

## **Congratulations !**

You have purchased the latest in Benchtop Specific Ion-pH-mV-Temperature instrumentation. We trust that your new **900-I3** will give you many years of reliable service.

The **900-I3** 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:

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### **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-I3**. 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-I3**, 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.

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<p style="text-align: center;"><b>900-I3</b> <b>Three Channel Specific Ion- pH-mV and Temp. Meter</b> Date : 04-Sep-98 Author : MS Version : 3.0</p>
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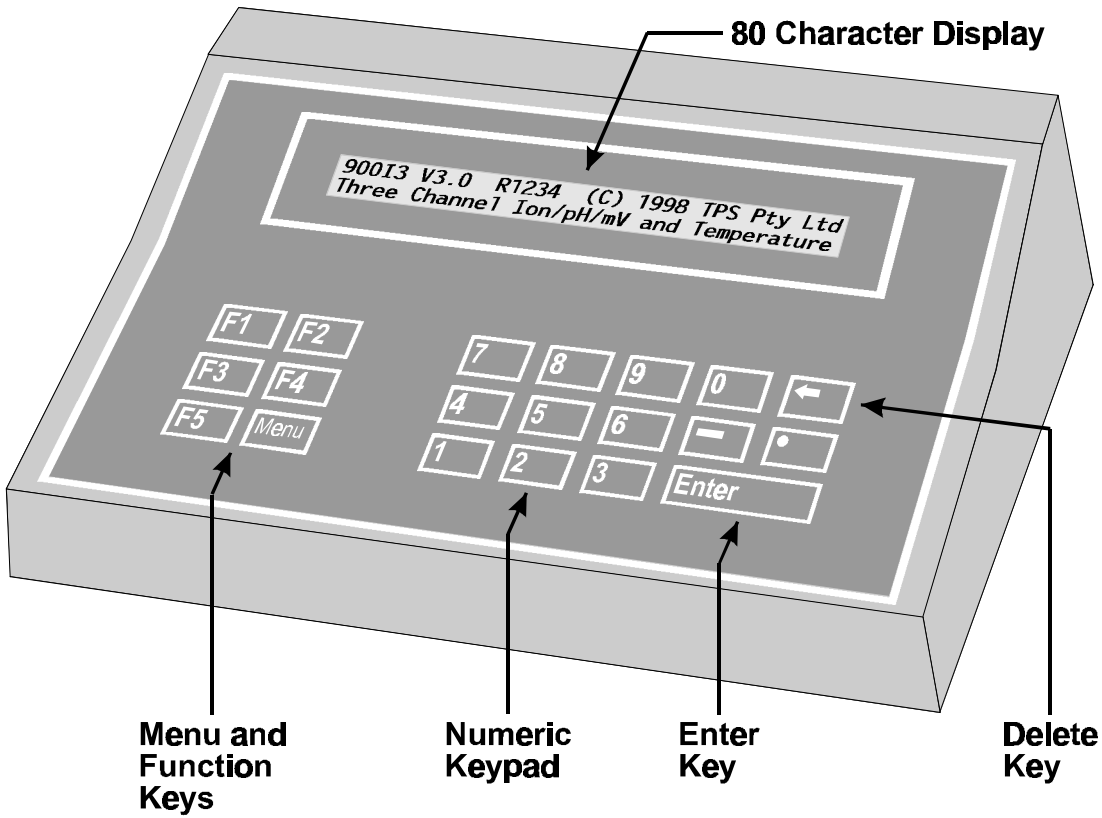
## Contents

<b>1. Introduction .....</b>	<b>4</b>
1.1 900-I3 Display and Controls.....	4
1.2 900-I3 Rear Panel Connectors .....	4
1.3 Menu and Function Keys.....	5
1.4 Numeric Keypad .....	5
1.5 Enter Key .....	5
1.6 Delete Key .....	5
1.7 80 Character Display .....	5
1.8 Unpacking Information .....	6
1.9 Specifications.....	7
<b>2. 900-I3 Menu Structure .....</b>	<b>8</b>
<b>3. Specific Ion Mode .....</b>	<b>9</b>
3.1 Selecting Specific Ion Mode.....	9
3.2 Setting Specific Ion Standards .....	10
3.2.1 <i>Setting Specific ion standards for ppM, ppK and % readouts.....</i>	<i>10</i>
3.2.2 <i>Setting Specific ion standards for Exponential readout.....</i>	<i>11</i>
3.3 Specific Ion Calibration.....	12
3.4 Specific Ion Calibration Notes.....	14
3.5 Specific Ion Calibration Messages.....	14
<b>4. pH Mode .....</b>	<b>15</b>
4.1 Selecting pH Mode.....	15
4.2 Setting the pH Buffer Set .....	16
4.3 pH Calibration.....	17
4.4 pH Calibration Notes.....	18
4.5 pH Calibration Messages.....	19
<b>5. Absolute Millivolt Mode.....</b>	<b>20</b>
5.1 Selecting Absolute Millivolt Mode.....	20
5.2 Absolute Millivolt Calibration.....	20
<b>6. Relative Millivolt Mode .....</b>	<b>21</b>
6.1 Selecting Relative Millivolt Mode.....	21
6.2 Relative Millivolt Calibration.....	21
6.3 Relative Millivolt Calibration Notes.....	22
<b>7. Temperature .....</b>	<b>23</b>
7.1 Temperature Calibration.....	23
7.2 Temperature Calibration Notes.....	23
7.3 Calibration Messages .....	23
7.4 Manual Temperature Setting .....	24
<b>8. Good Laboratory Practices (GLP).....</b>	<b>25</b>
8.1 To recall GLP information on the display .....	25
8.2 Failed Calibration.....	27
8.3 Printing GLP Information to the RS232 Port .....	27
8.4 Instrument Serial Number.....	28
8.5 Additional GLP Features.....	28

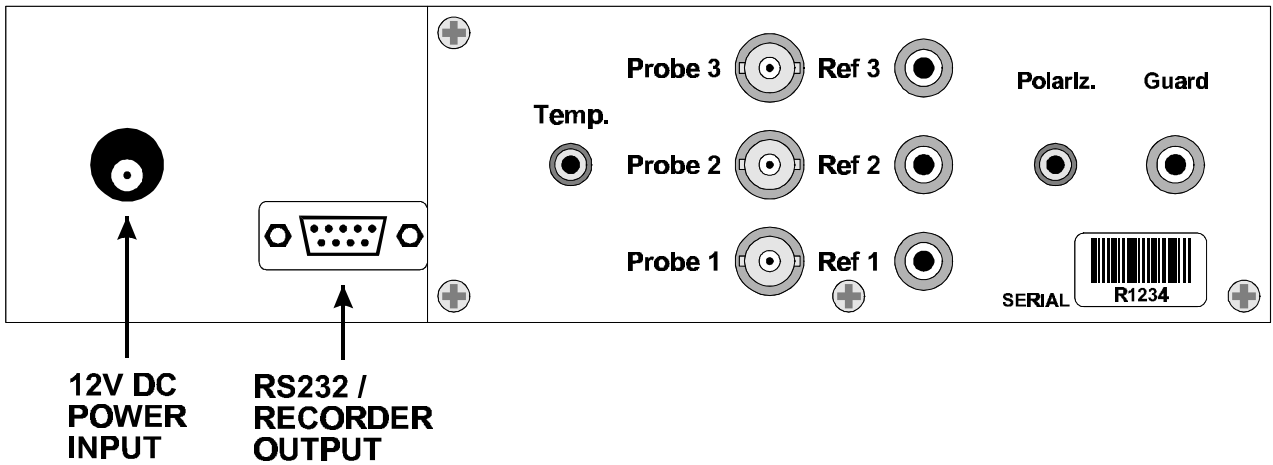
<b>9. Notepad Function .....</b>	<b>29</b>
9.1 Recording Readings into the Notepad.....	29
9.2 Recalling Readings from the Notepad .....	29
9.3 Erasing Records from the Notepad .....	30
9.4 Printing Records from the Notepad to the RS232 Port.....	30
<b>10. Automatic Datalogging .....</b>	<b>31</b>
<b>11. RS232 Port.....</b>	<b>33</b>
11.1 Setting the Baud Rate .....	33
11.2 Sending Readings to the RS232 Port .....	33
11.3 RS232 Configuration.....	33
11.4 Communication and Statistical Software.....	33
11.5 Commands .....	34
11.6 Data Format .....	35
11.7 GLP Data Format .....	36
11.8 RS232 Port Connections.....	36
<b>12. Recorder Port.....</b>	<b>37</b>
12.1 Recorder Port Configuration in Specific Ion Mode .....	37
12.2 Recorder Port Configuration in pH Mode .....	39
12.3 Recorder Port Configuration in Absolute or Relative mV Modes.....	39
12.4 Recorder Port Specifications.....	40
12.5 Recorder Port Connections .....	40
<b>13. Setting the Clock.....</b>	<b>41</b>
<b>14. Initialising the 900-I3 .....</b>	<b>42</b>
<b>15. Instrument firmware version number .....</b>	<b>42</b>
<b>16. Troubleshooting.....</b>	<b>43</b>
16.1 General Errors .....	43
16.2 Specific Ion, pH and mV Troubleshooting .....	43
16.3 Temperature Troubleshooting.....	44
<b>17. Appendices.....</b>	<b>45</b>
17.1 pH Electrode Fundamentals .....	45
17.1.1 <i>Asymmetry of a pH Electrode</i> .....	45
17.1.2 <i>Slope of a pH Electrode</i> .....	46
17.1.3 <i>Temperature Compensation</i> .....	46
17.2 Guard Connector .....	46
17.3 Polarisation Connector .....	47
17.4 Checking the reference junction of a pH electrode.....	47
17.5 Determining if an instrument or pH electrode is faulty.....	47
<b>18. Warranty.....</b>	<b>48</b>

# 1. Introduction

## 1.1 900-I3 Display and Controls



## 1.2 900-I3 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 10.

Also used at turn-on to select buffers for auto buffer recognition. See section 4.2.

**F3** : Press to start or stop automatic datalogging. See section 10.

Alternatively, press to transmit current reading plus date and time to the optional RS232 port. See section 11.2.

**F4** : Press to Zero Relative mV, when Relative mV is selected. See section 6.2.

**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-I3**. See section 14.

### 1.7 80 Character Display

80 character alphanumeric display with user-friendly menu and context-sensitive help system. Shows all three Specific Ion/pH/mV Channels plus Temperature, Date and Time simultaneously.

## 1.8 Unpacking Information

Before using your new **900-I3**, please check that the following accessories have been included:

Part No

### *Standard Kit...*

- |  |        |
|--|--------|
| 1. <b>900-I3</b> 3 Channel Specific Ion-pH-mV Meter..... | 121162 |
| 2. Temperature/ATC Sensor .....                          | 121245 |
| 3. Plug-Pack Power Supply .....                          | 130044 |
| 4. <b>900-I3</b> Handbook .....                          | 130050 |

### *Options that may have been ordered with your 900-I3...*

- |  |        |
|--|--------|
| 1. Flexible arm type electrode holder.....             | 130088 |
| 2. RS232 Serial Interface Option (includes cable)..... | 130029 |
| 3. Recorder Output Option (includes cable).....        | 130028 |
| 4. RS232 PLUS Recorder Output Option.....              | 130049 |
| (includes cable)                                       |        |
| 5. Communication software for Windows 3.1,.....        | 130086 |
| 95, and NT   |        |
| 6. Communication software for DOS .....                | 130075 |
| 7. RS232 Printer.....                                  | 130031 |

### *Sensors...*

Your choice of a complete range of Ion Selective, Reference, pH and Redox sensors.

### *Other spares...*

- |                                   |        |
|-----------------------------------|--------|
| 1. RS232 Interface Cable.....     | 130022 |
| 2. Recorder Cable.....            | 130021 |
| 3. RS232 PLUS Recorder Cable..... | 130030 |

## 1.9 Specifications

Mode	Range	Resolution	Accuracy
<b>Specific Ions</b>	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
<b>pH</b>	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
<b>mV</b>	0 to ±500.0 mV 0 to ±1500 mV (auto-ranging)	0.1 mV 1 mV	±0.15 mV ±1 mV
<b>Relative mV</b>	0 to ±500.0 mV 0 to ±1500 mV (auto-ranging)	0.1 mV 1 mV	±0.15 mV ±1 mV
<b>Temperature</b>	-10.0 to 120.0 °C	0.1 °C	±0.2 °C

### Additional Specific Ion Specifications

**Input Impedance** : >3 x 10<sup>12</sup> Ω  
**Asymmetry Range** : Auto detection  
**Slope Range** : 50.0 to 110.0 %  
**Temperature Compensation** : Automatic, 0 to 100 °C  
**Calibration** : Automatic calibration in user-definable standards.

### Additional pH Specifications

**Input Impedance** : >3 x 10<sup>12</sup> Ω  
**Asymmetry Range** : -1.00 to 1.00 pH  
**Slope Range** : 85.0 to 105.0 %  
**Temperature Compensation** : Automatic, 0 to 100 °C  
**Calibration** : Automatic calibration. Automatic recognition of pH4.00, 6.88, 7.00, 9.22 and 10.06 buffers. Manual entry of any other buffer value.

### Additional Temperature Specifications

**Temp. Sensor Offset Range** : -10.0°C to +10.0°C

### General Specifications

**Memory** : 1200 readings including date and time  
**Automatic Logging** : User-set for one reading every 1 to 90 seconds, minutes or hours.  
**RS232 Port (optional)** : 300, 1200 & 9600 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 Value of last Ion and pH calibration for each Channel, plus Temperature calibration are stored. This information can be recalled or sent to the optional RS232 port at any time.  
**Power** : 12V DC, 50mA. Plug-pack power supply 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 °C  
 Humidity : 0 to 90 % R.H.

## 2. 900-I3 Menu Structure

A detailed breakdown of the menu system of the **900-I3** is shown below. This diagram provides a quick reference for the menu functions available for the **900-I3**.

Press the function keys in normal display mode, to perform the following tasks:

**F1** : Press to record readings into the Notepad. See section 9.1.

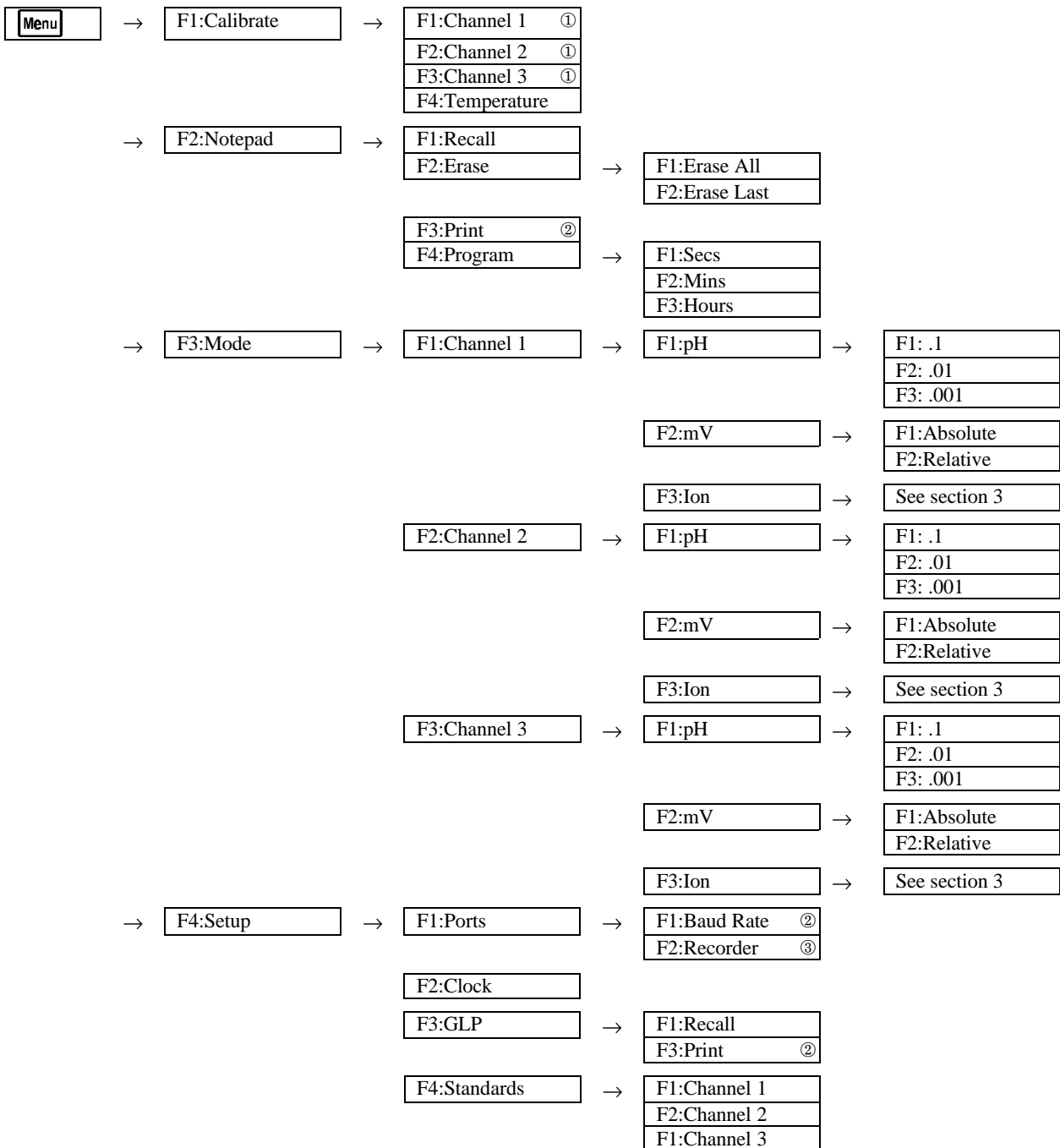
**F3** : Press to start or stop automatic datalogging. See section 10.

If logging period is set to zero, press to transmit current reading plus date and time to the optional RS232 port. See section 11.2.

**F4** : Press to Zero Relative mV, when Relative mV is selected. See section 6.2.

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

**Menu** : Press to access the user-friendly menu system, as detailed below.



① Only those Channels that are currently set to Ion or pH mode are offered for calibration.

② These functions available when RS232 Port option is fitted.

③ This function available when Recorder Port option is fitted.

### 3. Specific Ion Mode

#### 3.1 Selecting Specific Ion Mode

- Select Specific Ion Mode for Channel 1, 2 or 3.  
(e.g. **Menu** → **F3: Mode** → **F1: Channel 1** → **F3: Ion**)
- The Valency selection screen is now displayed...

<b>VALENCY</b>	<b>&gt;F1: +Mono</b>	<b>F2: - Mono</b>
	<b>F3: ++Di</b>	<b>F4: -- Di</b>

The arrow indicates the current selection.

Press **F1** to select Monovalent Cation (e.g. Na<sup>+</sup>).

Press **F2** to select Monovalent Anion (e.g. F<sup>-</sup>).

Press **F3** to select Divalent Cation (e.g. Cu<sup>2+</sup>).

Press **F4** to select Divalent Anion (e.g. S<sup>2-</sup>).

Press **Menu** to quit without changing the current setting.

- The Units selection screen is now displayed...

<b>UNI TS</b>	<b>&gt;F1: ppM</b>	<b>F2: ppK</b>
	<b>F3: %</b>	<b>F4: Exponent i al</b>

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.

- The Ion Resolution screen is now displayed...

<b>Ion Resol uti on</b>	<b>F1: 3 Di gits</b>	<b>F2: 2 Di gits</b>
	<b>&gt;F3: Auto- Roundi ng</b>	

The arrow indicates the current selection.

Press **F1** to select resolution to 3 significant digits. In this mode, the readings may become slightly noisy 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 significant digit is lost.

Press **F3** to select Auto-rounding. Readings in this mode are displayed to 3 significant 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.

### 3.2 Setting Specific Ion Standards

The Primary and Secondary Specific Ion standards must be set before attempting Specific Ion calibration.

The Primary and Secondary Specific Ion standard values are entered and stored separately for each Channel.

The standards for a Channel must be re-entered when changing Specific Ion modes for that Channel.

All Primary and Secondary Specific Ion standards must be re-entered if the 900-I3 is initialised.

#### 3.2.1 Setting Specific ion standards for ppM, ppK and % readouts

1. Select the Specific Ion standards set-up menu for Channel 1, 2 or 3.

(e.g. **Menu** → **F4: Setup** → **F4: Standards** → **F1: Channel 1**).

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.

### 3.2.2 Setting Specific Ion standards for Exponential readout

1. Select the Specific Ion standards set-up menu for Channel 1, 2 or 3.  
(e.g. **Menu** → **F4: Setup** → **F4: Standards** → **F1: Channel 1**).
2. The Primary Standard set-up screen will now be displayed.

Enter Primary Standard : 0.0010<sup>+00</sup>

Readings in Exponential mode are expressed in Scientific notation. For example, 1.0010<sup>-04</sup> should be read as 1.00 x 10<sup>-4</sup>.

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<sup>+</sup> or press **F2** for 10<sup>-</sup>.

Enter the power. This can be entered as 1 or 2 digits (e.g. "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 : 0.0010<sup>+00</sup>

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<sup>+</sup> or press **F2** for 10<sup>-</sup>.

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

Use the **←** key to make any corrections.

Press **Enter** to save the Secondary standard.

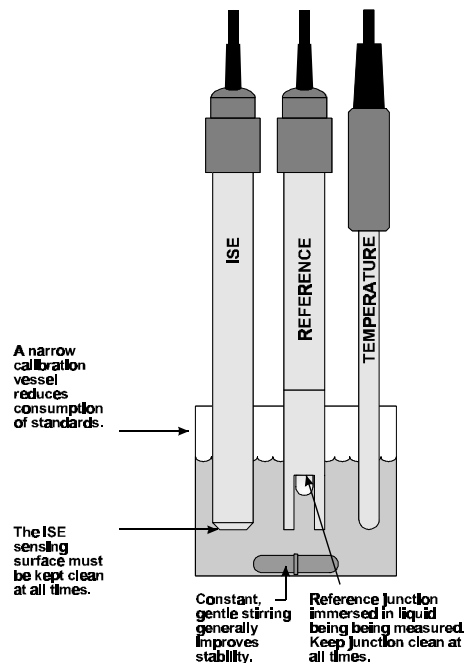
Alternatively, press **Menu** to quit without changing the current setting.

### 3.3 Specific Ion Calibration

1. Plug the Ion Selective Electrode into the **Probe 1**, **Probe 2** or **Probe 3** socket.  
If a separate Reference Electrode is being used, plus this into the matching 4mm **Ref 1**, **Ref 2** or **Ref 3** socket provided.  
Plug the Temperature sensor into the **Temp.** socket.
2. Switch the meter on.
3. Select and set up Ion mode, as detailed in section 3.1.  
Set up the Primary and Secondary Specific Ion standards, as detailed in section 3.2.  
For the purposes of this handbook, the **900-I3** has been set up for 100ppM as the Primary Standard and 10.0ppM as the Secondary Standard.
4. Ensure that temperature has already been calibrated (section 7.1) or manually set (section 7.4).  
**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 Channel 1, 2 or 3.

(e.g. **Menu** → F1: Calibrate → F1: Channel 1 → 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-I3** is currently not Primary calibrated. For example...

Cal ?	0. 1 <sup>m</sup>	25. 0 <sup>0</sup> c
Ion 100. ppM 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-I3** will now display the Offset of the Ion Selective Electrode, before asking if you wish to go on to a Secondary Calibration...

Press Enter to go on for Second Standard Calibration {Slope}, or Menu to Quit
---

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, above.

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 same Channel as selected in step 7, above.

(e.g. **Menu** → F1: Calibrate → F1: Channel 1 → F3: Secondary).

The **900-I3** will have done this for you if you pressed **Enter** at the end of step 7.

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-I3** is currently not Secondary calibrated. For example...

11*0ppM	56. 7mV	25. 0 <sup>0</sup> c
Ion 10. 0ppM 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-I3** will now display the Slope of the Ion Selective Electrode.

A “ \* ” in the display will be replaced by a decimal point after a successful 2-point Slope calibration, for the Channel that was calibrated.

11. The **900-I3** is now ready for Specific Ion measurements for the Channel that was calibrated. Rinse the Ion Selective, Reference and Temperature sensors in distilled water and blot dry before placing them into unknown samples.

### 3.4 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. Calibration information for each Channel is retained in memory when the **900-I3** is switched off, even when the power supply is removed. This information can be recalled or printed later using the GLP function (see section 8).
4. The **900-I3** 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 3.2).

### 3.5 Specific Ion Calibration Messages

1. If a Primary Calibration has been successfully performed, the **900-I3** will display the following message, and the Offset value of the sensor. For example...

100*ppM		25. 0 <sup>0</sup> C
Calibration OK.	mV @ STD1=0. 1mV	

2. If a Secondary Calibration has been successfully performed, the **900-I3** will display the following message, and the slope value of the sensor. For example...

10. 0ppM	56. 7mV	25. 0 <sup>0</sup> C
Calibration OK.	Slope=95. 6%	

3. If a Secondary Calibration has failed, the **900-I3** will display the following message, and the failed slope value of the electrode. For example...

35*2ppM	25. 4mV	25. 0 <sup>0</sup> C
Calibration Failed.	Slope=42%	

### Notes

1. The **900-I3** 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 16.2) for possible remedies.

## 4. pH Mode

### 4.1 Selecting pH Mode

1. Select pH Mode for Channel 1, 2 or 3.

(e.g. **Menu** → **F3: Mode** → **F1: Channel 1** → **F1: pH**).

2. The pH Resolution screen is now displayed...

<b>Select pH Resolution</b>		
<b>F1: 0. 1</b>	<b>&gt;F2: 0. 01</b>	<b>F3: 0. 001</b>

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.

## 4.2 Setting the pH Buffer Set

The 900-I3 can be programmed to automatically recognise any of the following buffer sets during pH calibration. All pH values listed below are at 20 °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. Switch the **900-I3** OFF.
2. Press and **HOLD** the **F1** key while turning the **900-I3** back on.
3. 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.

4. 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.

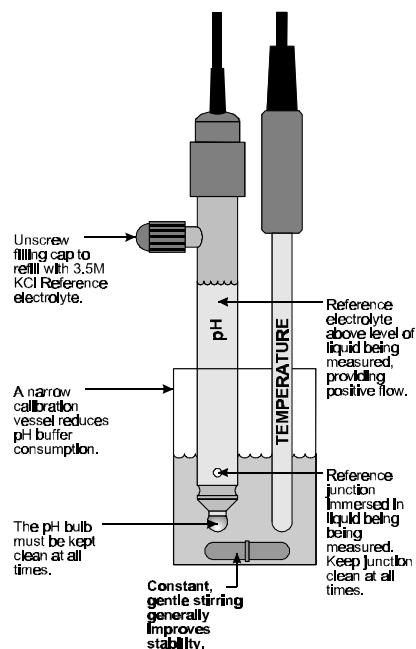
Press **Menu** to quit without changing the current setting.

### **Notes**

1. The selected buffer set will be the same for all Channels that are set to pH mode.
2. The selected buffer set is kept in memory when the meter is switched off.
3. The buffers are re-set to pH4.00, pH6.88 and pH9.23 during initialisation.
4. 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.
5. pH9.23 and pH10.01 buffers are highly unstable. Avoid using these buffers if possible. Discard immediately after use.
6. 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.

### 4.3 pH Calibration

1. Plug the pH sensor into the **Probe 1**, **Probe 2** or **Probe 3** socket and the temperature sensor into the **Temp.** socket. Switch the meter on.
2. Select pH Mode and the desired pH resolution (see section 4.1).
3. Ensure that temperature has already been calibrated, or manually set (see sections 7.1 and 7.4).  
NOTE: If the decimal point in the temperature reading is shown by a “ \* ”, then 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 4.2.
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 Channel 1, 2 or 3.  
(e.g. **Menu** → **F1: Calibrate** → **F1: Channel 1** → **F1: pH**).

The display should now look something like this...

<p><b>6*85pH Buffer=6.86</b>      <b>25.0<sup>0</sup>c</b></p> <p><b>Press ENTER to Calibrate, or Edit Buffer.</b></p>
--

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-I3**.

The buffer that the **900-I3** 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**.

If a 1 point calibration has been performed, 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, above.

**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 same Channel as selected in step 7, above.

(e.g.  → F1: Cal i brate → F1: Channel 1 → F1: pH).

The display should now look similar to the example shown in step 7. Note that the **900-I3** has automatically recognised the second buffer.

Wait for the displayed reading to stabilise before attempting to calibrate the **900-I3**.

Press  to calibrate to the displayed buffer.

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

11. The **900-I3** is now ready for pH measurements for the Channel that was calibrated. 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.

#### 4.4 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. Calibration information for each Channel is retained in memory when the **900-I3** is switched off, even when the power supply is removed. This information can be recalled or printed later using the GLP function (see section 8).

#### 4.5 pH Calibration Messages

1. If a 1-point calibration has been successfully performed, the **900-I3** 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-I3** will display the following message, and the failed asymmetry value of the electrode.

**Calibrate Failed, +1.2 pH Asymmetry**  
**Repeat Cal. or Initialize Calibration**

3. If a 2-point calibration has been successfully performed, the **900-I3** 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-I3** will display the following message, and the failed slope value of the electrode.

**Calibrate Failed, 80% Slope**  
**Repeat Cal. or Initialize Calibration**

5. The **900-I3** 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 16.2) for possible remedies.

## **5. Absolute Millivolt Mode**

### **5.1 Selecting Absolute Millivolt Mode**

Select absolute mV mode for Channel 1, 2 or 3.

(e.g.  → F3: Mode → F1: Channel 1 → F2: mV → F1: Absolute)

The **900-I3** will display the actual millivolts produced by the sensor in this mode.

### **5.2 Absolute Millivolt Calibration**

The millivolt section of the **900-I3** is factory calibrated. There is no user-calibration facility for this mode.

Temperature compensation is not applicable in Millivolt mode.

## 6. Relative Millivolt Mode

### 6.1 Selecting Relative Millivolt Mode

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

Select relative mV mode for Channel 1, 2 or 3.

(e.g. **Menu** → **F3: Mode** → **F1: Channel 1** → **F2: mV** → **F2: Relative**)

The **900-I3** will display the millivolt data relative to a known, user-selectable zero point.

Absolute millivolt data is also displayed for Channel 1 only.

### 6.2 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.

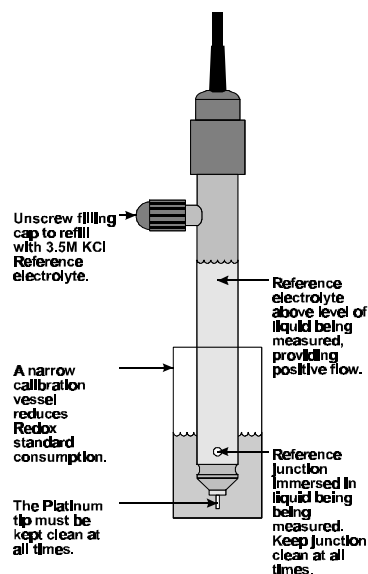
1. Plug the Redox sensor into the **Probe 1**, **Probe 2** or **Probe 3** socket. Temperature compensation is not applied in Relative mV mode, so the temperature sensor does not need to be connected.
2. Switch the meter on.
3. Select Relative mV Mode for Channel 1, 2 or 3.

(e.g. **Menu** → **F3: Mode** → **F1: Channel 1** → **F2: mV** → **F2: Relative**)

4. The display should now be showing Relative mV on the top line with absolute mV on the bottom line. The following example shows all 3 Channels set to Relative mV. Note that the Absolute mV reading is only displayed for Channel 1.

500. 0mVR	500. 0mVR	500. 0mVR	25. 0 <sup>0</sup> c
500. 0mV	F4: Zeros	31/12/98	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, and the absolute mV reading will remain unchanged. In the following example, Channel 1 is in Relative mV mode, and Channels 2 and 3 are in Specific Ion and pH modes...

0. 0mVR	10. 0ppM	7. 00pH	25. 0 <sup>0</sup> C
500. 0mV	F4: Zeros	31/12/98	12: 00: 00

- (b) If more than one Channel is in Relative mV mode, the **900-I3** will offer a choice of Zeroing any one Channel, or all Channels. For example...

500. 0mVR	500. 0mVR	500. 0mVR	25. 0 <sup>0</sup> C
Zero F1: Chan1	F2: Chan2	F3: Chan3	F4: All

Press **F1**, **F2**, **F3** or **F4** according to your requirements.

9. The **900-I3** Relative mV mode is now zeroed and is ready for use. The readout can be re-zeroed by repeating the steps detailed above whenever required.

### 6.3 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-I3** is switched off, even when the power supply is removed.
3. The Relative mV zero offset for any one Channel is reset when leaving Relative mV mode for that Channel.

## 7. Temperature

The temperature readout must be calibrated or manually set before attempting Specific Ion or pH calibration. The decimal point is replaced by a “ \* ” if the reading is not calibrated.

### 7.1 Temperature Calibration

1. Plug the temperature sensor into the **Temp.** socket.
2. Switch the meter on.
3. Place the temperature 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** → **F4: Temperature**).

The Temperature Calibration screen is now displayed. For example...

Enter Actual Temperature : _	24. 0 <sup>0</sup> C
Temperature Calibration	Menu Quits

The current reading from the Temperature 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.

### 7.2 Temperature Calibration Notes

1. Temperature calibration information is retained in memory when the **900-I3** is switched off, even when the power supply is removed. This information can be recalled later using the GLP function (see section 8).
2. Temperature does not need to be re-calibrated unless the Temperature sensor is replaced or the meter is initialised.

### 7.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **900-I3** will display the following message and the offset of the sensor.

Temperature Calibration OK 0. 1 <sup>0</sup> C Offset
--

2. If a temperature calibration has failed, the **900-I3** will display the following message, and the failed offset value of the sensor.

Temperature Calibration Failed 11. 0 <sup>0</sup> C Offset
---

3. The **900-I3** has an allowable Offset range of -10.0 to +10.0 °C. If calibration fails due to the Offset being outside these limits, then please consult the Troubleshooting guide (section 16.3) for possible remedies.

## 7.4 Manual Temperature Setting

If the temperature sensor is not 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** → **F4: Temperature**).
4. The current temperature setting is now displayed. For example...

<p>Enter Manual Temperature : 25.0 °C Menu Quits</p>
--

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-I3** now returns to normal measurement mode. Note the flashing “**M**” in the temperature readout, indicating that Manual Temperature Compensation is in use. For example...

<p>10.0ppM      7.00pH      500.0mV      25.0<sup>0</sup>cM 31/12/98    12:00:00</p>
--

## **8. Good Laboratory Practices (GLP)**

The **900-I3** keeps a record of the date and time of the last Specific Ion, pH and Temperature calibrations as part of GLP guidelines.

The last Specific Ion and pH calibration data are stored separately for each Channel.

### **8.1 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.

<b>900I 3 V3. 0 R1234</b>	<b>@ 31/12/98 12: 00</b> <b>F4: Next</b>
---------------------------	---

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 over the page. Press **Menu** to abort at any time.

*GLP Display sequence...*

900I3 V3.0 R1234	@ 31/12/98 13:00
	F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Ion1 Offset=0.1mV	31/12/98 11:00
Ion Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Ion1 Slope=99.0%	31/12/98 11:05
Ion Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
pH1 Asymmetry=0.10pH	31/12/98 11:10
pH Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
pH1 Slope= 99.0%	31/12/98 11:15
pH Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Ion2 Offset=0.1mV	31/12/98 11:20
Ion Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Ion2 Slope=99.0%	31/12/98 11:25
Ion Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
pH2 Asymmetry=0.10pH	31/12/98 11:30
pH Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
pH2 Slope= 99.0%	31/12/98 11:35
pH Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Ion3 Offset=0.1mV	31/12/98 11:40
Ion Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Ion3 Slope=99.0%	31/12/98 11:45
Ion Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
pH3 Asymmetry=0.10pH	31/12/98 11:50
pH Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
pH3 Slope= 99.0%	31/12/98 11:55
pH Calibrated	F2: Back F4: Next
↑ <b>F2</b>	↓ <b>F4</b>
Temperature Offset=1.0 <sup>0</sup> c	31/12/98 12:00
Temp. Calibrated	F2: Back F4: Ends

## 8.2 Failed Calibration

If calibration has failed, the GLP function will reset the date and time for the failed parameter to zero. The 900-I3 still shows the results for the last successful calibration, as shown in the following examples.

1. Failed Ion Slope Calibration...

Ion1 Slope=99.0%	00/00/00 00:00
Ion Un-Calibrated	F2: Back F4: Next

2. Failed pH Asymmetry Calibration...

pH1 Asymmetry=0.10pH	00/00/00 00:00
pH Un-Calibrated	F2: Back F4: Next

3. Failed pH Slope Calibration...

pH1 Slope= 99.0%	00/00/00 00:00
pH Un-Calibrated	F2: Back F4: Next

4. Failed Temperature Offset Calibration...

Temperature Offset=1.0 <sup>o</sup> C	00/00/00 00:00
Temp. Un-Calibrated	F2: Back F4: Next

## 8.3 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. This function is available only when the optional RS232 port is fitted.

1. Switch the meter on.
2. Ensure that the **900-I3** RS232 cable is connected to the instrument and to the printer or PC.
3. 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.

4. The GLP information is sent to the RS232 port in formatted ASCII text. For example...

```
900I3 V3.0 R1234 @ 31/12/1998 13:00
Ion1 Offset= 0.1mV @ 31/12/1998 11:00
Ion1 Slope= 99.0% @ 31/12/1998 11:05
pH1 Asy= 0.10pH @ 31/12/1998 11:10
pH1 Slope= 99.0% @ 31/12/1998 11:15
Ion2 Offset= 0.1mV @ 31/12/1998 11:20
Ion2 Slope= 99.0% @ 31/12/1998 11:25
pH2 Asy= 0.10pH @ 31/12/1998 11:30
pH2 Slope= 99.0% @ 31/12/1998 11:35
Ion3 Offset= 0.1mV @ 31/12/1998 11:40
Ion3 Slope= 99.0% @ 31/12/1998 11:45
pH3 Asy= 0.10pH @ 31/12/1998 11:50
pH3 Slope= 99.0% @ 31/12/1998 11:55
Temperature Offset= 1.0oC @ 31/12/1998 12:00
Ends
```

#### 8.4 Instrument Serial Number

In case the serial number that is fitted to the rear of the **900-I3** is removed or becomes illegible, it is also available on the **900-I3** display.

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

```
900I3srV3.0 R1234 (C) 1998 TPS Pty Ltd
Three Channel Ion/pH/mV and Temperature
```

The “s” after **900I3** is shown when the RS232 serial Port option is fitted.

The “r” after **900I3** is shown when the Recorder Port option is fitted.

2. The serial number is displayed when recalling the GLP information (section 8.1).
3. The serial number is included on the printout of GLP information (section 8.3).
4. The GLP information can be downloaded to a PC using the optional Windows ® software (part number 130086).

#### 8.5 Additional GLP Features

Another GLP requirement is to record the date and time of every reading. The **900-I3** does this for you when readings are recorded either with the Notepad function (section 9) or the Automatic Logging function (section 10).

## 9. Notepad Function

### 9.1 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. 0ppM	7. 00pH	500. 0mV	25. 0 <sup>0</sup> C
Log# 1,	Press F1	31/12/98	12: 00: 00

2. Press **F1**, to record all three Channels of Ion/pH/mV data, plus Temperature, Date and Time into the notepad. This will be labeled 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 1200.

### 9.2 Recalling Readings from the Notepad

To recall records from the Notepad onto the **900-I3** display...

1. Select the Notepad menu (**Menu** → **F2: Notepad**)
2. Select **F1: Recal 1** from the menu.

Record number 1 is now displayed.

For example...

10. 0ppM	7. 00pH	500. 0mV	25. 0 <sup>0</sup> C
Log# 1,	F2: ↑	F4: ↓	31/12/98 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 roll rapidly 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 optional RS232 port.

### 9.3 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-I3** 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.

### 9.4 Printing Records from the Notepad to the RS232 Port

This function is only available when the optional RS232 port is fitted.

1. Connect one end of the RS232 cable to the **RS232/Recorder** socket of the **900-I3**.
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-I3** are the same. If necessary, alter the baud rate of the **900-I3** (see section 11.1).

The **900-I3** 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.



9. **Note:** The clock must be set before the **900-I3** will allow automatic logging to start. The message “**Clock Not Set**” is displayed if the clock is not set. See section 13 for details on setting the clock.

## **11. RS232 Port**

This section is applicable if the optional RS232 port is fitted.

### **11.1 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-I3** will jump directly to the RS232 set-up screen. The available baud rates are listed, along with the RS232 port configuration...

<b>Baud Rate:</b>	<b>F1: 300</b>	<b>F2: 1200</b>	<b>&gt;F3: 9600</b>
	<b>8 bits, No Parity, 1 Stop bit, XON/XOFF</b>		

The arrow indicates the current selection.

3. Press **F1** to select 300 baud.  
Press **F2** to select 1200 baud.  
Press **F3** to select 9600 baud.  
Press **Menu** to quit and retain the current setting.

### **11.2 Sending Readings to the RS232 Port**

Press **F3** to instantly send readings to the RS232 port whenever the **900-I3** is in normal measurement mode. This function is disabled if the automatic logging period is set to greater than zero (see section 10).

Records can be sent directly to the RS232 port rather than stored in memory during automatic datalogging. See section 10 for details.

Press **F3** while recalling data on the display (see section 9.2) to send that record to the RS232 port.

### **11.3 RS232 Configuration**

The **900-I3** RS232 configuration is 8 Bits, No Parity, 1 Stop Bit, XON/XOFF Protocol.

This information is displayed when setting the baud rate (see section 11.1)

### **11.4 Communication and Statistical Software**

Communication between the **900-I3** and a PC can be handled with any RS232 communication software. The diskette supplied by TPS contains a BASIC program for this purpose. A Windows version is also 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-I3** is formatted in columns that can be imported by programs such as Microsoft<sup>®</sup> Excel<sup>®</sup> and Lotus 123<sup>®</sup>.

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

## 11.5 Commands

The following commands can be sent from a PC to the **900-I3**. Note that <cr> denotes carriage return and <lf> denotes a line feed.

Action	Command	Notes
Request current data	?D<cr>	Returns current data from all Specific Ion/pH/mV Channels that are switched on, plus Temperature, date and time from the <b>900-I3</b> . The log number returned is set to Zero.
Request logged data	?R<cr>	Returns all logged records from the <b>900-I3</b> memory. The data ends with the message <b>ENDS</b> <cr>
Erase logged data	?E<cr>	Erases all logged records from the <b>900-I3</b> memory. Returns the message <b>ERASED</b> <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... <b>900I3•V3.0•R1234•1200</b> <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 11.7 for data format and handshaking).

## 11.6 Data Format

Data is returned to the RS232 Port by the **900-I3** in the following format...

**LLLL•11111111UUU•22222222UUU•33333333UUU•TTTTTuuu•dd/mm/yyyy•hh: mm: ss**

where....

**LLLL** is the Log Number, 4 characters, right justified. The **900-I3** sends a Zero for instant readings (see section 11.2).

• is one space

**11111111** is Channel 1 Specific Ion, pH, mV or Relative mV data, 8 characters, right justified.

The **900-I3** sends “**•••Uncal**” when this Channel has not been Primary Calibrated in Specific Ion mode.

**UUU** is the unit description, which can be any one of the following...

<b>ppM</b>	for parts per Million readout in Specific Ion mode.
<b>ppK</b>	for parts per Thousand readout in Specific Ion mode.
<b>%••</b>	for % readout in Specific Ion mode.
<b>•••</b>	for Exponential readout in Specific Ion mode.
<b>•••</b>	For Specific Ion mode when Primary Calibration has not been performed, or has failed.
<b>pH•</b>	for pH readout.
<b>mV•</b>	for Absolute Millivolts readout.
<b>mVR</b>	for Relative Millivolts readout.
(“•” is one space.)	

• is one space.

**22222222** is Channel 2 Specific Ion, pH, mV or Relative mV data, 8 characters, right justified.

The **900-I3** sends “**•••Uncal**” when this Channel has not been Primary Calibrated in Specific Ion mode.

**UUU** is the unit description, which can be any one of those listed in the table above.

• is one space.

**33333333** is Channel 3 Specific Ion, pH, mV or Relative mV data, 8 characters, right justified.

The **900-I3** sends “**•••Uncal**” when this Channel has not been Primary Calibrated in Specific Ion mode.

**UUU** is the unit description, which can be any one of those listed in the table above.

• is one space.

**TTTTT** is Temperature data, 5 characters, right justified.

**uuu** is the unit description. The **900-I3** sends “**oC•**” for real temperature data (where • is one space), or “**oCm**” for manual temperature compensation values.

• is one space.

**dd/mm/yyyy** is the date, month and year data. The year is sent as 4 digits for Year 2000 compliance.

• is one space

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

When requested by a PC with the ?D or ?R commands (section 11.5), the data is terminated with a carriage return.

When the data is sent by the **900-I3** using the Print function (section 9.4) or the Instant Send function (section 11.2), the data ends with a carriage return and a line feed.

### 11.7 GLP Data Format

GLP information is returned as up to 7 lines terminated by a carriage return. When using the “?G” command (section 11.5), the computer must respond with a character after receiving each line.

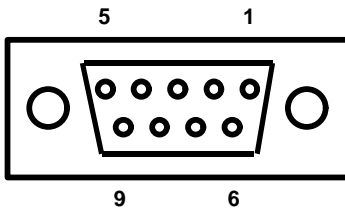
For example...

```

900I3 V3.0 R1234 @ 31/12/97 13:00
Ion1      Offset=    0.1mV    @ 31/12/1998 11:00
Ion1      Slope=     99.0%    @ 31/12/1998 11:05
pH1       Asy=       0.10pH   @ 31/12/1998 11:10
pH1       Slope=     99.0%    @ 31/12/1998 11:15
Ion2      Offset=    0.1mV    @ 31/12/1998 11:00
Ion2      Slope=     99.0%    @ 31/12/1998 11:05
pH2       Asy=       0.10pH   @ 31/12/1998 11:10
pH2       Slope=     99.0%    @ 31/12/1998 11:15
Ion3      Offset=    0.1mV    @ 31/12/1998 11:00
Ion3      Slope=     99.0%    @ 31/12/1998 11:05
pH3       Asy=       0.10pH   @ 31/12/1998 11:10
pH3       Slope=     99.0%    @ 31/12/1998 11:15
Temperature Offset=   1.0oC   @ 31/12/1998 11:20
ENDS

```

### 11.8 RS232 Port Connections



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

## **12. Recorder Port**

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

The optional Recorder Port can be used to send any one Channel of Specific Ion, pH, mV or Relative mV data to a chart recorder or other analogue logging device.

The Recorder Port is not activated until it has been configured, as per sections 12.1, 12.2 or 12.3. If the readout mode of the selected Channel is changed, the Recorder Port is de-activated to prevent potentially misleading outputs.

### **12.1 Recorder Port Configuration in Specific Ion Mode**

1. Select the Ports Set-up menu (**Menu**) → **F4: Setup** → **F1: Ports**).
2. If the both the Recorder and the RS232 port options are fitted, then select **F2: Recorder**.  
If the Recorder Port option **only** is fitted, then the **900-I3** will jump directly to the Channel Selection screen...

<b>RECORDER</b>	<b>F1: Channel 1</b>	<b>F2: Channel 2</b>
	<b>F3: Channel 3</b>	<b>&gt;F4: OFF</b>

The arrow indicates the current selection.

Press **F1**, **F2** or **F3** to select Channel 1, 2 or 3.

Press **F4** to switch the Recorder Port OFF.

3. After selecting Channel 1, 2 or 3, the first Recorder Port configuration screen is displayed...

<b>Select Option</b>	<b>&gt;F1: Ion</b>	<b>F2: mV</b>
----------------------	--------------------	---------------

The arrow indicates the current selection.

Press **F1** to set the Recorder output to be directly proportional to the concentration readout on the **900-I3** display.

Press **F2** to set the Recorder output to be proportional to the millivolt signal being produced by the Ion Selective Electrode. This millivolt signal is temperature compensated for the Recorder output.

4. (a) If **F1: Ion** was selected at step 3 above, the **900-I3** will now ask you to enter the Specific Ion reading that will produce full scale on the Recorder Port. For example...

Enter Full Scale : 1000      ppm

For ppm, ppK and % readouts, type in the Specific Ion reading, including decimal point, that will produce full scale.

For Exponential mode, type in 3 significant digits of the value that will produce full scale. 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 (e.g. "04" is treated the same as "4").

Use the **←** key to make any corrections.

Press **Enter** to save the value.

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

The **900-I3** will confirm the setting before returning to normal measurement mode. For example...

Channel 1 Ion selected,  
1000. ppm = 2 volts

- (b) If **F2: mV** was selected at step 3 above, the **900-I3** will confirm the setting before returning to normal measurement mode...

Channel 1 mV output selected,  
- 1500mV = 0 volts, +1500mV = 2 volts

## 12.2 Recorder Port Configuration in pH Mode

1. Select the Ports Set-up menu (**Menu**) → **F4: Setup** → **F1: Ports**).
2. If the both the Recorder and the RS232 port options are fitted, then select **F2: Recorder**.  
If the Recorder Port option *only* is fitted, then the **900-I3** will jump directly to the Channel Selection screen...

RECORDER F1: Channel 1      F2: Channel 2  
                  F3: Channel 3      >F4: OFF

The arrow indicates the current selection.

Press **F1**, **F2** or **F3** to select Channel 1, 2 or 3.

Press **F4** to switch the Recorder Port OFF.

3. After selecting Channel 1, 2 or 3, the **900-I3** will display the Recorder Port configuration for 3 seconds, before returning to normal measurement mode...

Channel 1 pH selected,  
0pH = 0 volts, 14pH = 2 volts

## 12.3 Recorder Port Configuration in Absolute or Relative mV Modes

1. Select the Ports Set-up menu (**Menu**) → **F4: Setup** → **F1: Ports**).
2. If the both the Recorder and the RS232 port options are fitted, then select **F2: Recorder**.  
If the Recorder Port option *only* is fitted, then the **900-I3** will jump directly to the Channel Selection screen...

RECORDER F1: Channel 1      F2: Channel 2  
                  F3: Channel 3      >F4: OFF

The arrow indicates the current selection.

Press **F1**, **F2** or **F3** to select Channel 1, 2 or 3.

Press **F4** to switch the Recorder Port OFF.

3. After selecting Channel 1, 2 or 3, the **900-I3** will display the Recorder Port configuration for 3 seconds, before returning to normal measurement mode...

Channel 1 mV selected,  
- 1500mV = 0 volts, +1500mV = 2 volts

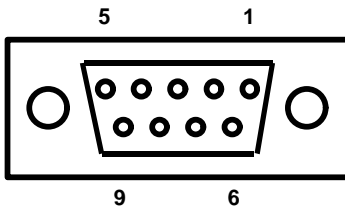
### 12.4 Recorder Port Specifications

Mode	Display Range	Output Range	Examples (Reading = mV Out)
Specific Ion	Full auto-ranging concentration readout, with user-set resolution.	2000 mV at user-selectable Full Scale ( section 12.1). 0 mV at approx. 2 decades of concentration below Full Scale.	If Full Scale is set to 1000ppM, then... 10 ppM ≈ 0 mV 1000 ppM = 2000 mV
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, ISE 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

**Output Impedance** : Approximately 1000 Ohms

**Resolution** : Approximately 2 mV

### 12.5 Recorder Port Connections



Pin No	Connection
6	Recorder Output Signal
7	Recorder Output Common

### **13. 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**.
4. Alternatively, press menu to quit and retain the current setting.
5. If you pressed **Enter** above, the display will now show the current date, for example...

```
Date is now      31/12/1998
Enter new date  31/12/1998  dd/mm/yyyy
```

6. Use the Numeric Keypad to enter the current date, then press **Enter**.
7. Alternatively, press menu to quit and retain the current setting.


#### **Notes**

1. The **900-I3** tests that a valid day of the month is entered. If an invalid date is entered (e.g. 31/02/1998), the **900-I3** 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-I3** also tests for leap years.

## **14. Initialising the 900-I3**

If the calibration settings of the **900-I3** exceed the allowable limits, the unit may need to be initialised to factory default values. This action may be required if the electrode is replaced.

To initialise the **900-I3**...

1. Switch the **900-I3** off.
2. Press and hold the  key while switching the **900-I3** back on.
3. The following messages should be displayed...

I n i t i a l i z i n g

then...

S y s t e m I n i t i a l i z e d  
U n i t s h o u l d b e R e - c a l i b r a t e d b e f o r e u s e

then...

900I3srV3.0 R1234 (C) 1998 TPS Pty Ltd  
Three Channel Ion/pH/mV and Temperature

The “s” after **900I3** is shown when the RS232 serial Port option is fitted.

The “r” after **900I3** is shown when the Recorder Port option is fitted.

4. The meter then displays pH, Temperature, Date and Time. Note that the decimal points have been replaced with a “ \* ”, to indicate that the unit requires re-calibration.

## **15. Instrument firmware version number**

If you need to phone or fax TPS for any further technical assistance, the version number of your **900-I3** firmware may of benefit to us. The version number is displayed by the **900-I3** at turn-on.

## 16. Troubleshooting

### 16.1 General Errors

Error Message	Possible Causes	Remedy
<b>Factory Calibration Data Failure.</b> <b>mV and Temperature Readings Inaccurate</b>	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service. mV & Temperature readings may be up to 10% incorrect. Specific Ion and pH readings will be accurate after a 2-point calibration (use manual temperature compensation).
<b>EEPROM Write Failure</b> <b>Return to Factory for Service</b>	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.

### 16.2 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.	Initialize the unit. See section 14.
1 Point calibration fails. (Specific Ion offset causes over-range reading, or pH asymmetry is greater than $\pm 1.00$ pH.)	<ol style="list-style-type: none"> <li>Reference junction blocked.</li> <li>Reference electrolyte contaminated.</li> </ol>	<p>Clean reference junction, as per instructions supplied with the pH or reference electrode.</p> <p>Flush with distilled water and replace electrolyte.</p>
2 Point calibration fails. (Specific Ion slope is less than 50%, or pH slope is less than 85.0%.)	<ol style="list-style-type: none"> <li>Specific Ion standards or pH Buffers not correctly set.</li> <li>Ion sensor surface or pH glass bulb not clean.</li> <li>Electrode is aged.</li> <li>Connector is damp.</li> <li>Specific Ion standards or pH Buffers are inaccurate.</li> </ol>	<p>Ensure that you are using Specific Ion standards as per the Standards set-up (see section 3.2).</p> <p>For automatic pH buffer recognition, ensure that you are using buffers that match the selected buffer set (see section 4.2). Otherwise, ensure that the buffer value is entered correctly at pH calibration.</p> <p>Clean glass bulb as per instructions supplied with the electrode.</p> <p>Attempt rejuvenation, as per instructions supplied with the electrode. If not successful, replace electrode.</p> <p>Dry in a warm place.</p> <p>Replace standards or buffers.</p>
Unstable readings.	<ol style="list-style-type: none"> <li>Reference Electrolyte chamber needs to be refilled.</li> <li>Reference junction blocked.</li> <li>Glass bulb not clean.</li> <li>Bubble in glass bulb.</li> <li>Faulty connection to meter.</li> <li>Reference junction not immersed.</li> <li>KCl crystals around reference junction, inside the electrolyte chamber.</li> </ol>	<p>Refill with saturated KCl filling solution.</p> <p>Clean reference junction, as per instructions supplied with the electrode.</p> <p>Clean glass bulb as per instructions supplied with the electrode.</p> <p>Flick the electrode to remove bubble.</p> <p>Check connectors. Replace if necessary.</p> <p>Ensure that the reference junction is fully immersed. See diagrams in sections 3.3 &amp; 4.3.</p> <p>Rinse electrolyte chamber with warm distilled water until dissolved. Replace electrolyte.</p>
Inaccurate readings, even when calibration is successful.	Reference junction blocked.	Clean reference junction, as per instructions supplied with the electrode.
Displays 7.00 for all solutions.	Electrical short in connector.	<ol style="list-style-type: none"> <li>Check connector. Replace if necessary.</li> <li>Replace electrode.</li> </ol>
Displays 4-5 pH for all solutions.	pH electrode glass bulb or internal stem cracked.	Replace pH electrode.

### 16.3 Temperature Troubleshooting

<b>Symptom</b>	<b>Possible Causes</b>	<b>Remedy</b>
Temperature inaccurate and cannot be calibrated.	<ol style="list-style-type: none"> <li>1. Faulty connector.</li> <li>2. Faulty temperature probe.</li> </ol>	<p>Check the connector and replace if necessary.</p> <p>Fit new temperature probe, part number 121245.</p>
Displays flashing “ <b>M</b> ” when temperature probe plugged in.	<ol style="list-style-type: none"> <li>1. Faulty <b>TEMP</b> socket.</li> <li>2. Faulty temperature probe.</li> </ol>	<p>Return the instrument to the TPS factory for service.</p> <p>Fit a new temperature probe, part number 121245.</p>

## 17. Appendices

### 17.1 pH Electrode Fundamentals

A combination pH Electrode is two electrodes in one. 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 second part of the electrode, 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.

#### 17.1.1 Asymmetry of a pH 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. Figure 17-1 illustrates how asymmetry is expressed.

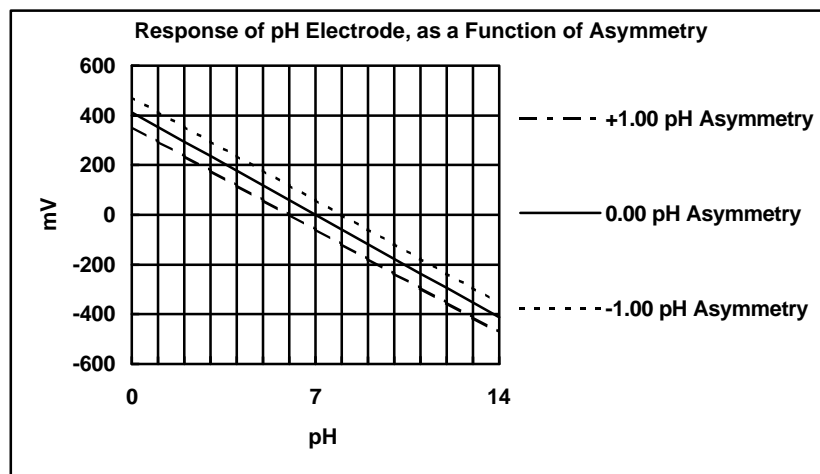


Figure 17-1

### 17.1.2 Slope of a pH 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 -59mV/pH unit at 25 °C. As the pH goes down, an ideal pH electrode produces +59mV/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 59mV/pH unit has “100% Slope”. An electrode that produces 50.15mV/pH unit has “85% Slope” (see Figure 17-2).

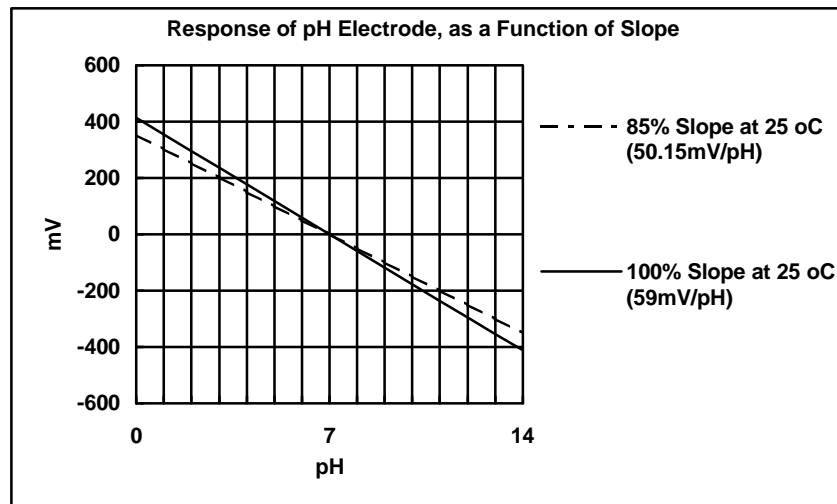


Figure 17-2

### 17.1.3 Temperature Compensation

The slope of a pH electrode 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 17-3 shows the slope of a pH electrode at various temperatures.

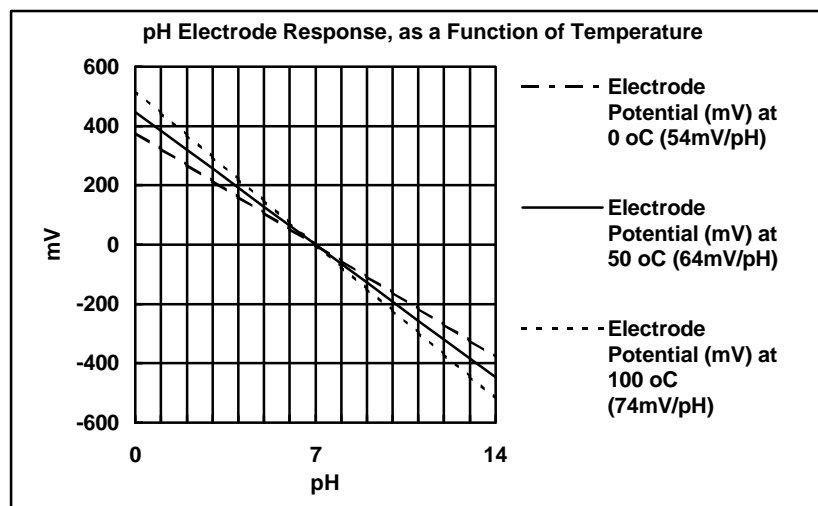


Figure 17-3

## 17.2 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.

### 17.3 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 any ONE of the **Probe 1**, **Probe 2** or **Probe 3** sockets 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 selected Channel of the **900-I3** is in Absolute mV mode.

### 17.4 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 selected Channel of the **900-I3**, as per section 4.3.
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 +/-0.02 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-I3** and repeat the test.
6. If the value obtained is still outside 7.06 +/-0.02 pH, then the electrode should be replaced.

### 17.5 Determining if an instrument or pH electrode is faulty

The following test can be performed to help determine if the **900-I3** or the pH electrode is faulty.

1. Plug the pH electrode into a different Channel, and attempt to calibrate it. If this also fails, then continue to step 2, below.
2. Initialise the 900-I3 (see section 14).
3. Disconnect the pH electrode from the selected Channel.
4. Connect the centre pin of the **Probe 1**, **Probe 2** or **Probe 3** connector with the outside frame of the connector, using a short piece of wire or a paper clip etc.
5. The meter should display approximately pH7.00, depending on the current calibration settings.
6. If the **900-I3** is operating correctly, the reading should be totally stable with the wire firmly in place. If not, the meter requires servicing.
7. 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).
8. 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 selected Channel of the **900-I3** is faulty and requires servicing.

## **18. 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.