Congratulations !

The **900-LAB** is complete water quality lab in a single benchtop unit. It combines Dissolved Oxygen, Conductivity, TDS, Temperature and two channels of pH, mV or Specific Ions.

Despite its impressive list of features, the **900-LAB** 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 **900-LAB**. It also contains a full listing of all of the items that you should have received with unit. 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 **900-LAB**, 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.

TPS Pty Ltd
4 Jamberoo Street
Springwood, Brisbane,
Australia, 4127

Phone : (07) 32 900 400
International : 61 7 32 900 400

Fax : (07) 3808 4871
International : 61 7 3808 4871

E-mail : tps@tps.com.au

Web Site : www.tps.com.au

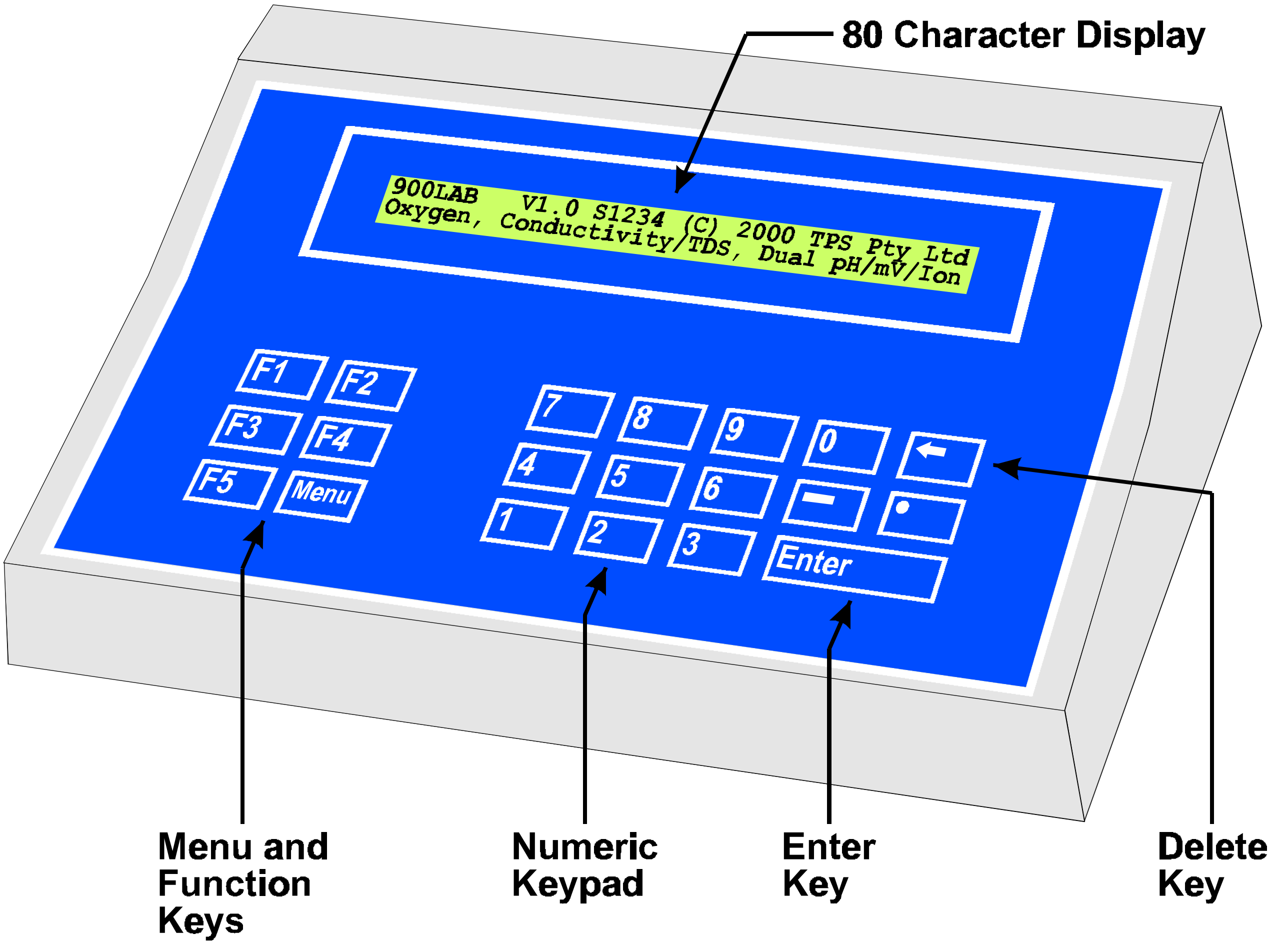
900-LAB
Dissolved Oxygen, Conductivity, TDS, pH, mV, Specific Ion, Temperature Meter

Date : 04-Dec-2000
Author : MS
Version : 1.0

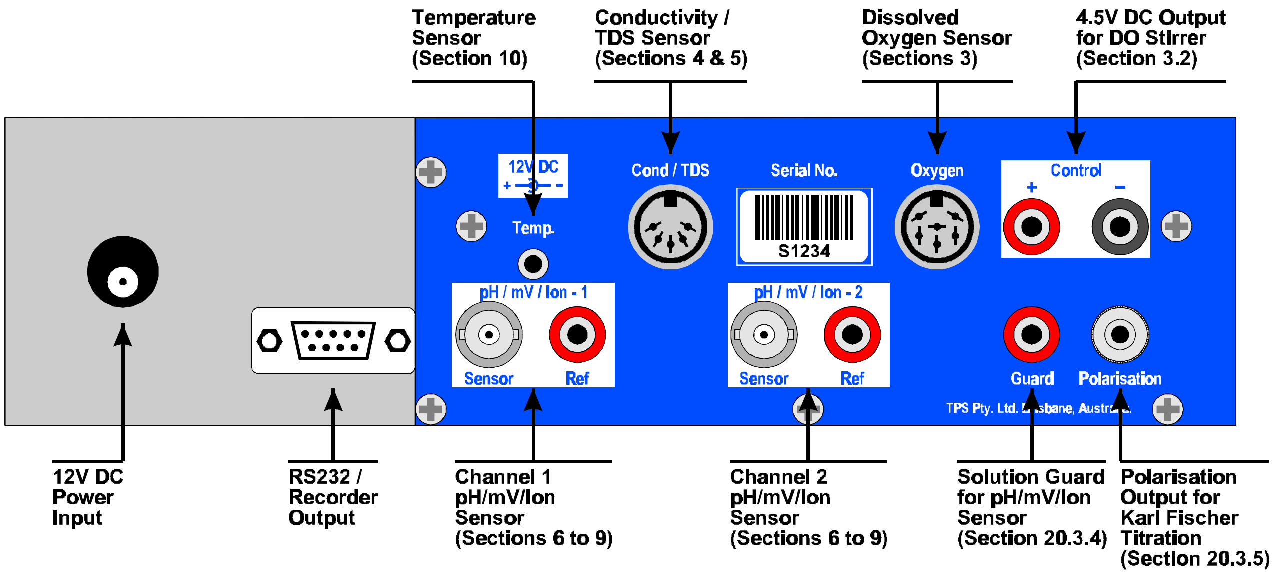
Contents

1. Introduction

1.1 900-LAB Display and Controls



1.2 900-LAB Rear Panel Connectors



1.3 Menu and Function Keys

Press the F1 to F5 function keys to select desired options within the menu system.

Additionally, these keys perform the following function directly in normal measurement mode…

F1 : Press to record readings into the Notepad. See section 12.

F3 : Press to start or stop automatic datalogging. See section 13.
Alternatively, press to transmit current reading plus date and time to the RS232 port. See section 14.2.

F4 : Press to Zero Relative mV, when Relative mV is selected. See section 9.2.

F5 : Press to obtain context-sensitive help messages. This function is disabled within menus.

1.4 Numeric Keypad

Used to enter values during set-up and calibration. A negative sign and decimal point are provided.

1.5 Enter Key

Press the Enter key to accept default values or those entered on the Numeric Keypad.

1.6 Delete Key

Press the ← key to make corrections to values entered on the Numeric Keypad.

Press and hold this key at turn-on to initialise the **900-LAB**. See section 17.

1.7 80 Character Display

80 character alphanumeric display with user-friendly menu and context-sensitive help system. Shows Dissolved Oxygen, Conductivity/TDS, Channel 1 pH/mV/Specific Ion, Channel 2 pH/mV/Specific Ion, Temperature, Date and Time simultaneously.

1.8 Unpacking Information

Before using your new **900-LAB**, please check that the following accessories have been included:

Part No

Standard Kit…

1. **900-LAB** Laboratory Analyser................................ 126123
2. k=1/ATC Conductivity/TDS Sensor........................ 122226
3. Plastic Body Combination pH Sensor...................... 121207
4. Temperature/ATC Sensor 121245
5. pH6.88 Buffer, 200mL.. 121306
6. pH4.00 Buffer, 200mL.. 121381
7. 2.76 mS/cm Conductivity Standard, 200mL 122306
8. 2.0 ppK TDS Standard, 200mL 122307
9. Plug-Pack Power Supply... 130044
10. **900-LAB** Handbook 130050

Optional sensors that may have been ordered with your 900-LAB…

1. ED1 Dissolved Oxygen sensor................................ 123400
2. 1m Cable for ED1 DO_2 sensor 123234
3. YSI Non-stirring DO_2 sensor for BOD bottles........ 123214
4. YSI Self-stirring DO_2 sensor for BOD bottles 123213
5. YSI Field type DO_2 sensor...................................... 123204
6. 1m Cable for YSI Field DO_2 sensor 123211
7. Plastic Body Combination Redox Sensor 121262

Instrument Options…

1. Flexible arm type electrode holder 130088
2. RS232 Serial Interface Cable 130022
3. Recorder Output Option (includes cable)................ 130028
4. Communication software for Windows 3.1, ... 130086
   95, 98 and NT
5. Adaptor for 4.5V DC output for Oxygen Stirrers.... 123307

A complete range of Conductivity/TDS, Ion Selective, Reference, pH and Redox sensors is available from TPS.

1.9 Specifications

1.9.1 Dissolved Oxygen

Ranges	Resolution	Accuracy
ED1 Sensor		
0 to 20.00 ppM 20.0 to 40.0 ppM	0.01 ppM 0.1 ppM	±0.2% of full scale of selected range
0 to 250.0 % Saturation 250 to 450 % Saturation	0.1 % Saturation 1 % Saturation	±0.3 % Saturation
0 to 50.0 % Gaseous 50 to 100 % Gaseous	0.1 % Gaseous 1 % Gaseous	±0.1 % Gaseous
YSI Sensors		
0 to 25.00 ppM 25.0 to 40.0 ppM	0.01 ppM 0.1 ppM	±0.2% of full scale of selected range
0 to 300.0 % Saturation 300 to 450 % Saturation	0.1 % Saturation 1 % Saturation	±0.3 % Saturation
0 to 60.0 % Gaseous 60 to 100 % Gaseous	0.1 % Gaseous 1 % Gaseous	±0.1 % Gaseous
Note : ***Ranges are automatically selected. Exact auto-ranging points and full scales are subject to sensor performance.***		

Sensor Type...Clark type polarographic sensor, with in-built ATC.

Salinity Correction................................0 to 50.0 ppK, automatic using conductivity/TDS reading.

Temperature Compensation.................Automatic for membrane permeability.
Automatic for Dissolved Oxygen solubility in ppM mode.

Calibration ....Automatic zero and span calibration.

Sensor Span Range ....65 to 200 %

1.9.2 Conductivity

Ranges	Resolution	Accuracy
k=0.1 Sensor		
0 to 2.000 µS/cm 0 to 20.00 µS/cm 0 to 200.0 µS/cm 0 to 2000 µS/cm	0.001 µS/cm 0.01 µS/cm 0.1 µS/cm 1 µS/cm	±0.5% of full scale of selected range at 25 ^{O}C
k=1.0 Sensor		
0 to 20.00 µS/cm 0 to 200.0 µS/cm 0 to 2000 µS/cm 0 to 20.00 mS/cm	0.01 µS/cm 0.1 µS/cm 1 µS/cm 0.01 mS/cm	±0.5% of full scale of selected range at 25 ^{O}C
k=10 Sensor		
0 to 200.0 µS/cm 0 to 2000 µS/cm 0 to 20.00 mS/cm 0 to 200.0 mS/cm	0.1 µS/cm 1 µS/cm 0.01 mS/cm 0.1 mS/cm	±0.5% of full scale of selected range at 25 ^{O}C
Note : Ranges are automatically selected. Exact auto-ranging points and full scales are subject to sensor performance.		

Sensor Type..Glass body with two platinised platinum plates.
In-built ATC.

Temperature Compensation................Automatic, 0 to 100 ^{O}C

Calibration...Automatic zero and span calibration.

Sensor Span Range...............................k=0.1 : k=0.075 to k=0.133
k=1.0 : k=0.75 to k=1.33
k=10 : k=7.5 to k=13.3

1.9.3 TDS

Ranges	Resolution	Accuracy
k=0.1 Sensor		
0 to 1.000 ppM 0 to 10.00 ppM 0 to 100.0 ppM 0 to 1000 ppM	0.001 ppM 0.01 ppM 0.1 ppM 1 ppM	±0.5% of full scale of selected range at 25 ^{O}C
k=1.0 Sensor		
0 to 10.00 ppM 0 to 100.0 ppM 0 to 1000 ppM 0 to 10.00 ppK	0.01 ppM 0.1 ppM 1 ppM 0.01 ppK	±0.5% of full scale of selected range at 25 ^{O}C
k=10 Sensor		
0 to 100.0 ppM 0 to 1000 ppM 0 to 10.00 ppK 0 to 100.0 ppK	0.1 ppM 1 ppM 0.01 ppK 0.1 ppK	±0.5% of full scale of selected range at 25 ^{O}C
Note : Ranges are automatically selected. Exact auto-ranging points and full scales are subject to sensor performance.		

Sensor Type...Glass body with two platinised platinum plates.
In-built ATC.

Temperature Compensation.................Automatic, 0 to 100 ^{O}C

Calibration..Automatic zero and span calibration.

Sensor Span Range...............................k=0.1 : k=0.075 to k=0.133
k=1.0 : k=0.75 to k=1.33
k=10 : k=7.5 to k=13.3

1.9.4 Specific Ions

Ranges	Resolution	Accuracy
Auto-ranging in units of ppM, ppK, % and Exponential Notation	User selectable for 3 significant digits, 2 significant digits or Auto-rounding.	± Least significant digit

Sensor Type..Compatible with all combination and half cell Ion Selective Electrodes for monovalent or divalent anions or cations.

Input Impedance..................................>3 x 10^{12} Ohms

Temperature Compensation.................Automatic, 0 to 100 ^{O}C

Calibration ....Automatic asymmetry and slope calibration in user-defined standards.

Sensor Asymmetry Range ....Auto detection at calibration.

Sensor Slope Range...............................50.0 to 110.0 %

1.9.5 pH

Ranges	Resolution	Accuracy
0 to 14.000 pH 0 to 14.00 pH 0 to 14.0 pH	0.001 pH 0.01 pH 0.1 pH	±0.002 pH ±0.01 pH ±0.1 pH

Sensor Type..Glass bulb pH sensor, combination or half cell.

Input Impedance..................................>3 x 10^{12} Ohms

Temperature Compensation.................Automatic, 0 to 100 ^{O}C

Calibration ....Automatic asymmetry and slope calibration.

Automatic Buffer Recognition.............pH4.00, pH6.88, pH7.00, pH9.23 & pH10.06.
Any other can be entered during calibration.

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

Sensor Slope Range...............................85.0 to 105.0 %

1.9.6 Absolute and Relative mV

Ranges	Resolution	Accuracy
0 to ± 400.0 mV 0 to ±1500 mV (auto-ranging)	0.1 mV 1 mV	±0.15 mV ±1 mV

Sensor Type..Platinum tip ORP sensor, combination or half cell.
Ion Selective Electrodes can also be used in this mode.

Input Impedance..................................>3 x 10^{12} Ohms

1.9.7 Temperature

Range	Resolution	Accuracy
-10.0 to 120.0 ^{O}C	0.1 ^{O}C	±0.2 ^{O}C

Sensor Type..Silicon transistor

Calibration..Automatic offset calibration

Sensor Offset Range..............................-10.0 to 10.0 ^{O}C

1.9.8 General Specifications

Memory..1360 readings including date and time

Automatic Logging...............................User-set for one reading every 2 to 90 seconds, minutes or hours.

RS232 Port...300, 9600 & 19200 baud.
8 bits, no parity, 1 stop bit, XON/XOFF Protocol.

Clock..Calendar clock displays date, month, year, hours, minutes & seconds.

Good Laboratory Practices..................Date, time and results of last calibration for all parameters are stored. This information can be recalled or sent to the RS232 port at any time.

Power..12V DC, 50mA. AC/DC adaptor is included in standard kit.

Dimensions...270 x 210 x 75 mm

Mass..Instrument only : Approx. 1.0 kg
Full Kit : Approx. 3.0 kg

Environment..Temperature : 0 to 45 ^{O}C
Humidity : 0 to 90 % R.H.

2. 900-LAB Menu Structure

A detailed breakdown of the menu system of the **900-LAB** is shown below. This diagram provides a quick reference for the menu functions available for the **900-LAB**.

- Menu →
  - F1:Calibrate →
    - F1:Oxygen
    - F2:Conductivity or: F2:TDS
    - F3:pH-1 or: F3:Ion-1
    - F4:pH-2 or: F4:Ion-2
    - F5:Temp.

    F3 and F4 do not appear in the menu when the channel is in mV mode or is switched off.
  - F2:Notepad →
    - F1:Recall
    - F2:Erase →
      - F1:Erase All
      - F2:Erase Last
    - F3:Print
    - F4:Program →
      - F1:Secs
      - F2:Mins
      - F3:Hours
  - F3:Mode →
    - F1:Oxygen →
      - F1:ppM
      - F2:ppM (Sal)
      - F3:%Sat
      - F4:%Gas
    - F2:TDS or: F2:Conductivity
    - F3:pH/mV/Ion-1 →
      - F1:pH
      - F2:mV
      - F3:Ion
      - F4:Rel mV
      - F5:Off
    - F4:pH/mV/Ion-2 →
      - F1:pH
      - F2:mV
      - F3:Ion
      - F4:Rel mV
      - F5:Off
  - F4:Setup →
    - F1:Ports →
      - F1:Baud Rate
      - F2:Recorder *
    - F2:Clock
    - F3:GLP →
      - F1:Recall
      - F3:Print
    - F4:Standards →
      - F1:Cond.
      - F2:TDS
      - F3:Ion-1
      - F4:Ion-2
      - F5:pH Buffer
    - F5:k factor →
      - F1:k=.1 +
      - F2:k=10 +

* This function only available when Recorder Port option is fitted.
+ This function not available when a TPS k=1.0 sensor is connected.

3. Dissolved Oxygen Mode

3.1 Selecting Dissolved Oxygen Mode

1. Select Dissolved Mode ([Menu] → **F3:Mode** → **F1:Oxygen**).
2. The Dissolved Oxygen readout units selection screen is now displayed…

```
MODE   F1:ppM              F2:ppM (Sal)
      >F3:% Sat            F4:% Gas
```

The arrow indicates the current selection.

Press [F1] to select Dissolved Oxygen readout in ppM units. This selection will not apply Salinity correction to the displayed readings.

Press [F2] to select Dissolved Oxygen readout in Salinity-corrected ppm units. This selection will use the Conductivity or TDS reading for automatic salinity correction.

Press [F3] to select Dissolved Oxygen readout in % Saturation units.

Press [F4] to select Dissolved Oxygen readout in % Gaseous units.

Press [Menu] to quit without changing the current setting.

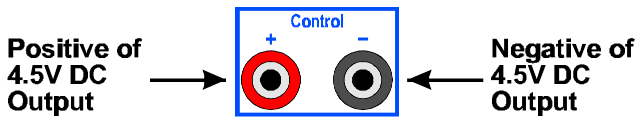
3.2 Power for Dissolved Oxygen Stirrer

The **900LAB** is equipped with a 4.5V DC output to power a stirrer for the Dissolved Oxygen sensor. This power output is suitable for the YSI self-stirring BOD sensor (part number 123213), or the TPS submersible DO_2 stirrer (part number 123305).

The 4.5V output is available at the **Control** connectors on the rear of the **900-LAB**. Simply connect the positive cable to the **+** connector and the negative cable to the **–** connector.

The Control output is capable of supplying 150 mA, which is ample for the two stirrers detailed above. The 4.5V output is continuous when the **900-LAB** is switched on.

When using the YSI self-stirring BOD sensor (part number 123213), please use the optional adaptor cable (part number 123307) to connect to the two 4mm banana plugs.



3.3 Dissolved Oxygen Calibration

1. Plug the Dissolved Oxygen sensor into the **Oxygen** socket.
2. Switch the meter on.
3. Select the Dissolved Oxygen readout mode to be used, as detailed in section 3.1.
4. Ensure that the Temperature readout has been calibrated. When the separate Temperature sensor is connected, the **900-LAB** will use it for Automatic Temperature Compensation in the ppM Dissolved Oxygen modes. When the Temperature sensor is not connected, the **900-LAB** will use a Temperature sensor built into the tip of the Dissolved Oxygen sensor for Automatic Temperature Compensation in the ppM Dissolved Oxygen modes.

   It is vital that the correct Temperature sensor is calibrated. See section 10.1 for a detailed explanation.
5. Rinse the Dissolved Oxygen sensor (and Temperature sensor, if applicable) in distilled water and blot dry.

3.3.1 Zero Calibration

1. Place the sensor(s) into an oxygen-free solution. This solution may be prepared by dissolving 2g of Sodium Sulphite in 100mL of distilled water. A 50g bottle of Sodium Sulphite powder (part number 123302) is supplied with a new Dissolved Oxygen sensor for this purpose.
2. Allow the reading to stabilise at or near zero. This may take 2-3 minutes.
3. Select Oxygen Calibration. (Menu → **`F1:Calibrate`** → **`F1:Oxygen`**)

   When the reading is below approximately 25 % Saturation, 2 ppM or 5% Gaseous, the **900-LAB** will display the ZERO calibration screen…

```
 1*0%Sat                          25.0°c
Oxygen   ZERO   Calibration, Press Enter
```

4. Press Enter to calibrate.

   A “*” will not be removed from the display after a Zero Calibration.
5. Remove the sensor(s) from the Zero solution, rinse well in distilled water and blot dry.

   The **900-LAB** will now prompt you to perform an AIR calibration.

3.3.2 Span Calibration in Air (all Oxygen modes)

1. Hang the Dissolved Oxygen sensor (and Temperature sensor, if applicable) in air. The tip of the Dissolved Oxygen sensor should be pointing downwards.

   Allow the reading to stabilise. After a zero calibration, this may take up to 5 minutes.

2. Select Oxygen Calibration. (Menu → **`F1:Calibrate`** → **`F1:Oxygen`**)

   When the reading is above approximately 25% Saturation, 2 ppM or 5% Gaseous, the **900-LAB** will display the AIR calibration screen…

```
 101.0%Sat                       25.0°c
Oxygen   AIR    Calibration, Press Enter
```

   Press Enter to calibrate.

   A "*" in the display will be replaced by a decimal point after a successful air calibration.

3. The **900-LAB** is now calibrated and is ready for Dissolved Oxygen measurements. Rinse the Dissolved Oxygen sensor in distilled water and blot dry before placing it into unknown samples.

3.3.3 Span Calibration in Solution (Salinity-corrected ppM Mode only)

This span calibration provides an alternative to calibrating the Dissolved Oxygen sensor in air. It is only available when the **900-LAB** is in Salinity-corrected ppM mode. Please note that the normal AIR calibration (section 3.3.2) is still available for Salinity-corrected ppM mode.

1. Measure the Dissolved Oxygen content of the solution to be used for calibration. This is generally done with a Winkler titration. The **900-LAB** span calibration should be performed immediately the Dissolved Oxygen content of the solution is known, as the value may not be stable.

2. Place the Dissolved Oxygen and Conductivity/TDS sensors (and Temperature sensor, if applicable) into the calibration solution. Ensure that the Conductivity/TDS sensor is correctly immersed (see section 20.2.1).

   The solution must be stirred at a moderate rate.

   Allow the reading to stabilise. After a zero calibration, this may take up to 5 minutes.

3. Select Oxygen Calibration. (Menu → **`F1:Calibrate`** → **`F1:Oxygen`**)

   When the reading is above approximately 2 ppM, the **900-LAB** will display the AIR/SPAN calibration screen. Note the cursor underlining the "**A**" in "**Air**".

   ```
    9.10ppMs                         25.0°c
   Oxygen AIR/SPAN Calibration, Press Enter
   ```

   Use the numeric keypad to enter the Dissolved Oxygen value of the solution. The words "AIR/SPAN" are deleted and the value being entered is displayed. The Conductivity or TDS reading also appears as soon as the first numeric key is pressed.

   Press the ← to correct any errors.

   Ensure that the Dissolved Oxygen, Conductivity/TDS and Temperature readings are fully stable.

   Press Enter to calibrate.

   A "*" in the display will be replaced by a decimal point after a successful air calibration.

4. The **900-LAB** is now calibrated and is ready for Dissolved Oxygen measurements. Rinse the Dissolved Oxygen sensor in distilled water and blot dry before placing it into unknown samples.

3.4 Dissolved Oxygen Calibration Notes

1. The relationship of % Saturation and ppM depends on a number of variables, so ***always calibrate in the mode required***. Do not try to infer Oxygen content from one mode to another.
2. The **900-LAB** automatically detects if a TPS ED1 or a YSI sensor is connected. When the unit has been calibrated for one type, and the other type is then connected, the message "**`Probe`**" appears in the Dissolved Oxygen display. It is necessary to re-calibrate for the new sensor to obtain accurate readings.
3. A zero calibration should be performed at least monthly. In applications where there is a low level of dissolved oxygen, a zero calibration may have to be done weekly.
4. An air calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.
5. All calibration information is retained in memory when the **900-LAB** is switched off. This information can be recalled or printed later using the GLP function (see section 11).

3.5 Dissolved Oxygen Calibration Messages

1. If a Zero calibration has been successfully performed, the **900-LAB** will display the following message and the Zero value of the sensor…

```
  0.0%Sat                         25.0°c
Calibration OK,     Zero=0.5%
```

2. If a Zero calibration has failed, the **900-LAB** will display the following message and the failed Zero value of the sensor. The unit will return to normal display mode with a " * " in place of the decimal point in the Dissolved Oxygen reading.

```
 15.0%Sat                         25.0°c
Calibration Failed, Zero=15.0%
```

3. If an Air/Span calibration has been successfully performed, the **900-LAB** will display the following message and the Span value of the sensor…

```
100.0%Sat                         25.0°c
Calibration OK,     Span=100.0%
```

4. If an Air/Span calibration has failed, the **900-LAB** will display the following message, and the failed Span value of the sensor. The decimal point will be replaced by a " * " when the unit returns to normal display mode.

```
205.0%Sat                         25.0°c
Calibration Failed, Span=205.0%
```

5. The **900-LAB** will display the following message if the calibration point is too high. The unit must be calibrated in the lower of the two ranges that are provided for each Oxygen mode.

```
300.%Sat                          25.0°c
Oxygen Out of range,Not Calibrated
```

6. The allowable Span range for a Dissolved Oxygen sensor is 65.0 to 200.0 %. If calibration fails due to the Span value being outside these limits, then please consult the Troubleshooting guide (section 19.2) for possible remedies.

4. Conductivity Mode

4.1 Selecting Conductivity Mode

1. Select Conductivity Mode (Menu → **F3:Mode** → **F2:Conductivity**).

   If the Mode menu shows **F2:TDS**, the **900-LAB** is already in Conductivity mode.

   In this case, simply press Menu to quit and remain in Conductivity mode.

2. The **900-LAB** now proceeds to Conductivity measurement mode. Note that a " * " is shown in place of the decimal point until a successful calibration has been performed (see section 4.4).

4.2 Setting the Conductivity calibration standard

The factory default for this item is 2.76mS/cm. If this is satisfactory, go directly to section 4.3.

1. Select the Conductivity Standard entry

   (Menu → **F4:Setup** → **F4:Standards** → **F1:Cond.**).

   The following screen is now displayed…

```
Cond. Standard:2760 uS
Range 20uS/cm to 2000mS/cm
```

2. Type in the value of the Conductivity standard that is to be used for calibration, including the decimal point. Use the ← key to make any corrections.

3. Press Enter to save the value of the standard solution.

   Alternatively, press Menu to quit without changing the current setting.

4. The **900-LAB** will now ask you to enter the units for the Conductivity standard…

```
Conductivity Standard:2760
Select Units   F1:uS/cm   F2:mS/cm
```

   Press F1 to set the Conductivity Standard as µS/cm.

   Press F2 to set the Conductivity Standard as mS/cm.

5. The Conductivity standard is now programmed for use at calibration.

4.3 Setting the Conductivity sensor k factor

The **900-LAB** automatically recognises a k=1.0 sensor. If a k=1.0 sensor is being used, go directly to section 4.4.

The **900-LAB does not** automatically recognise k=0.1 or k=10 sensors. When a k=0.1 or k=10 sensor is used, the **900-LAB** must be set to the correct k factor before use.

To select a k=0.1 or k=10 sensor…

1. Select k factor entry (Menu → **`F4:Setup`** → **`F5:k factor`**).
2. The k factor entry screen is now displayed…

```
Select nominal k factor,
 F1:k=.1        >F2:k=10
```

The arrow indicates the current selection.

Press F1 if a k=0.1 sensor is being used.

Press F2 if a k=10 sensor is being used.

Press Menu to quit without changing the current setting.

Notes

1. The manual k factor selection is kept in memory when the meter is switched off.
2. The manual k factor selection is reset to k=10 during initialisation.
3. The **900-LAB** will always automatically recognise a k=1.0 sensor, regardless of the manual k factor selection.
4. Calibration settings for k=0.1, k=1.0 and k=10 sensors are NOT stored separately.

   The **900-LAB** requires re-calibration when a new k factor sensor is connected.

4.4 Conductivity Calibration

Before attempting a Conductivity calibration, ensure that the **900-LAB** has been set up correctly according to sections 4.1 to 4.3.

Automatic Temperature Compensation is done via a temperature sensor inside the Conductivity sensor. It is therefore not necessary to calibrate the Temperature readout of the **900-LAB** before taking Conductivity measurements.

1. Plug the Conductivity sensor into the **Cond/TDS** socket.
2. Rinse the Conductivity sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. DO NOT BLOT THE ELECTRODE PLATES.

Zero Calibration

3. Let the sensor dry in air.
4. Select Conductivity Calibration (Menu → **`F1:Calibrate`** → **`F2:Conductivity`**).
5. The **900-LAB** will recognise the low conductivity signal and attempt a Zero calibration. For example…

```
          0*01uS                  25.0°c
Cond. ZERO      Calibration,Press Enter
```

6. When the reading has stabilised at or near zero, press Enter to calibrate or Menu to quit. The " ∗ " will not be removed after a zero calibration.

Standard Calibration

7. Place the Conductivity sensor into a sample of Conductivity standard. Ensure that it is immersed correctly, with adequate clearance to the floor and walls of the vessel. See section 20.2.1 for details of correct sensor immersion.

   DO NOT place the sensor directly into the bottle of standard. Discard the used sample of standard after use.

   Select Conductivity Calibration (Menu → **`F1:Calibrate`** → **`F2:Conductivity`**). The calibration screen will be displayed with the Conductivity standard to be used. For example…

```
           2*86mS                 25.0°c
Cond. 2760uS    Calibration,Press Enter
```

8. When the reading has stabilised, press Enter to calibrate. The " ∗ " will now be replaced by a decimal point if calibration was successful.
9. The **900-LAB** is now calibrated for Conductivity and is ready for use in this mode.

4.5 Conductivity Calibration Notes

1. A Zero calibration should be performed at least monthly. In low conductivity applications (where a zero error is particularly significant), a zero calibration may have to be done weekly.
2. A Standard calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.
3. Conductivity and TDS calibration data is stored separately in memory. Ensure that the **900-LAB** has been correctly calibrated for the mode in which it will be used. The **900-LAB** does not require re-calibration when alternating between Conductivity and TDS modes, providing the instrument has been correctly calibrated for each mode on the k factor sensor to be used.
4. All calibration information is retained in memory when the **900-LAB** is switched off. This information can be recalled or printed later using the GLP function (see section 11).
5. The **900-LAB** displays the value of the standard to which it will attempt to calibrate. Ensure that the standard value displayed corresponds to the standard that you are using. Alter the Standards set-up if necessary (see section 4.2).
5. Calibration settings for k=0.1, k=1.0 and k=10 sensors are NOT stored separately.

   The **900-LAB** requires re-calibration when a new k factor sensor is connected.

4.6 Conductivity Calibration Messages

1. If a Zero Calibration has been successfully performed, the **900-LAB** will display the following message…

```
           0.00uS                 25.0°c
Calibration OK, Zero=0.01uS
```

2. If a Standard Calibration has been successfully performed, the **900-LAB** will display the following message and the calculated k factor of the sensor. For example…

```
           2.76mS                 25.0°c
Calibration OK, k=0.99
```

3. If a Standard Calibration has failed, the **900-LAB** will display the following message and the calculated k factor of the sensor. For example…

```
Calibrate Failure. Check STD=2760uS/cm
k=3.64, Exceeds Limit.
```

Notes

1. The allowable k factor range is +/-25% of nominal. This range is ample to allow for correctly functioning Conductivity sensors. If calibration fails due to the k factor being outside these limits, then please consult the Troubleshooting guide (section 19.3) for possible remedies.

5. TDS Mode

5.1 Selecting TDS Mode

1. Select TDS Mode ([Menu] → **F3:Mode** → **F2:TDS**).

   If the Mode menu shows **F2:Conductivity**, the **900-LAB** is already in TDS mode.

   In this case, simply press [Menu] to quit and remain in TDS mode.

2. The **900-LAB** now proceeds to TDS measurement mode. Note that a " * " is shown in place of the decimal point until a successful calibration has been performed (see section 5.4).

5.2 Setting the TDS calibration standard

The factory default for this item is 2.00ppK. If this is satisfactory, go directly to section 5.3.

1. Select the TDS Standard entry

   ([Menu] → **F4:Setup** → **F4:Standards** → **F2:TDS**).

   The following screen is now displayed…

```
TDS Standard:2000ppM
Range 20 ppM to 500 ppK
```

2. Type in the value of the TDS standard that is to be used for calibration, including the decimal point. Use the [←] key to make any corrections.

3. Press [Enter] to save the value of the standard solution.

   Alternatively, press [Menu] to quit without changing the current setting.

4. The **900-LAB** will now ask you to enter the units for the TDS standard…

```
TDS Standard:36.00
Select Units   F1:ppM     F2:ppK
```

   Press [F1] to set the TDS Standard as ppM (parts per Million).

   Press [F2] to set the TDS Standard as ppK (parts per Thousand).

5. The TDS standard is now programmed for use at calibration.

5.3 Setting the TDS sensor k factor

The **900-LAB** automatically recognises a k=1.0 sensor. If a k=1.0 sensor is being used, go directly to section 5.4.

The **900-LAB does not** automatically recognise k=0.1 or k=10 sensors. When a k=0.1 or k=10 sensor is used, the **900-LAB** must be set to the correct k factor before use.

To select a k=0.1 or k=10 sensor…

1. Select k factor entry ([Menu] → **`F4:Setup`** → **`F5:k factor`**).
2. The k factor entry screen is now displayed…

   ```
   Select nominal k factor,
    F1:k=.1        >F2:k=10
   ```

   The arrow indicates the current selection.

   Press [F1] if a k=0.1 sensor is being used.

   Press [F2] if a k=10 sensor is being used.

   Press [Menu] to quit without changing the current setting.

Notes

1. The manual k factor selection is kept in memory when the meter is switched off.
2. The manual k factor selection is reset to k=10 during initialisation.
3. The **900-LAB** will always automatically recognise a k=1.0 sensor, regardless of the manual k factor selection.
4. Calibration settings for k=0.1, k=1.0 and k=10 sensors are NOT stored separately.

   The **900-LAB** requires re-calibration when a new k factor sensor is connected.

5.4 TDS Calibration

Before attempting a TDS calibration, ensure that the **900-LAB** has been set up correctly according to sections 5.1 to 5.3.

Automatic Temperature Compensation is done via a temperature sensor inside the TDS sensor. It is therefore not necessary to calibrate the Temperature readout of the **900-LAB** before taking TDS measurements.

1. Plug the TDS sensor into the **Cond/TDS** socket.
2. Rinse the TDS sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. DO NOT BLOT THE ELECTRODE PLATES.

Zero Calibration

3. Let the sensor dry in air.
4. Select TDS Calibration (Menu → **F1:Calibrate** → **F2:TDS**).
5. The **900-LAB** will recognise the low TDS signal and attempt a Zero calibration. For example…

```
          0*01ppM                    25.0°c
TDS   ZERO       Calibration,Press Enter
```

6. When the reading has stabilised at or near zero, press Enter to calibrate or Menu to quit. The " * " will not be removed after a zero calibration.

Standard Calibration

7. Place the TDS sensor into a sample of TDS standard. Ensure that it is immersed correctly, with adequate clearance to the floor and walls of the vessel. See section 20.2.1 for details of correct sensor immersion.

   DO NOT place the sensor directly into the bottle of standard. Discard the used sample of standard after use.

   Select TDS Calibration (Menu → **F1:Calibrate** → **F2:TDS**). The calibration screen will be displayed with the TDS standard to be used. For example…

```
           2*10ppK                   25.0°c
TDS   2000ppM    Calibration,Press Enter
```

8. When the reading has stabilised, press Enter to calibrate. The " * " will now be replaced by a decimal point if calibration was successful.
9. The **900-LAB** is now calibrated for TDS and is ready for use in this mode.

5.5 TDS Calibration Notes

1. A Zero calibration should be performed at least monthly. In low TDS applications (where a zero error is particularly significant), a zero calibration may have to be done weekly.
2. A Standard calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.
3. Conductivity and TDS calibration data is stored separately in memory. Ensure that the **900-LAB** has been correctly calibrated for the mode in which it will be used. The **900-LAB** does not require re-calibration when alternating between Conductivity and TDS modes, providing the instrument has been correctly calibrated for each mode on the k factor sensor to be used.
4. All calibration information is retained in memory when the **900-LAB** is switched off. This information can be recalled or printed later using the GLP function (see section 11).
5. The **900-LAB** displays the value of the standard to which it will attempt to calibrate. Ensure that the standard value displayed corresponds to the standard that you are using. Alter the Standards set-up if necessary (see section 5.2).
6. Calibration settings for k=0.1, k=1.0 and k=10 sensors are NOT stored separately.

   The **900-LAB** requires re-calibration when a new k factor sensor is connected.

5.6 TDS Calibration Messages

1. If a Zero Calibration has been successfully performed, the **900-LAB** will display the following message…

```
           0.00ppM                25.0°c
Calibration OK, Zero=0.01ppM
```

2. If a Standard Calibration has been successfully performed, the **900-LAB** will display the following message and the calculated k factor of the sensor. For example…

```
           2.00ppK                25.0°c
Calibration OK, k=0.99
```

3. If a Standard Calibration has failed, the **900-LAB** will display the following message and the calculated k factor of the sensor. For example…

```
Calibrate Failure. Check STD=2000ppM
k=3.64, Exceeds Limit.
```

Notes

2. The allowable k factor range is +/-25% of nominal. This range is ample to allow for correctly functioning TDS sensors. If calibration fails due to the k factor being outside these limits, then please consult the Troubleshooting guide (section 19.3) for possible remedies.

6. Specific Ion Mode

6.1 Selecting Specific Ion Mode

1. Select Specific Ion Mode for the desired pH/mV/Specific Ion channel…

   [Menu] → **F3:Mode** → **F3:pH/mV/Ion-1** → **F3:Ion**

   or

   [Menu] → **F3:Mode** → **F4:pH/mV/Ion-2** → **F3:Ion**

2. The Valency selection screen is now displayed…

```
VALENCY  >F1:+Mono          F2:-Mono
           F3:++Di          F4:--Di
```

   The arrow indicates the current selection.

   Press [F1] to select Monovalent Cation (e.g. Na^{+}).

   Press [F2] to select Monovalent Anion (e.g. F^{-}).

   Press [F3] To select Divalent Cation (e.g. Cu^{2+}).

   Press [F4] to select Divalent Anion (e.g. S^{2-}).

   Press [Menu] to quit without changing the current setting.

3. The Units selection screen is now displayed…

```
UNITS  >F1:ppM           F2:ppK
         F3:%            F4:Exponential
```

   The arrow indicates the current selection.

   Press [F1] to select readout in ppM (parts per Million).

   Press [F2] to select readout in ppK (parts per Thousand).

   Press [F3] to select readout in %.

   Press [F4] to select readout in Exponential units (e.g. Molar).

   Press [Menu] to quit without changing the current setting.

4. The Ion Resolution screen is now displayed…

```
Ion Resolution >F1:3 Digits  F2:2 Digits
                F3:Auto-Rounding
```

   The arrow indicates the current selection.

   Press [F1] to select resolution to 3 significant digits. In this mode, the readings may become slightly unstable towards the end of each decade, due to the logarithmic nature of the sensor signal.

   Press [F2] to select resolution to 2 significant digits. Readings in this mode are very stable, although 1 signficant digit is lost.

   Press [F3] to select Auto-rounding. Readings in this mode are displayed to 3 signficant digits for most of the decade, and automatically rounded for stability towards the end of the decade. Auto-rounding is recommended for most users.

   Press [Menu] to quit without changing the current setting.

5. The **900-LAB** now displays the following message, before proceeding to the Specific Ion standards setup for this channel.

   This step is bypassed if there were no changes to the current Specific Ion setup.

   ```
   Ion setup changed or New,
   Must Enter Standards for this channel
   ```

   Proceed to section 6.2 for details on setting the Primary and Secondary Specific Ion standards.

6.2 Setting Specific Ion Standards

The Primary and Secondary Specific Ion standards must be set before attempting Specific Ion calibration. The standards must be re-entered when changing Specific Ion modes or if the **900-LAB** is initialised.

NOTE : When the Specific Ion standards are changed, the Specific Ion readout for that channel must be re-calibrated.

6.2.1 Setting Specific ion standards for ppM, ppK and % readouts

1. Select the Specific Ion standards set-up menu for the relevant channel…

   [Menu] → **F4:Setup** → **F4:Standards** → **F3:Ion-1**

   or

   [Menu] → **F4:Setup** → **F4:Standards** → **F4:Ion-2**

2. The Primary Standard set-up screen will now be displayed.

   ```
   Enter Primary Standard : 0.00     ppM
   ```

   Type in the value of the Primary standard, including the decimal point. Use the [←] key to make any corrections.

   Press [Enter] to save the Primary standard.

   Alternatively, press [Menu] to quit without changing the current setting.

3. The Secondary Standard set-up screen is now displayed.

   ```
   Enter Secondary Standard : 0.00     ppM
   ```

   Type in the value of the Secondary standard, including the decimal point. Use the [←] key to make any corrections.

   The Secondary Standard must be at least 2 to 100 times higher or lower than the primary standard.

   Press [Enter] to save the Secondary standard.

   Alternatively, press [Menu] to quit without changing the current setting.

4. If the Specific Ion standards were changed, the Specific Ion readout for that channel must be re-calibrated. The **900-LAB** provides the following prompt as a reminder…

   ```
   Calibration settings reset,
   Channel 1 must be Calibrated
   ```

6.2.2 Setting Specific ion standards for Exponential readout

1. Select the Specific Ion standards set-up menu for the relevant channel…

   [Menu] → **F4:Setup** → **F4:Standards** → **F3:Ion-1**

   or

   [Menu] → **F4:Setup** → **F4:Standards** → **F4:Ion-2**

2. The Primary Standard set-up screen will now be displayed.

   ```
   Enter Primary Standard : 0.00 10± 00
   ```

   Readings in Exponential mode are expressed in Scientific notation. For example, **1.00 10⁻04** should be read as 1.00 x 10^{-4}, ie. 0.0001.

   Type in 3 significant digits of the value of the Primary standard. The decimal point is fixed for you in this mode.

   Now press [F1] for 10^{+} or press [F2] for 10^{-}.

   Enter the power. This can be entered as 1 or 2 digits (eg. "**04**" is treated the same as "**4**").

   Use the [←] key to make any corrections.

   Press [Enter] to save the Primary standard.

   Alternatively, press [Menu] to quit without changing the current setting.

3. The Secondary Standard set-up screen will now be displayed.

   ```
   Enter Secondary Standard : 0.00 10± 00
   ```

   The Secondary Standard must be at least 2 to 100 times higher or lower than the primary standard.

   Type in 3 significant digits of the value of the Secondary standard. The decimal point is fixed for you in this mode.

   Now press [F1] for 10^{+} or press [F2] for 10^{-}.

   Enter the power. This can be entered as 1 or 2 digits (eg. "**04**" is treated the same as "**4**").

   Use the [←] key to make any corrections.

   Press [Enter] to save the Secondary standard.

   Alternatively, press [Menu] to quit without changing the current settings.

4. If the Specific Ion standards were changed, the Specific Ion readout for that channel must be re-calibrated. The **900-LAB** provides the following prompt as a reminder…

   ```
   Calibration settings reset,
   Channel 1 must be Calibrated
   ```

6.3 Specific Ion Calibration

1. Plug the Ion Selective Electrode into the Channel 1 or Channel 2 **Sensor** socket.

   If a separate Reference Electrode is being used, plus this into the separate Channel 1 or Channel 2 **REF** socket provided.

   Plug the Temperature sensor into the **TEMP** socket.

2. Switch the meter on.

3. Select and set up the Ion mode for the relevant channel, as detailed in section 6.1.

   Set up the Primary and Secondary Specific Ion standards, as detailed in section 6.2.

   For the purposes of this handbook, the **900-LAB** has been set up for 10ppM as the Primary Standard and 100ppM as the Secondary Standard.

4. Ensure that temperature has already been calibrated (section 10.1) or manually set (section 10.4).

   NOTE: A " ∗ " in place of the decimal point in the temperature readout indicates that temperature is not calibrated.

5. Remove the wetting caps from the Ion Selective and Reference electrodes, if fitted.

   Rinse the Ion Selective, Reference and Temperature sensors in distilled water and blot dry.

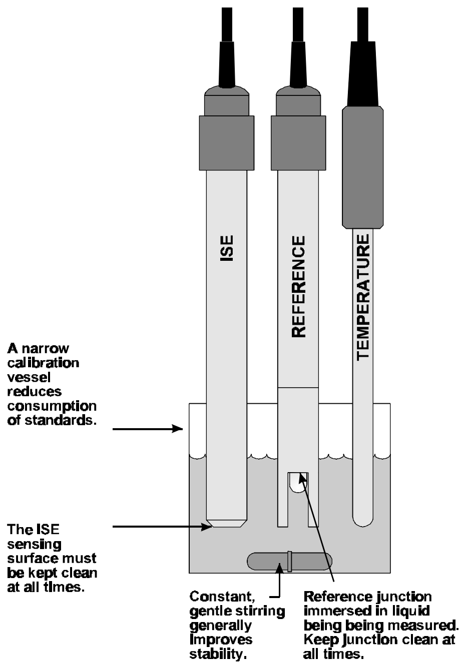
Primary Calibration

6. Place the Ion Selective, Reference and Temperature sensors into the Primary Standard.

   Ensure that the Ion Selective Electrode sensing surface and the reference electrode's reference junction are both covered, as per the diagram below.

   Add any Ionic Strength Adjusting Buffer (ISAB) that may be required (see the Ion Selective Electrode's handbook).

   A magnetic stirrer providing constant, gentle stirring generally improves stability.



Continued over the page…

7. Select Primary Calibration for the relevant channel…

   [Menu] → **F1:Calibrate** → **F3:Ion-1** → **F1:Primary**

   or

   [Menu] → **F1:Calibrate** → **F4:Ion-2** → **F1:Primary**

   The primary calibration screen is now displayed. The current reading is displayed on the top left, followed by the actual mV data coming from the sensor. The message "**Cal**" instead of the reading indicates that the **900-LAB** is currently not Primary calibrated. For example…

```
 Cal   0.1mV                         25.0°c
Ion 10.0ppM Calibration, Press Enter
```

   When the mV reading has stabilised, press [Enter] to calibrate to the Primary Standard value.

   Press [Menu] to quit without calibrating.

   The **900-LAB** will now display the Offset of the Ion Selective Electrode, before returning to normal display mode.

   Note that the " * " will not removed from the Specific Ion readout until a Secondary calibration has been successfully performed

8. Rinse the Sensors in distilled water and blot dry.

Secondary Calibration

9. Place the Ion Selective, Reference and Temperature sensors into the Secondary Standard.

   Ensure that the Ion Selective Electrode sensing surface and the reference electrode's reference junction are both covered, as per the diagram in step 6.

   Ensure that any Ionic Strength Adjusting Buffer (ISAB) that may be required has been added (see the Ion Selective Electrode's handbook).

   A magnetic stirrer providing constant, gentle stirring generally improves stability.

10. Select Secondary Calibration for the relevant channel…

   [Menu] → **F1:Calibrate** → **F3:Ion-1** → **F2:Secondary**

   or

   [Menu] → **F1:Calibrate** → **F4:Ion-2** → **F2:Secondary**

   The secondary calibration screen is now displayed. The current reading is displayed on the top left, followed by the actual mV data coming from the sensor. A " * " in place of the decimal point indicates that the **900-LAB** is currently not Secondary calibrated. For example…

```
    11*0ppM     56.7mV              25.0°c
Ion 100.ppM Calibration, Press Enter
```

   When the mV reading has stabilised, press [Enter] to calibrate to the Secondary Standard value.

   Press [Menu] to quit without calibrating.

   The **900-LAB** will now display the Slope of the Ion Selective Electrode, before returning to normal display mode.

   A " * " in the display will be replaced by a decimal point after a successful 2-point Slope calibration.

11. The **900-LAB** is now calibrated and is ready for Specific Ion measurements. Rinse the Ion Selective, Reference and Temperature sensors in distilled water and blot dry before placing them into unknown samples.

6.4 Specific Ion Calibration Notes

1. A Primary Calibration should be performed at least weekly. In applications where the reference electrode junction can become blocked, such as dairy products, mining slurries etc, a Primary Calibration may have to be done daily.
2. A full Primary and Secondary Calibration should be performed at least monthly. Of course, more frequent calibration will result in greater confidence in results.
3. All calibration information is retained in memory when the **900-LAB** is switched off, even when the power supply is removed. This information can be recalled or printed later using the GLP function (see section 11).
4. The **900-LAB** displays the value of the standard to which it will attempt to calibrate. Ensure that the standard value displayed corresponds to the standard that you are using. Alter the Standards set-up if necessary (see section 6.2).

6.5 Specific Ion Calibration Messages

1. If a Primary Calibration has been successfully performed, the **900-LAB** will display the following message and the Offset value of the sensor. For example…

```
    100*ppM                      25.0°c
Calibration OK,  mV @ STD1=0.1mV
```

2. If a Secondary Calibration has been successfully performed, the **900-LAB** will display the following message and the slope value of the sensor. For example…

```
    10.0ppM     56.7mV           25.0°c
Calibration OK,  Slope=95.6%
```

3. If a Secondary Calibration has failed, the **900-LAB** will display the following message and the failed slope value of the electrode. For example…

```
    35*2ppM     25.4mV           25.0°c
Calibration Failed, Slope=42%
```

Notes

1. The **900-LAB** has an unlimited Offset range, as long as the reading is not over-ranged. This is to allow for the large variety of Ion Selective Electrodes available.
2. The allowable Slope range is 50.0 to 110.0 %. This range is ample to allow for correctly functioning Ion Selective Electrodes. If calibration fails due to the Slope being outside these limits, then please consult the Troubleshooting guide (section 19.4) for possible remedies.

7. pH Mode

7.1 Selecting pH Mode

1. Select pH Mode for the desired pH/mV/Specific Ion channel…

   [Menu] → **F3:Mode** → **F3:pH/mV/Ion-1** → **F1:pH**

   or

   [Menu] → **F3:Mode** → **F4:pH/mV/Ion-2** → **F1:pH**

2. The pH Resolution screen is now displayed…

   ```
   Select pH Resolution
    F1:0.1    >F2:0.01     F3:0.001
   ```

   The arrow indicates the current selection.

   Press [F1] to select 0.1 pH resolution.

   Press [F2] to select 0.01 pH resolution.

   Press [F3] to select 0.001 pH resolution.

   Press [Menu] to quit without changing the current selection.

7.2 Selecting the pH Buffer Set

The **900-LAB** can be programmed to automatically recognise any of the following buffer sets during pH calibration. All pH values listed below are at 25 ^{O}C.

1. pH4.00, pH6.88, pH9.22
2. pH4.00, pH6.88, pH10.06
3. pH4.00, pH7.00, pH9.22
4. pH4.00, pH7.00, pH10.06.

To select the pH buffer set for automatic recognition…

1. Select the pH Buffer set-up menu.

   (Menu → **F4:Setup** → **F4:Standards** → **F5:pH Buffer**).

2. The primary buffer selection menu is now displayed…

   ```
   Select Primary Buffer
   >F1:6.88pH     F2:7.00pH
   ```

   The arrow indicates the current selection.

   Press F1 to select pH6.88 as the Primary Buffer.

   Press F2 to select pH7.00 as the Primary Buffer.

   Press Menu to quit without changing the current setting.

3. The secondary buffers selection menu is now displayed…

   ```
   Select Secondary Buffers
   >F1:4.00/9.22pH     F2:4.00/10.06pH
   ```

   The arrow indicates the current selection.

   Press F1 to select pH4.00 and pH9.22 as the Secondary Buffers.

   Press F2 to select pH4.00 and pH10.06 as the Secondary Buffers.

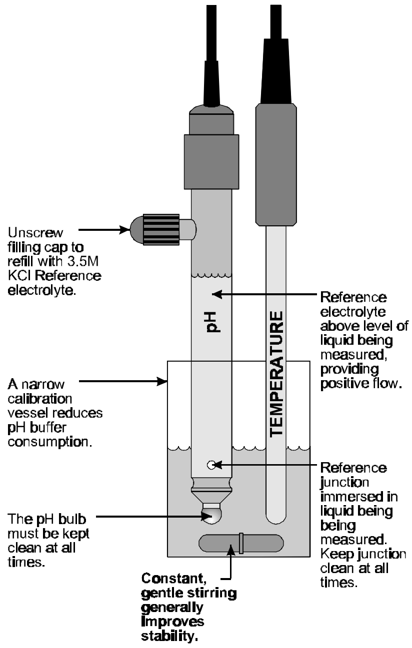
   Press Menu to quit without changing the current setting.

Notes

1. The selected buffer set is kept in memory when the meter is switched off.
2. The buffers are re-set to pH4.00, pH6.88 and pH9.23 during initialisation.
3. pH6.88 buffer is a DIN 19266 and NBS Primary-standard pH solution. Its use as the primary buffer is highly recommended for the most accurate possible results. If pH7.00 buffer is used, ensure that it is manufactured to at least 0.01pH accuracy. pH7.00 buffer has a buffer capacity less than half that of pH6.88 buffer and is therefore much less stable.
4. pH9.23 and pH10.01 buffers are highly unstable. Avoid using these buffers if possible. Discard immediately after use.
5. If you wish to use a pH buffer other than one of those listed above, its value can be keyed in during calibration. Make sure that you have pH versus Temperature data for the buffer.

7.3 pH Calibration

1. Plug the pH sensor into the **SENSOR** socket of the relevant channel and the temperature sensor into the **TEMP** socket. Switch the meter on.
2. Select pH Mode and the desired pH resolution for the relevant channel (see section 7.1).
3. Ensure that temperature has already been calibrated, or manually set (see sections 10.1 and 10.4). NOTE: For real temperature readings, the decimal point is shown by a " * ", when the temperature readout is not calibrated.
4. Remove the wetting cap from the pH sensor. Rinse the pH and Temperature sensors in distilled water and blot them dry.
5. Ensure that the primary and secondary buffers to be used have been correctly selected for automatic buffer recognition. See section 7.2.
6. Place both electrodes into a small sample of primary buffer (pH6.88 or 7.00), so that the bulb and reference junction are both covered as per the diagram below.



DO NOT place the electrodes directly into the buffer bottle.

7. Select pH Calibration for the relevant channel…

   Menu → **F1:Calibrate** → **F3:pH-1**

   or

   Menu → **F1:Calibrate** → **F4:pH-2**

   The display should now look something like this…

   ```
      6*85pH      Buffer=6.87        25.0°c
   Press ENTER to Calibrate,or Edit Buffer.
   ```

   The current pH reading is shown on the left. Note the " * ", indicating that pH is currently not calibrated. Wait for this reading to stabilise before attempting to calibrate the **900-LAB**.

   The buffer that the **900-LAB** has attempted to recognise is also displayed with the correct value at the current temperature.

   Press Enter to calibrate to the displayed buffer.

   Otherwise, enter an alternative buffer using the Numeric Keypad, and then press Enter.

   The meter is now 1 point calibrated. Note that the " * " will not be removed until a full 2 point calibration has been performed.

8. Rinse the pH and Temperature sensors in distilled water and blot them dry.

9. Place both sensors into a small sample of secondary buffer (pH4.00, 9.23 or 10.01), so that the bulb and reference junction are both covered as per the diagram in step 6.

   DO NOT place the electrodes directly into the buffer bottle.

   NOTE: pH9.23 and pH10.01 buffers are highly unstable. Avoid using these buffers if possible. Discard immediately after use.

10. Select pH Calibration for the relevant channel…

    Menu → **F1:Calibrate** → **F3:pH-1**

    or

    Menu → **F1:Calibrate** → **F4:pH-2**

    The display should now look similar to the example shown in step 7. Note that the **900-LAB** has automatically recognised the second buffer.

    Wait for the displayed reading to stabilise before attempting to calibrate the **900-LAB**.

    Press Enter to calibrate to the displayed buffer.

    Otherwise, enter an alternative buffer using the Numeric Keypad, and then press Enter.

11. The **900-LAB** is now calibrated and is ready for use. Discard the used samples of buffer.
    Rinse the pH and Temperature sensors in distilled water and blot them dry before placing them into unknown samples.

7.4 pH Calibration Notes

1. A 1-point calibration should be performed at least weekly. In applications where the electrode junction can become blocked such as dairy products, mining slurries etc, a 1-point calibration may have to be done daily.
2. A full 2-point calibration should be performed at least monthly. Of course, more frequent calibration will result in greater confidence in results.
3. All calibration information is retained in memory when the **900-LAB** is switched off, even when the power supply is removed. This information can be recalled or printed later using the GLP function (see section 11).

7.5 pH Calibration Messages

1. If a 1-point calibration has been successfully performed, the **900-LAB** will display the following message and the asymmetry of the electrode. Note that the slope value from the last calibration is also shown.

```
Asymmetry Calibration Successful
+0.10pH Asym      100% Slope
```

2. If a 1-point calibration has failed, the **900-LAB** will display the following message and the failed asymmetry value of the electrode.

```
Calibrate Failed, 1.2 pH Asymmetry
Repeat Cal. or Initialise Calibration
```

3. If a 2-point calibration has been successfully performed, the **900-LAB** will display the following message and the asymmetry and slope of the electrode.

```
Slope & Asymmetry Calibration Successful
+0.10pH Asym       99.0% Slope
```

4. If a 2-point calibration has failed, the **900-LAB** will display the following message and the failed slope value of the electrode.

```
Calibrate Failed, 80% Slope
Repeat Cal. or Initialise Calibration
```

5. The **900-LAB** has an allowable Asymmetry range of –1.00 to +1.00 pH. The allowable Slope range is 85.0 to 105.0 %. If calibration fails due to either the Asymmetry or the Slope being outside these limits, then please consult the Troubleshooting guide (section 19.4) for possible remedies.

8. Absolute Millivolt Mode

8.1 Selecting Absolute Millivolt Mode

Select absolute mV mode for the relevant channel…

Menu → **F3:Mode** → **F3:pH/mV/Ion-1** → **F2:mV**

or

Menu → **F3:Mode** → **F4:pH/mV/Ion-2** → **F2:mV**

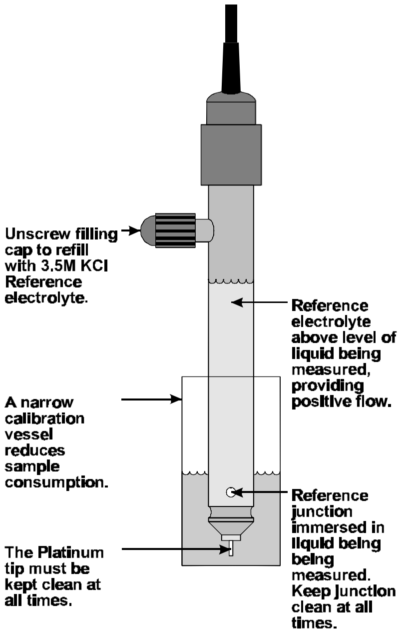
The **900-LAB** will display the actual millivolts produced by the sensor in this mode.

8.2 Absolute Millivolt Calibration

The millivolt section of the **900-LAB** is factory calibrated. There is no user-calibration facility for this mode.

Temperature compensation is not applicable in Millivolt mode.

Simply plug the Redox sensor into the **SENSOR** socket for the relevant channel and proceed to take measurements. Ensure that the platinum tip and reference junction are both covered, as per the diagram below.



9. Relative Millivolt Mode

9.1 Selecting Relative Millivolt Mode

Select Relative mV mode when measurements relative to a known standard are required.

To select Relative mV mode for the relevant channel…

[Menu] → **F3:Mode** → **F3:pH/mV/Ion-1** → **F4:Rel mV**

or

[Menu] → **F3:Mode** → **F4:pH/mV/Ion-2** → **F4:Rel mV**

The **900-LAB** will display the millivolt data relative to a known, user-selectable zero point.

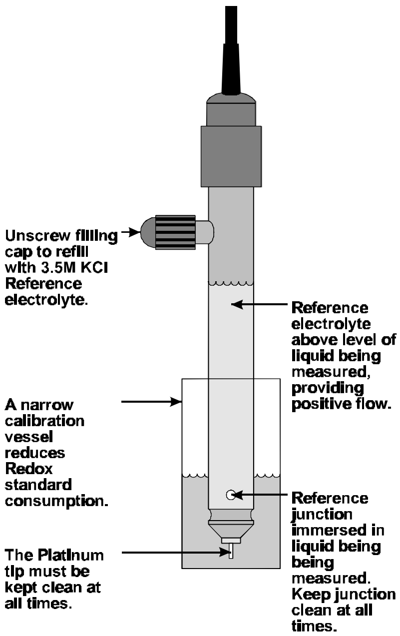
9.2 Relative Millivolt Calibration

Calibration of the Relative mV mode is simply a matter of zeroing the reading when the sensor is in the known standard.

1. Plug the Redox sensor into the **SENSOR** socket. Temperature compensation is not applied in Relative mV mode, so the temperature sensor does not need to be connected.
2. Switch the meter on.
3. Select Relative mV Mode for the relevant channel, as per section 9.1
4. The display now shows the millivolt data with the units “**mVR**” The “**R**” indicates Relative mV. The example below shows both pH/mV/Ion channels set for Relative mV…

```
10.00ppM  2760.uS   400.0mVR   400.0mVR
25.0°c                 31/12/00 12:00:00
```

5. Remove the wetting cap from the Redox sensor.
6. Rinse the sensor in distilled water and blot dry.
7. Place the Redox sensor into a sample of the known standard. Ensure that the platinum tip and reference junction are both covered, as per the diagram below.



8. When the reading has stabilised, press the [F4] key to zero the Relative mV reading.

   (a) If only one Channel is in Relative mV mode, the Relative mV reading will now be zero. In the following example, Channel 1 is in Relative mV mode, and Channel 2 is in pH mode…

   ```
    10.00ppM  2760.uS     0.0mVR    7.00pH
    25.0°c                 31/12/00 12:00:00
   ```

   (b) If more than one Channel is in Relative mV mode, the **900-LAB** will offer a choice of Zeroing one Channel, or both Channels. For example…

   ```
    10.00ppM  2760.uS   400.0mVR   400.0mVR
   Zero F1:Chan1 F2:Chan2 F4:Both
   ```

   Press [F1], [F2] or [F4] according to your requirements.

9. The **900-LAB** Relative mV mode is now zeroed and is ready for use. The readout can be re-zeroed by pressing the [F4] key whenever required.

9.3 Relative Millivolt Calibration Notes

1. Temperature compensation does not apply in Relative mV mode,
2. The Relative mV offset is retained in memory when the **900-LAB** is switched off.
3. The Relative mV zero offset is reset when entering or leaving Relative mV mode.

10. Temperature Mode

The temperature readout must be calibrated or manually set before attempting Specific Ion, pH or ppM Dissolved Oxygen calibration.

The decimal point is replaced by a " * " if the reading is not calibrated.

The **900-LAB** is able to take Temperature readings from the Temperature sensor, ED1 Dissolved Oxygen sensor or YSI Dissolved Oxygen sensor. If both the Temperature sensor and a Dissolved Oxygen sensor are connected at the same time, the Temperature reading is taken from the Temperature sensor.

If the **900-LAB**'s Temperature readout was calibrated on an ED1 sensor and then a YSI sensor is connected, the unit displays "**Probe**" instead of the Temperature data. The same occurs when an ED1 sensor is connected after the unit was calibrated on a YSI sensor. This warning is only displayed when the separate Temperature sensor is not connected. It is necessary to re-calibrate the Temperature readout if Temperature measurements from the new Dissolved Oxygen are required.

10.1 Temperature Calibration

1. To calibrate the separate Temperature sensor, plug the temperature sensor into the **TEMP** socket.

   To calibrate the Temperature readout from a Dissolved Oxygen sensor, plug the Dissolved Oxygen sensor into the **Oxygen** socket and ensure that the separate Temperature is not connected.

2. Switch the meter on.

3. Place the Temperature or Dissolved Oxygen sensor into a beaker of room temperature water, alongside a good quality mercury thermometer. Stir the probe and the thermometer gently to ensure an even temperature throughout the beaker.

4. Select Temperature Calibration (Menu → **F1:Calibrate** → **F5:Temp.**).

   The Temperature Calibration screen is now displayed. The bottom line provides confirmation of which sensor is being calibrated. The following example shows the Temperature sensor being calibrated.

   ```
   Enter Actual Temperature : _      24.0°C
   Using Temperature Probe.      Menu Quits
   ```

   The current reading from the Temperature or Dissolved Oxygen sensor is displayed on the far right of the top line.

5. When this reading has stabilised, use the Numeric Keypad to enter the same temperature as measured by the mercury thermometer.

6. Press the Enter key to calibrate the temperature readout.

   Alternatively, press the Menu key to abort temperature calibration.

10.2 Temperature Calibration Notes

1. Temperature calibration information is retained in memory when the **900-LAB** is switched off, even when the power supply is removed. This information can be recalled later using the GLP function (see section 11).

2. Temperature does not need to be re-calibrated unless the Temperature or Dissolved Oxygen sensor is replaced or the meter is initialised.

3. The **900-LAB** keeps the Temperature calibration data for the Temperature sensor and one type of Dissolved Oxygen sensor separately so these can be swapped as required.

10.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **900-LAB** will display the following message and the offset of the sensor.

   Calibration OK, Offset=0.1^{o}c

2. If a temperature calibration has failed, the **900-LAB** will display the following message and the failed offset value of the sensor.

   Calibration Failed, Offset=11.0^{o}c

3. The **900-LAB** has an allowable Offset range of -10.0 to +10.0 ^{O}C. If calibration fails due to the Offset being outside these limits, then please consult the Troubleshooting guide (section 19.5) for possible remedies.

10.4 Manual Temperature Setting

If neither the Temperature or Dissolved Oxygen sensors are connected, the temperature of the sample solution must be set manually for accurate Specific Ion or pH measurements. A separate thermometer will be required for this.

1. Switch the meter on.
2. Measure the temperature of the sample.
3. Select Temperature Calibration (Menu → **F1:Calibrate** → **F5:Temp.**).
4. The current temperature setting is now displayed. For example…

```
Enter Manual Temperature : 25.0 °C
                               Menu Quits
```

5. Enter the temperature of the sample, using the Numeric Keypad.
   Press Enter to save the new value.
   Alternatively, press Menu to quit and retain the current setting.
6. The **900-LAB** now returns to normal measurement mode. Note the flashing "**M**" in the temperature readout, indicating that Manual Temperature Compensation is in use. For example…

```
10.00ppM   2.76mS     7.00pH     7.00pH
 25.0°cM                31/12/00 12:00:00
```

11. Good Laboratory Practices (GLP)

The **900-LAB** keeps a record of the date and time of the last calibrations for all parameters as part of GLP guidelines.

11.1 To recall GLP information on the display

1. Switch the meter on.
2. Select the GLP menu ([Menu] → **F4:Setup** → **F3:GLP**).
3. Select **F1:Recall** from the menu.
4. The instrument model, firmware version number, and instrument serial number are displayed, along with a prompt describing how to scroll through the GLP information.

```
900LAB  V1.0 S1234      @ 31/12/00 12:00
                                 F4:Next
```

5. Press the [F4] key to sequentially scroll through the GLP information for all parameters. Press the [F2] key to scroll back to previous data. The sequence of information displayed is shown below. Press [Menu] to abort at any time.

GLP Display sequence…

```
900LAB  V1.0 S1234      @ 31/12/00 12:00
                                 F4:Next
```

↑[F2] ↓[F4]

```
Oxygen Zero=0.1%          31/12/00 12:00
Oxygen Calibrated        F2:Back F4:Next
```

↑[F2] ↓[F4]

```
Oxygen Span=100.0%        31/12/00 12:10
Oxygen Calibrated        F2:Back F4:Next
```

↑[F2] ↓[F4]

```
Cond. Zero=0.01uS         31/12/00 12:20
Cond Calibrated          F2:Back F4:Next
```

↑[F2] ↓[F4]

```
Cond. k=1.01              31/12/00 12:40
Cond Calibrated          F2:Back F4:Next
```

↑[F2] ↓[F4]

```
TDS Zero=0.01ppM          31/12/00 12:50
TDS Calibrated           F2:Back F4:Next
```

↑[F2] ↓[F4]

Continued over the page…

GLP Display sequence, continued…

```
TDS k=1.01                 31/12/00 13:00
TDS Calibrated            F2:Back F4:Next
```

↑ F2 ↓ F4

```
Ion1 Offset=0.0mV          31/12/00 13:10
Ion1 Calibrated           F2:Back F4:Next
```

↑ F2 ↓ F4

```
Ion1 Slope=100.0%          31/12/00 13:20
Ion1 Calibrated           F2:Back F4:Next
```

↑ F2 ↓ F4

```
pH1 Asymmetry=0.10pH       31/12/00 13:30
pH1 Calibrated            F2:Back F4:Next
```

↑ F2 ↓ F4

```
pH1 Slope= 99.0%           31/12/00 13:40
pH1 Calibrated            F2:Back F4:Next
```

↑ F2 ↓ F4

```
Ion2 Offset=0.0mV          31/12/00 13:50
Ion2 Calibrated           F2:Back F4:Next
```

↑ F2 ↓ F4

```
Ion2 Slope=100.0%          31/12/00 14:00
Ion2 Calibrated           F2:Back F4:Next
```

↑ F2 ↓ F4

```
pH2 Asymmetry=0.10pH       31/12/00 14:10
pH2 Calibrated            F2:Back F4:Next
```

↑ F2 ↓ F4

```
pH2 Slope= 99.0%           31/12/00 14:20
pH2 Calibrated            F2:Back F4:Next
```

↑ F2 ↓ F4

```
Temp Probe Offset=1.0°c   31/12/00 14:30
Temp Probe Calibrated     F2:Back F4:Next
```

↑ F2 ↓ F4

```
ED1 Temp Offset=1.0°c     31/12/00 14:40
Oxygen Temp Calibrated    F2:Back F4:Ends
```

11.2 Failed Calibration

If calibration has failed, the GLP function will reset the date and time for the failed parameter to zero. The **900-LAB** still shows the results for the last successful calibration, as shown in the following example of a failed pH calibration….

```
pH Asymmetry= 0.10pH       00/00/00 00:00
pH Un-Calibrated          F2:Back F4:Next
```

11.3 Printing GLP Information to the RS232 Port

The GLP information stored in the instrument's memory can be sent to a printer or PC via the RS232 port.

1. Switch the meter on.
2. Connect one end of the RS232 cable to the **RS232/Recorder** socket of the **900-LAB**.
3. Connect the other end of the RS232 cable to an RS232 Printer, or to the COM1 or COM2 ports of a PC.
4. Send the GLP information to the RS232 port:

   Menu → **F4:Setup** → **F3:GLP** → **F3:Print**

   The message "**Printing GLP Data**" is displayed while sending the data to the RS232 port.
5. The GLP information is sent to the RS232 port in formatted ASCII text. For example…

```
900LAB V1.0 S1234 @ 31/12/2000 12:00
Oxygen       Zero=      0.1%     @ 31/12/2000 12:00
Oxygen       Span=    100.0%     @ 31/12/2000 12:10
Conductivity Zero=     0.01uS    @ 31/12/2000 12:20
Conductivity k=        1.01      @ 31/12/2000 12:30
TDS          Zero=     0.01ppM   @ 31/12/2000 12:40
TDS          k=        1.01      @ 31/12/2000 12:50
Ion 1        Offset=    0.0mV    @ 31/12/2000 13:00
Ion 1        Slope=   100.0%     @ 31/12/2000 13:10
pH  1        Asy=      0.10pH    @ 31/12/2000 13:20
pH  1        Slope=    99.0%     @ 31/12/2000 13:30
Ion 2        Offset=    0.0mV    @ 31/12/2000 13:40
Ion 2        Slope=   100.0%     @ 31/12/2000 13:50
pH  2        Asy=      0.10pH    @ 31/12/2000 14:00
pH  2        Slope=    99.9%     @ 31/12/2000 14:10
Temp. Probe  Offset=    1.0oC    @ 31/12/2000 14:20
Temp. YSI    Offset=    1.0oC    @ 31/12/2000 14:30
Ends
```

11.4 Instrument Serial Number

In case the serial number that is fitted to the rear of the **900-LAB** is removed or becomes illegible, it is also available on the **900-LAB** display.

1. The serial number is displayed at turn-on, for example…

```
900LABsr V1.0 S1234 (C) 2000 TPS Pty Ltd
Oxygen, Conductivity/TDS, Dual pH/mV/Ion
```

   The "s" after **900LAB** is shown when the RS232 serial Port option is fitted.

   The "r" after **900LAB** is shown when the Recorder Port option is fitted.

2. The serial number is displayed when recalling the GLP information (section 11.1).
3. The serial number is included on the print-out of GLP information (section 11.3).
4. The GLP information can be downloaded to a PC using the optional Windows™ software (part number 130086).

11.5 Additional GLP Features

Another GLP requirement is to record the date and time of every reading. The **900-LAB** does this for you when readings are recorded either with the Notepad function (section 12) or the Automatic Logging function (section 13).

12. Notepad Function

12.1 Recording Readings into the Notepad

To record readings into the Notepad memory…

1. Press [F1] in normal display mode. The display should now look like this:

```
10.00ppM   2.76mS     7.00pH     7.00pH
Log#   1, Press F1     31/12/00 12:00:00
```

2. Press [F1], to record all parameters plus Date and Time into the notepad. This will be labelled as reading number 1.

   Alternatively, press [Menu] to quit without recording the reading.

3. Repeat steps 1 & 2 as often as required. The maximum number of readings that can be stored in the Notepad is 1360.

12.2 Recalling Readings from the Notepad

To recall records from the Notepad onto the **900-LAB** display…

1. Select the Notepad menu ([Menu] → **`F2:Notepad`**)

2. Select **`F1:Recall`** from the menu.

   Record number 1 is now displayed.

   For example…

```
10.00ppM   2.76mS     7.00pH     7.00pH
 25.1°c #1    F2:↑ F4:↓ 31/12/00 12:00:00
```

3. Press [F2] to display the next record.
   Press [F4] to display the previous record.
   Press and hold [F2] or [F4] to scroll continuously through the readings.
   To display a specific record, type in the desired record number using the Numeric Keypad and press [Enter].
   Press [F3] to send the displayed record to the RS232 port.

12.3 Erasing Records from the Notepad

To erase records from the Notepad…

1. Select the Erase Notepad menu (Menu → **F2:Notepad** → **F2:Erase**)
2. The **900-LAB** now displays the Erase menu, for example…

```
Erase Notepad, (  100 )  Select Option
F1:Erase All  F2:Erase Last   Menu Exits
```

   The number of readings stored in the Notepad is displayed. See the “100” in the example above.

3. Press F1 to erase all of the readings stored in the Notepad.
   Press F2 to erase the last recorded reading only.
   Press Menu to quit without erasing any records.

12.4 Printing Records from the Notepad to the RS232 Port

1. Connect one end of the RS232 cable to the **RS232/Recorder** socket of the **900-LAB**.
2. Connect the other end of the RS232 cable to an RS232 Printer, or to the COM1 or COM2 ports of a PC.
3. Ensure that the baud rate for the printer or PC and the **900-LAB** are the same. If necessary, alter the baud rate of the **900-LAB** (see section 14.1).

   The **900-LAB** uses XON/XOFF protocol. Ensure that the printer is set accordingly.

4. Select the Notepad menu. (Menu → **F2:Notepad**).
5. Select **F3:Print** from the menu.
6. Printing starts as soon as F3 is pressed. The display shows the word “**Printing**” until printing is completed.

13. Automatic Datalogging

The **900-LAB** can automatically log records into the Notepad. First the logging period must be programmed, then automatic logging can be started and stopped as required.

1. Select the Notepad menu ([Menu] → **F2:Notepad**)
2. Select **F4:Program** from the menu.

   The display should now look similar to that shown below. The current Logging/Printing Period is displayed.

   ```
   Enter Logging/Printing Period : 0 secs
   ```

3. Use the Numeric Keypad to set the period at which the **900-LAB** will automatically log records into memory or to the RS232 port.

   Press [Enter] to save the Logging/Printing Period.

   Press [Menu] to quit without changing the current setting.

4. After pressing [Enter], the **900-LAB** will ask you to enter the units. The Logging/Printing Period you have set is also displayed. For example…

   ```
         Logging/Printing Period : 2
   Select Units, F1:Secs, F2:Mins, F3:Hours
   ```

   Press [F1] to save the Logging/Printing Period as seconds.

   Press [F2] to save the Logging/Printing Period as minutes.

   Press [F3] to save the Logging/Printing Period as hours.

5. The **900-LAB** will ask if the records are to be logged into the Notepad, or sent directly to the RS232 port. The display will look like this…

   ```
   F1:Log to Notepad,  F2:Send to RS232
   ```

   Press [F1] to log records into the Notepad (maximum of 1360 readings).

   Press [F2] to send records directly to the RS232 port.

6. The automatic logging function is now programmed, and can be started and stopped as required.
7. To start automatic logging, press [F3] in normal display mode.

   When the **900-LAB** is logging into the Notepad, the display will look like this…

   ```
   10.00ppM   2.76mS     7.00pH     7.00pH
    25.1c    Log#   1     31/12/00 12:00:00
   ```

   The log number will increment and the **900-LAB** will beep each time a reading is recorded.

   If the **900-LAB** is sending records directly to the RS232 port, the display will look like this…

   ```
   10.00ppM   2.76mS     7.00pH     7.00pH
    25.1c    Sending      31/12/00 12:00:00
   ```

   The **900-LAB** will beep each time a record is sent to the RS232 port.

8. Press [F3] to stop automatic logging.

Notes

1. The clock must be set before the **900-LAB** will allow automatic logging to start. The message "**Clock Not Set**" is displayed if the clock is not set. See section 16 for details on setting the clock.
2. Pressing [Menu] during automatic datalogging halts logging. Press [F3] after returning to normal display mode to re-start automatic datalogging.

14. RS232 Port

14.1 Setting the Baud Rate

1. Select the Ports Set-up menu (Menu → **`F4:Setup`** → **`F1:Ports`**)
2. If both the RS232 ***and*** Recorder port options are fitted, then select **`F1:Baud Rate`**.

   If the RS232 Port option ***only*** is fitted, then the **900-LAB** will jump directly to the RS232 set-up screen. The available baud rates are listed, along with the RS232 port configuration…

   ```
   Baud Rate:   F1:300  >F2:9600   F3:19200
   8 bits, No Parity, 1 Stop bit, XON/XOFF
   ```

   The arrow indicates the current selection.
3. Press F1 to select 300 baud.
   Press F2 to select 9600 baud.
   Press F3 to select 19200 baud.
   Press Menu to quit and retain the current setting.

14.2 Sending Readings to the RS232 Port

Press F3 to instantly send readings to the RS232 port whenever the **900-LAB** is in normal display mode. This function is disabled if the automatic logging period is set to greater than zero (see section 13).

Records can be sent directly to the RS232 port rather than stored in memory during automatic datalogging. See section 13 for details.

Press F3 while recalling data on the display (see section 12.2) to send that record to the RS232 port.

14.3 RS232 Configuration

The **900-LAB** RS232 configuration is 8 Bits, No Parity, 1 Stop Bit, XON/XOFF Protocol.

This information is displayed when setting the baud rate (see section 14.1)

14.4 Communication and Statistical Software

Communication between the **900-LAB** and a PC can be handled with any RS232 communication software. A TPS communication software package for Windows™ is optionally available (part number 130086).

Once the data is saved to disk, the next problem is how to use it. The data sent by the **900-LAB** is formatted in fixed-width columns that can be imported by programs such as Microsoft® Excel® and Lotus 123®.

Information on how to use the software is provided in the README files on the diskette.

14.5 Commands

The following commands can be sent from a PC to the **900-LAB**. Note that <cr> denotes carriage return and <lf> denotes a line feed.

Action	Command	Notes
Request current data	?D<cr>	Returns the current data of all parameters plus date and time from the **900-LAB**. The log number returned is set to Zero.
Request logged data	?R<cr>	Returns all logged records from the **900-LAB** memory. The data ends with the message **ENDS**<cr>
Erase logged data	?E<cr>	Erases all logged records from the **900-LAB** memory. Returns the message **ERASED**<cr> to confirm that the records have been erased.
Request status information	?S<cr>	Returns the model name, firmware version number, instrument serial number and number of logged readings in memory, for example… **900L••V1.0•S1234•1360**<cr>, where • are spaces. Note that the number of logged readings is right-justified.
Request GLP information	?G<cr>	Returns all calibration GLP information, plus the instrument model, serial number and current date (see section 14.7 for data format and hand-shaking).

14.6 Data Format

Data is returned to the RS232 Port by the **900-LAB** in the following format.

Please note that a “ • ” shown anywhere in this section denotes one space.

LLLL•DDDDDDuuu•CCCCCCuuu•11111111uuu•22222222uuu•TTTTTuuu•dd/mm/yyyy•hh:mm:ss

where….

LLLL is the Log Number, 4 characters, right justified. The **900-LAB** sends a Zero for instant readings (see section 14.2).

DDDDDD is Dissolved Oxygen data. 6 characters, right justified.

uuu is the Dissolved Oxygen units description, which can be any of the following…

ppm	for parts per Million readout without Salinity correction. Note the lower case “**m**”.
ppM	for parts per Million readout with Salinity correction applied. Note the upper case “**M**”.
%S•	for % Saturation readout.
%G•	for % Gaseous readout.

CCCCCC is Conductivity or TDS data. 6 characters, right justified.

uuu is the Conductivity/TDS units description, which can be any of the following…

uS•	for µS/cm Conductivity readout.
mS•	for mS/cm Conductivity readout.
ppM	for parts per Million TDS readout.
ppK	for parts per Thousand TDS readout.

11111111 is Channel 1 pH/mV/Ion data. 8 characters, right justified.

The **900-LAB** sends “**•••Uncal**” when the 900-LAB has not been Primary Calibrated in Specific Ion mode.

uuu is the pH/mV/Ion unit description, which can be any one of the following…

pH•	for pH readout.
mV•	for Absolute Millivolts readout.
mVR	for Relative Millivolts readout.
ppM	for parts per Million readout in Specific Ion mode.
ppK	for parts per Thousand readout in Specific Ion mode.
%••	for % readout in Specific Ion mode.
•••	for Exponential readout in Specific Ion mode.
•••	For Specific Ion mode when Primary Calibration has not been performed, or has failed.

Continued over the page…

Data format, continued…

22222222 is Channel 2 pH/mV/Ion data. 8 characters, right justified.

The **900-LAB** sends "**•••Uncal**" when the 900-LAB has not been Primary Calibrated in Specific Ion mode.

uuu is the pH/mV/Ion unit description, which can be any one of the following…

pH•	for pH readout.
mV•	for Absolute Millivolts readout.
mVR	for Relative Millivolts readout.
ppM	for parts per Million readout in Specific Ion mode.
ppK	for parts per Thousand readout in Specific Ion mode.
%••	for % readout in Specific Ion mode.
•••	for Exponential readout in Specific Ion mode.
•••	For Specific Ion mode when Primary Calibration has not been performed, or has failed.

TTTTT is Temperature data, 5 characters, right justified.

uuu is the Temperature unit description, which can be either of the following…

oC•	for real Temperature data.
oCm	for manual Temperature compensation values.

dd/mm/yyyy is the date, month and year data.

hh:mm:ss is the hours, minutes and seconds data.

When requested by a PC with the ?D or ?R commands (section 14.5), the data is terminated with a carriage return.

When the data is sent by the **900-LAB** using the Print function (section 12.4) or the Instant Send function (section 14.2), the data ends with a carriage return and a line feed.

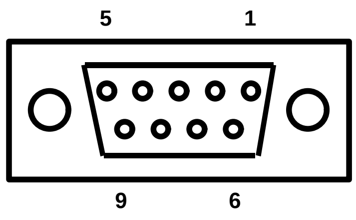
14.7 GLP Data Format

GLP information is returned as 18 lines terminated by a carriage return. When using the "?G" command (section 14.5), the computer must respond with a character after receiving each line.

For example…

```
900LAB V1.0 S1234 @ 31/12/2000 12:00
Oxygen       Zero=       0.1%    @ 31/12/2000 12:00
Oxygen       Span=     100.0%    @ 31/12/2000 12:10
Conductivity Zero=      0.01uS   @ 31/12/2000 12:20
Conductivity k=         1.01     @ 31/12/2000 12:30
TDS          Zero=      0.01ppM  @ 31/12/2000 12:40
TDS          k=         1.01     @ 31/12/2000 12:50
Ion 1        Offset=     0.0mV   @ 31/12/2000 13:00
Ion 1        Slope=    100.0%    @ 31/12/2000 13:10
pH  1        Asy=       0.10pH   @ 31/12/2000 13:20
pH  1        Slope=     99.0%    @ 31/12/2000 13:30
Ion 2        Offset=     0.0mV   @ 31/12/2000 13:40
Ion 2        Slope=    100.0%    @ 31/12/2000 13:50
pH  2        Asy=       0.10pH   @ 31/12/2000 14:00
pH  2        Slope=     99.9%    @ 31/12/2000 14:10
Temp. Probe  Offset=     1.0oC   @ 31/12/2000 14:20
Temp. YSI    Offset=     1.0oC   @ 31/12/2000 14:30
Ends
```

14.8 RS232 Port Connections



Pin No	Connection
2	Receive RS232 Data
3	Transmit RS232 Data
5	Ground

15. Recorder Port

This section is applicable if the optional Recorder port is fitted.

The optional Recorder Port can be used to send the data from any one parameter to a chart recorder or other analogue logging device.

15.1 Recorder Port Configuration

1. Select the Recorder set-up menu

   (Menu → **F4:Setup** → **F1:Ports** → **F2:Recorder**).

   The **900-LAB** will now display the Recorder Port configuration screen…

   ```
   RECORDER  F1:Oxygen >F2:Conductivity
             F3:pH-1    F4:pH-2   F5:Temp.
   ```

   The arrow indicates the current selection.

2. Press F1 to set the Recorder output to Dissolved Oxygen data.

   Press F2 to set the Recorder output to Conductivity or TDS data.

   Press F3 to set the Recorder output to Channel 1 pH/mV/Ion data.

   Press F4 to set the Recorder output to Channel 2 pH/mV/Ion data.

   Press F5 to set the Recorder output to Temperature data.

   Press Menu to quit and retain the current setting.

15.2 Recorder Port Specifications

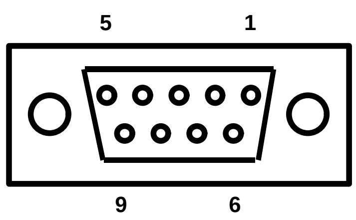
Mode	Range	Output Range	Examples (Reading = mV Out)
Dissolved Oxygen	0.00 to 40.0 ppM 0.0 to 500 %Sat'n 0.0 to 100 %Gas	0 to 2000 mV	0.00 ppM = 0 mV 100.0 %Sat'n = 400 mV
Conductivity	0 to 3.000 µS/cm 0 to 30.00 µS/cm 0 to 300.0 µS/cm 0 to 3000 µS/cm 0 to 30.00 mS/cm 0 to 300.0 mS/cm	0 to 2000 mV for full scale of selected range.	0.000 µS/cm = 0 mV 2760 mS/cm = 1840 mV
TDS	0 to 2.000 ppM 0 to 20.00 ppM 0 to 200.0 ppM 0 to 2000 ppM 0 to 20.00 ppK 0 to 200.0 ppK	0 to 2000 mV for full scale of selected range.	0.00 ppM = 0 mV 1000 ppM = 1000 mV 36.0 ppK = 360 mV
Specific Ion	The output for Specific Ion corresponds to the temperature compensated mV signal produced by the Ion sensor. The range for this is –1500 to +1500 mV	0 to 2000 mV	0.0 mV = 1000 mV +750 mV = 1500 mV -600 mV = 600 mV (mV output of sensor, regardless of concentration readout on display)
pH	0 to 14.000 pH 0 to 14.00 pH 0 to 14.0 pH	0 to 2000 mV (for all resolutions)	7.00 pH = 1000 mV
Absolute mV	-1500 to +1500 mV	0 to 2000 mV	0.0 mV = 1000 mV +750 mV = 1500 mV -600 mV = 600 mV
Relative mV	-1500 to +1500 mVR	0 to 2000 mV	0.0 mVR = 1000 mV +750 mVR = 1500 mV -600 mVR = 600 mV

Note : The ranges shown above exceed the range specifications detailed in section 1.9 to allow for variations due to sensor performance.

Output Impedance : Approximately 1000 Ohms

Resolution : Approximately 2 mV

15.3 Recorder Port Connections



Pin No	Connection
6	Recorder Output Signal
7	Recorder Output Common

16. Setting the Clock

1. Select the Clock Set-up menu (Menu → **F4:Setup** → **F2:Clock**)
2. The display now shows the current time, for example…

```
Time is now    12:00
Enter new time 12:00
```

3. Use the Numeric Keypad to enter the current time, then press Enter.

   Alternatively, press menu to quit and retain the current setting.
4. If you pressed Enter above, the display will now show the current date, for example…

```
Date is now    31/12/2000
Enter new Date 31/12/2000 dd/mm/yyyy
```

5. Use the Numeric Keypad to enter the current date, then press Enter.

   Alternatively, press menu to quit and retain the current setting.

Notes

1. The **900-LAB** tests that a valid day of the month is entered. If an invalid date is entered (eg. 31/02/2001), the **900-LAB** beeps and displays the message "**Invalid Date**". The meter then returns to the clock setting screen, so that the correct date can be entered.
2. The **900-LAB** also tests for leap years.

17. Initialising the 900-LAB

If the calibration settings of the **900-LAB** exceed the allowable limits, the unit may need to be initialised to factory default values. This action may be required if a sensor is replaced.

To initialise the **900-LAB**…

1. Switch the **900-LAB** off.
2. Press and hold the key while switching the **900-LAB** back on.
3. The following messages will be displayed…

```
Initialising
```

then…

```
       System Initialised
Unit should be Re-calibrated before use
```

then…

```
900LABsr V1.0 S1234 (C) 2000 TPS Pty Ltd
Oxygen, Conductivity/TDS, Dual pH/mV/Ion
```

The "**s**" after **900I** is shown when the RS232 serial Port option is fitted.

The "**r**" after **900I** is shown when the Recorder Port option is fitted.

4. The meter then proceeds to normal display mode. Note that the decimal points have been replaced with a " * ", to indicate that each parameter requires re-calibration.

18. Instrument firmware version number

If you need to phone or fax TPS for any further technical assistance, the version number of your **900-LAB** firmware may of benefit to us. The version number is displayed by the **900-LAB** at turn-on.

19. Troubleshooting

19.1 General Errors

Error Message	Possible Causes	Remedy
Factory Calibration Data Failure	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service.
EEPROM Write Failure **Return to Factory for Service**	User calibration settings have been lost or corrupted.	Switch the meter OFF and switch back ON. If the problem persists, return the unit to TPS for service.

19.2 Dissolved Oxygen 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 17.
• Zero calibration fails (Zero is greater than 7.0%) • Air calibration fails (Span is less than 70% or greater than 135%). • Unstable or inaccurate readings.	1. Membrane is leaking or broken.	Replace membrane and refill electrode.
	2. Gap between membrane and gold cathode is dry.	ED1 Undo the barrel 3 turns, then re-tighten to re-flush the filling solution. YSI Gently pump the pressure compensation diaphragm several times.
	3. Incorrectly fitted membrane.	Membrane should be smooth and convex with no wrinkles. Re-fit membrane if necessary.
	4. Electrode is empty.	Replace membrane and re-fill electrode.
	5. Electrode is faulty.	Return electrode to factory for repair or replacement
Blackened Silver anode.	Electrode has been exposed to sulphides or other chemical poisoning.	ED1 Remove barrel and soak in 5% Ammonia solution for 10 minutes. If anode is still blackened, sand silver tube with #800 Wet & Dry sandpaper. YSI Remove pressure compensation diaphragm and membrane, then soak in 5% Ammonia solution for 10 minutes. If cleaning is unsuccessful, return the sensor to the TPS factory for cleaning and service.
Tarnished or scratched Gold cathode.	Electrode has been chemically poisoned or physically damaged.	Return to the TPS factory for cleaning and service.
Meters displays "**Probe**" instead of Dissolved Oxygen data.	Meter has been calibrated on ED1 and then a YSI sensor is connected, or vice versa.	Re-calibrate the Dissolved Oxygen reading on the new sensor. Meter only keeps calibration data for one Dissolved Oxygen sensor.
Meter displays **OVR ppM** or **OVR%** instead of Dissolved Oxygen data.	1. Electrode has not yet polarised.	Wait for 2-3 minutes for the electrode to polarise after the **900-LAB** is switched on.
	2. Electrode is faulty	Return electrode to factory for repair or replacement.

19.3 Conductivity / TDS Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new probe.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 17.
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. Clean the glass around the platinum plate area. DO NOT rub the black platinised surfaces. If instrument does not calibrate at Zero with sensor disconnected, then the instrument is faulty.
Standard calibration fails, and k factor is greater than 25% ***above*** the nominal value.	1. Sensor is not immersed correctly. 2. Sensor may have a build-up of dirt or oily material on electrode plates. 3. Platinum-black coating has worn off. 4. Standard solution is inaccurate. 5. Sensor is faulty. 6. Faulty instrument.	Immerse sensor correctly with adequate clearance to the floor and walls of the vessel, as per section 20.2.1. Clean sensor as per the instructions detailed in section 20.2.2. Sensor requires replatinization as per section 20.2.2. Alternatively, return to the factory for replatinization. Replace standard solution. Return sensor to factory for repair or replacement. Return to factory for repair.
Standard calibration fails, and k factor is greater than 25% ***below*** the nominal value.	1. Standard solution is inaccurate. 2. Sensor may have a build-up of conductive material, such as salt. 3. Sensor is faulty. 4. Faulty instrument.	Replace standard solution. Clean sensor as per the instructions detailed in section 20.2.2. Return sensor to factory for repair or replacement. Return to factory for repair.
Inaccurate readings, even when calibration is successful.	1. Sensor may have a build-up of dirt or oily material on electrode plates. 2. Platinum-black coating has worn off.	Clean sensor as per the instructions detailed in section 20.2.2. Sensor requires replatinization as per section 20.2.2. Alternatively, return to the factory for replatinization.
Readings drift.	Sensor may have a build-up of dirt or oily material on electrode plates.	Clean sensor as per the instructions detailed in section 20.2.2.
Readings are low or near zero.	1. Sensor may have a build-up of dirt or oily material on electrode plates. 2. Sensor is not immersed correctly. 3. Sensor is faulty. 4. Faulty instrument.	Clean sensor as per the instructions detailed in section 20.2.2. Immerse sensor correctly with adequate clearance to the floor and walls of the vessel, as per section 20.2.1. Return sensor to factory for repair or replacement. Return to factory for repair.

19.4 Specific Ion, pH and mV Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new probe.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 17.
1 Point calibration fails. (Specific Ion offset causes over-range reading, or pH asymmetry is greater than ±1.00 pH.)	1. Reference junction blocked. 2. Reference electrolyte contaminated.	Clean reference junction as per instructions supplied with the pH or reference electrode. Flush with distilled water and replace electrolyte.
2 Point calibration fails. (Specific Ion slope is less than 50%, or pH slope is less than 85.0%.)	1. Specific Ion standards or pH Buffers not correctly set. 2. Ion sensor surface or pH glass bulb not clean. 3. Electrode is aged. 4. Connector is damp. 5. Specific Ion standards or pH Buffers are inaccurate.	Ensure that you are using Specific Ion standards as per the Standards set-up (see section 6.2). For automatic pH buffer recognition, ensure that you are using buffers that match the selected buffer set (see section 7.2). Otherwise, ensure that the buffer value is entered correctly at pH calibration. Clean sensor surface or glass bulb as per instructions supplied with the electrode. Attempt rejuvenation as per instructions supplied with the electrode. If unsuccessful, replace electrode. Dry in a warm place. Replace standards or buffers.
Unstable readings.	1. Reference Electrolyte chamber needs to be refilled. 2. Reference junction blocked. 3. Ion sensor surface or pH glass bulb not clean. 4. Bubble in pH glass bulb. 5. Faulty connection to meter. 6. Reference junction not immersed. 7. KCl crystals around reference junction inside the electrolyte chamber.	Refill with saturated KCl filling solution. Clean reference junction as per instructions supplied with the electrode. Clean glass bulb as per instructions supplied with the electrode. Flick the electrode to remove bubble. Check connectors. Replace if necessary. Ensure that the reference junction is fully immersed. See diagrams in sections 6.3 & 7.3. 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 electrode.
Displays constant Ion reading or pH7.00 for all solutions.	Electrical short in connector.	1. Check connector. Replace if necessary. 2. Replace electrode.
Displays 4-5 pH for all solutions.	pH electrode glass bulb or internal stem cracked.	Replace pH electrode.

19.5 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Temperature inaccurate and cannot be calibrated.	1. Faulty connector.	Check the connector and replace if necessary.
	2. Faulty Dissolved Oxygen or Temperature sensor, whichever is being calibrated.	Return Dissolved Oxygen or Temperature sensor for repair, or replace sensor.
	3. Faulty Dissolved Oxygen cable if Dissolved Oxygen sensor is being used for Temperature readout.	Return Dissolved Oxygen cable for repair or replace cable.
Displays flashing "**M**" when Temperature and/or Dissolved Oxygen sensor plugged in.	1. Faulty instrument socket.	Return the instrument to the TPS factory for service.
	2. Faulty Dissolved Oxygen or Temperature sensor, whichever is being calibrated.	Return Dissolved Oxygen or Temperature sensor for repair, or replace sensor.
	3. Faulty Dissolved Oxygen cable if Dissolved Oxygen sensor is being used for Temperature readout.	Return Dissolved Oxygen cable for repair or replace cable.

20. Appendices

20.1 Dissolved Oxygen

20.1.1 Dissolved Oxygen Sensor Fundamentals

The electrode used is the amperometric type of Clark Electrode and is suitable for the measurement of oxygen pressures in the range 0 to 100 cm of mercury. While the probe actually reads partial pressure of oxygen, the circuit is calibrated to be read in percentage saturation or parts per million (Milligrams/litre). The operation of the Clark type probe relies on the diffusion of oxygen through a suitable membrane into a constant environment of potassium chloride. Solution measurements are best performed with a reasonable flow past the membrane. At sufficiently high flow rates, the oxygen current is totally independent of the flow (a few cm/sec is sufficient). The cell must not be shaken however or unstable readings will result from electrolyte surge bringing new oxygen from the reservoir to the working cathode surface.

20.1.2 Operating Principle

The Clark oxygen electrode consists of a gold cathode and a silver/silver chloride anode, placed in an electrolyte solution. This solution is contained behind a plastic membrane. In this case the plastic is 0.001 inch PTFE (Teflon) sheet. It must be realised that using membranes of very different thicknesses will result in an error in the temperature compensation that is applied in the instrument for the membrane permeability. This coefficient is +4.2%/^{o}C at 25^{o}C for this thickness membrane.

A polarising voltage of about 800 millivolts is applied between the two electrodes. The gold electrode is placed close to the membrane and because of the polarising voltage, oxygen diffusing through the membrane will be reduced at the gold electrode.

$$\text{Equation :} \quad O_2 + 2H^+ + 2 \text{ electrons} \rightarrow H_2O_2$$

This reduction process will produce a current through the oxygen electrode. A load resistor (actually a thermistor in this case) situated in the electrode itself, converts this current into a voltage proportional to the oxygen partial pressure. The thermistor provided within the body of the electrode has a temperature coefficient of -4.2%/^{O}C. This gives an accurate temperature compensation for the temperature/permeability effect of the membrane, over a range of about 5 to 45 ^{O}C about a centre value of 25^{O}C. Note this compensation is not for the solubility effects. A separate sensor also built into the tip of the probe achieves this.

20.1.3 Probe Storage

The Oxygen probe should be kept moist when not in use to prevent the thin film of electrolyte behind the membrane from drying out. To achieve this, the probe can be stored with the tip in water or in a humid environment.

For long term storage of several weeks or more, remove the membrane and empty out the electrolyte. Replace the membrane without electrolyte to avoid contamination of the gold and silver surfaces. When the electrode is stored in this way, the membrane should be replaced and the electrode refilled before use.

20.1.4 Maintenance Of The Membrane

The membrane does not require replacement as long as it remains intact. If punctured or suspected of leaking around the edges, it must be replaced. To replace the membrane, please see the separate instruction leaflet supplied with your sensor.

20.1.5 Notes On Units Of Dissolved Oxygen

The terms "Oxygen Concentration" and "Oxygen Partial Pressure" frequently give rise to some confusion.

- Oxygen Concentration is the absolute quantity of oxygen present per unit mass of the liquid.
- Oxygen Partial Pressure is the oxygen fraction of the total pressure of all of the gases present.

For any one liquid system, Oxygen Concentration and Oxygen Partial Pressure are proportional. However, if the solubility of oxygen in the liquid should change owing to increased quantities of solutes, etc., then the ratio of the Concentration to the Partial Pressure must change. Thus, if one saturates distilled water and a 25% solution of Sodium Chloride with air at atmospheric pressure (25^{o}C) both solutions will have almost exactly the same Oxygen Partial Pressure, namely 15.5 cm of mercury. However, the dissolved Oxygen Concentration parts per million (milligrams per litre) will be 8.2 in the distilled water and 2.01 in the salt solution. This is a rather extreme example, as ocean water is only 3.6% saline. It does however stress the importance of correct interpretation of the salinity.

The Clark Electrode measures the partial pressure of oxygen diffusing through a membrane. The current is a linear measure of this partial pressure, assuming sufficient liquid flow conditions.

With air at sea level, the 20.9% oxygen exerts about 15.5 cm of Mercury pressure. Water in equilibrium with air and with no oxygen demand (C.O.D., B.O.D. etc.), is saturated and has this dissolved oxygen partial pressure. If we define 100% Saturation in Partial Pressure terms, then 15.5 cm. Hg = 100% Saturation. This is a practical unit to use. The probe linear readout is then a linear function of % Saturation. Organic cell walls behave like the probe and pressure units are valuable.

% Saturation is the best unit for industrial control and not ppM, contrary to popular beliefs. The partial pressure (and consequently the pressure defined % Saturation) varies only slightly with temperature. (Recall at this stage that the permeability of the membrane has a temperature coefficient, but the electronics has scaled this out by the operation of the Automatic Membrane Temperature Compensator Thermistor incorporated in the D.O. probe).

If mass units are used for measurement of Dissolved Oxygen, the temperature problem of relating the linear partial pressure reading of the probe to the mass (ppM or mg/L) at different temperatures becomes more involved. As well, there is the mass variation due to dissolved salts (salinity correction). Therefore, the fully corrected instrument would need 3 correction systems.

(a) Membrane correction for temperature permeability effects ;

(b) Solubility correction of Dissolved Oxygen with temperature and ;

(c) Salinity correction of Dissolved Oxygen by weight (Salinity has no effect on pressure units readout).

In the **900-LAB** instrument,

(a) Membrane correction is achieved AUTOMATICALLY ;

(b) To provide the mass units (ppM) readout (so popular due to the Winkler process used in the past), the **900-LAB** Meter has Solubility Correction via an additional temperature sensor in the electrode ;

(c) Salinity correction is performed automatically via the Conductivity/TDS sensor.

20.1.6 Equilibrium Conditions

Whilst Saline Water has a lower ppM than does Fresh Water, it does not mean it necessarily has less biologically available oxygen. Both have 100% Saturation (presuming no Chemical Oxygen Demand (C.O.D.), Biological Oxygen Demand (B.O.D.), etc.) because both are in partial pressure equilibrium with air. Any usage of oxygen is immediately replenished by the dissolving of more from air to meet partial pressure equilibrium requirements. This is so for both saline and fresh water. The reporting of oxygen at a lower level (in ppM units) in the Salt Water is therefore QUITE MISLEADING !

In closed systems, such as tanks, pipes and deep waters, equilibrium is not so readily available and the Salinity Effect gains the importance in the reporting of Dissolved Oxygen. It is suggested, unless such closed (or deep, low diffusion) systems are encountered, that Oxygen should be reported in % Saturation or ppM of equivalent Fresh Water.

20.1.7 Velocity Past The Membrane

Workers have shown that the relationship between the diffusion current (oxygen current) and the external velocity of the liquid is expotential. Some workers using thicker membranes have shown even less dependence of the diffusion current on liquid velocity. Because of the expotential nature of the relationship, considerable changes in velocity have to be made before noticing any change in the diffusing current once the flow is sufficiently high. Tests with this electrode have shown that flow rates above 0.2 litres/minute past the membrane give results indistinguishable from those with appreciably higher flow rates (5 litres/minute). Fluctuations in readings due to air bubbles passing through the membrane are a different matter, however.

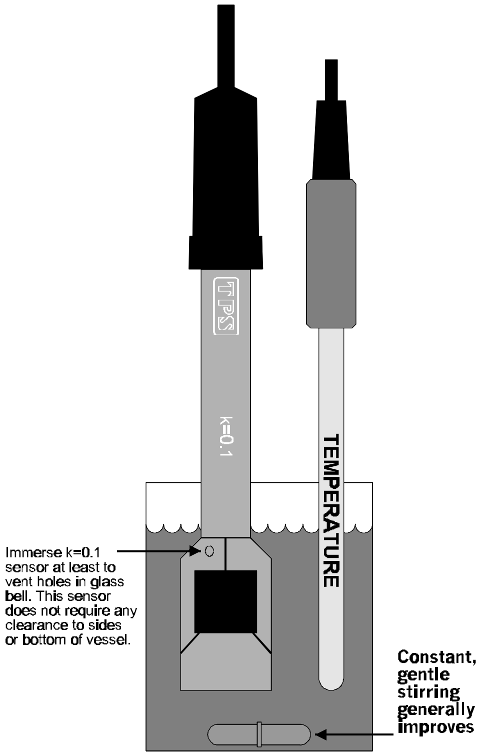
With the type of electrode to be used with this instrument, very little change in diffusion current is caused by altering the pH of the external environment. Pressure changes over a moderate range exerted on the membrane also cause no change. The ED1 Dissolved Oxygen sensor is sealed by glands for total immersion to a depth of 3 metres. The EDYSI has a pressure compensation diaphragm to allow submersion to 60 metres.

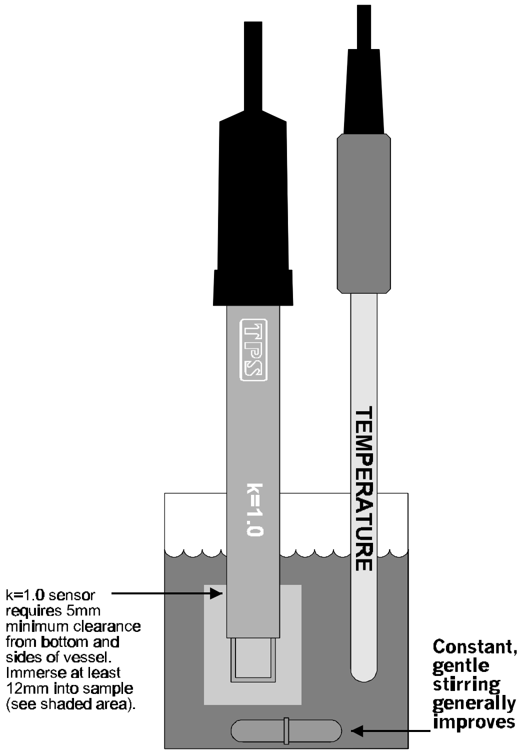
20.2 Conductivity/TDS

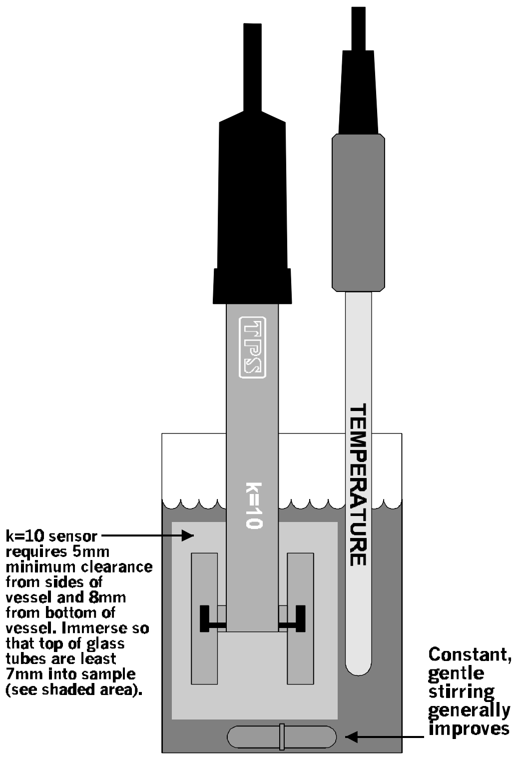
20.2.1 Correct immersion of Conductivity sensors

Platinised platinum Conductivity sensors take measurements in a field around the electrode plates, not just directly between the plates. When a sensor is too close to the surface of the liquid being measured, or if it is too close to the floor or walls of the measurement vessel, Conductivity readings can be affected.

Conductivity sensors must therefore be correctly immersed into calibration standards and sample solutions for accurate measurements. The following diagrams show correct immersion depth and floor and wall clearance for TPS k=0.1, k=1.0 and k=10 sensors.







Notes

1. If a Conductivity sensor is to be used in a vessel that is too small to allow correct sensor immersion, accurate results can still be obtained. To do this, ensure that the sensor is calibrated in the same size vessel at the same immersion as for sample measurements. Although the sensor's sensitivity is still affected, it will be affected to the same degree for calibration and for sample measurements.
2. Immersion levels for user-selectable k factor sensors may be different to those shown above. It would be advisable to conduct tests with these sensors to check when the floor and walls and liquid levels in the vessel begin to affect readings.

20.2.2 Care, Cleaning and Maintenance of Conductivity Sensors

Care of Conductivity sensors
The conductivity section of the sensor supplied with your **900-LAB** consists of two platinum plates 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 detail later in this section). You can help to maintain the platinum-black layer by following these simple rules:

1. **NEVER** touch or rub the electrode plates 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 electrode plates. 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.

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

Cleaning Conductivity of Sensors.
Platinised platinum Conductivity sensors can only be cleaned by rinsing in a suitable solvent.

DO NOT wipe the electrode plates, as this will remove the platinum-black layer.

1. Rinsing in distilled water will remove most build-ups of material on the electrode plates.
2. Films of oils or fats on the electrode plates 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 electrode plates, 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 (see detail later in this section).

Replatinising Conductivity Sensors

There are several ways to replatinise Conductivity electrodes.

1. The simplest way is to return the electrode to the TPS factory. We can fully clean the electrode, 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 electrodes for the right amount of time at the correct current. Ordering details are as follows…

Automatic Conductivity Electrode Replatiniser	Part No 122160
20mL Platinising Solution (suitable for approx 30 uses)	Part No 122300

3. Conductivity electrodes can be manually replatinised, according to the following procedure…

   (a) Soak the electrode in a solution of 1 part Concentrated HCl and 10 parts distilled water for approximately 5 minutes.

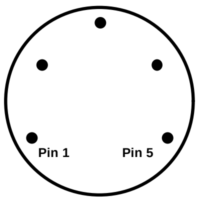
   (b) Rinse the electrode well in distilled water.

   (c) Immerse the electrode in platinising solution at least to the vent hole in the glass body. 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. **Caution : This is a dangerous solution and should be handled with the utmost care.**

   (d) Apply a direct current of 10mA between pins 1 and 5 of the electrode plug, as per the diagram below. Reverse the polarity every 30 seconds. After approximately 8 minutes (4 minutes per electrode plate), they should have an even “sooty” appearance. Avoid excess current as this will cause incorrect platinising.

   (e) After platinising, rinse the electrode well in distilled water.

   (f) If you have any doubts about any of these steps, then you should consider returning the electrode to the factory. The cost of replatinising is quite low, and you will be guaranteed of the best possible result.



Sensor Connector

20.3 pH and Specific Ions

pH electrodes are generally combination electrodes, where the pH sensing membrane and the reference system are contained in a single body. The sensing membrane is the round or spear shaped bulb at the tip of the electrode. This produces a voltage that changes with the pH of the Solution. This voltage is measured with respect to 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.

Specific Ion sensors are commonly supplied as mono or combination sensors. Mono sensors contain just the Ion sensing membrane and must be used with a separate reference electrode. Combination Specific Ion sensors, like combination pH sensors, contain both the sensing membrane and the reference section in a single body.

20.3.1 Asymmetry of a pH or Specific Electrode

An “ideal” pH electrode produces 0 mV output at 7.00 pH. In practice, pH electrodes 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.

All Specific Ion electrodes produce 0 mV at different levels. This is why the **900-LAB** has an unlimited Asymmetry range.

Figure 20-1 illustrates how asymmetry is expressed for a pH electrode.

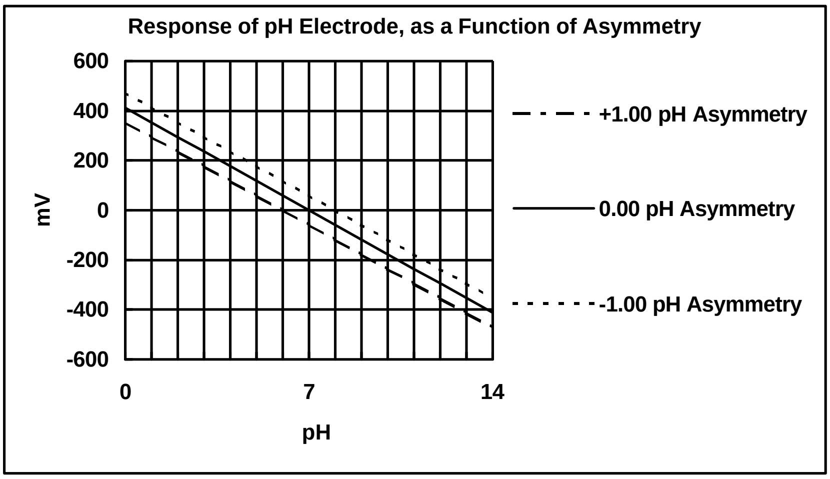


Figure 20-1

20.3.2 Slope of a pH or Specific Ion Electrode

As mentioned above, a pH electrode produces 0 mV output at around 7.00 pH. As the pH goes up, an "ideal" pH electrode produces –59.16mV/pH unit at 25 ^{O}C As the pH goes down, an ideal pH electrode produces +59.16mV/pH unit. In practice, pH electrodes usually produce slightly less than this. The output of a pH electrode is expressed as a percentage of an ideal electrode. For example, an ideal electrode that produces 59.16mV/pH unit has "100% Slope". An electrode that produces 50.15mV/pH unit has "85% Slope".

Specific Ion electrodes that measure monovalent cations (+) produce 59.16mV per decade change in ion activity. As the concentration goes up, the output of the sensor goes down.

Specific Ion electrodes that measure monovalent anions (–)produce 59.16mV per decade change in ion activity. As the concentration goes up, the output of the sensor also goes up.

Specific Ion electrodes that measure divalent cations (2+) produce 28mV per decade change in ion activity. As the concentration goes up, the output of the sensor goes down.

Specific Ion electrodes that measure divalent anions (2–) produce 28mV per decade change in ion activity. As the concentration goes up, the output of the sensor goes up.

As for pH electrodes, Specific Ion electrodes produce slightly less then these figures in real practice.

Figure 20-2 illustrates the principle of electrode slope, using a pH sensor as an example.

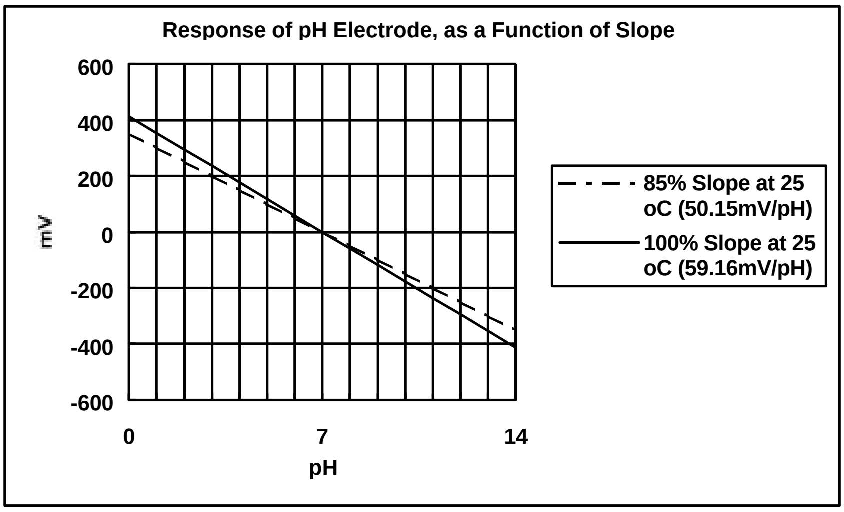


Figure 20-2

20.3.3 Temperature Compensation

The slope of a pH and Specific Ion electrodes is affected by temperature. This effect is compensated for either by using an Automatic Temperature Compensation (ATC) probe or by entering the sample temperature manually. Figure 20-3 shows the slope of a pH electrode at various temperatures.

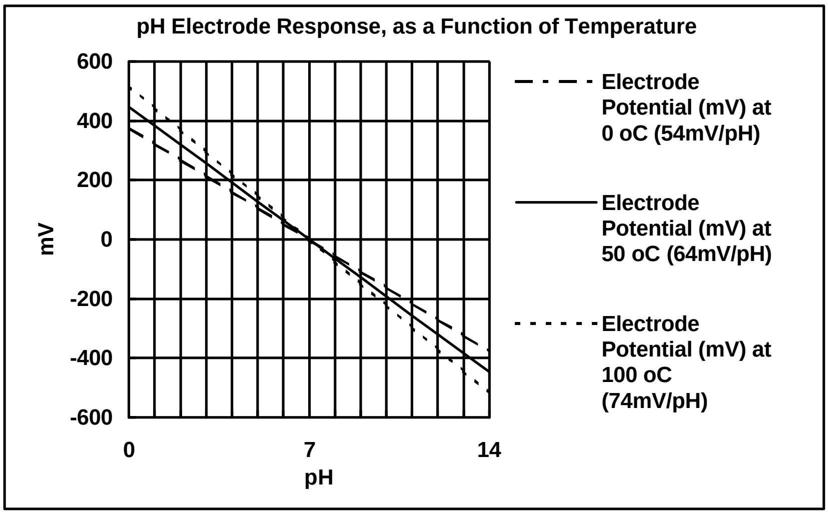


Figure 20-3

20.3.4 pH/mV/Ion Guard Connector

In some circumstances, the Specific Ion, pH or mV readings may become unstable. This may be due to static charge in the sample vessel, or electrical noise from nearby electrical equipment. In these cases, a solution guard may eliminate the problem.

A solution earth rod is available from TPS (part no 121360). This connects directly to the **Guard** socket. Alternatively, run a wire from the **Guard** socket to a stainless steel fitting in contact with the sample.

20.3.5 Polarisation Connector

The polarisation output connector on the rear panel is for Karl Fischer titrations. This titration is a method for determining minute quantities of water in non-aqueous liquids.

The TPS Double Platinum electrode (part no 122207) has two connectors. The larger BNC connector fits to the **pH/mV/Ion-1 Sensor** or **pH/mV/Ion-2 Sensor** socket and the smaller 3.5mm phono plug fits to the **Polarisation** socket.

DO NOT PLUG THE DOUBLE PLATINUM ELECTRODE INTO THE TEMPERATURE SOCKET.

When performing Karl Fischer titrations, ensure that the **900-LAB** is in mV mode for the relevant channel.

20.3.6 Checking the reference junction of a pH electrode

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

1. Calibrate the **900-LAB**, as per section 7.3.
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 electrode.
5. Re-calibrate the **900-LAB** and repeat the test.
6. If the value obtained is still outside 7.06 +/-0.05 pH, then the electrode should be replaced.

20.3.7 Determining if an instrument or electrode is faulty

The following test can be performed to help determine if the **900-LAB** or the pH/Redox/Ion electrode is faulty.

1. Initialise the **900-LAB** (see section 17).
2. Disconnect the pH, Redox or Ion electrode from the channel to be tested.
3. Connect the centre pin of the **SENSOR** connector of the relevant channel with the outside frame of the connector, using a short piece of wire or a paper clip etc.
4. The meter should display approximately pH7.00, depending on the current calibration settings.
5. If the **900-LAB** 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 **900-LAB** is faulty and requires servicing.

21. Warranty

TPS Pty. Ltd. guarantees all instruments and electrodes 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 electrodes 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.

PLEASE NOTE:
A guarantee card is packed with the instrument or electrode. 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.

PROCEDURE FOR SERVICE
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 electrode 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.