**Congratulations !**

The **90-P** is waterproof dual channel pH/mV plus temperature logger.

Despite its impressive list of features, the **90-P** 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 **90-P**. 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 **90-P**, 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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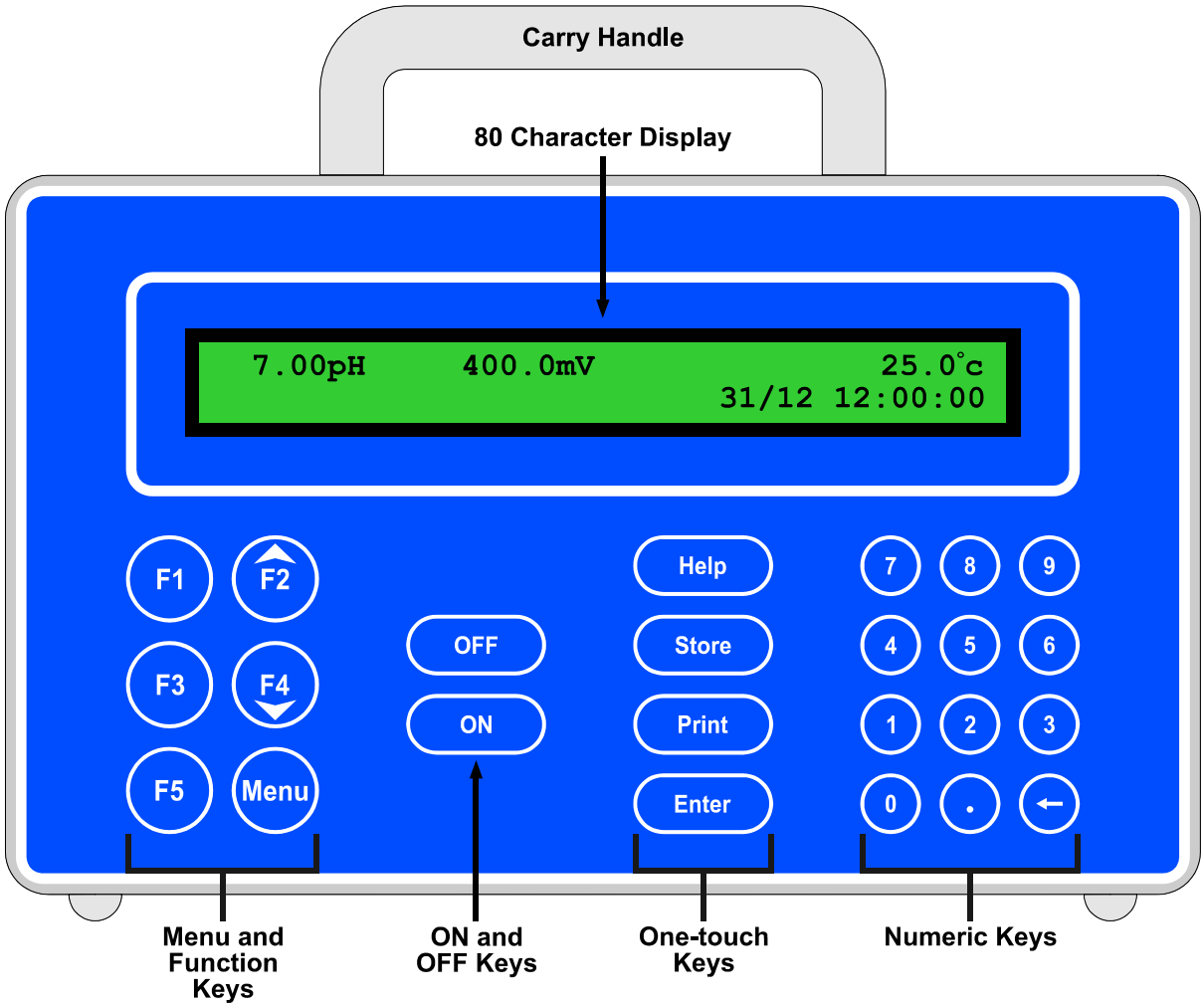
**90-P**
**Dual Channel pH/mV and Temperature Logger**
Date : 02-Mar-2006
Author : AB
Version : 7.1

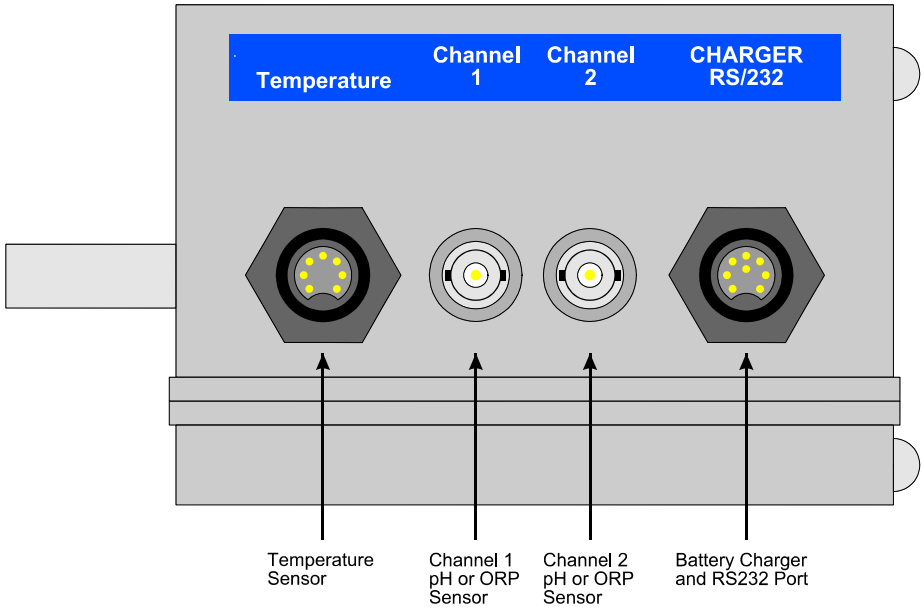
# Contents

# 1. Introduction

## 1.1 90-P Display and Controls




## 1.2 90-P Side 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…

F4 : Press to start automatic datalogging in the Sampling Period and Duration mode. See section 7.3.3.

## 1.4 One-touch Keys

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

Store : Press to record readings into the Logger. See section 7.

Print : Press to transmit current reading plus date and time to the RS232 port. See section 8.2.

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

## 1.5 Numeric Keys

Used to enter values during set-up and calibration.

## 1.6 Delete Key

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

## 1.7 ON and OFF Keys

Press the relevant key to switch the **90-P** on and off as required.

## 1.8 80 Character Display

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

## 1.9 Unpacking Information

Before using your new **90-P**, please check that the following accessories have been included:

| | Part No |
|---|---|
| ***Standard Kit…*** | |
| 1. **90-P** Field Lab with mV readout | 121145 |
| 2. pH6.88 Buffer, 200mL | 121306 |
| 3. pH4.00 Buffer, 200mL | 121381 |
| 4. Plug-Pack Power Supply | 130009 |
| 5. **90-P** Handbook | 130050 |
| ***Sensors…*** | |
| 1. Submersible pH Sensor, Gel Filled, 5m | 111224 |
| 2. Intermediate Junction pH Sensor, 5m | 111227 |
| 3. Submersible Redox Sensor, Gel Filled, 5m | 111259 |
| 4. Intermediate Junction Redox Sensor, 5m | 121267 |
| 5. Temperature Sensor, 5m | 124210 |
| ***Options…*** | |
| 1. Extended cable for sensors (order by the metre) | 130040 |
| 2. RS232 Serial Interface Cable | 130015 |
| 3. USB interface adaptor (for use with 130015 above) | 130087 |
| 4. Communication software for Windows (all versions of Windows 95 and later) | 130086 |
| 5. Solar Panel | 130012 |
| 6. Clip lead for external 12V DC battery | 130013 |
| 7. Hard Carry case for meter and accessories | 130058 |
| ***Spares…*** | |
| 1. 7.2V NiCad Battery Pack | 130027 |
| 2. Senson® Vapaguard™ Tab corrosion inhibitor | NRP2 |

## 1.10 Specifications

### *1.10.1 pH*

| Range | Resolution | Accuracy |
|---|---|---|
| 0 to 14.00 pH | 0.01 pH | ±0.01 pH |

**Sensor Type** .....Glass bulb combination pH sensor with BNC connector.

**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, pH9.22 & 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 %

### *1.10.2 Millivolts*

| Ranges | Resolution | Accuracy |
|---|---|---|
| 0 to ±2000 mV | 1 mV | ±1 mV |

**Sensor Type** .....Platinum tip ORP sensor with BNC connector. Combination Ion Selective Electrodes can also be used in this mode.

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

### *1.10.3 Temperature*

| Range | Resolution | Accuracy |
|---|---|---|
| -30.0 to 110.0 $^{O}$C | 0.1 $^{O}$C | ±0.2 $^{O}$C |

**Sensor Type** .....Silicon transistor.

**Calibration**.....Automatic offset and span calibration

**Sensor Offset Range**.....-15.0 to 15.0 $^{O}$C

**Sensor Span Range** .....93 to 107 %

### *1.10.4 General Specifications*

**Memory**.....2336 readings including date and time with A&B function disabled.

1808 readings including date and time with A&B function enabled.

**Automatic Logging**.....**Rate per Day**
1 to 288 readings per day.

**Time of Day**
1 to 12 discrete times of the day, in 24 hour format.

**Sampling Period and Duration**
One reading every 1 to 300 seconds for a duration of 1 to 720 minutes or continuous.

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

**Clock**.....Calendar clock displays date, month, hours, minutes & seconds. Year is Y2K compliant and is attached to all stored data.

**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**.....7.2V, 1300mAH NiCad battery built in.

Battery charger for country of destination is included.

Solar panel and external battery clip lead optionally available.

**Battery Saver**.....Auto switch-off after 5 minutes or 1 hour. Battery saver can be switched off to allow continuous use.

**Dimensions**.....230 x 140 x 100 mm

**Mass**.....Instrument only : Approx. 1.5 kg
Full Kit : Approx. 3.0 kg

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

## 2. 90-P Menu Structure

A detailed breakdown of the menu system of the **90-P** is shown below. This diagram provides a quick reference for the menu functions available for the **90-P**.

- Menu
  - → F1:Calibrate
    - → F1:pH Channel 1 (F1 & F2 are only available when the channel is set to pH.)
    - F2:pH Channel 2
    - F3:Temperature
  - → F2:Mode
    - → F1:Channel 1
      - → F1:pH
      - F2:mV
      - F3:OFF
    - F2:Channel 2
      - → F1:pH
      - F2:mV
      - F3:OFF
  - → F3:Logger
    - → F1:Recall
    - F2:Erase
      - → F1:Erase All
      - F2:Erase Last
    - F3:Print Log
    - F4:Start
    - or: F4:Stop
    - F5:Program
      - → F1:Rate per Day
      - F2:Time of Day
      - F3:Sampling Period and Duration
  - → F4:Setup
    - → F1:pH Buffers
    - F2:GLP
      - → F1:Recall
      - F3:Print
      - F4:Initialise Meter
    - F3:Set AB
      - → F1:A=Pond,No B
      - F2:A=Pond,B=Data
      - F3:A=Data,No B
      - F4:A&B=Data
      - F5:OFF
  - F5:System
    - → F1:Bat. Saver
      - → F1:OFF
      - F2:5 minutes
      - F3:1 hour
    - F2:Set Clock
    - F3:Baud Rate
      - → F1:300
      - F2:9600
      - F3:19200

# 3. pH Mode

## 3.1 Selecting the pH Buffer Set

The **90-P** can be programmed to automatically recognise any of the following buffer sets during pH calibration.

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** → **F1:pH Buffers**).

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.

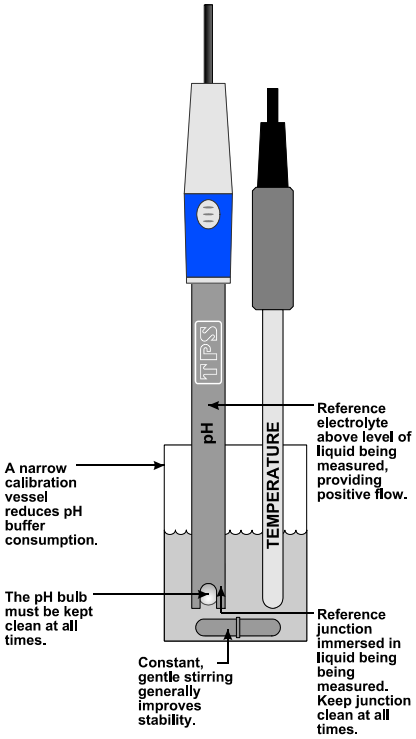
   Press Menu to quit without changing the current setting.

**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 pH9.22 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. pH9.22 and pH10.06 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.

## 3.2 pH Calibration

1. Plug the pH sensor into the **Channel 1** or **Channel 2** socket and the Temperature sensor into the **Temperature** socket. Switch the meter on.
2. Ensure that temperature has already been calibrated (see section 5.1) or manually set (see section 5.4. NOTE: The decimal point in the Temperature reading is shown by a " ✱ ", when the temperature readout is not calibrated.
3. Remove the wetting cap from the pH sensor. Rinse the pH and Temperature sensors in distilled water and blot them dry.
4. Ensure that the primary and secondary buffers to be used have been correctly selected for automatic buffer recognition. See section 3.1.
5. 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.

6. Select pH calibration for the required channel.

(Menu → **F1:Calibrate → F1:pH Channel 1 or F2:pH Channel 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 **90-P**.

The buffer that the **90-P** 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.

7. Rinse the pH and Temperature sensors in distilled water and blot them dry.
8. Place both sensors into a small sample of secondary buffer (pH4.00, 9.22 or 10.06), so that the bulb and reference junction are both covered as per the diagram in step 5.

   **DO NOT** place the electrodes directly into the buffer bottle.

   **NOTE: pH9.22 and pH10.06 buffers are highly unstable. Avoid using these buffers if possible. Discard immediately after use**.
9. Select pH calibration for the required channel.

   (Menu → **F1:Calibrate** → **F1:pH Channel 1 or F2:pH Channel 2**).

   The display should now look similar to the example shown in step 6. Note that the **90-P** has automatically recognised the second buffer.

   Wait for the displayed reading to stabilise before attempting to calibrate the **90-P**.

   Press Enter to calibrate to the displayed buffer.

   Otherwise, enter an alternative buffer using the Numeric Keypad, and then press Enter.
10. The **90-P** is now pH calibrated and is ready for use in this mode. Discard the used samples of buffer.

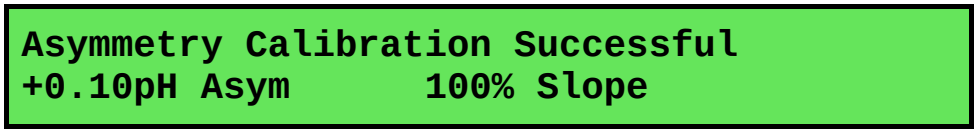
    Rinse the pH and Temperature sensors in distilled water and blot them dry before placing them into unknown samples.

### 3.3 pH Calibration Notes

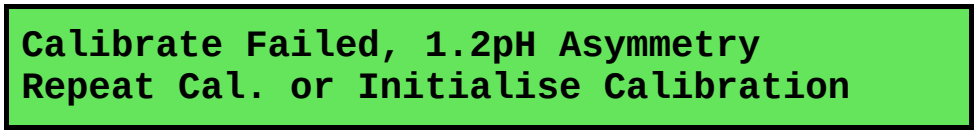
1. A 1-point calibration should be performed at least weekly. In applications where the electrode junction can become blocked such as dairy products, mining slurries etc, a 1-point calibration may have to be done daily.
2. A full 2-point calibration should be performed at least monthly. Of course, more frequent calibration will result in greater confidence in results.
3. All calibration information is retained in memory when the **90-P** is switched off, even when the power supply is removed. This information can be recalled or printed later using the GLP function (see section 6).

### 3.4 pH Calibration Messages

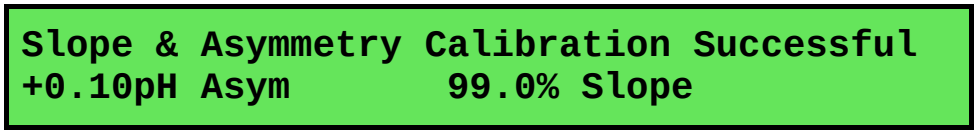
1. If a 1-point calibration has been successfully performed, the **90-P** will display the following message and the asymmetry of the electrode. Note that the slope value from the last calibration is also shown.




2. If a 1-point calibration has failed, the **90-P** will display the following message and the failed asymmetry value of the electrode.




3. If a 2-point calibration has been successfully performed, the **90-P** will display the following message and the asymmetry and slope of the electrode.




4. If a 2-point calibration has failed, the **90-P** will display the following message and the failed slope value of the electrode.


5. The **90-P** 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 14.2) for possible remedies.

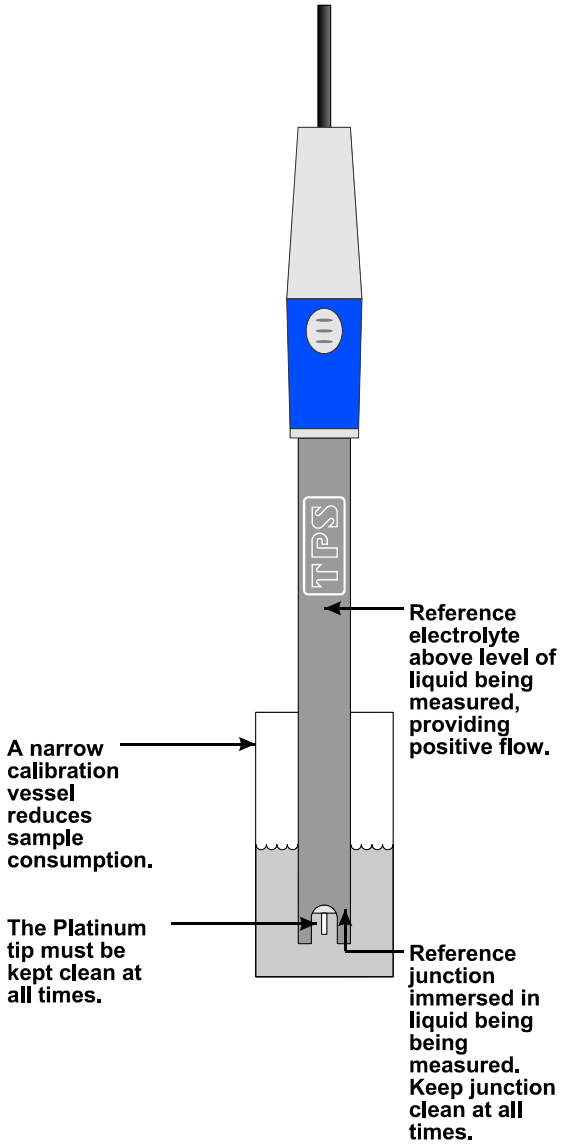
# 4. Millivolt Mode

## 4.1 Millivolt Measurements

The millivolt section of the **90-P** 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 **mV** socket. Ensure that the platinum tip and reference junction are both covered, as per the diagram below.



# 5. Temperature Mode

The temperature readout must be calibrated before attempting pH calibration and measurements.

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

## 5.1 Temperature Calibration

1. Plug Temperature sensor into the **Temperature** socket.
2. Switch the meter on.
3. Place the sensor into a beaker of room temperature water, alongside a good quality mercury thermometer. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.
4. Select Temperature Calibration (Menu → **F1:Calibrate** → **F3:Temperature**).

   The Temperature Calibration screen is now displayed…

```
Enter Actual Temperature : _      24.0°c
Temperature Calibration        Menu Quits
```

5. The current reading from the sensor is displayed on the far right of the top line.

   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.

   The **90-P** is now 1 point temperature calibrated. This will provide precision to approximately ±0.5 $^{O}$C. The following screen is displayed…

```
1 Point Calibration OK,     Offset=0.1°c
Press Enter for Span Cal. or Menu Quits
```

   Press Menu if ±0.5 $^{O}$C is adequate for your application. The **90-P** will now return to normal measurement mode and the " ✱ " in the Temperature readout will have been replaced by a decimal point.

   Press Enter to go on to a second point calibration if a higher degree of precision is required.

7. When a second point calibration is being performed, the **90-P** will now display the second calibration screen..

```
Enter Actual Temperature : _      36.0°c
15.0 > Temp > 35.0             Menu Quits
```

   Please note that the sensor must now be placed into a container of water that is at least 10 $^{O}$C higher or lower than the first calibration point.

   An insulated container with around 1 Litre or more of water will provide a stable environment to do the second point Temperature calibration. The Temperature of the water in a small, uninsulated container will change too rapidly, making a successful second point calibration virtually impossible.

The current reading from the sensor is displayed on the far right of the top line.

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

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

   Alternatively, press the Menu key to abort the second point temperature calibration. The first point calibration settings will still be preserved.

9. The **90-P** is now Temperature calibrated and is ready for use in this mode.

   The full ±0.2 $^{O}$C accuracy specification will apply after a successful 2 point calibration.

## 5.2 Temperature Calibration Notes

1. Temperature calibration information is retained in memory when the **90-P** is switched off. This information can be recalled later using the GLP function (see section 6).
2. Temperature does not need to be re-calibrated unless the Temperature sensor is replaced or the meter is initialised.

## 5.3 Calibration Messages

1. If a 1 point temperature calibration has been successfully performed, the **90-P** will display the following message and the offset value of the sensor. The bottom line appears after 3 seconds.

```
1 Point Calibration OK,     Offset=0.1°c
Press Enter for Span Cal. or Menu Quits
```

2. If a 1 point temperature calibration has failed, the **90-P** will display the following message and the failed offset value of the sensor.

```
1 Point Calibration Failed,Offset=16.0°c
```

3. The **90-P** has an allowable Offset range of -15.0 to +15.0 $^{O}$C. If calibration fails due to the Offset being outside these limits, then please consult the Troubleshooting guide (section 14.3) for possible remedies.

4. If a 2 point temperature calibration has been successfully performed, the **90-P** will display the following message and the span value of the sensor.

```
2 Point Calibration OK,     Span=101.0%
```

5. If a 2 point temperature calibration has failed, the **90-P** will display the following message and the failed span value of the sensor.

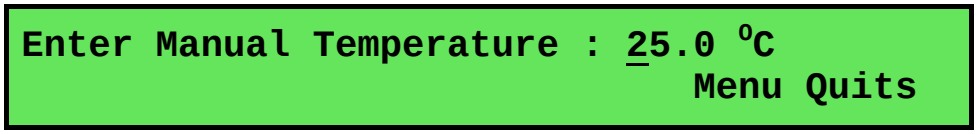
```
2 Point Calibration Failed, Span=200.0%
```

6. The **90-P** has an allowable span range of 93.0 to 107.0 %. If calibration fails due to the Span being outside these limits, then please consult the Troubleshooting guide (section 14.3) for possible remedies.

## 5.4 Manual Temperature Setting

If a Temperature sensor is not connected, the temperature of the sample solution must be set manually for accurate pH measurements. A separate thermometer will be required for this. Temperature compensation is not applicable for Millivolt mode.

1. Switch the meter on.
2. Measure the temperature of the sample.
3. Select Temperature Calibration (Menu → **F1:Calibrate** → **F3:Temperature**).
4. The current temperature setting is now displayed. For example…




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. When returning to normal measurement mode, note the "**M**" in the temperature readout, indicating that Manual Temperature Compensation is in use. For example…

# 6. Good Laboratory Practices (GLP)

The **90-P** keeps a record of the date and time of the last calibrations for all parameters as part of GLP guidelines.

## 6.1 To recall GLP information on the display

1. Switch the meter on.
2. Select the GLP menu (Menu → **F4:Setup** → **F2: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.

```
90P  V7.0 S1234          @ 31/12/02 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…***

```
90P  V7.0 S1234          @ 31/12/02 12:00
                                 F4:Next
```

↑F2 ↓F4

```
pH1 Asymmetry=0.10pH       31/12/02 08:00
pH1 Calibrated            F2:Back F4:Next
```

↑F2 ↓F4

```
pH1 Slope= 99.0%           31/12/00 08:30
pH1 Calibrated            F2:Back F4:Next
```

↑F2 ↓F4

```
pH2 Asymmetry=0.10pH       31/12/02 09:00
pH2 Calibrated            F2:Back F4:Next
```

↑F2 ↓F4

```
pH2 Slope= 99.0%           31/12/02 09:30
pH2 Calibrated            F2:Back F4:Next
```

↑F2 ↓F4

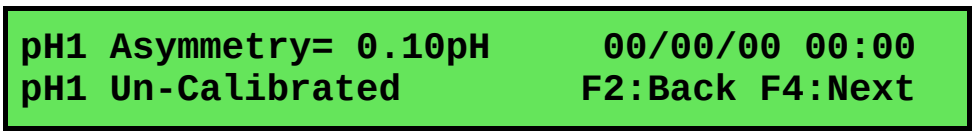
```
Temperature Offset=1.0°c   31/12/02 10:00
Temp Probe Calibrated     F2:Back F4:Next
```

↑F2 ↓F4

```
Temperature Span=100.0%    31/12/02 10:30
Temp Probe Calibrated     F2:Back F4:Ends
```

## 6.2 Failed Calibration

If calibration has failed, the GLP function will reset the date and time for the failed parameter to zero. The **90-P** still shows the results for the last successful calibration, as shown in the following example of a failed pH calibration….




## 6.3 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 **Charger** socket of the **90-P**. The battery charger, optional battery adaptor, or optional solar panel may be connected to the in-line socket on the RS232 cable, if required.
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** → **F2:GLP** → **F3:Print (or** (Print)**)**

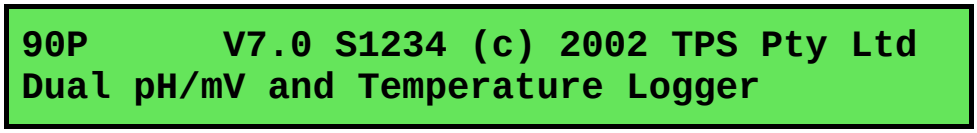
   The message "**Printing GLP Data**" is displayed while sending the data to the RS232 port.
5. The GLP information is sent to the RS232 port in formatted ASCII text. For example…

```
90P V7.0 S1234 @ 31/12/2002 12:00
pH1          Asy=       0.10pH    @ 31/12/2000 08:30
pH1          Slope=     99.0%     @ 31/12/2000 09:00
pH2          Asy=       0.10pH    @ 31/12/2000 09:30
pH2          Slope=     99.0%     @ 31/12/2000 10:00
Temperature  Offset=     1.0oC    @ 31/12/2000 10:30
Temperature  Span=     100.0%     @ 31/12/2000 11:00
Ends
```

## 6.4 Instrument Serial Number

In case the serial number that is fitted to the rear of the **90-P** is removed or becomes illegible, it is also available on the **90-P** display.

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




2. The serial number is displayed when recalling the GLP information (section 6.1).
3. The serial number is included on the print-out of GLP information (section 6.3).
4. The GLP information can be downloaded to a PC using the optional Windows® software (part number 130086).

## 6.5 Additional GLP Features

Another GLP requirement is to record the date and time of every reading. The **90-P** does this for you when readings are recorded either with the Manual Datalogging function (section 7.2) or the Automatic Datalogging function (section 7.3).

# 7. Datalogging

## 7.1 Setting the A & B Data Input Function

The A & B Data Input function allows the operator to enter extra numerical data whenever datalogging manually. The A & B Data Input function can also be set for any one of the following…

- "A" as Pond number with no extra "B" data input.
- "A" as Pond number with extra "B" data input.
- "A" as data input with no extra "B" data input.
- "A" and "B" both as data input.
- A & B Data Input Function switched OFF.

The Logger memory must be erased before changing the A & B Data Input setting.

To set the A & B Data Input function…

1. Select the A & B setup menu (Menu → **F4:Setup** → **F3:Set AB**). The **90-P** will prompt you to erase the Logger before proceeding, if any data is stored in memory.

```
SET  F1:A=Pond,No B  F2:A=Pond,B=Data
A/B  F3:A=Data,No B  F3:A&B=Data >F5:OFF
```

   The arrow indicates the current selection.

2. Press F1 to set "A" as Pond number with no extra "B" data input.
   Press F2 to set "A" as Pond number with extra "B" data input.
   Press F3 to set "A" as data input with no extra "B" data input.
   Press F4 to set "A" and "B" both as data input.
   Press F5 to switch the A & B Data Input function OFF.
   Press Menu to quit and retain the current setting.
3. The A & B Data Input function is now set and is ready for use during Manual Datalogging.

## 7.2 Manually Recording Readings into the Logger

### *7.2.1 When A & B Data Input has been set to OFF*

1. Press Store in normal display mode. The display should now look like this…

```
  7.00pH     400.0mV                25.0°c
Log#1,    <Enter>          31/12 12:00:00
```

2. Press Enter to record all parameters plus Date and Time into the Logger memory. 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 Logger with the A & B Data Input function switched OFF is 2336.

### *7.2.2 When A is set to Pond, with no extra B data*

1. Press Store in normal display mode. The display should now look like this…


2. Use the numeric keypad to key in the Pond number, then press Enter to record all parameters, Date, Time and the Pond number into the Logger memory. 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 Pond number will automatically increment by one from the last recorded reading.

   The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 1808.

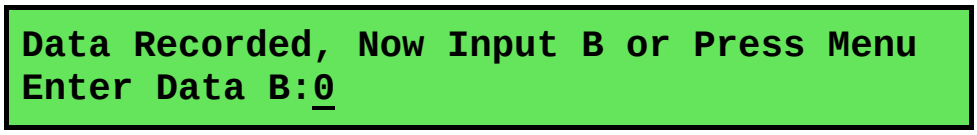
### *7.2.3 When A is set to Pond, and B is set to data*

1. Press Store in normal display mode. The display should now look like this…


2. Use the numeric keypad to key in the Pond number, then press Enter to record all parameters, Date, Time and the Pond number into the Logger memory. This will be labelled as reading number 1.

   Alternatively, press Menu to quit without recording the reading.

3. The **90-P** now proceeds to the B data entry screen…




   Use the numeric keypad to key in up to four characters for the "B" data item. The decimal point is available. Press Enter to record the "B" data item, or press Menu to quit. Quitting at this point records a Zero as the "B" data item.

4. Repeat steps 1 to 3 as often as required.

   The Pond number will automatically increment by one from the last recorded reading.

   The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 1808.

### *7.2.4 When A is set to Data with no B data*

1. Press Store in normal display mode. The display should now look like this…


2. Press Enter to record all parameters, plus Date and Time into the Logger memory. This will be labelled as reading number 1.

   Alternatively, press Menu to quit without recording the reading.

3. The **90-P** now proceeds to the A data entry screen…


   Use the numeric keypad to key in up to four characters for the "A" data item. The decimal point is available. Press Enter to record the "A" data item, or press Menu to quit. Quitting at this point records a Zero as the "A" data item.

4. Repeat steps 1 to 3 as often as required.

   The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 1808.

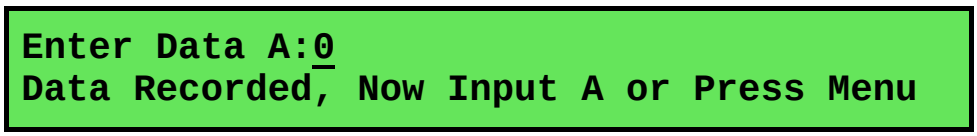
### *7.2.5 When A and B are both set to Data*

1. Press Store in normal display mode. The display should now look like this…


2. Press Enter to record all parameters, plus Date and Time into the Logger memory. This will be labelled as reading number 1.

   Alternatively, press Menu to quit without recording the reading.

3. The **90-P** now proceeds to the A data entry screen…




   Use the numeric keypad to key in up to four characters for the "A" data item. The decimal point is available. Press Enter to record the "A" data item, or press Menu to quit. Quitting at this point records Zero's as the "A" and "B" data items.

4. The **90-P** now proceeds to the B data entry screen…


   Use the numeric keypad to key in up to four characters for the "B" data item. The decimal point is available. Press Enter to record the "B" data item, or press Menu to quit. Quitting at this point records a Zero as "B" data item.

5. Repeat steps 1 to 4 as often as required.

The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 1808.

## 7.3 Automatic Datalogging

The **90-P** can automatically log records into the Logger. There are three automatic datalogging modes to choose from…

1. Rate Per Day
   - Logs from 1 to 288 readings per day, evenly spaced throughout each 24 hour period.
   - Unit is dormant between readings and “wakes up” when a reading is due.
   - Unit continues to log until automatic datalogging is disabled, or until the memory is full.
2. Time of Day
   - Logs at up to12 discrete times of the day, which can be unevenly spaced throughout each 24 hour period.
   - Unit is dormant between readings and “wakes up” when a reading is due.
   - Unit continues to log until automatic datalogging is disabled, or until the memory is full.
3. Sampling Period and Duration
   - Logs a reading every 1 to 300 seconds for a duration of 1 to 720 minutes.
   - Duration can be set to log continuously until the memory is full.
   - Unit is turned on continuously in this logging mode.

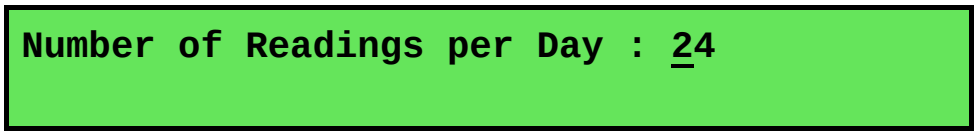
The automatic datalogging parameters of the **90-P** must first be programmed, then logging can be started and stopped as required.

### *7.3.1 Rate per Day Datalogging*

***Programming Rate per Day Datalogging***

1. Select the Logger Program menu (Menu → **F3:Logger F5:Program**)
2. Select **F1:Rate per Day** from the menu.

   The display should now look similar to that shown below. The current Rate per Day is displayed…

3. Use the Numeric Keypad to set the number of readings per day which the **90-P** will automatically log into memory. This can be set from 1 to 288 (i.e. 1 reading every 24 hours to 1 reading every 5 minutes).

   Press Enter to save the Rate per Day.

   Press Menu to quit without changing the current setting.

4. The Rate per Day datalogging is now programmed, and can be started and stopped as required.

**Notes**

1. The **90-P** distributes the number of readings evenly throughout a 24 hour clock cycle, regardless of what time automatic logging is started and stopped. For example, if the **90-P** is programmed to log 4 readings per day, they will be logged at 24:00, 6:00, 12:00 and 18:00 o'clock.

***Starting and Stopping Rate per Day Datalogging***

Starting Rate per Day datalogging is a two step process…

1. Select the Logger menu (Menu → **F3:Logger**)

   Select **F4:Start** from the menu.

2. Switch the **90-P** OFF.

   This step is essential, as the Rate per Day datalogging is only enabled when the **90-P** is switched OFF.

Stopping Rate per Day datalogging is a one step process…

1. Select the Logger menu (Menu → **F3:Logger**)

   Select **F4:Stop** from the menu.

**Notes**

1. The **90-P** remains dormant between readings and only switches itself ON when a reading is due.

### *7.3.2 Time of Day Datalogging*

***Programming Time of Day Datalogging***

1. Select the Logger Program menu (Menu → **F3:Logger F5:Program**)
2. Select **F2:Time of Day** from the menu.

   The display should now look similar to that shown below. Any currently programmed times are displayed…

```
LOG  00:00 00:00 00:00 00:00 00:00 00:00
TIME 00:00 00:00 00:00 00:00 00:00 00:00
```

3. Use the Numeric Keypad to set the first time of the day at which the **90-P** will automatically log into memory.
4. Press Enter to move to the next time of the day.
5. Repeat steps 7 and 8 to enter up to 12 times of the day. The times do not need to be evenly spread throughout the day. Times must be entered in 24 hour clock format.
6. Press Menu to save the programmed times of the day and quit.
7. The Time of Day datalogging is now programmed, and can be started and stopped as required.

**Notes**

1. For 12:00 o'clock midnight, enter the time as "**24:00**".
2. The times of the day do not need to be entered in chronological order. The **90-P** will sort them after pressing Menu.

***Starting and Stopping Time of Day Datalogging***

Starting Time of Day datalogging is a two step process…

1. Select the Logger menu (Menu → **F3:Logger**)

   Select **F4:Start** from the menu.
2. Switch the **90-P** OFF.

   This step is essential, as the Time of Day datalogging is only enabled when the **90-P** is switched OFF.

Stopping Time of Day datalogging is a one step process…

1. Select the Logger menu (Menu → **F3:Logger**)

   Select **F4:Stop** from the menu.

**Notes**

1. The **90-P** remains dormant between readings and only switches itself ON when a reading is due.

### *7.3.3 Sampling Period and Duration Datalogging*

***Programming Sampling Period and Duration Datalogging***

1. Select the Logger Program menu (Menu → **F3:Logger F5:Program**)
2. Select **F3:Sampling Period and Duration** from the menu.
3. The **90-P** now prompts you to enter the sampling period in seconds. The current sampling period is displayed…

   ```
   Enter Sampling Period (secs) : 5
   ```

   Use the Numeric Keypad to set the **90-P** to log a reading every 1 to 300 seconds.

   Press Enter to save the new sampling period and move to setting the duration.

   Press Menu to retain the previous sampling period and move to setting the duration.
4. The **90-P** now prompts you to enter the duration in minutes. The current duration is displayed…

   ```
   Enter Duration of Sampling (mins) : 10
   Enter 0 for continuous
   ```

   Use the Numeric Keypad to set the total duration for which the **90-P** will log readings into memory from 1 to 720 minutes. Alternatively, enter 0 to log continuously until logging is stopped by the user or the memory is full.

   Press Enter to save the new duration.

   Press Menu to quit and retain the previous duration.
5. The Sampling Period and Duration datalogging is now programmed, and can be started and stopped as required.

***Starting and Stopping Sampling Period and Duration Datalogging***

Starting and stopping Sampling Period and Duration datalogging is a two step process…

1. Press F4 in normal measurement mode.

   The **90-P** now prompts you to press Enter to begin logging. For example…

   ```
   Press Enter to Sample every 5 seconds,
   For 10 minutes, or Menu to Quit 12:00:00
   ```

   The time is shown to enable the user to synchronise the sampling times if required.
2. Press Enter to start logging.

   To stop logging before the end of the duration press F4.

**Notes**

1. The **90-P** remains switched on continuously for Sampling Period and Duration datalogging.

## 7.4 Recalling Readings from the Logger

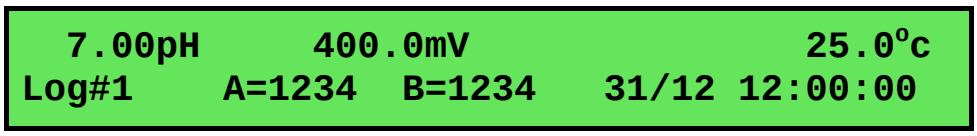
To recall records from the Logger onto the **90-P** display…

1. Select the Logger menu (Menu → **F3:Logger**)
2. Select **F1:Recall** from the menu.

   Record number 1 is now displayed.

   The following example shows the display when the A & B Data Input function was switched off during logging…


   The following example shows the display when "A" and "B" were both set to data during logging…




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.

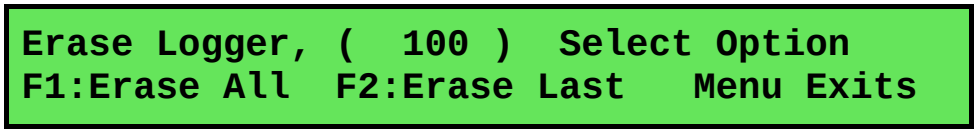
   To display a specific record, type in the desired record number using the Numeric Keypad and press Enter.

   Press Print to send the displayed record to the RS232 port.

## 7.5 Erasing Records from the Logger

To erase records from the Logger…

1. Select the Erase Logger menu (Menu → **F3:Logger** → **F2:Erase**)
2. The **90-P** now displays the Erase menu, for example…




   The number of readings stored in the Logger is displayed. See the "**100**" in the example above.

3. Press F1 to erase all of the readings stored in the Logger.

   Press F2 to erase the last recorded reading only.

   Press Menu to quit without erasing any records.

## 7.6 Printing Records from the Logger to the RS232 Port

1. Connect one end of the RS232 cable to the **Charger** socket of the **90-P**.
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 **90-P** are the same. If necessary, alter the baud rate of the **90-P** (see section 8.1).

   The **90-P** uses XON/XOFF protocol. Ensure that the printer is set accordingly.

4. Select the Logger menu. (Menu → **F3:Logger**).
5. Select **F3:Print Log** from the menu or press Print.
6. Printing starts as soon as F3 or Print is pressed. The display shows the word "**Printing**" until printing is completed.

# 8. RS232 Port

## 8.1 Setting the Baud Rate

1. Select the Baud Rate menu (Menu → **F5:System** → **F3:Baud Rate**)
2. 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.

## 8.2 Sending Readings to the RS232 Port

Press Print to instantly send readings to the RS232 port whenever the **90-P** is in normal display mode.

Each time the **90-P** logs a reading, that reading is sent directly to the RS232 port.

Press Print while recalling data on the display (see section 7.4) to send that record to the RS232 port.

## 8.3 RS232 Configuration

The **90-P** RS232 configuration is 8 Bits, No Parity, 1 Stop Bit, XON/XOFF Protocol.

This information is displayed when setting the baud rate (see section 8.1)

## 8.4 Communication and Statistical Software

Communication between the **90-P** 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 **90-P** is formatted in fixed-width columns that can be imported by programs such as Microsoft® Excel® and Lotus 123®.

Help on importing the data into Microsoft® Excel® is provided in section 8.8 and the "excel.txt" file in the folder where you installed the WinTPS program.

## 8.5 Commands

The following commands can be sent from a PC to the **90-P**. 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 **90-P**. The log number returned is set to Zero. |
| Request logged data | ?R<cr> | Returns all logged records from the **90-P** memory. The data ends with the message **ENDS**<cr> . |
| Erase logged data | ?E<cr> | Erases all logged records from the **90-P** memory. Returns the message **ERASED**<cr> to confirm that the records have been erased. |

***Continued over the page…***

***RS232 Commands, continued…***

<table>
<tr><td>Request status information</td><td>?S<cr></td><td>Returns the model name, firmware version number, instrument serial number and number of logged readings in memory, for example…<br>90P•V7.0•S1234•2336•ALB+v%<cr><br>where • are spaces. Note that the number of logged readings is right-justified. The meaning of the last group of characters is as follows…<table><tr><td>A or P</td><td>A indicates A & B function is enabled.<br>P indicates A is set to Pond Number.</td></tr><tr><td>L</td><td>Automatic datalogging is enabled.</td></tr><tr><td>B</td><td>Low Battery warning.</td></tr><tr><td>+</td><td>Extended datalogging function is fitted.</td></tr><tr><td>v</td><td>Battery volts is available with ?V command.</td></tr><tr><td>%</td><td>Indicates new 90 series, V6.0 and up.</td></tr></table></td></tr>
<tr><td>Request GLP information</td><td>?G<cr></td><td>Returns all calibration GLP information, plus the instrument model, serial number and current date (see section 8.7 for data format and hand-shaking).</td></tr>
<tr><td>Enable Rate per Day or Time of Day automatic datalogging</td><td>?J<cr></td><td>Starts automatic datalogging when the 90-P is set up for Rate per Day or Time of Day automatic datalogging (see sections 7.3.1 and 7.3.2).<br>The meter must then be powered down with the OFF key or with the ?K command (see below).</td></tr>
<tr><td>Disable Rate per Day or Time of Day automatic datalogging</td><td>?F<cr></td><td>Stops automatic datalogging when the 90-P is set up for Rate per Day or Time of Day automatic datalogging (see sections 7.3.1 and 7.3.2).</td></tr>
<tr><td>Power ON</td><td>Any 10 characters</td><td>Switches the 90-P ON.<br>A specific command is not available while the 90-P is off, so RS232 activity caused by the 10 characters switches the unit ON.</td></tr>
<tr><td>Power OFF</td><td>?K<cr></td><td>Switches the 90-P OFF. Use the command after the ?G command (above) to actually start rate per Day or Time of Day automatic datalogging.</td></tr>
<tr><td>Request battery volts</td><td>?V<cr></td><td>Returns the current voltage level in the battery pack, for example…<br>7.20V<cr></td></tr>
<tr><td>Positions of Data Fields</td><td>?P<cr></td><td>Returns the number of data fields, along with their position and length. When the A&B Data Input function is disabled…<br>6,1,10,12,8,21,4,26,6,35,6,44,5<br>This denotes 6 fields, the first of which is at column 1 and is 10 characters long. The second field is at column 12 and is 8 characters long and so on.<br>When the A&B Data Input function is enabled…<br>8,1,10,12,8,21,4,26,6,35,6,44,5,52,4,58,4</td></tr>
<tr><td>Data Column Header</td><td>?H<cr></td><td>Returns a text string which can be used to provide headers for each data field. Spaces are included to ensure that the headers are correctly aligned with the data.</td></tr>
</table>

## 8.6 Data Format

Data is returned to the RS232 Port by the **90-P** in the following format.

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

**dd/mm/yyyy•hh:mm:ss•LLLL•111111uu•222222uu•TTTTTuuLaaaaA•bbbbB**

where….

| | |
|---|---|
| **dd/mm/yyyy** | is the date, month and year data. |
| **hh:mm:ss** | is the hours, minutes and seconds data. |
| **LLLL** | is the Log Number, 4 characters, right justified. The **90-P** sends a Zero for instant readings (see section 8.2). |
| **111111** | is Channel 1 pH or mV data. 6 characters, right justified. |
| **uu** | is the unit description, sent as either "**pH**" or "**mV**". |
| **222222** | is mV data. 6 characters, right justified. |
| **uu** | is the unit description, sent as either "**pH**" or "**mV**". |
| **TTTTT** | is Temperature data, 5 characters, right justified. |
| **uu** | is the Temperature unit description. Sent as "**oC**" for measured temperature data, or "**oM**" for manual temperature data. |
| **L** | is the Low Battery indicator. Sent as "**L**" when the battery is below 5.60 volts.<br>**Caution** : Data recorded with a low battery may be unreliable.<br>The **90-P** sends a space when the battery is above 5.60 volts. |
| **aaaa** | A-Data input, 4 characters, left justified. |
| **A** | A-Data input identifier. Sent as "**A**" for A-Data or "**P**" for Pond number. See section 7.1 for further details on the A and B Data input function. |
| **bbbb** | B-Data input, 4 characters, left justified. |
| **B** | B-Data input identifier. Sent as "**B**". See section 7.1 for further details on the A and B Data input function. |

**Notes**

1. The "**aaaaA**" and "**bbbbB**" sections of the data string are not sent at all when the A and B data input function is switched off (see section 7.1).
2. When requested by a PC with the ?D or ?R commands (section 8.5), the data is terminated with a carriage return.
3. When the data is sent by the **90-P** using the Print function (section 7.6) or the Instant Send function (section 8.2), the data ends with a carriage return and a line feed.

## 8.7 GLP Data Format

GLP information is returned as 7 lines terminated by a carriage return. When using the "?G" command (section 8.5), the computer must respond with a character after receiving each line.

For example…

```
90P V7.0 S1234 @ 31/12/2002 12:00
pH1          Asy=       0.10pH    @ 31/12/2000 08:30
pH1          Slope=     99.0%     @ 31/12/2000 09:00
pH2          Asy=       0.10pH    @ 31/12/2000 09:30
pH2          Slope=     99.0%     @ 31/12/2000 10:00
Temperature  Offset=     1.0oC    @ 31/12/2000 10:30
Temperature  Span=     100.0%     @ 31/12/2000 11:00
Ends
```

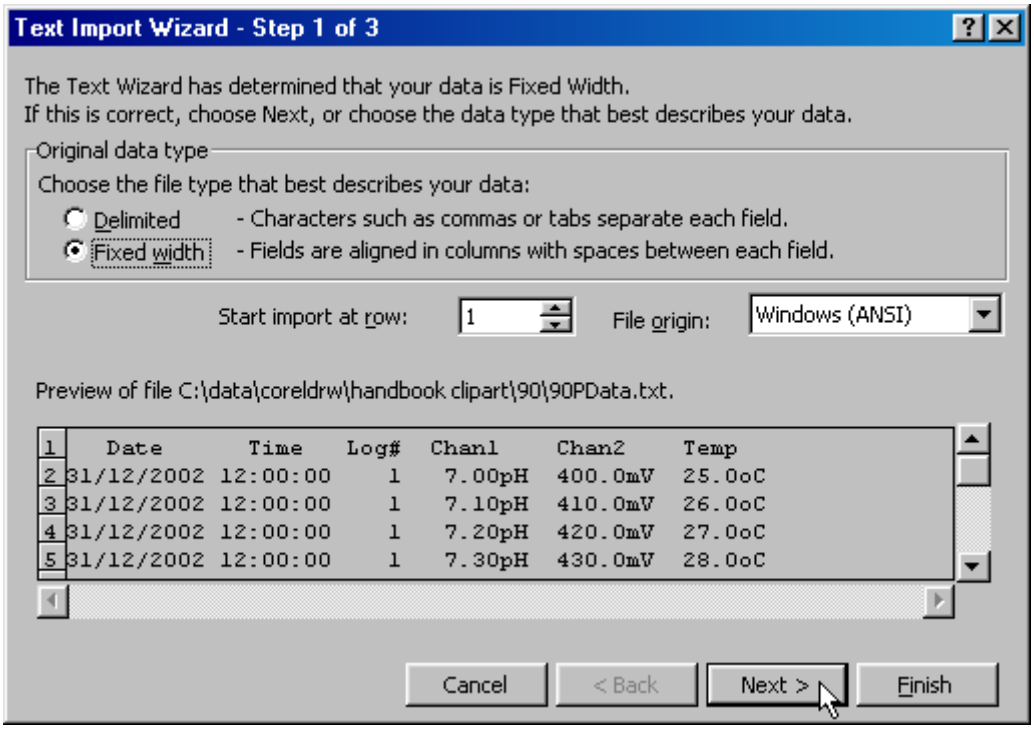
## 8.8 Importing Data into Microsoft Excel

The following procedure details the method for importing a **90-P** text data file into Microsoft® Excel®.

1. Start Microsoft® Excel® and select File → Open
2. In the "Files of type:" pull-down box, choose "Text Files (*prn; *.txt; *.csv)".
3. Navigate to the folder where your data file is stored and double-click it to start the Text Import Wizard.

   Note : The default data folder for the WinTPS software is "C:\My Documents\WinTPS".
4. In step 1 of the Text Import Wizard select "Fixed width", as per the sample screen below, then press "Next >".

   Note that the data column headers in row appear only when the data is downloaded using the WinTPS software.

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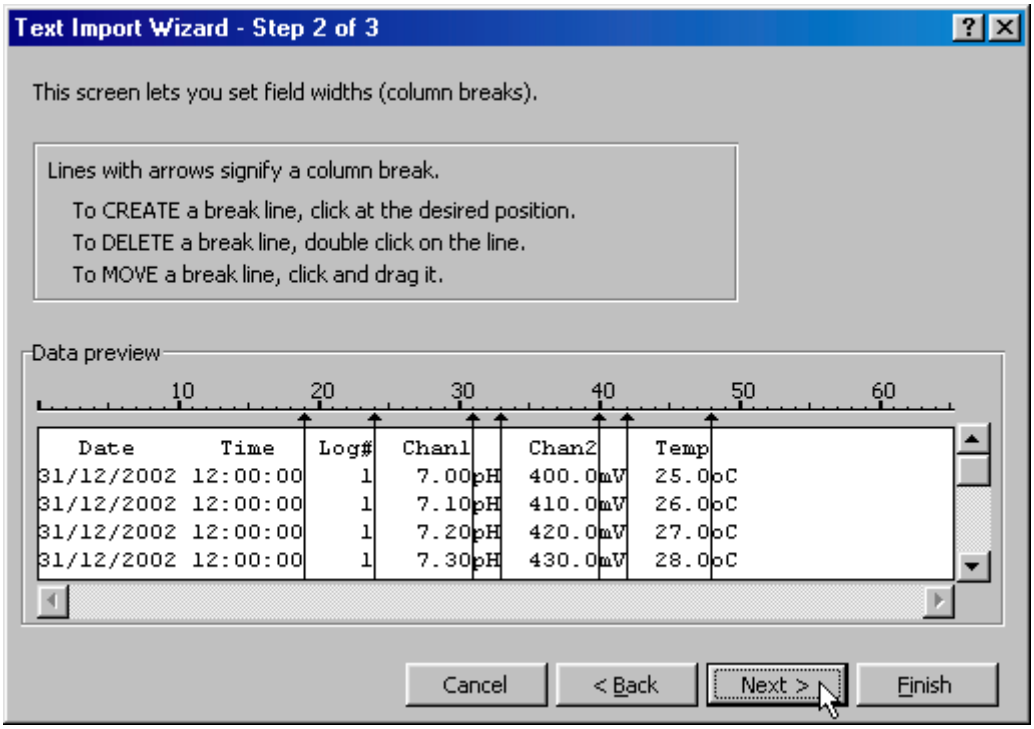
5. Step 2 of the Text Import Wizard allows you to select the points at which each data field will break into a new column. The sample screens below show where TPS recommends the breaks be inserted.

   The date and time have been incorporated into a single column to ensure that the X-axis is correctly formatted if the data is to be charted later.

   Press “Next >” after all the column breaks have been inserted.




6. Simply press “Finish” at step 3 of the Text Import Wizard. TPS recommends that the data format for each column be set once the data is in spreadsheet format.

   For help on formatting the data columns, charting, graphing or other operations please consult the Microsoft® Excel® help file. Alternatively please contact TPS and we will try to provide further assistance.

## 9. Setting the Clock

1. Select the Clock Set-up menu (Menu → **F5:System** → **F2:Set 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 in 24 hour format, 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 in dd/mm/yyyy format, then press Enter.

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

### Notes

1. Press the ⇦ key to make any corrections as required.
2. The **90-P** tests that a valid time of the day is entered. If an invalid time is entered (eg. 25:00), the **90-P** displays the message "**Invalid Time**", then returns to the time setting screen so that the correct time can be entered.
3. The **90-P** tests that a valid day of the month is entered. If an invalid date is entered (eg. 31/02/2001), the **90-P** displays the message "**Invalid Date**", then returns to the date setting screen so that the correct date can be entered.
4. The **90-P** also tests for leap years.

## 10. Initialising the 90-P

If the calibration settings of the **90-P** 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 or if the memory is corrupted.

To initialise the **90-P**…

1. Select the GLP menu (Menu → **F4:Setup** → **F2:GLP**).
2. Select **F4:Initialise Meter** from the menu.
3. The **90-P** will now ask if you are sure that you wish to initialise the unit…

   ```
   Initialise Unit, Are you sure ?
   F1:Yes    F2:No
   ```

   Press F1 to initialise the **90-P** and reset all calibration data and erase all logged readings.

   Press F2 to quit and retain the current calibration settings and logged readings.
4. If **F1:Yes** was selected above, the **90-P** will display the number of logged readings in memory and provide an additional warning that these will be erased. For example…

   ```
   Logger contains Data. 2336 readings
   will be Erased. Continue ?  F1:Yes F2:No
   ```

   Press F1 to initialise the **90-P** and reset all calibration data and erase all logged readings.

   Press F2 to quit and retain the current calibration settings and logged readings.
5. If **F1:Yes** was selected above, the **90-P** will display the following messages to indicated that the unit has been successfully initialised.

   ```
                Initialising
   ```

   then…

   ```
                Initialised
   Re-Calibrate unit before use.
   ```
6. The meter then goes back to the GLP menu. When returning to display mode later, note that each of the decimal points has been replaced with a " ∗ " to indicate that each parameter requires re-calibration.

## 11. Instrument firmware version number

If you need to phone or fax TPS for any further technical assistance, the version number of your **90-P** firmware may help us to assist you. The version number is displayed by the **90-P** at turn-on.

## 12. Battery Saver Function

The **90-P** is equipped with a battery saver function. If no button has been pressed for 5 minutes or 1 hour , the unit beeps and flashes the display for 20 seconds and then shuts off. This function can also be switched off for continuous use.

To program the battery saver function:

1. Select Battery Saver menu (Menu → **F5:System** → **F1:Bat. Saver**).
2. The battery saver menu is now displayed…


   The arrow indicates the current selection.

3. Press F1 to disable the battery saver function for continuous use.

   Press F2 to set the battery saver function to 5 minutes. The meter will switch itself off if no key has been pressed for five minutes.

   Press F3 to set the battery saver function to 1 hour. The meter will switch itself off if no key has been pressed for 1 hour.

   Press Menu to quit the battery saver menu and retain the current setting.

### Notes

1. The symbol flashes when the battery volts drops below 5.60 volts. At approximately 5.10 volts the meter turns itself off.
2. The accuracy of the data degrades when the symbol is flashing. The **90-P** should not be used to take readings or calibrate while the is flashing.

# 13. Moisture Protection

## 13.1 Silica Gel Pack

Due to the size of the **90-P** enclosure, it tends to expand in hot environments and contract in cold environments. This process can cause moist air to be drawn into the enclosure, which would then cause corrosion damage to the circuit.

To avoid this problem, TPS has mounted a breathing system inside the enclosure. This system consists of a long, thin tube which is vented to the atmosphere at one end and into a bottle of Silica gel at the other end. This ensures that the **90-P** breathes dry air. In humid environments, the Silica gel pack should be regularly checked.

To check the Silica gel pack…

1. Undo the 4 plastic screws on the rear of the unit.
2. Inspect the bottle of Silica gel.

   Blue indicates that the Silica gel is still dry (proceed to step 5).

   Pink indicates that the Silica gel is moist (proceed to step 3).
3. Empty the Silica gel into a microwave proof dish and place it into a microwave oven.

   Place approximately 100mL water in a microwave proof cup into the microwave oven. This will absorb some of the microwave energy and stop the Silica gel balls bursting.

   Turn the microwave oven ON using a moderate setting for approximately 1 minute, or until the Silica gel turns blue.

   **CAUTION : THE SILICA GEL MAY BE VERY HOT AT THIS POINT.**
4. Remove the Silica gel from the microwave oven and allow to cool.

   Pour the Silica gel back into the bottle and re-fit the bottle onto the rear cover of the instrument.
5. Re-fit the rear cover onto the instrument, ensuring that is the correct way around. The cover has locating lugs in two of the corners to make correct fitment simple.

## 13.2 Corrosion Inhibitor Tab

To provide extra protection against corrosion, the **90-P** is fitted with a Senson® Vapaguard™ corrosion inhibitor tab. This tab disperses a special vapour throughout the enclosure which actively fights corrosion on any of the components.

The corrosion inhibitor tab has a limited life and should be replaced every 2 to 3 years to ensure effective protection.

The TPS part number for a new corrosion inhibitor tab is NRP2.

# 14. Troubleshooting

## 14.1 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**<br>**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. |
| Flashing  symbol. | Battery is below 5.60 volts. | Recharge the battery. A full charge will take approximately 18 hours. Note that the unit will switch itself off when the battery falls below 5.10 volts.<br>Data obtained while the  is flashing may be unreliable. Do not take readings or calibrate while the  is flashing. |
| Meter displays the word **OFF**, and switches off. | Battery is below 5.10 volts. | Recharge the battery.<br>If this fails, check the charger.<br>If charger is OK, replace the battery. |
| Meter will not turn on. | Battery is exhausted. | Recharge the battery for approximately 18 hours.<br>If this fails, check the charger.<br>If charger is OK, replace the battery. |
| Battery does not charge up when charger is connected. | 1. Faulty battery charger.<br>2. Faulty battery. | 1. Connect the charger and switch the power on.<br>2. Display the battery volts in the battery saver menu (see section 12).<br>3. If the battery volts are increasing then the charger is OK. If the battery volts do not increase, then the charger is faulty.<br>4. Replace the charger or the battery, as required. |

## 14.2 pH and Redox Troubleshooting

| Symptom | Possible Causes | Remedy |
|---|---|---|
| Unit fails to calibrate, even with new pH probe. | Calibration settings outside of allowable limits due to previous failed calibration. | Switch the unit OFF and then back ON again and repeat calibration.<br>Initialise the unit. See section 10. |
| 1 Point calibration fails (pH asymmetry is greater than ±1.00 pH.) | 1. Reference junction blocked.<br>2. Reference electrolyte contaminated. | Clean reference junction as per instructions supplied with the pH or reference electrode.<br>Flush with distilled water and replace electrolyte. |
| 2 Point calibration fails. (pH slope is less than 85.0%.) | 1. pH Buffers not correctly set.<br>2. pH glass bulb not clean.<br>3. Electrode is aged.<br>4. Connector is damp.<br>5. pH Buffers are inaccurate. | For automatic pH buffer recognition, ensure that you are using buffers that match the selected buffer set (see section 3.1). Otherwise, ensure that the buffer value is entered correctly at pH calibration.<br>Clean sensor surface or glass bulb as per instructions supplied with the electrode.<br>Attempt rejuvenation as per instructions supplied with the electrode. If unsuccessful, replace electrode.<br>Dry in a warm place.<br>Replace buffers. |
| Unstable readings. | 1. Reference Electrolyte chamber needs to be refilled.<br>2. Reference junction blocked.<br>3. pH glass bulb or Redox platinum tip not clean.<br>4. Bubble in pH glass bulb.<br>5. Faulty connection to meter.<br>6. Reference junction not immersed.<br>7. KCl crystals around reference junction inside the electrolyte chamber. | Refill with saturated KCl filling solution.<br>Clean reference junction as per instructions supplied with the electrode.<br>Clean glass bulb or platinum tip as per instructions supplied with the electrode.<br>Flick the electrode to remove bubble.<br>Check connectors. Replace if necessary.<br>Ensure that the reference junction is fully immersed. See diagrams in sections 3.2 or 4.1.<br>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 reading around pH7.00 or 0 mV for all solutions. | Electrical short in connector. | 1. Check connector. Replace if necessary.<br>2. Replace electrode. |
| Displays 4-5 pH for all solutions. | pH electrode glass bulb or internal stem cracked. | Replace pH electrode. |

## 14.3 Temperature Troubleshooting

| Symptom | Possible Causes | Remedy |
|---|---|---|
| Temperature inaccurate and cannot be calibrated. | 1. Faulty connector.<br>2. Faulty Temperature sensor. | Check the connector and replace if necessary.<br>Return Temperature sensor for repair, or replace sensor. |
| Displays manual temperature setting (eg. **25.0°CM**) when Temperature sensor plugged in. | 1. Faulty instrument socket.<br>2. Faulty Temperature sensor. | Return the instrument to the TPS factory for service.<br>Return Temperature sensor for repair, or replace sensor. |

# 15. Appendices

## 15.1 pH

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.

### *15.1.1 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.

Figure 15-1 illustrates how asymmetry is expressed for a pH electrode.

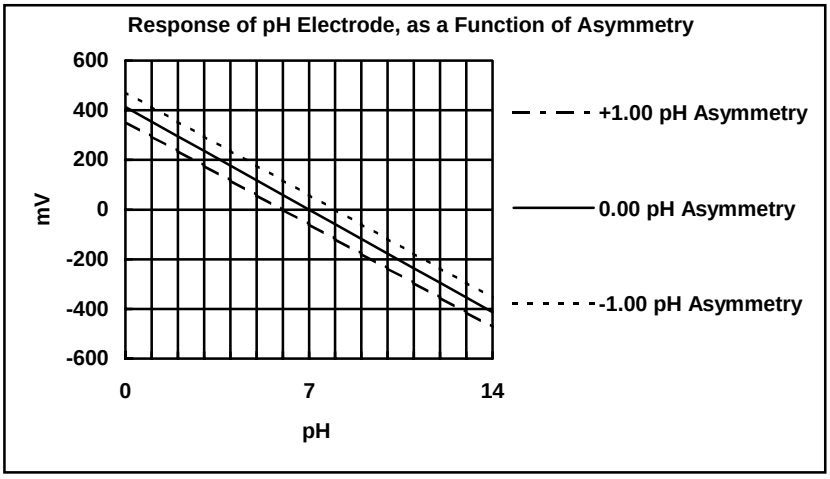



**Figure 15-1**

### *15.1.2 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 –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".

Figure 15-2 illustrates the principle of electrode slope, using a pH sensor as an example.

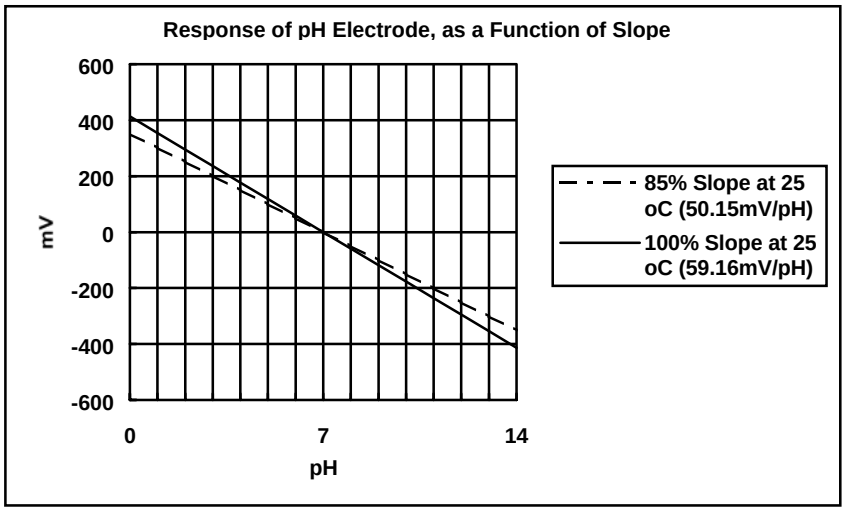



**Figure 15-2**

### *15.1.3 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. Figure 15-3 shows the slope of a pH electrode at various temperatures.

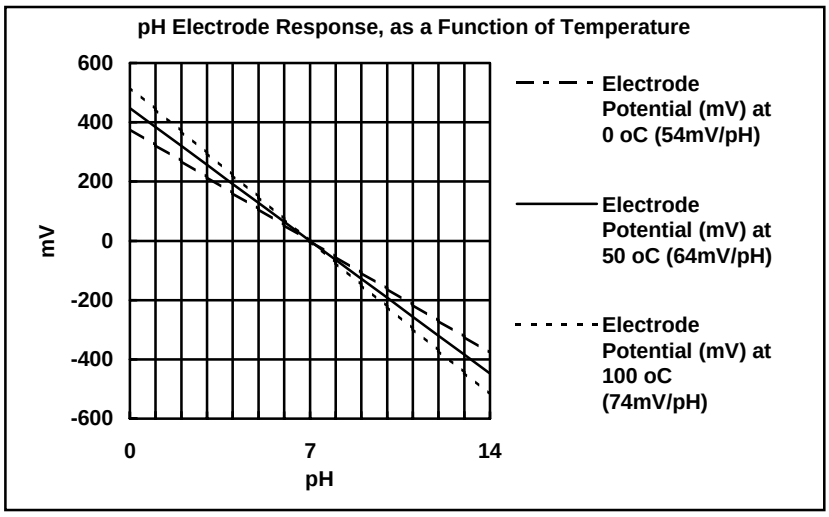



**Figure 15-3**

### *15.1.4 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 **90-P**, as per section 3.2.
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 **90-P** and repeat the test.
6. If the value obtained is still outside 7.06 +/-0.05 pH, then the electrode should be replaced.

### *15.1.5 Determining if an instrument or electrode is faulty*

The following test can be performed to help determine if the **90-P** or the pH electrode is faulty.

1. Initialise the **90-P** (see section 10).
2. Disconnect the pH electrode from the relevant **Channel 1 or Channel 2** BNC connector.
3. Connect the centre pin of the BNC connector with the outside frame of the connector, using a short piece of wire or a paper clip etc.
4. The meter should display approximately pH7.00, depending on the current calibration settings.
5. If the **90-P** 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. After an initial jump, 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, the input circuitry of the **90-P** is faulty and requires servicing.

# 16. 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.

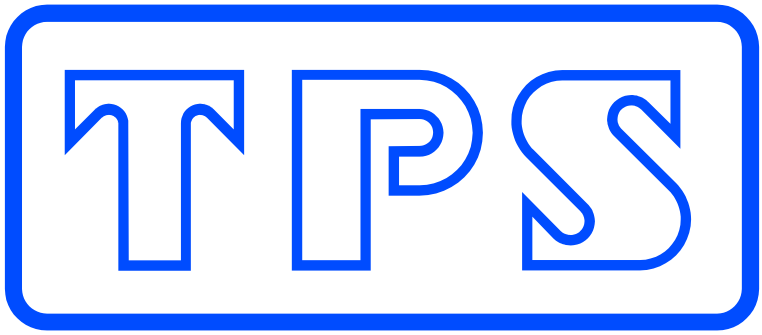
To obtain this service, please follow this procedure:
Return the instrument AND ALL SENSORS to TPS freight pre-paid and insured in its original packing or suitable equivalent. INSIST on a proof of delivery receipt from the carrier for your protection in the case of shipping claims for transit loss or 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.


TPS