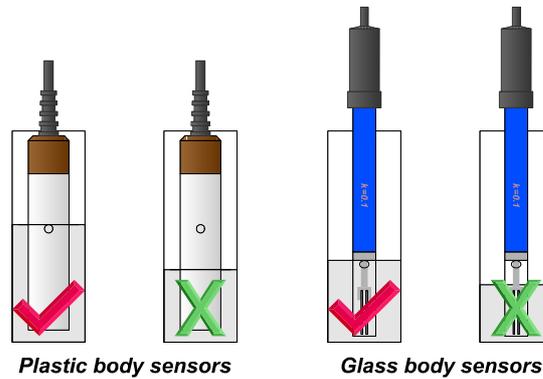
Plastic body sensors   *Glass body sensors*

DO NOT place the sensor directly into the bottle of standard.

Discard the used sample of standard after use. It is advisable to use a narrow sample vessel to minimise the use of standard solution.

When the reading has stabilised, press and hold the ⓒⓐⓛ key for 2 seconds to calibrate.

The " ∗ " will now be replaced by a decimal point, if calibration was successful.

7. The **Aqua-TP** is now calibrated for Salinity and is ready for use in this mode.

3.2 Calibration Notes

1. A Zero calibration should be performed monthly.

2. A Standard calibration should be performed weekly.

3. Salinity and TDS calibration data is stored separately in memory. Ensure that the **Aqua-TP** has been correctly calibrated for the mode in which it will be used. The **Aqua-TP** does not require re-calibration when alternating between Salinity and TDS modes, providing the instrument has been correctly calibrated for both.

4. All calibration information is retained in memory when the **Aqua-TP** is switched off, even when the battery is removed.

3.3 Calibration Messages

1. If a Zero calibration has been successfully performed, the **Aqua-TP** will display zero value of the sensor. For example…

```
Cal. OK
Zero=0.01%
```

2. If a Standard calibration has been successfully performed, the **Aqua-TP** will display the calculated k factor of the sensor. For example…

```
Cal. OK
k=1.10
```

3. If a Standard calibration has failed, the **Aqua-TP** will display the calculated k factor of the sensor following message, and then the failed span value of the sensor.

```
Cal. Failed
k=0.60
```

Note that the decimal point is replaced by a " $*$ " when a Standard calibration fails.

4. TDS Calibration

A " ∗ " in place of the decimal point indicates that the TDS readout is not calibrated, or a past calibration has failed. The " ∗ " will be removed once a TDS calibration has been successfully performed in TDS standard.

4.1 Calibration

1. Switch the **Aqua-TP** on.

2. Select TDS mode (see section 2).

3. Plug the Salinity/TDS sensor into the sensor socket.

4. Rinse the Salinity/TDS sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. DO NOT BLOT THE SENSOR WIRES.

5. **Zero Calibration**
   Let the sensor dry in air.

   When the reading has stabilised at or near zero, press and hold the ⓒⓐⓛ key for 2 seconds.

   A " ∗ " will not be removed after a zero calibration.

6. **Standard Calibration**
   Place the sensor into a sample of 2000ppM (2.00ppK) TDS standard, so that it is immersed at least to the vent hole in the white plastic cover. The white plastic cover MUST be in place for correct readings.

   Glass sensors must be immersed to the hole in the glass body. See the diagrams over the page.
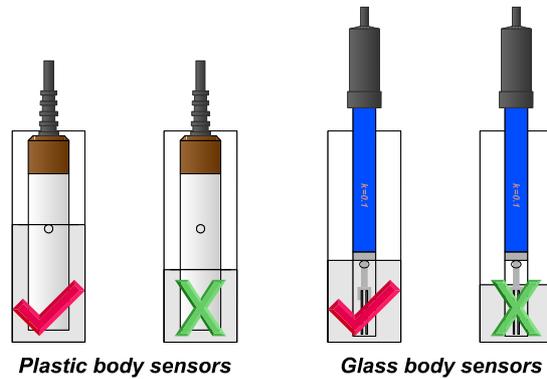
Plastic body sensors   *Glass body sensors*

DO NOT place the sensor directly into the bottle of standard.

Discard the used sample of standard after use. It is advisable to use a narrow sample vessel to minimise the use of standard solution.

When the reading has stabilised, press and hold the ⓒ key for 2 seconds to calibrate.

The " ∗ " will now be replaced by a decimal point, if calibration was successful.

7. The **Aqua-TP** is now calibrated for TDS and is ready for use in this mode.

4.2 Calibration Notes

1. A Zero calibration should be performed at least monthly.

2. A Standard calibration should be performed at least weekly.

3. Salinity and TDS calibration data is stored separately in memory. Ensure that the **Aqua-TP** has been correctly calibrated for the mode in which it will be used. The **Aqua-TP** does not require re-calibration when alternating between Salinity and TDS modes, providing the instrument has been correctly calibrated for both.

4. All calibration information is retained in memory when the **Aqua-TP** is switched off, even when the battery is removed.

4.3 Calibration Messages

1. If a Zero calibration has been successfully performed, the **Aqua-TP** will display zero value of the sensor. For example…

```
Cal. OK
Zero= 0.ppM
```

2. If a Standard calibration has been successfully performed, the **Aqua-TP** will display the calculated k factor of the sensor. For example…

```
Cal. OK
k=1.10
```

3. If a Standard calibration has failed, the **Aqua-TP** will display the calculated k factor of the sensor following message, and then the failed span value of the sensor.
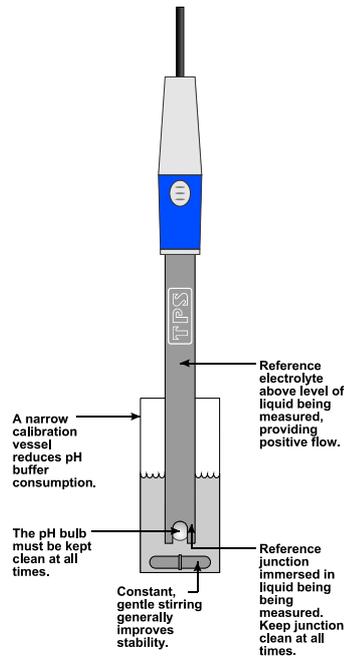
```
Cal. Failed
k=0.60
```

Note that the decimal point is replaced by a " ∗ " when a Standard calibration fails.

5. <u>pH Calibration</u>

A " ∗ " in place of the decimal point indicates that the pH readout is not calibrated, or a past calibration has failed. The " ∗ " will be removed once a full two-point pH calibration has been successfully performed.

5.1 Calibration

1. Switch the **Aqua-TP** on.

2. Select pH Mode (see section 2).

3. Plug the pH sensor into the BNC socket (this is the metal socket). For automatic temperature compensation, plug the Salinity/TDS sensor into the Salinity/TDS socket (this is the 6-pin plastic socket). If the Salinity/TDS sensor is not connected, then the **Aqua-TP** will use manual temperature compensation.

4. Ensure that temperature has already been calibrated, or manually set (see sections 7.1 and 7.4). NOTE: If the decimal point in the temperature reading is replaced by a " ∗ ", then the temperature readout is not calibrated.

5. Remove the wetting cap from the pH sensor.

6. Rinse the pH and Salinity/TDS sensors in distilled water and blot them dry.

7. Ensure that you are using the buffers which have been selected for automatic buffer recognition. See section 8 for a detailed explanation.

8. Place the pH sensor into a small sample of pH6.88 (or pH7.00) buffer, so that the bulb and reference junction are both covered. See the diagram over the page. Place the Salinity/TDS sensor into a separate beaker of water that is at the same temperature as the buffer.

Reference electrolyte above level of liquid being measured, providing positive flow.

A narrow calibration vessel reduces pH buffer consumption.

The pH bulb must be kept clean at all times.

Reference junction immersed in liquid being measured. Keep junction clean at all times.

Constant, gentle stirring generally improves stability.

DO NOT place the sensors directly into the buffer bottle. Discard the used buffer after use.

9. When the reading has stabilised, press and hold the Ⓒⓐⓛ key for 2 seconds to calibrate. If a 1 point calibration has been performed, a "∗" will not be removed until a full 2 point calibration has been performed.

10. Rinse the pH and Salinity/TDS sensors in distilled water and blot them dry.

11. Place the pH sensor into a small sample of pH4.00, pH9.23 or pH10.00 Buffer, so that the bulb and reference junction are both covered, as per the diagram in step 8. **DO NOT** place the sensors directly into the buffer bottle. Discard the used buffer after use.

    pH9.23 and pH10.00 buffers are highly unstable. Avoid using these buffers if possible. Discard immediately after use.

12. When the reading has stabilised, press and hold the Ⓒⓐⓛ key for 2 seconds to calibrate. The " ∗ " will now be replaced by a decimal point, if calibration was successful.

13. The **Aqua-TP** is calibrated for pH and is ready for use in this mode.

5.2 pH Calibration Notes

1. A 1-point calibration in pH6.88 or pH7.00 buffer should be performed at least weekly.

2. A full 2-point calibration should be performed at least monthly.

3. All calibration information is retained in memory when the **Aqua-TP** is switched off, even when the battery is removed.

4. The **Aqua-TP** displays the value of the pH buffer that it has attempted to recognise at calibration. Ensure that the buffer value displayed corresponds to the buffer that you are using.

5.3 pH Calibration Messages

1. If a 1-point calibration has been successfully performed, the **Aqua-TP** will display the following message, and then display the asymmetry and slope of the sensor. If the meter has not been calibrated at two points at this stage, the slope is set to 100.0%.

```
1 point 6.88
Cal. OK
```
then:
```
Asym= 0.10pH
Slope=100.0%
```

2. If a 1-point calibration has failed, the **Aqua-TP** will display the following message, then the failed asymmetry value of the sensor.

```
1 point 6.88
Cal. Failed
```
then:
```
Asym= 1.50pH
```

3. If a 2-point calibration has been successfully performed, the **Aqua-TP** will display the following message, and then the asymmetry and slope of the sensor.

```
2 point 4.00
Cal. OK
```
then:
```
Asym= 0.10pH
Slope= 99.5%
```

4. If a 2-point calibration has failed, the **Aqua-TP** will display the following message, and then the failed slope value of the sensor.
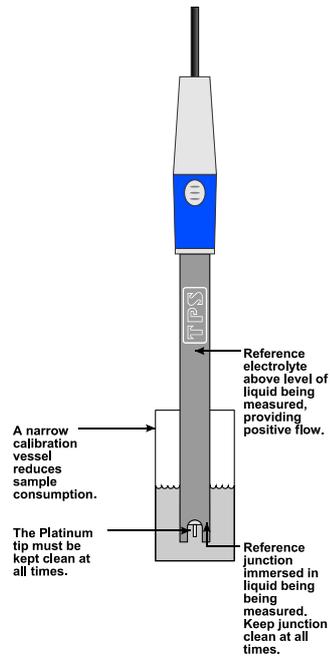
```
2 point 4.00
Cal. Failed
```
then:
```
Slope= 70.0%
```

6. <u>ORP Calibration</u>

A " ∗ " in place of the decimal point indicates that the ORP readout is not calibrated, or a past calibration has failed. The " ∗ " will be removed once an ORP calibration has been successfully performed.

6.1 Calibration

1. Switch the **Aqua-TP** on.

2. Select ORP Mode (see section 2).

3. Plug the ORP sensor into the BNC socket (this is the metal socket). As temperature compensation is not applicable to ORP readings, the Salinity/TDS sensor does not need to be connected.

4. Remove the wetting cap from the ORP sensor, rinse in distilled water and blot dry.

5. Make up a fresh quantity of ZoBell standard by making a 1:1 mix of Part A and Part B. 10mL of each should be enough, depending on the diameter of the calibration vessel.

6. Place the ORP sensor into the ZoBell standard so that the platinum tip and reference junction are both covered, as per the diagram over the page.

Reference
electrolyte
above level of
liquid being
measured,
providing
positive flow.

A narrow
calibration
vessel
reduces
sample
consumption.

The Platinum
tip must be
kept clean at
all times.

Reference
junction
immersed in
liquid being
being
measured.
Keep junction
clean at all
times.

Discard the used ZoBell after use as it goes off rapidly.

7. When the reading has stabilised, press and hold the ⓒ️al key for 2 seconds to calibrate. The " ∗ " will now be replaced by a decimal point, if calibration was successful.

8. The **Aqua-TP** is calibrated for ORP and is ready for use in this mode.

6.2 ORP Calibration Notes

1. An ORP calibration should be performed at least weekly.

2. All calibration information is retained in memory when the **Aqua-TP** is switched off, even when the battery is removed.

6.3 ORP Calibration Messages

1. If an ORP calibration has been successfully performed, the **Aqua-TP** will display the following message, and display the Zero value of the sensor…

    ```
    ORP Cal. OK
    Zero=    5.mV
    ```

2. If an ORP calibration has failed, the **Aqua-TP** will display the following message, and the failed Zero value of the sensor.

    ```
    ORP Cal.Fail
    Zero=   70.mV
    ```

7. Temperature Calibration

A " * " in place of the decimal point indicates that the Temperature readout is not calibrated, or a past calibration has failed. The " * " will be removed once Temperature has been successfully calibrated.

7.1 Calibration

1. Switch the **Aqua-TP** on.

2. Select Temperature mode (see section 2).

3. Plug the Salinity/TDS sensor into the sensor socket.

4. Place the sensor into a beaker of room temperature water, alongside a good quality mercury thermometer. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.

5. When the reading has stabilised, press and hold the Ⓒⁿ key for 2 seconds.

6. The reading from the sensor is now displayed on the top line, and the value you are going to set is on the bottom line. For example…

```
Enter  25.0℃
Temp ↑ 26.0↓
```

7. Press the ⊙ and ⊙ keys until the bottom line shows the same temperature as the mercury thermometer.

8. Press the Ⓒⁿ key to calibrate the temperature readout.

    Alternatively, press the ⓜ key to abort temperature calibration.

7.2 Calibration Notes

1. Temperature calibration information is stored in memory when the meter is switched off, even if the battery is removed.

2. Temperature does not need to be re-calibrated unless the Salinity/TDS sensor is replaced or the meter is initialised.

3. The temperature readout does not affect the accuracy of the Salinity or TDS measurements. Temperature compensation is performed by a separate sensor built into the Salinity/TDS sensor, which does not require calibration.

7.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **Aqua-TP** will display the offset value of the sensor. For example…

```
Cal. OK
Offset=1.0t
```

2. If a temperature calibration has failed, the **Aqua-TP** will display the failed offset value of the sensor.

```
Cal. Failed
Offset=10.5t
```

7.4 Manual Temperature Setting

1. Switch the **Aqua-TP** on.

2. Select Temperature mode (see section 2).

3. Manual temperature setting is only available if the Salinity/TDS sensor is not connected.

4. Press and hold the Ⓒⓐⓛ key for 2 seconds. The current Manual Temperature Setting is now displayed, for example…

```
Enter Man.
Temp ↑ 25.0↓
```

5. Press the ⊙ and ⊙ keys until the bottom line shows the temperature which you wish to set. This value should be the same as the temperature of the solution you are measuring.

6. Press the Ⓒⓐⓛ key to set the temperature.

8. Selecting Buffers for Auto Buffer Recognition

The **Aqua-TP** is factory set to automatically recognise pH4.00, pH6.88 and pH9.23 buffers. However, some users may prefer to use pH7.00 instead of pH6.88 and pH10.00 instead of pH9.23. The following procedure describes how to set which of these buffers are automatically recognised at calibration.

1. Switch the meter **OFF**.

2. Press and HOLD the ⓒⓐⓛ key while switching the meter back on.

3. Release the ⓒⓐⓛ key when the message, "**Buffer 1 Select**" is displayed.

4. The display will now show the currently selected primary buffer, for example…

```
6.88pH              ⌃ or ⌄      7.00pH
↑↓Select               ↔        ↑↓Select
```
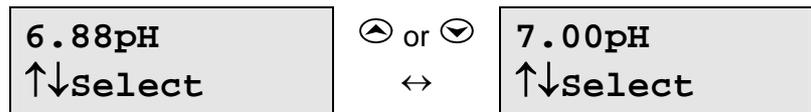
5. Use the ⌃ or ⌄ keys to alternate between pH6.88 and pH7.00 buffers.

6. Press the ⓜⓞⓓⓔ key to save the primary buffer.

7. After the message, "**Buffer 2 Select**", the display will now show the currently selected secondary pH buffers, for example…

```
4.00/9.23pH         ⌃ or ⌄      4.00/10.0pH
↑↓Select               ↔        ↑↓Select
```
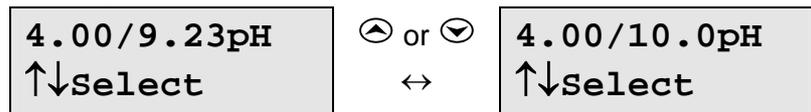
8. Use the ⌃ or ⌄ keys to alternate between pH9.23 and pH10.00 buffers (the display shows pH10.0 for the latter but this buffer is stored as pH10.00).

9. Press the ⓜⓞⓓⓔ key to save the secondary pH buffers.

10. The buffer recognition setting is kept in memory when the meter is switched off, even if the battery is removed. The buffers are re-set to pH6.88 and pH9.23 during initialisation.

NOTE: pH6.88 buffer is a DIN 19266 and NBS Primary-standard pH solution, and is far more stable than pH7.00 buffer. If pH7.00 buffer is used, ensure that it is made to 0.01pH accuracy.
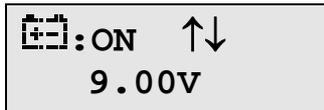
9. Battery

9.1 Battery Saver Function

The **Aqua-TP** is equipped with a battery saver function. If no button has been pressed for five minutes, the unit beeps and flashes the display for 20 seconds, and then shuts off. This function can be disabled for continuous use.

To enable or disable the battery saver function:

1. Switch the **Aqua-TP** on.

2. With the meter already switched on, press and HOLD the 🔘 key for 3 seconds.

3. The battery saver menu is now displayed. For example…

    ```
    ┌─────────────────────┐
    │ ⊡:ON    ↑↓          │
    │    9.00V            │
    └─────────────────────┘
    ```

4. In this mode, use the ⊙ or ⊙ keys to toggle the battery saver function on or off.

    NOTE: The display also shows the battery volts. This gives the operator an idea of how much battery life is remaining. The ⊡ symbol flashes when the battery volts drops below 7.50 volts. At 6.00 volts the meter turns itself off.

5. When you have set the battery saver function to the desired position, press the ⓜⓞⓓⓔ key to return to normal measurement mode.

9.2 Changing the Battery

1.   Turn the instrument over and locate the 2 battery cover screws on the rear. See the diagram below.
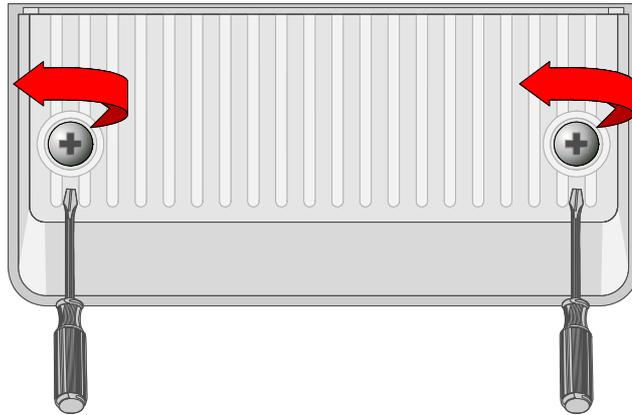
2.   Raise the fold out stand (so it is out of the way) and then fully loosen both screws. It is not necessary to pull the screws all the way out. Lift off the battery cover.

3.   Replace the battery with a new alkaline 9V battery.

4.   Re-fit the battery cover and tighten the screws. **Do not over-tighten**.

10. Initialising the Aqua-TP

If the calibration settings of the **Aqua-TP** exceed the allowable limits, and the unit cannot be re-calibrated, then it may need to be initialised to factory default values. This action may be required if a sensor is replaced.

To initialise the **Aqua-TP**…

1. Switch the **Aqua-TP** off.

2. Press AND HOLD the ⊖ key while switching the **Aqua-TP** on.

3. The following messages are now displayed…

```
Memory & Cal
Reset !
```
↓
```
You MUST
Re-Calibrate
```
↓
```
TPS AQUA-TP
V1.0  S1234
```

4. The meter then displays Salinity, pH and Temperature. Note that the decimal points have been replaced with a " ∗ ", to indicate that the unit requires re-calibration.

11. <u>Troubleshooting</u>

11.1 General Error Messages

Error Message	Possible Causes	Remedy
Factory Cal. Fail **See Handbook**	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service.
Memory Failed Calib. Lost Memory Reset ! You MUST Re-Cal.	User calibration settings have been lost or corrupted.	Re-calibrate the instrument. Both a Zero and a Standard calibration will be required for Salinity and TDS (sections 3 and 4), a 2 point calibration for pH (section 5 and a 1 point calibration for ORP (section 6) and Temperature (section 7).
Meter displays the word **OFF**, and switches off.	Battery is below 6.00 volts.	Replace the battery.
Meter will not turn on.	Battery is exhausted.	Replace the battery.
Flashing symbol.	Battery is below 7.50 volts.	Replace the battery soon. Note that the unit will switch itself off when the battery falls below 6.00 volts.

11.2 Salinity and TDS Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new sensor.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 10.
Unit attempts Span calibration instead of Zero calibration.	Sensor has Zero error.	Thoroughly rinse sensor in distilled water and allow to completely dry in air before attempting zero calibration. If instrument does not calibrate at Zero with sensor disconnected, then the instrument is faulty.
Standard calibration fails, and k factor is greater than 1.35.	1. Sensor is not immersed deeply enough.	Immerse sensor at least to the vent hole in the white plastic cover.
	2. Sensor may have a build-up of dirt or oily material on sensor wires.	Clean sensor, as per the instructions detailed in section 12.1.
	3. Platinum-black coating has worn off.	Sensor requires replatinisation. Return to the factory, or see details in section 12.2.
	4. Standard solution is inaccurate.	Replace standard solution.
	5. Sensor is faulty.	Return sensor to factory for repair or replacement.
Standard calibration fails, and k factor is less than 0.75.	1. White protective cover is not fitted.	The white protective cover MUST be fitted for correct readings.
	2. Standard solution is inaccurate.	Replace standard solution.
	3. Sensor may have a build-up of conductive material, such as salt.	Clean sensor, as per the instructions detailed in section 12.1.
	4. Sensor is faulty.	Return sensor to factory for repair or replacement.

Continued next page...

Salinity and TDS Troubleshooting, continued...

Inaccurate readings, even when calibration is successful.	1. Sensor may have a build-up of dirt or oily material on sensor wires.	Clean sensor, as per the instructions detailed in section 12.1.
	2. Platinum-black coating has worn off.	Sensor requires replatinisation. Return to the factory, or see details in section 12.2.
Readings drift.	1. Sensor may have a build-up of dirt or oily material on sensor wires.	Clean sensor, as per the instructions detailed in section 12.1.
Readings are low or near zero.	1. Sensor may have a build-up of dirt or oily material on sensor wires.	Clean sensor, as per the instructions detailed in section 12.1.
	2. Sensor is not immersed deeply enough.	Immerse sensor at least to the vent hole in the white plastic cover.
	3. Sensor is faulty.	Return sensor to factory for repair or replacement.

11.3 pH Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new sensor.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 10.
1 Point calibration fails (Asymmetry is greater than +/- 1.00 pH).	1. Reference junction blocked.	Clean reference junction, as per instructions supplied with the sensor.
	2. Reference electrolyte contaminated.	Flush with distilled water and replace electrolyte.
2 Point calibration fails (Slope is less than 85.0%).	1. Incorrect primary buffer.	Ensure that you are using the buffers which the **Aqua-TP** has been set to automatically recognise (See section 8).
	2. Glass bulb not clean.	Clean glass bulb as per instructions supplied with the sensor.
	3. Sensor is aged.	Attempt rejuvenation, as per instructions supplied with the sensor. If not successful, replace sensor.
	4. Connector is damp.	Dry in a warm place.
	5. Buffers are inaccurate.	Replace buffers.

pH Troubleshooting, continued...

Unstable readings.	1. Reference junction blocked.	Clean reference junction, as per instructions supplied with the sensor.
	2. Glass bulb not clean.	Clean glass bulb as per instructions supplied with the sensor.
	3. Bubble in glass bulb.	Flick the sensor to remove bubble.
	4. Faulty connection to meter.	Check connectors. Replace if necessary.
	5. Reference junction not immersed.	Ensure that the bulb AND the reference junction are fully immersed.
	6. KCl crystals around reference junction, inside the electrolyte chamber.	Rinse electrolyte chamber with warm distilled water until dissolved. Replace electrolyte.
Inaccurate readings, even when calibration is successful.	Reference junction blocked.	Clean reference junction, as per instructions supplied with the sensor.
Displays 7.00 for all solutions.	Electrical short in connector.	1. Check connector. Replace if necessary. 2. Replace sensor.
Displays 4-5 pH for all solutions.	Glass bulb or internal stem cracked.	Replace sensor.

11.4 ORP Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new sensor.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 10.
Calibration fails (Zero is outside ±60mV range).	1. Reference junction blocked.	Clean reference junction, as per instructions supplied with the sensor.
Unstable readings.	1. Reference junction blocked.	Clean reference junction, as per instructions supplied with the sensor.
	2. Platinum tip not clean.	Clean platinum tip as per instructions supplied with the sensor.
	3. Faulty connection to meter.	Check connectors. Replace if necessary.
	4. Reference junction not immersed.	Ensure that the platinum tip AND the reference junction are fully immersed.
Inaccurate readings, even when calibration is successful.	Reference junction blocked.	Clean reference junction, as per instructions supplied with the sensor.
Displays 0mV for all solutions.	Electrical short in connector.	1. Check connector. Replace if necessary. 3. Replace sensor.

11.5 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Displays "**OVR°C**" or Manual Temp when sensor is plugged in.	1. Faulty sensor.	Fit new sensor, part number 122201.
	2. Faulty instrument.	Return instrument to factory for repair.
Temperature inaccurate and cannot be calibrated.	1. Faulty connector.	Check the connector and replace if necessary.
	2. Faulty sensor.	Fit new sensor, part number 122201.
	3. Faulty instrument.	Return instrument to factory for repair.

12. Appendices

12.1 Care, Cleaning and Maintenance of Salinity/TDS Sensors

12.1.1 Care of Salinity/TDS sensors

The Salinity/TDS section of the sensor supplied with your **Aqua-TP** consists of two platinum wires that are plated with a layer of "platinum-black". This is quite a soft layer and is required for stable, accurate measurements. In time, the platinum-black layer may wear off in some applications, at which time the sensor will require replatinising (see section 12.2). You can help to maintain the platinum-black layer by following these simple rules:

1. **NEVER** touch or rub the sensor wires with your fingers, cloth etc.
2. Avoid using the sensor in solutions that contain a high concentration of suspended solids, such as sand or soil, which can abrade the sensor wires. Filter these types of solutions first, if possible.
3. Avoid concentrated acids. If you must measure acids, remove the sensor immediately after taking the measurement and rinse well with distilled water.

Salinity/TDS sensors can be stored dry. Ensure that the sensor is stored in a covered container, to avoid dust and dirt build-up.

12.1.2 Cleaning of Salinity/TDS of Sensors.

Platinised platinum Salinity/TDS sensors can only be cleaned by rinsing in a suitable solvent. **DO NOT wipe the sensor wires**, as this will remove the platinum-black layer.

1. Rinsing in distilled water will remove most build-ups of material on the sensor wires.
2. Films of oils or fats on the sensor wires can usually be removed by rinsing the sensor in methylated spirits.
3. Stubborn contamination can be removed by soaking the sensor in a solution of 1 part Concentrated HCl and 10 parts distilled water. The sensor should not be soaked for more than approximately 5 minutes, otherwise the platinum-black layer may start to dissolve.
4. If all of these methods fail, then the last resort is to physically scrub the sensor wires, which will remove the contaminant and the layer of platinum-black. Use only a cloth or nylon scouring pad. DO NOT USE STEEL WOOL. The sensor will then need to be cleaned in HCl, as per step 3 and replatinised, as per section 12.2.

12.2 Replatinising Salinity/TDS Sensors

There are several ways to replatinise Salinity/TDS sensors.

1. The simplest way is to return the sensor to the TPS factory. We can fully clean the sensor, replatinise it and test all aspects of its performance.

2. An automatic replatiniser is available from TPS, along with replatinising solution. This will plate the sensors for the right amount of time at the correct current. Ordering details are as follows:

   Automatic Salinity/TDS Sensor Replatiniser   Part No 122160
   20mL Platinising Solution (for approx 30 uses)   Part No 122300

3. Salinity/TDS sensors can be manually replatinised, according to the following procedure:
   1) Soak the sensor in a solution of 1 part Concentrated HCl and 10 parts distilled water for approximately 5 minutes.
   2) Rinse the sensor well in distilled water.
   3) Immerse the sensor in platinising solution at least to the vent hole in the white plastic cover. Platinising solution is available from TPS (part no 122300). Alternatively, platinising solution can be prepared by dissolving 1g of Hydrogen Chloroplatinate (H_2PtCl_{16}) in 30mL of distilled water, and including about 0.01g of Lead Acetate (($CH_3COO)_2Pb$) and a drop or two of concentrated HCl.
   4) Apply a direct current of 10mA between pins 1 and 5 of the sensor plug, as per the diagram below. Reverse the polarity every 30 seconds. After approximately 8 minutes (4 minutes per sensor wire), they should have an even "soot" like appearance. Avoid excess current as this will cause incorrect platinising.
   5) After platinising, rinse the sensor well in distilled water.
   6) If you have any doubts about any of these steps, then you should consider returning the sensor to the factory. The cost of replatinising is quite low, and you will be guaranteed of the best possible result.
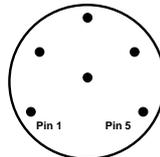
Sensor Connector

12.3 pH Sensor Fundamentals

A combination pH sensor is two sensors in one. The sensing membrane is the round or spear shaped bulb at the tip of the sensor. This produces a voltage that changes with the pH of the solution. This voltage is measured with respect to the second part of the sensor, the reference section. The reference section makes contact with the sample solution using a salt bridge, which is referred to as the reference junction. A saturated solution of KCl is used to make contact with the sample. It is vital that the KCl solution has an adequate flow rate in order to obtain stable, accurate pH measurements.

12.3.1 Asymmetry of a pH Sensor

An "ideal" pH sensor produces 0 mV output at 7.00 pH. In practice, pH sensors generally produce 0 mV output at slightly above or below 7.00 pH. The amount of variance from 7.00 pH is called the asymmetry. Figure 12-1 illustrates how asymmetry is expressed.
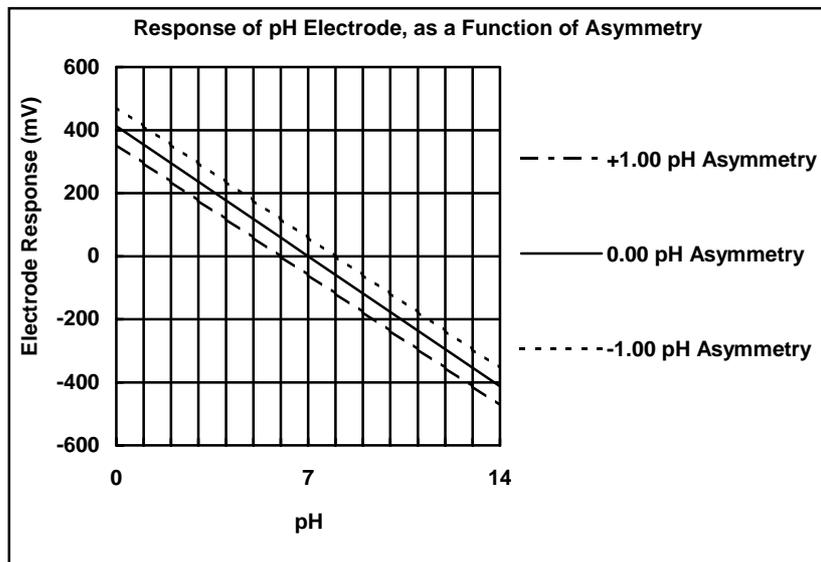
Response of pH Electrode, as a Function of Asymmetry

- — · — · +1.00 pH Asymmetry
- ——— 0.00 pH Asymmetry
- · · · · · · -1.00 pH Asymmetry

Electrode Response (mV) vs pH

Figure 12-1

12.3.2 The Slope of a pH Sensor

As mentioned above, a pH sensor produces 0 mV output at around 7.00 pH. As the pH goes up, an "ideal" pH sensor produces -59mV/pH unit at 25 ^{O}C As the pH goes down, an ideal pH sensor produces +59mV/pH unit. In practice, pH sensors usually produce slightly less than this. The output of a pH sensor is expressed as a percentage of an ideal sensor. For example, an ideal sensor that produces 59mV/pH unit has "100% Slope". An sensor that produces 50.15mV/pH unit has "85% Slope" (see Figure 12-2).
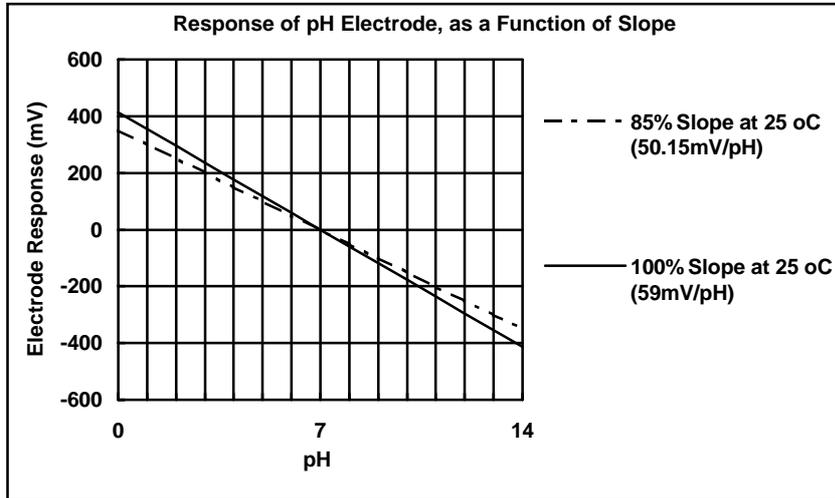
Figure 12-2

12.3.3 Temperature Compensation

The slope of a pH sensor (section 12.3.2) is affected by temperature. This effect is compensated for either by using an Automatic Temperature Compensation (ATC) sensor or by entering the sample temperature manually. Figure 12-3 shows the slope of a pH sensor at various temperatures.
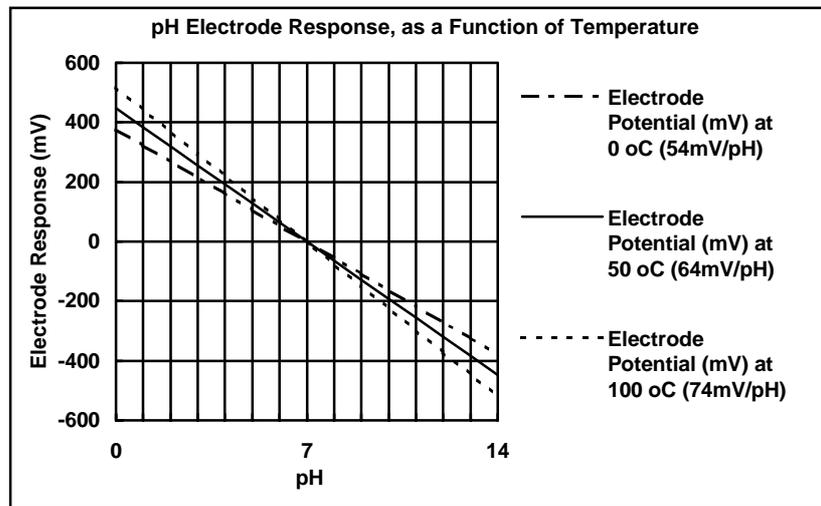

Figure 12-3

12.4 Checking the reference junction of a pH sensor.

If pH readings are inaccurate or unstable, the reference junction of the sensor may be blocked. The following test can be performed to determine if the reference junction of a pH sensor is making adequate contact with the sample solution.

1. Calibrate the **Aqua-TP**, as per section 5.

2. Dilute 1 part of pH6.88 buffer with 9 parts of distilled water.

3. Measure the pH of the diluted buffer. The result should be 7.06 +/-0.05 pH.

4. If the value obtained is outside of these limits, then clean the reference junction as per the instructions supplied with the pH sensor.

5. Re-calibrate the **Aqua-TP** and repeat the test.

6. If the value obtained is still outside 7.06 +/-0.05 pH, then the sensor should be replaced.

12.5 Determining if an instrument or sensor is faulty
The following test can be performed to help determine if the **Aqua-TP** or the pH sensor is faulty.

1. Initialise the **Aqua-TP** (see section 10).

2. Disconnect the pH sensor.

3. Connect the centre pin of the BNC connector with the outside frame of the connector, using a short piece of wire or a paper clip etc.

4. The meter should read approximately 7.00. If you press the ⓒ key for 2 seconds, the **Aqua-TP** will calibrate to around 6.88 pH, depending upon the temperature readout.

5. If the **Aqua-TP** is operating correctly, the reading should be totally stable with the wire firmly in place. If not, the meter requires servicing.

6. Now carefully disconnect the wire from the centre pin only (make sure the other end of the wire remains connected to the outside frame of the connector).

7. The reading should steadily drift away from 7.00 (either up or down) at a rate of approximately 1 pH or less every 3 seconds. If the drift rate is faster than this, then input circuitry of the **Aqua-TP** may be faulty and could require servicing.

12.6 Instrument software version number.

If you need to phone or fax TPS for any further technical assistance, the version number of your **Aqua-TP** firmware may of benefit to us. Please obtain the version number before phoning or faxing.

The version number is displayed on the bottom left of the display when the **Aqua-TP** is switched on. For example…

```
TPS AQUA-TP
V1.0  S1234
```

"**V1.0**" in this example is the firmware version number.

"**S1234**" in this example is the instrument's serial number.

13. <u>Warranty</u>

TPS Pty. Ltd. guarantees all instruments and sensors to be free from defects in material and workmanship when subjected to normal use and service. This guarantee is expressly limited to the servicing and/or adjustment of an instrument returned to the Factory, or Authorised Service Station, freight prepaid, within twelve (12) months from the date of delivery, and to the repairing, replacing, or adjusting of parts which upon inspection are found to be defective. Warranty period on sensors is three (3) months.

There are no express or implied warranties which extend beyond the face hereof, and TPS Pty. Ltd. is not liable for any incidental or consequential damages arising from the use or misuse of this equipment, or from interpretation of information derived from the equipment.

Shipping damage is not covered by this warranty.

<u>Please note</u>

A guarantee card is packed with the instrument or sensor. This card must be completed at the time of purchase and the registration section returned to TPS Pty. Ltd. within 7 days. No claims will be recognised without the original guarantee card or other proof of purchase. This warranty becomes invalid if modifications or repairs are attempted by unauthorised persons, or the serial number is missing.

<u>Procedure for service</u>

If you feel that this equipment is in need of repair, please re-read the manual. Sometimes, instruments are received for "repair" in perfect working order. This can occur where batteries simply require replacement or re-charging, or where the sensor simply requires cleaning or replacement.

TPS Pty. Ltd. has a fine reputation for prompt and efficient service. In just a few days, our factory service engineers and technicians will examine and repair your equipment to your full satisfaction.

To obtain this service, please follow this procedure

Return the instrument AND ALL SENSORS to TPS freight pre-paid and insured in its original packing or suitable equivalent. INSIST on a proof of delivery receipt from the carrier for your protection in the case of shipping claims for transit loss or damage. It is your responsibility as the sender to ensure that TPS receives the unit.

Please check that the following is enclosed with your equipment:

- **Your Name and daytime phone number.**

- **Your company name, ORDER number, and return street address.**

- **A description of the fault. (Please be specific.)**
  (Note: "Please Repair" does NOT describe a fault.)

Your equipment will be repaired and returned to you by air express where possible.

For out-of-warranty units, a repair cost will be calculated from parts and labour costs. If payment is not received for the additional charges within 30 days, or if you decline to have the equipment repaired, the complete unit will be returned to you freight paid, not repaired. For full-account customers, the repair charges will be debited to your account.

- **Always describe the fault in writing.**
- **Always return the sensors with the meter.**