Congratulations !

The **smart*CHEM*-CP** combines several popular measurement parameters. With Conductivity, TDS, pH, mV and Temperature, it provides excellent value for money in one benchtop unit.

Despite its impressive list of features, the **smart*CHEM*-CP** is a breeze to operate. This manual has been designed to help you get started, and also contains some handy application tips. If at any stage you require assistance, please contact either your local TPS representative or the TPS factory in Brisbane.

The manual is divided into the following sections:

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

2. **Introduction**
   The introduction has a diagram and explanation of the display and controls of the **smart*CHEM*-CP**. It also contains a full listing of all of the items that you should have received with the 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 **smart*CHEM*-CP**, 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.

smart*CHEM*-CP
Conductivity, TDS, pH, mV, Temperature Meter
Date   : 08-Jul-2002
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Version : 1.0

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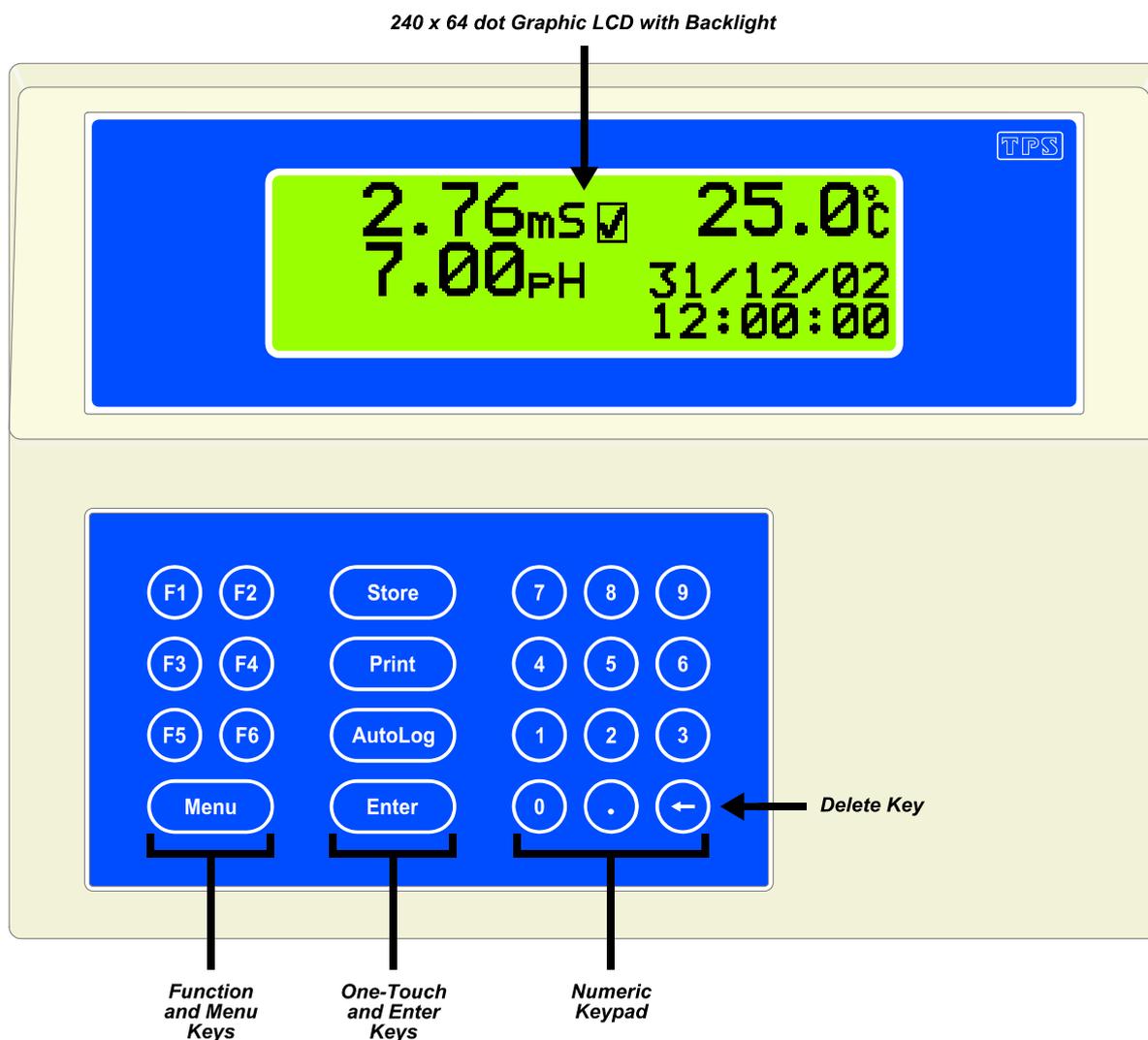Email   : tps@tps.com.au

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1. Introduction

1.1 smart*CHEM*-CP Display and Controls

240 x 64 dot Graphic LCD with Backlight

Delete Key

Function and Menu Keys

One-Touch and Enter Keys

Numeric Keypad

1.2 smart*CHEM*-CP Rear Panel Connectors

On / Off Switch

Karl Fischer Polarisation
DO2 Stirrer Output
Recorder Output

Conductivity /
TDS Sensor

Reference Sensor

OFF

ON

Power / RS232   Accessories   Temperature   Cond / TDS   Ref   pH / mV / Ion

12V DC Power
Input and
RS232 Port

Temperature
Sensor

pH/mV/Ion Sensor
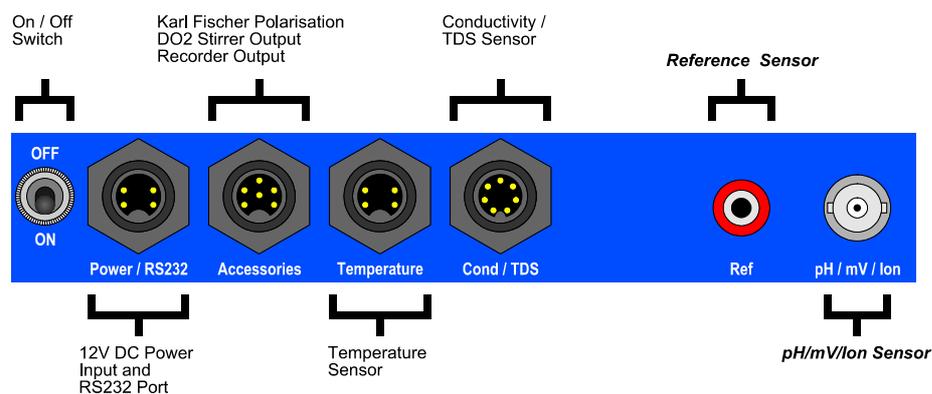
Turn the retaining nut clockwise until it clicks into place when plugging in plastic connectors. This is essential to produce a waterproof seal.

Always replace the waterproof cap when a connector is not in use to maintain waterproof integrity.

1.3 Function and Menu Keys

Press (Menu) to enter the user-friendly menu system. (Menu) is also used to step backwards through the menu one level at a time, and as an "escape" key to quit functions such as calibration, data entry etc.

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…

(F6)   : Press to Zero Relative mV, when Relative mV is selected. See section 7.2.

(F5)   : Press to start and stop the Automatic Stability Function. See section 9.

1.4 One-touch Keys

(Store)   : Press to manually record readings into the Logger. See section 13.1.

(Print)   : Press to transmit current reading plus date and time to the RS232 port. See section 14.2.

(AutoLog)   : Press to start and stop Automatic Datalogging. See section 13.2.

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

1.5 Numeric Keypad
Used to enter values during set-up and calibration. A decimal point is provided.

1.6 Delete Key
Press ⌫ to make corrections to values entered on the Numeric Keypad.

1.7 240 x 64 Dot Graphic Display
Graphic display with large, clear digits and letters. Features a user-friendly menu and context-sensitive help system. Shows Conductivity/TDS, pH/mV, Temperature, Date and Time simultaneously.

Backlight can be set to On, Off or Energy Saver modes. See section 10.

1.8 Unpacking Information

Before using your new **smart*CHEM*-CP**, please check that the following accessories have been included:

Part No

Standard Kit…
1. **smart*CHEM*-CP** Cond/TDS/pH/mV Meter 126127
2. k=1/ATC/Temp Conductivity/TDS Sensor.............. 122230
3. Plastic Body Combination pH Sensor 121207
4. Temperature/ATC Sensor 121248
5. pH6.88 Buffer, 200mL 121306
6. pH4.00 Buffer, 200mL 121381
7. 2.76 mS/cm Conductivity Standard, 200mL 122306
8. 2.0 ppK TDS Standard, 200mL 122307
9. Plug-Pack Power Supply 130037
10. **smart*CHEM*-CP** Handbook 130050

Optional sensors that may have been ordered with your smartCHEM-CP…
1. k=0.1/ATC/Temp Conductivity/TDS Sensor 122232
2. k=10/ATC/Temp Conductivity/TDS Sensor 122234
3. Intermediate Junction pH Sensor 121234
4. Plastic Body Combination Redox Sensor 121262
5. Intermediate Junction Redox Sensor 121263
6. Double Platinum Karl Fischer Sensor 122209

Instrument Options…
1. Flexible arm type electrode holder 130088
2. RS232 Serial Interface Cable 130041
3. Recorder Output Option (includes cable) 130028
4. WinTPS RS232 Communication software for 130086
    Windows 95, 98 and ME

1.9 Specifications

1.9.1 Conductivity

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

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

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

Calibration ....Automatic zero and span calibration.

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

1.9.2 TDS

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

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

Temperature Compensation................. Automatic, 0 to 100 °C

Calibration .... Automatic zero and span calibration.

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

1.9.3 pH

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

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

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

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

Calibration...Automatic asymmetry and slope calibration.

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

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

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

1.9.4 Absolute and Relative mV

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

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

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

1.9.5 Temperature

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

Sensor Type..Silicon transistor

Calibration...Automatic offset calibration

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

1.9.6 General Specifications

Memory .... 2340 readings including date and time

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

RS232 Port .... 1200, 9600, 19200 & 38400 baud.
8 bits, no parity, 1 stop bit, XON/XOFF Protocol.

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

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

Power .... 12V DC, 90 mA (backlight off) / 130 mA (backlight on). AC/DC adaptor to suit country of destination is included in standard kit.

Dimensions .... 240 x 180 x 105 mm

Mass .... Instrument only : Approx. 1.0 kg
Full Kit   : Approx. 2.5 kg

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

2. smart*CHEM*-CP Menu Structure

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

Menu	→	F1:Calibrate	→	F1:Cond. or TDS	
				F2:pH or mV	F2 does not appear in the menu when the mode is set to Relative mV.
				F3: Temperature	

→ F2:Logger → F1:Recall

F2:Erase → F1:Erase All
F2:Erase Last

F3:Print
F4:Program → F1:Secs
F2:Mins
F3:Hours

→ F3:Mode → F1:Cond
F2:TDS
F3:0.01pH
F4:0.001pH
F5:mV
F6:Rel mV

→ F4:Setup → F1:Standards → F1:Cond.
F2:TDS
F3:pH Buffer

F2:Clock
F3:Backlight → F1:On
F2:Off
F3:Energy Saver

F4: Ports → F1:Baud Rate
F3:Recorder *

F5:Initialise → F1:All
F2:pH SlopeB **

→ F5:GLP → F1:Recall
F2:Alarm → F1:Daily
F2:1 Week
F3:2 Weeks
F4:4 Weeks
F5:OFF

F3:Print
F6:Access → F1:Change code
F3:Enable & Enter code or F3:Disable Security

*   This function only available when Recorder Port option is fitted.

**   This menu item is only shown when pH has a valid 3-point calibration.

3. Conductivity Mode

3.1 Selecting Conductivity Mode

1. Select Conductivity Mode (`Menu` → `F3:Mode` → `F1:Cond`).

2. The **smart*CHEM*-CP** now proceeds to Conductivity measurement mode. Note that a " ∗ " is shown in place of the decimal point until a successful calibration has been performed (see section 3.4).

3.2 Setting the Conductivity calibration standard

The factory default for this item is 2.76mS/cm. If this is satisfactory, go directly to section 3.3.

1. Select the Conductivity Standard entry

   (`Menu` → `F4:Setup` → `F1:Standards` → `F1:Conductivity`).

   The following screen is now displayed…

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

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

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

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

4. The **smart*CHEM*-CP** will now ask you to enter the units for the Conductivity standard…

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

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

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

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

3.3 Conductivity sensor k factor

The **smart*CHEM*-CP** automatically recognises whether a k=0.1, k=1.0 or k=10 Conductivity sensor is being used via links in the connector.

Calibration settings for the various k factors are NOT stored separately. The **smart*CHEM*-CP** requires re-calibration when a new k factor sensor is connected.

If the **smart*CHEM*-CP** has been calibrated on one k factor sensor and a different k factor sensor is subsequently connected, the word "`Probe`" appears instead of the Conductivity reading. In this case, it is necessary to re-calibrate the Conductivity reading before proceeding.

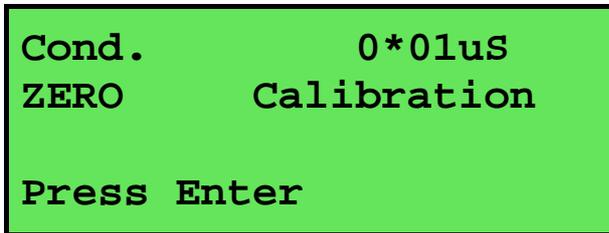## 3.4 Conductivity Calibration

Before attempting a Conductivity calibration, ensure that the **smart*CHEM*-CP** has been set up correctly according to sections 3.1 to 3.3.

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

1. Plug the Conductivity sensor into the **Cond / TDS** socket.

2. Rinse the Conductivity sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. DO NOT BLOT THE ELECTRODE PLATES.
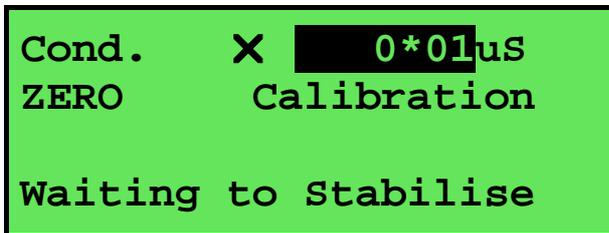
Zero Calibration

3. Let the sensor dry in air.

4. Select Conductivity Calibration ((Menu) → **F1:Calibrate** → **F1:Cond.**).

5. The **smart*CHEM*-CP** will recognise the low conductivity signal and attempt a Zero calibration. For example…

```
Cond.          0*01uS
ZERO       Calibration


Press Enter
```

6. Press (Enter) to calibrate. The Automatic Stability Function will now show a ⊠ and highlight the reading while it is unstable…

```
Cond.      ✕    0*01uS
ZERO       Calibration


Waiting to Stabilise
```

When the Conductivity reading has stabilised, the unit will calibrate itself.

To calibrate immediately without waiting for complete stability, press (F5) to disable the Automatic Stability Function.

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

Continued over the page…

Standard Calibration

7. Place the Conductivity sensor into a sample of Conductivity standard. Ensure that it is immersed correctly at least to the top of the vent hole in the side of the sensor.

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

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

   ```
   Cond.        2*86mS
   2760.uS  Calibration


   Press Enter
   ```

8. Press Enter to calibrate. The Automatic Stability Function will now show a ⊠ and highlight the reading while it is unstable…

   ```
   Cond.    ✕     2*86uS
   2760.uS  Calibration


   Waiting to Stabilise
   ```

   When the Conductivity reading has stabilised, the unit will calibrate itself.

   To calibrate immediately without waiting for complete stability, press ⑤ to disable the Automatic Stability Function.

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

9. The **smart*CHEM*-CP** is now calibrated for Conductivity and is ready for use in this mode.

3.5 Conductivity Calibration Notes

1. A Zero calibration should be performed at least monthly. In low conductivity applications (where a zero error is particularly significant), a zero calibration may have to be done weekly.

2. A Standard calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.

3. Conductivity and TDS calibration data is stored separately in memory. Ensure that the **smart*CHEM*-CP** has been correctly calibrated for the mode in which it will be used. The **smart*CHEM*-CP** does not require re-calibration when alternating between Conductivity and TDS modes, providing the instrument has been correctly calibrated for each mode on the k factor sensor to be used.

4. All calibration information is retained in memory when the **smart*CHEM*-CP** is switched off. This information can be recalled or printed later using the GLP function (see section 11).

5. The **smart*CHEM*-CP** 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).

6. Calibration settings for k=0.1, k=1.0 and k=10 sensors are NOT stored separately.

    The **smart*CHEM*-CP** requires re-calibration when a new k factor sensor is connected.

3.6 Conductivity Calibration Messages

1. If a Zero Calibration has been successfully performed, the **smart*CHEM*-CP** will display the following message…

```
Calibration OK,
Zero=0.01uS
```

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

```
Calibration OK,
k=0.99
```

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

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

Notes

1. The allowable k factor range is +/-25% of nominal. This range is ample to allow for correctly functioning Conductivity sensors. If calibration fails due to the k factor being outside these limits, please consult the Troubleshooting guide (section 19.2) for possible remedies.

4. TDS Mode

4.1 Selecting TDS Mode

1. Select TDS Mode (`Menu` → `F3:Mode` → `F2:TDS`).

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

4.2 Setting the TDS calibration standard

The factory default for this item is 2.00ppK. If this is satisfactory, go directly to section 4.3.

3. Select the TDS Standard entry

   (`Menu` → `F4:Setup` → `F1:Standards` → `F3:TDS`).

   The following screen is now displayed…

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

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

5. Press `Enter` to save the value of the standard solution.

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

6. The **smart*CHEM*-CP** will now ask you to enter the units for the TDS standard…

   ```
   TDS
   Standard:2000
   Select Units
   F1:ppM     F2:ppK
   ```

   Press `F1` to set the TDS Standard as ppM.

   Press `F2` to set the TDS Standard as ppK.

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

4.3 TDS sensor k factor

The **smart*CHEM*-CP** automatically recognises whether a k=0.1, k=1.0 or k=10 TDS sensor is being used, via links in the connector.

Calibration settings for the various k factors are NOT stored separately. The **smart*CHEM*-CP** requires re-calibration when a new k factor sensor is connected.

If the **smart*CHEM*-CP** has been calibrated on one k factor sensor and a different k factor sensor is subsequently connected, the word "`Probe`" appears instead of the TDS reading. In this case, it is necessary to re-calibrate the TDS reading before proceeding.
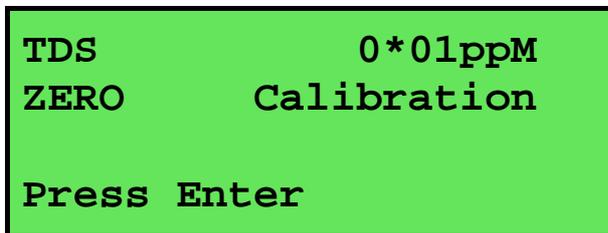
4.4 TDS Calibration

Before attempting a TDS calibration, ensure that the **smart*CHEM*-CP** has been set up correctly according to sections 4.1 to 4.3.

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

1. Plug the TDS sensor into the **Cond / TDS** socket.

2. Rinse the TDS sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. DO NOT BLOT THE ELECTRODE PLATES.
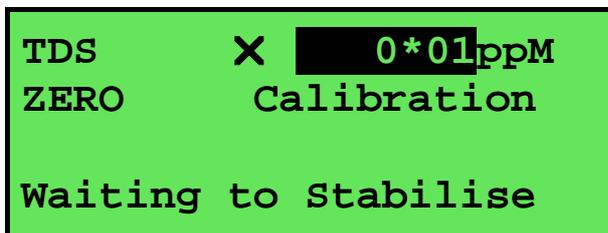
Zero Calibration

3. Let the sensor dry in air.

4. Select TDS Calibration (Menu → **F1:Calibrate** → **F1:TDS**).

5. The **smart*CHEM*-CP** will recognise the low TDS signal and attempt a Zero calibration. For example…

```
TDS              0*01ppM
ZERO        Calibration


Press Enter
```

6. Press Enter to calibrate. The Automatic Stability Function will now show a ⊠ and highlight the reading while it is unstable…

```
TDS       ✗       0*01ppM
ZERO        Calibration


Waiting to Stabilise
```

When the TDS reading has stabilised, the unit will calibrate itself.

To calibrate immediately without waiting for complete stability, press F5 to disable the Automatic Stability Function.

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

Continued over the page…

Standard Calibration

7. Place the TDS sensor into a sample of TDS standard. Ensure that it is immersed correctly at least to the top of the vent hole in the side of the sensor.

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

    Select TDS Calibration (Menu → **F1:Calibrate** → **F1:TDS**). The calibration screen will be displayed with the TDS standard to be used. For example…
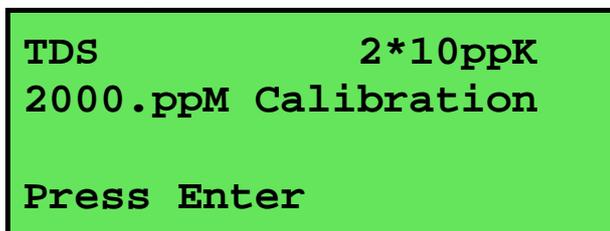
    ```
    TDS           2*10ppK
    2000.ppM Calibration


    Press Enter
    ```

8. Press Enter to calibrate. The Automatic Stability Function will now show a ⊠ and highlight the reading while it is unstable…
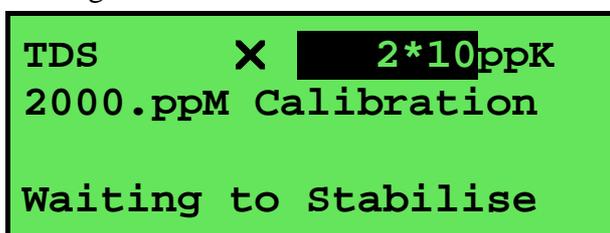
    ```
    TDS        ✕      2*10ppK
    2000.ppM Calibration


    Waiting to Stabilise
    ```

    When the TDS reading has stabilised, the unit will calibrate itself.

    To calibrate immediately without waiting for complete stability, press ⑤ to disable the Automatic Stability Function.

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

9. The **smart*CHEM*-CP** is now calibrated for TDS and is ready for use in this mode.

4.5 TDS Calibration Notes

1. A Zero calibration should be performed at least monthly. In low conductivity applications (where a zero error is particularly significant), a zero calibration may have to be done weekly.

2. A Standard calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.

3. Conductivity and TDS calibration data is stored separately in memory. Ensure that the **smart*CHEM*-CP** has been correctly calibrated for the mode in which it will be used. The **smart*CHEM*-CP** does not require re-calibration when alternating between Conductivity and TDS modes, providing the instrument has been correctly calibrated for each mode on the k factor sensor to be used.

4. All calibration information is retained in memory when the **smart*CHEM*-CP** is switched off. This information can be recalled or printed later using the GLP function (see section 11).

5. The **smart*CHEM*-CP** displays the value of the standard to which it will attempt to calibrate. Ensure that the standard value displayed corresponds to the standard that you are using. Alter the Standards set-up if necessary (see section 4.2).

6. Calibration settings for k=0.1, k=1.0 and k=10 sensors are NOT stored separately.

   The **smart*CHEM*-CP** requires re-calibration when a new k factor sensor is connected.

4.6 TDS Calibration Messages

1. If a Zero Calibration has been successfully performed, the **smart*CHEM*-CP** will display the following message…

```
Calibration OK,
Zero=0.01ppM
```

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

```
Calibration OK,
k=0.99
```

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

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

Notes

1. The allowable k factor range is +/-25% of nominal. This range is ample to allow for correctly functioning TDS sensors. If calibration fails due to the k factor being outside these limits, please consult the Troubleshooting guide (section 19.2) for possible remedies.

5. pH Mode

5.1 Selecting pH Mode

To select or change the pH Mode…

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

```
Mode
>F1:Cond     F2:TDS____
>F3:0.01pH  F4:0.001pH
 F5:mV       F6:Rel mV
```

The arrow indicates the current selection.

Press ⊙ to select pH mode with 0.01 pH resolution.

Press ⊙ to select pH mode 0.001 pH resolution.

Press (Menu) to quit without changing the current selection.

5.2 Selecting the pH Buffer Set

The **smart*CHEM*-CP** can be programmed to automatically recognise any of the following buffer sets during pH calibration.

1. pH4.00, pH6.88, pH9.23
2. pH4.00, pH6.88, pH10.06
3. pH4.00, pH7.00, pH9.23
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:Standards → F5:pH Buffer**).

2. The primary buffer selection menu is now displayed…

    ```
    Select Primary
    Buffer
    >F1:6.88pH
     F3:7.00pH
    ```

    The arrow indicates the current selection.

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

    Press F3 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
    >F1:4.00/9.23pH
     F3:4.00/10.06pH
    ```

    The arrow indicates the current selection.
    Press F1 to select pH4.00 and pH9.23 as the Secondary Buffers.
    Press F3 to select pH4.00 and pH10.06 as the Secondary Buffers.
    Press Menu to quit without changing the current setting.

Notes

1. The selected buffer set is kept in memory when the meter is switched off.

2. The buffers are re-set to pH4.00, pH6.88 and pH9.23 during initialisation.

3. pH6.88 buffer is a DIN 19266 and NBS Primary-standard pH solution. Its use as the primary buffer is highly recommended for the most accurate possible results. If pH7.00 buffer is used, ensure that it is manufactured to at least 0.01pH accuracy. pH7.00 buffer has a buffer capacity less than half that of pH6.88 buffer and is therefore much less stable.

4. pH9.23 and pH10.06 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 pH versus Temperature data for the buffer is known.

5.3 Calibration Buffer Sequence

Before proceeding to pH Calibration (section 5.4), please consider the sequence in which the buffers should be used. This will vary depending on whether a 1, 2 or 3 point pH calibration is required.

5.3.1 1 Point Calibration

A 1 point pH calibration can be performed in any buffer and will only adjust for the asymmetry of the pH sensor. See section 20.2.1 for a detailed explanation of asymmetry. A 1 point calibration will not remove the " * ", which is shown in place of the decimal point when pH is un-calibrated or has failed calibration.

5.3.2 2 Point Calibration

A 2 point calibration is performed automatically after a successful 1 point calibration, when the pH sensor is calibrated in a buffer that is at least 1.50pH higher or lower than the buffer that was used for the first point.

A 2 point calibration can be performed in any two pH buffers, and in any order, as long as they are at least 1.50pH apart.

5.3.3 3 Point Calibration

A 3 point calibration must be performed in the correct order.

For the pre-programmed buffers (see section 5.2), this order can be any one of the following…

First Point	Second Point	Third Point
pH6.88 or pH7.00	pH4.00	pH9.23 or pH10.06
pH4.00	pH6.88 or pH7.00	pH9.23 or pH10.06

When using buffers other than the pre-programmed buffers, please use the following guidelines to determine the correct order in which to perform a 3 point calibration…

1. *Definitions*
   a) A neutral buffer must be between pH6.50 and pH7.50, inclusive.

   b) An acidic buffer must be 1.50pH or more lower than the neutral buffer that is being used.

   c) A basic buffer must be 8.50pH or higher.

2. *Buffer Order*
   a) Neutral $\rightarrow$ Acid $\rightarrow$ Base

   b) Acid $\rightarrow$ Neutral $\rightarrow$ Base

3. *Notes*
   a) When using buffers other than the pre-programmed buffers, ensure that the pH versus Temperature characteristics are known. The buffer value corresponding to the calibration temperature must be keyed in correctly.

   b) pH sensors offer an extremely linear response over a wide range. A 2 point calibration would normally be sufficient for most measurements between pH2.00 and pH10.00.

   c) When a 3 point calibration has been successfully performed, an extra line appears in the GLP Recall (section 11.1) and the GLP print-out (section 11.3) labelled "`SlopeB`".

5.4 pH Calibration

1. Plug the pH sensor into the **pH/mV/Ion** BNC socket and the temperature sensor into the **Temperature** socket. Switch the meter on.

2. Select pH Mode and the desired pH resolution (see section 5.1).

3. Ensure that temperature has already been calibrated, or manually set (see sections 8.1 and 8.4). NOTE: For real temperature readings, the decimal point is shown by a " ∗ ", when the temperature readout is not calibrated.

4. Remove the wetting cap from the pH sensor. Rinse the pH and Temperature sensors in distilled water and blot them dry.

5. Ensure that the primary and secondary buffers to be used have been correctly selected for automatic buffer recognition. See section 5.2.

6. Place both sensors into a small sample of buffer so that the bulb and reference junction are both covered as per the diagram below. Choose the buffer to be used according to the details in section 5.3.
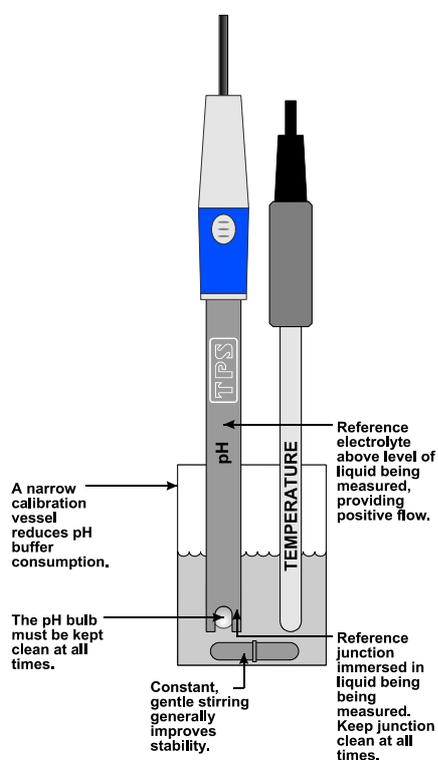
    DO NOT place the electrodes directly into the buffer bottle.

7. Select pH Calibration (Menu → **F1:Calibrate** → **F2:pH**).

    The display should now look something like this…

```
 6*85pH      6.87
 25.0ºC      Buffer
Press Enter to Cal.
or Edit Buffer.
```
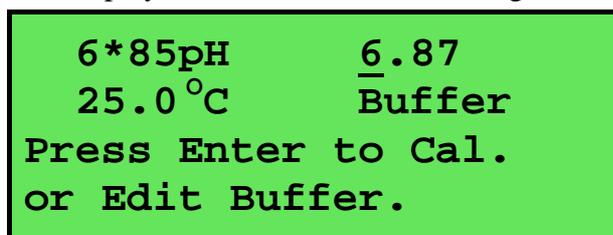
    The current pH reading is shown on the left. Note the " ∗ ", indicating that pH is currently not calibrated.

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

8. Press ⏎(Enter) to calibrate to the displayed buffer. Otherwise, enter an alternative buffer using the Numeric Keypad, and then press ⏎(Enter). The Automatic Stability Function will now show a ⊠ and highlight any unstable readings…

```
 6.85pH       6.88
 25.0 OC  X    Buffer


Waiting to Stabilise
```
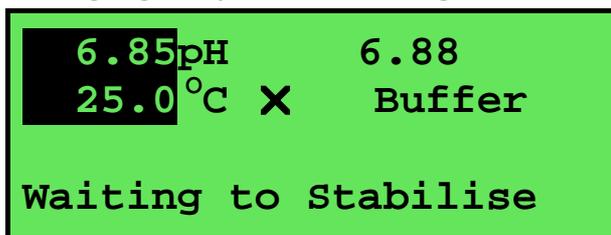
When the pH and Temperature readings have stabilised, the unit will calibrate itself.

To calibrate immediately without waiting for complete stability, press ⑤(F5) to disable the Automatic Stability Function.

9. The meter is now 1 point calibrated. Note that the " ∗ " will not be removed until a 2 point calibration has been performed. Rinse the pH and Temperature sensors in distilled water and blot them dry.

10. Repeat steps 6 to 8 in a second buffer to perform a 2 point calibration. See section 5.3.2 for details on the correct sequence of buffers to ensure the instrument is correctly calibrated at the 2 points. If a " ∗ " was shown in place of the decimal point, this will be removed after a successful 2 point calibration.

11. Repeat steps 6 to 8 in a third buffer to perform a 3 point calibration, if required. See section 5.3.3 for details on the correct sequence of buffers to ensure the instrument is correctly calibrated at the 3 points.

12. The **smart*CHEM*-CP** is now calibrated for pH 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.

5.5 pH Calibration Notes

1. **DO NOT** place the electrodes directly into buffer bottles. Decant a small quantity and discard after use.

2. **pH9.23 and pH10.06 buffers are highly unstable. Avoid using these buffers if possible. Discard immediately after use**.

3. 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.

4. A full 2 point calibration should be performed at least monthly. Of course, more frequent calibration will result in greater confidence in results.

5. All calibration information is retained in memory when the **smart*CHEM*-CP** is switched off. This information can be recalled or printed later using the GLP function (see section 11).

6. When a 3 point calibration has been successfully performed, an extra line appears in the GLP Recall (section 11.1) and the GLP print-out (section 11.3) labelled "`SlopeB`".

7. To clear the Slope B from a 3 point calibration without losing all other calibration data, please refer to the section regarding Initialisation (section 17).

5.6 pH Calibration Messages

1. If a 1-point calibration has been successfully performed, the **smart*CHEM*-CP** will display the following message and the asymmetry of the electrode.

```
Asymmetry
Calibration OK
+0.10pH Asym
```

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

```
Calibration Failed,
Repeat Cal. or
Initialise
1.1 pH Asymmetry
```

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

```
Slope & Asymmetry
Calibration OK
+0.10pH Asym
99.0% Slope
```
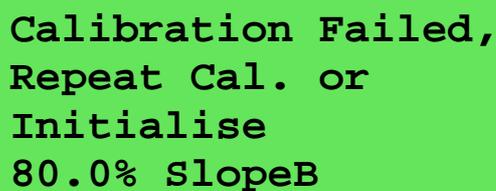
4. If a 2-point calibration has failed, the **smart*CHEM*-CP** will display the following message and the failed slope value of the electrode.

```
Calibration Failed,
Repeat Cal. or
Initialise
80.0% Slope
```

5. If a 3-point calibration has been successfully performed, the **smart*CHEM*-CP** will display the following message and the asymmetry and second slope of the electrode.

```
3 Point
Calibration OK
99.0% SlopeB
```

6. If a 3-point calibration has failed, the **smart*CHEM*-CP** will display the following message and the failed slope value of the electrode.

```
Calibration Failed,
Repeat Cal. or
Initialise
80.0% SlopeB
```

7. If the **smart*CHEM*-CP** has been 3-point calibrated and the incorrect buffer sequence is subsequently used, the following message will be displayed…
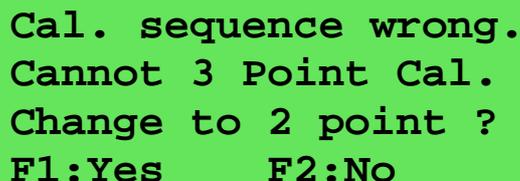
```
Cal. sequence wrong.
Cannot 3 Point Cal.
Change to 2 point ?
F1:Yes    F2:No
```

Press Ⓕ¹ to proceed with a 2 point calibration. The second slope currently in memory from the previous 3 point calibration will be deleted.

Press Ⓕ² to cancel, without re-calibrating.

See section 5.3.3 for details on the correct 3 point calibration buffer sequence.

8. The **smart*CHEM*-CP** 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, please consult the Troubleshooting guide (section 19.3) for possible remedies.

6. Absolute Millivolt Mode

6.1 Selecting Absolute Millivolt Mode

To select Absolute Millivolt Mode…

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

```
Mode
>F1:Cond    F2:TDS
>F3:0.01pH  F4:0.001pH
 F5:mV      F6:Rel mV
```

The arrow indicates the current selection.

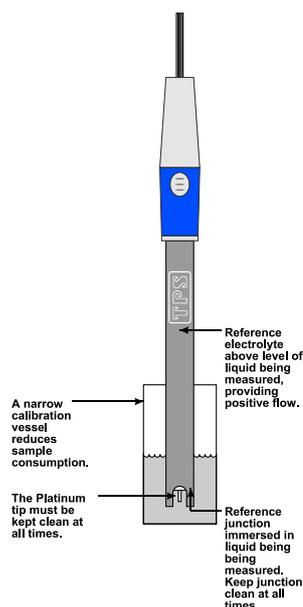Press (F5) to select Absolute Millivolt mode.

Press (Menu) to quit without changing the current selection.

2. The **smart*CHEM*-CP** will display the actual millivolts produced by the sensor in this mode.

6.2 Absolute Millivolt Calibration

This calibration procedure uses a Redox/ORP sensor and ZoBell calibration as examples. For other types of sensors (eg. ISE's) and solutions, please substitute them when carrying out this procedure.

1. Plug the Redox sensor into the **pH/mV/Ion** BNC socket. Temperature compensation is not applicable for Millivolt mode, so it is not necessary to connect a Temperature sensor. Switch the meter on.

2. Select Millivolt mode (see section 6.1).

3. Remove the wetting cap from the sensor, if fitted. Rinse the sensor in distilled water and blot dry.

4. Place the sensor into a small sample of known millivolt solution so that the platinum tip and reference junction are both covered as per the diagram below. ZoBell Redox standard can be made with a 1:1 mixture of Part A and Part B. This solution produces +231mV of Redox potential. **Caution: ZoBell solution is poisonous and should be handled with care.**

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

A narrow calibration vessel reduces sample consumption.

The Platinum tip must be kept clean at all times.

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

5. Select mV Calibration (**Menu** → **F1:Calibrate** → **F2:mV**).

   The display should now look something like this…
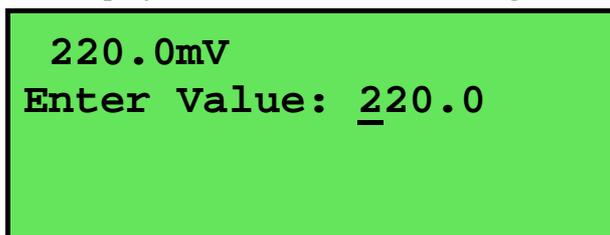
```
  220.0mV
Enter Value: 220.0
```

The current mV reading is shown on the top line.

The **smart*CHEM*-CP** displays the same value on the second line, on the assumption that the reading will be close to the expected calibration point.

6. Enter the value of the calibration solution using the Numeric Keypad, and then press **Enter**. The Automatic Stability Function will now show a ☒ and highlight any unstable readings…
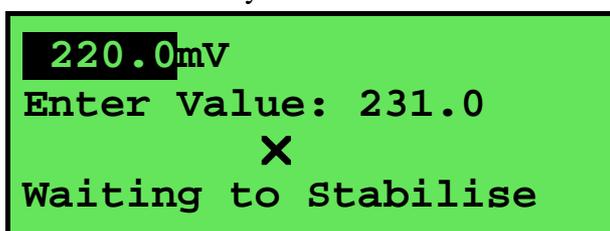
```
  220.0mV
Enter Value: 231.0
         ✕
Waiting to Stabilise
```

When the Millivolt reading has stabilised, the unit will calibrate itself.

To calibrate immediately without waiting for complete stability, press **F5** to disable the Automatic Stability Function.

7. The **smart*CHEM*-CP** is now calibrated for mV and is ready for use in this mode. Discard the used samples of standard.

    Rinse the Redox sensor in distilled water and blot dry before placing into unknown samples.

6.3 mV Calibration Notes

1. **DO NOT** place the sensor directly into stock bottles of standard. Decant a small quantity and discard after use.

2. **Redox standards are highly unstable. Discard immediately after use**.

3. A mV 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.

4. All calibration information is retained in memory when the **smart*CHEM*-CP** is switched off. This information can be recalled or printed later using the GLP function (see section 11).

6.4 mV Calibration Messages

1. If a mV calibration has been successfully performed, the **smart*CHEM*-CP** will display the following message and the offset of the sensor.
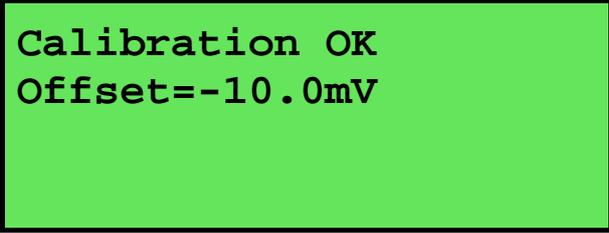
```
Calibration OK
Offset=-10.0mV
```

2. If a mV calibration has failed, the **smart*CHEM*-CP** will display the following message and the failed offset value of the sensor.

```
Calibration Failed,
Offset=-100.0mV
```

3. The **smart*CHEM*-CP** has an allowable Offset range of –60 to +60 mV. If calibration fails due to the Offset being outside these limits, please consult the Troubleshooting guide (section 19.3) for possible remedies.

7. Relative Millivolt Mode

7.1 Selecting Relative Millivolt Mode

To select Relative Millivolt Mode…

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

```
Mode
>F1:Cond     F2:TDS____
>F3:0.01pH   F4:0.001pH
 F5:mV        F6:Rel mV
```

The arrow indicates the current selection.

Press Ⓕ⑥ to select Relative Millivolt mode.

Press Menu to quit without changing the current selection.

2. The **smart*CHEM*-CP** will display the millivolt data relative to a known, user-selectable zero point
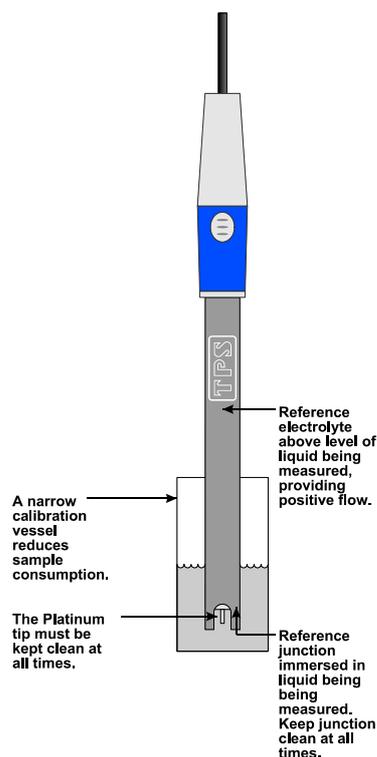
7.2 Relative Millivolt Calibration

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 **pH/mV/Ion** BNC socket. Temperature compensation is not applied in Relative mV mode, so the temperature sensor does not need to be connected. Switch the meter on.

2. Select Relative mV Mode, as per section 7.1

3. The display now shows the millivolt data with the units "**mVR**" The "**R**" indicates Relative mV, as per the example below…

```
  2.76mS    25.0°C
400.0mvR  31/12/02
          12:00:00
```

4. Remove the wetting cap from the Redox sensor.

5. Rinse the sensor in distilled water and blot dry.

6. Place the Redox sensor(s) into a sample of the known standard. Ensure that the platinum tip and reference junction are both covered as per the diagram below.

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

A narrow calibration vessel reduces sample consumption.

The Platinum tip must be kept clean at all times.

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

7. Press ⑥ to zero the Relative mV reading. The Automatic Stability Function will now show a ☒ and highlight the Relative mV reading while it is unstable. For example…


```
2.76mS  ✗  25.0°C
400.0mvR   31/12/02
Stabilising 12:00:00
```
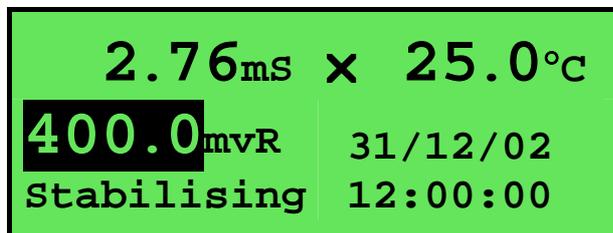
The Relative mV reading will automatically be zeroed once the reading becomes stable.

To calibrate immediately without waiting for complete stability, press ⑤ to disable the Automatic Stability Function.

8. The **smart*CHEM*-CP** Relative mV mode is now zeroed and is ready for use. The readout can be re-zeroed by pressing ⑥ whenever required.

7.3 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 **smart*CHEM*-CP** is switched off.

3. The Relative mV zero offset is reset when entering or leaving Relative mV mode.

8. Temperature Mode

The temperature readout must be calibrated or manually set before attempting pH calibration.

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

The **smart*CHEM*-CP** is able to take Temperature readings from the Temperature sensor or from the Conductivity/TDS sensor. If both the Temperature sensor and a Conductivity/TDS sensor are connected at the same time, the Temperature reading is taken from the Temperature sensor.

8.1 Temperature Calibration

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

   To calibrate the Temperature readout from a Conductivity/TDS sensor, plug the Conductivity/TDS sensor into the **Cond/TDS** socket and ensure that the separate Temperature is not connected.

2. Switch the meter on.

3. Place the Temperature or Conductivity/TDS 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** → **F3:Temperature**).

   The Temperature Calibration screen is now displayed. The bottom line provides confirmation of which sensor is being calibrated. The following example shows the Temperature sensor being calibrated.
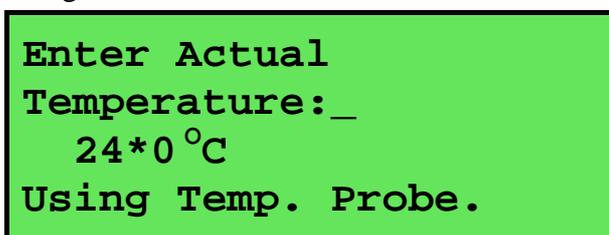
   ```
   Enter Actual
   Temperature:_
      24*0 °C
   Using Temp. Probe.
   ```

   The current reading from the Temperature or Conductivity/TDS sensor is displayed.

5. Type in the temperature as measured by the mercury thermometer using the Numeric Keypad and press Enter. The Automatic Stability Function will now show a ☒ and highlight the Temperature reading while it is unstable…
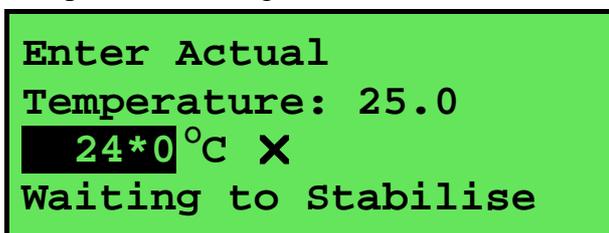
   ```
   Enter Actual
   Temperature: 25.0
      24*0 °C  ✗
   Waiting to Stabilise
   ```

   When the Temperature reading has stabilised, the unit will calibrate itself.

   To calibrate immediately without waiting for complete stability, press Ⓕ⑤ to disable the Automatic Stability Function.

6. The **smart*CHEM*-CP** is now calibrated for Temperature and is ready for use in this mode.

8.2 Temperature Calibration Notes

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

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

3. The **smart*CHEM*-CP** keeps the Temperature calibration data for the Temperature and Conductivity/TDS sensors separately so these can be swapped as required.
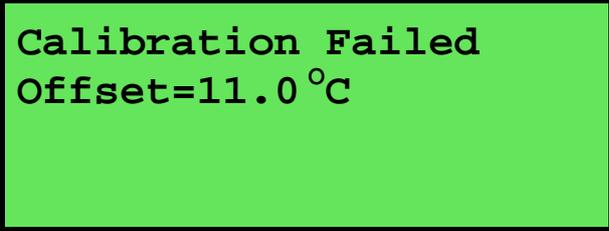
8.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **smart*CHEM*-CP** will display the following message and the offset of the sensor.
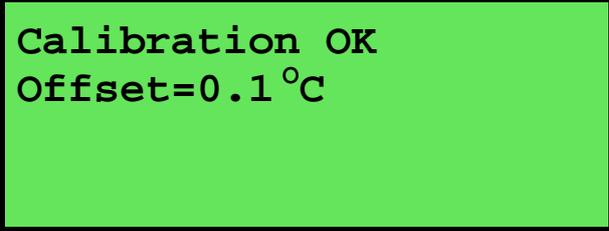
```
Calibration OK
Offset=0.1 °C
```

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

```
Calibration Failed
Offset=11.0 °C
```

3. The **smart*CHEM*-CP** has an allowable Offset range of -10.0 to +10.0 $^{\circ}$C. If calibration fails due to the Offset being outside these limits, please consult the Troubleshooting guide (section 19.4) for possible remedies.

8.4 Manual Temperature Setting

If the 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.

1. Switch the meter on.

2. Measure the temperature of the sample.

3. Select Temperature Calibration ($\boxed{Menu}$ → **F1:Calibrate** → **F3:Temperature**).

4. The current temperature setting is now displayed. For example…
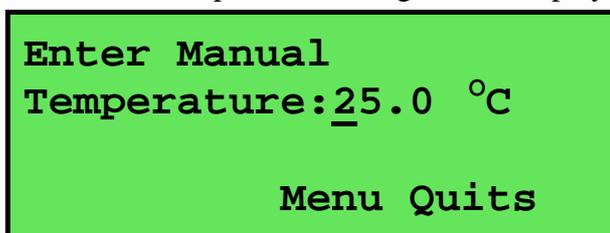
```
Enter Manual
Temperature:25.0 °C


          Menu Quits
```

5. Enter the temperature of the sample using the Numeric Keypad.
    Press $\boxed{Enter}$ to save the new value.
    Alternatively, press $\boxed{Menu}$ to quit and retain the current setting.

6. When returning the **smart*CHEM*-CP** to normal measurement mode, note the "**°C**" in the temperature readout alternating with an "**°M**" indicating that Manual Temperature Compensation is in use. For example…
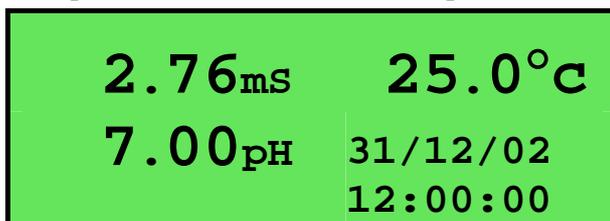
```
2.76 mS    25.0°c
7.00 pH  31/12/02
         12:00:00
```

9. Auto Stability Function (ASF)

ASF adds an extra level of versatility to the **smart*CHEM*-CP**. When ASF is activated, the **smart*CHEM*-CP** monitors all parameters that are currently in use. When **ALL** parameters become stable, the readings are frozen on the display.

ASF can be used in the following ways…

## 9.1 ASF During Normal Measurement

1. Press ⒡⑤ in normal measurement mode. All active parameters are highlighted and the ⊠ symbol appears in the display. For example…
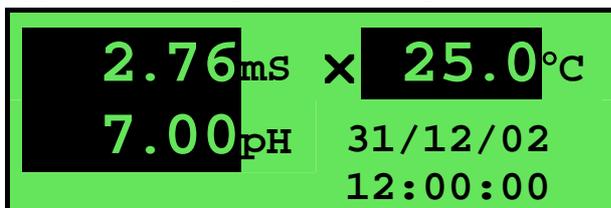
    ```
    2.76ms ✕  25.0°c
    7.00pH  31/12/02
            12:00:00
    ```

    As each parameter becomes stable, the highlighting is removed. If any parameter subsequently becomes unstable, the highlighting is applied again.

    The highlighting is provided to give the operator a visual indication of exactly which parameters have not stabilised in case user intervention is required.

2. When ALL parameters have stabilised, all highlighting will be removed and the ⊠ will change to a ✔. All readings are now frozen. For example…

    ```
    2.76ms ✔  25.0°c
    7.00pH  31/12/02
            12:00:00
    ```
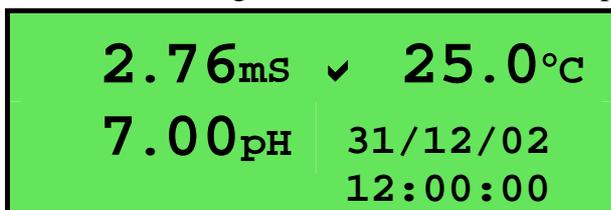
3. The operator can now make a note of the reading as required.

4. **To unfreeze the display in order to take the next reading, press ⒡⑤ again to re-start the ASF sampling process.**

5. Press ⒡⑤ a second time, while the ⊠ symbol is being displayed, to turn ASF off.

9.2 ASF During Calibration

The Automatic Stability Function is automatically invoked during calibration. The stability parameters programmed into the **smart*CHEM*-CP** have a finer tolerance during calibration than during normal measurement. This is done to ensure the most accurate possible calibration results.

Press ⒡⑤ while the ⊠ symbol is being displayed during calibration to turn ASF off and calibrate immediately, before the reading has stabilised.

See the calibration sections of this manual for further details on the ASF function during calibration.

9.3 ASF with Manual Datalogging

1. Press ⓕ⑤ then (Store) in normal measurement mode. All active parameters are highlighted and the ⊠ symbol appears in the display, along with the message "Auto Store". For example…
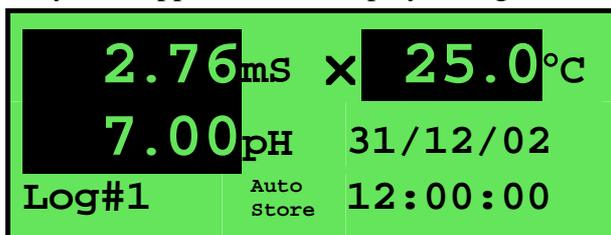
```
┌─────────────────────────────────┐
│  2.76ₘₛ ✗  25.0°C               │
│                                 │
│  7.00pH   31/12/02              │
│                                 │
│ Log#1    Auto   12:00:00        │
│          Store                  │
└─────────────────────────────────┘
```

   As each parameter becomes stable, the highlighting is removed. If any parameter subsequently becomes unstable, the highlighting is applied again.

   The highlighting is provided to give the operator a visual indication of exactly which parameters have not stabilised in case user intervention is required.

2. When ALL parameters have stabilised, all highlighting will be removed and the ⊠ will change to a ☑. All readings are now frozen and will be recorded into memory. For example…

```
┌─────────────────────────────────┐
│  2.76ₘₛ ✗  25.0°C               │
│                                 │
│  7.00pH   31/12/02              │
│                                 │
│ Log#1     Recorded              │
└─────────────────────────────────┘
```

3. **To unfreeze the display in order to take the next reading, press ⓕ⑤ and (Store) again to restart the ASF Auto-Store process.**

4. Press ⓕ⑤ a second time, while the ⊠ symbol is being displayed, to turn ASF off.
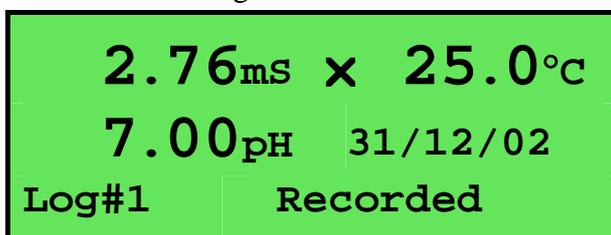
9.4 ASF with Automatic Datalogging

Using ASF with Automatic Datalogging allows continuous logging until all readings are stable. This is useful in titrations etc, where logging is no longer required once an end point is reached.

See section 13.2 for details on programming the Automatic Datalogging function.

1. Press ⑤ then (AutoLog) in normal measurement mode. All active parameters are highlighted and the ⊠ symbol appears in the display, along with the message "Auto Log". For example…

```
 2.76mS  ☒  25.0°C
 7.00pH   31/12/02
Log#1    Auto  12:00:00
         Log
```

    As each parameter becomes stable, the highlighting is removed. If any parameter subsequently becomes unstable, the highlighting is applied again.

    The highlighting is provided to give the operator a visual indication of exactly which parameters are not yet stable in case user intervention is required.

2. When ALL parameters have become stable, all highlighting will be removed and the ⊠ will change to a ✔. All readings are now frozen and automatic datalogging has stopped. For example…

```
 2.76mS  ✔  25.0°C
 7.00pH   31/12/02
          12:00:00
```

3. **To unfreeze the display in order to take the next reading, press ⑤ and (AutoLog) again to re-start the ASF automatic datalogging process.**

4. Press ⑤ a second time, while the ⊠ symbol is being displayed, to turn ASF off.

10. Display Backlight

The **smart*CHEM*-CP** is fitted with an Electro-Luminescence ("EL") backlight. This can be set up according to your preferences as follows…

1. Switch the meter on.

2. Select the Backlight menu ((Menu) → **F4:Setup** → **F3:Backlight**).

3. The Backlight menu is now displayed…

```
BACKLIGHT
 F1:On          F2:Off
>F3:Energy Saver
```
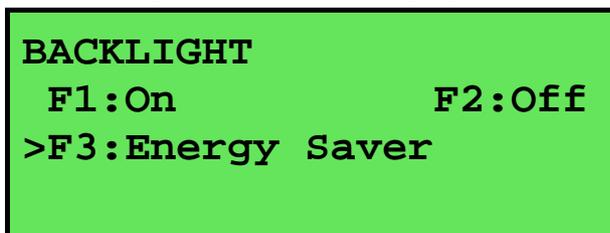
    The arrow indicates the current selection.

    Press ⑤ to set the Backlight to be on continuously.

    Press ⑤ to set the Backlight to be off continuously.

    Press ⑤ to set the Backlight to turn on automatically whenever a key is pressed. It will turn off automatically if no key has been pressed for 5 minutes.

11. Good Laboratory Practices (GLP)

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

11.1 To recall GLP information on the display

1. Switch the meter on.

2. Select the GLP menu (Menu → **F5: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. For example…

```
smartCHEM-CP V1.0 S1234    31/12/02 15:00

Temp Probe Offset=1.0oC    31/12/02 12:00
Temp Probe Calibrated

Cond Temp  Offset=2.0oC    31/12/02 12:10
Cond Temp  Calibrated
                                F4:Next
```

5. Press ⑨ to sequentially scroll through the GLP information for all parameters. Press ② to scroll back to previous data. The sequence of information displayed is shown below. Press Menu to abort at any time.

GLP Display sequence…

```
smartCHEM-CP V1.0 S1234    31/12/02 15:00

Temp Probe Offset=1.0oC    31/12/02 12:00
Temp Probe Calibrated

Cond Temp  Offset=2.0oC    31/12/02 12:10
Cond Temp  Calibrated
                                F4:Next
```

↑ F2   ↓ F4

```
Cond Zero=0.01uS           31/12/02 12:20
Cond k=1.01                31/12/02 12:30
Cond Calibrated

TDS  Zero=0.01ppM          31/12/02 12:40
TDS  k=1.01                31/12/02 12:50
TDS Calibrated
                        F2:Back F4:Next
```

↑ F2   ↓ F4

```
mV Offset=10mV             31/12/02 13:00

pH Asymmetry=0.10pH        31/12/02 13:10
pH SlopeA= 99.0%           31/12/02 13:20
pH SlopeB= 99.0%           31/12/02 13:30
pH Calibrated

                        F2:Back F4:Ends
```

11.2 Failed Calibration

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

```
mV Offset=10mV              31/12/02 13:00

pH Asymmetry=0.10pH         00/00/00 00:00
pH Slope= 99.0%             00/00/00 00:00

pH Calibrated

                            F2:Back F4:Ends
```

11.3 Printing GLP Information to the RS232 Port

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

1. Switch the meter on.

2. Connect one end of the RS232 cable to the **Power/RS232** socket of the **smart*CHEM*-CP**.

3. Connect the other end of the RS232 cable to an RS232 Printer, or to a Serial port on a PC.

4. Send the GLP information to the RS232 port:

    (Menu) → **F5:GLP** → **F3:Print**

    The message "**Printing GLP Data**" is displayed while sending the data to the RS232 port.

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

```
smartCHEM-CP V1.0 S1234 @ 31/12/2002 15:00
Conductivity Zero=      0.01uS   @ 31/12/2002 12:20
Conductivity k=         1.01     @ 31/12/2002 12:30
TDS          Zero=      0.01ppM  @ 31/12/2002 12:40
TDS          k=         1.01     @ 31/12/2002 12:50
mV           Offset=      10mV   @ 31/12/2002 13:00
pH           Asy=       0.10pH   @ 31/12/2002 13:10
pH           SlopeA=    99.0%    @ 31/12/2002 13:20
pH           SlopeB=    99.0%    @ 31/12/2002 13:30
Temp. Probe  Offset=    -1.2oC   @ 31/12/2002 12:00
Cond. Temp.  Offset=     0.0oC   @ 31/12/2002 12:10
Ends
```

11.4 GLP Calibration Alarm

A new feature of the **smart*CHEM*-CP** is the GLP calibration alarm. The operator can select how often they wish to be reminded that the instrument requires calibration, and for which parameters they wish to be reminded.

11.4.1 To set the GLP Calibration Alarm…

1. Select the GLP Calibration Alarm menu ((Menu) → **F5:GLP** → **F2:Alarm**).

2. The calibration alarm period can now be selected…
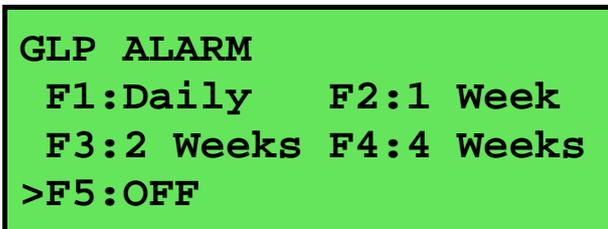
```
GLP ALARM
 F1:Daily    F2:1 Week
 F3:2 Weeks F4:4 Weeks
>F5:OFF
```

    The arrow indicates the current selection.

    Press ⁽ᶠ¹⁾ to be reminded that calibration is due every day.

    Press ⁽ᶠ²⁾ to be reminded that calibration is due every week.

    Press ⁽ᶠ³⁾ to be reminded that calibration is due every 2 weeks.

    Press ⁽ᶠ⁴⁾ to be reminded that calibration is due every 4 weeks.

    Press ⁽ᶠ⁵⁾ to switch the GLP Calibration Alarm system off.

    Press (Menu) to quit and retain the current setting.

3. If ⁽ᶠ¹⁾, ⁽ᶠ²⁾, ⁽ᶠ³⁾ or ⁽ᶠ⁴⁾ was pressed above, the **smart*CHEM*-CP** will now allow the operator to select which parameters will be flagged with a calibration alarm…

```
Select Channels
 F1:Cond.        F2:pH
 F3:Temperature
```

    Press the relevant ⁽ᶠ¹⁾ to ⁽ᶠ⁵⁾ function key to select which parameter or parameters you would like to be flagged with a calibration alarm whenever calibration is due. Note the " * " which appears next to the relevant parameter(s).

    Pressing the function key repeatedly adds and removes the " * ".

4. Press (Menu) to exit and save the selection.

11.4.2 How the GLP Alarm Operates

On the day that calibration is due, the following message will be displayed the first time the **smart*CHEM*-CP** is switched on…

```
GLP Alarm, Calibrate
Cond/TDS,
pH, Temperature
```

Only those parameters that were selected (see section 11.4.1) will be displayed.

This message will not be displayed again until the next time calibration is due.

In addition to the message shown above, the **smart*CHEM*-CP** also flashes the decimal point of each parameter that requires calibration, and flashes the message "**Cal Now**" on the display.

11.4.3 Notes on the GLP Calibration Alarm function

1. To remove the "**Cal Now**" message and flashing decimal points, each selected parameter must be correctly calibrated.

2. Switching the GLP Calibration Alarm function off will not clear "**Cal Now**" message and flashing decimal points. The relevant parameters must be calibrated.

3. When Weekly, 2 Weekly or 4 Weekly periods have been selected, the GLP Calibration Alarm will always be activated on the same day of the week as when the function was first activated, even if the unit is not calibrated on that day. For example, if the GLP Calibration Alarm is triggered weekly on a Monday and the meter is finally calibrated the following Wednesday, the next GLP Calibration Alarm will still be on the following Monday.

11.5 Instrument Serial Number
In case the serial number that is fitted to the rear of the **smart*CHEM*-CP** is removed or becomes illegible, it is also available on the **smart*CHEM*-CP** display.

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

```
smartCHEM-CP V1.0r
S1234 © 2002 TPS P/L
Conductivity/TDS
pH/mV, Temperature
```

   The "**r**" after **V1.0** is shown when the Recorder Port option is fitted.

2. The serial number is displayed when recalling the GLP information (section 11.1).

3. The serial number is included on the print-out of GLP information (section 11.3).

4. The GLP information can be downloaded to a PC using the optional Windows® software (part number 130086).

11.6 Additional GLP Features
Another GLP requirement is to record the date and time of every reading. The **smart*CHEM*-CP** does this for you whenever readings are recorded either with the Manual Datalogging function (section 13.1) or the Automatic Logging function (section 13.2).

12. Access Code

The Access Code is system is provided for those users who need to ensure the integrity of recorded data, calibration settings and so forth. The Access Code function will prevent anyone who does not know the code from entering the menu system. Keys that are available during normal measurement, (Store), (Print), (AutoLog) and (F1) to (F5)) are still available without the Access Code. This means that others are still able to carry out day-to-day work.

12.1 Enabling the Access Code System

1. Select the Access Code menu ((Menu) → **F6:Access**).

2. Select **F3:Enable & Enter Code** from the menu.
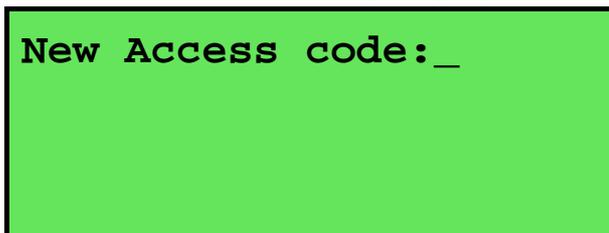
3. The **smart*CHEM*-CP** now prompts you to enter a new access code…
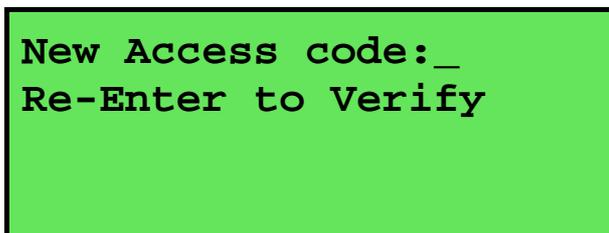
```
New Access code:_
```

Enter a new code of up to 4 digits using the numeric keypad.

If less than 4 digits are entered, press (Enter) to save the new code.

If 4 digits are entered, it is not necessary to press (Enter).

Press (Menu) to quit without enabling the Access Code system.

4. The **smart*CHEM*-CP** now prompts you to re-enter the access code for verification…

```
New Access code:_
Re-Enter to Verify
```

Re-enter the access code as per the previous step.

Press (Menu) to quit without enabling the Access Code system.

5. The **smart*CHEM*-CP** now confirms that the Access Code system is enabled before returning to the Access Code menu.

12.2 Using the Access Code System

When the Access Code system is enabled (as per section 12.1), the **smart*CHEM*-CP** prompts the operator to enter the access code whenever (Menu) is pressed in normal display mode. No further access code entry is required to access any of the menu functions. It is therefore imperative never to remain in any of the menus when leaving the unit. Always press (Menu) until the **smart*CHEM*-CP** is in normal display mode before leaving the unit.

For access codes with less than 4 digits, you must press (Enter) after entering the code.
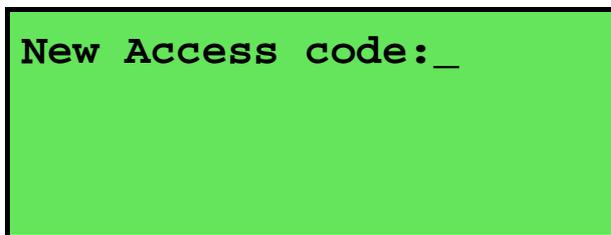
For access codes with 4 digits it is not necessary to press (Enter).

Notes

1. Do not store your Access Code on or near the unit.

2. If you forget the Access Code, please contact TPS. Once we have established your ownership of the unit, we will be able to give you an access code. We will need the serial number of the unit to provide this code.
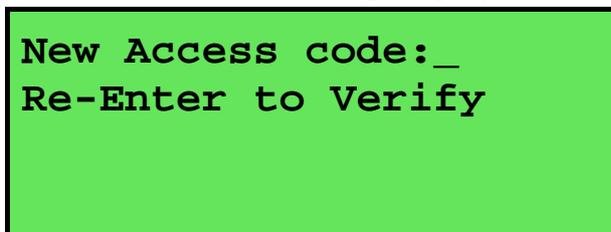
12.3 Changing the Access Code

1.   Select the Access Code menu ((Menu) → **F6:Access**).
     (Of course, you will need to enter the current access code after pressing (Menu).)

2.   Select **F1:Change Code** from the menu.

3.   The **smart*CHEM*-CP** now prompts you to enter a new access code…

> **New Access code:_**

Enter a new code of up to 4 digits using the numeric keypad.

If less than 4 digits are entered, press (Enter) to save the new code.

If 4 digits are entered, it is not necessary to press (Enter).

Press (Menu) to quit without changing the Access Code.

4.   The **smart*CHEM*-CP** now prompts you to re-enter the access code for verification…

> **New Access code:_**
> **Re-Enter to Verify**

Re-enter the access code as per the previous step.

Press (Menu) to quit without changing the Access Code.

5.   The **smart*CHEM*-CP** now confirms that the Access Code system is enabled before returning to the Access Code menu.

12.4 Disabling the Access Code System

1.   Select the Access Code menu ((Menu) → **F6:Access**).
     (Of course, you will need to enter the current access code after pressing (Menu).)

2.   Select **F3:Disable Security** from the menu.

3.   The **smart*CHEM*-CP** now confirms that Access Code system has been disabled before returning to the Access Code menu.

13. Datalogging

13.1 Manual Datalogging

To manually record readings into the Logger memory…

1. Press (Store) in normal display mode to record all parameters plus Date and Time into the Logger. This will be labelled as reading number 1. For example…

```
  2.76mS      25.0°C
  7.00pH   31/12/02
Log#1      Recorded
```

2. Repeat as often as required. The maximum number of readings that can be stored in the Logger is 2340.

Hint : Press (F5) before (Store) to make the **smart*CHEM*-CP** store the reading only when all the readings have stabilised. See section 9 for more details on the Auto Stability Function.

13.2 Automatic Datalogging

The **smart*CHEM*-CP** can automatically record readings into the Logger. First the logging period must be programmed, then automatic logging can be started and stopped as required.

1. Select the Logger menu ((Menu) → **F2:Logger**)

2. Select **F4:Program** from the menu.

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

```
Enter Logging/Print
Period: 0    secs
```
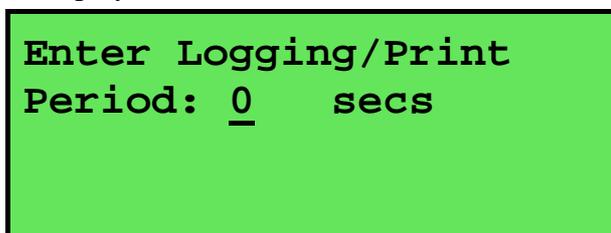
3. Use the Numeric Keypad to set the period at which the **smart*CHEM*-CP** will automatically log records into memory or to the RS232 port.

   Press (Enter) to save the Logging/Printing Period.

   Press (Menu) to quit without changing the current setting.

4. After pressing (Enter), the **smart*CHEM*-CP** will ask you to enter the units. The Logging/Printing Period you have set is also displayed. For example…

```
     Logging/Print
Period: 2
Select Units F1:Secs
F2:Mins, F3:Hours
```
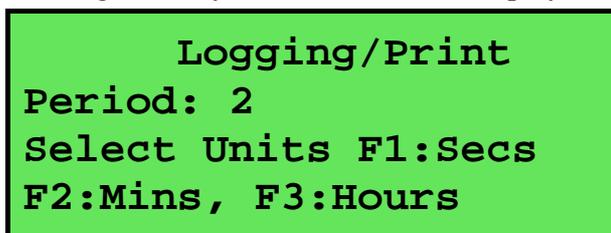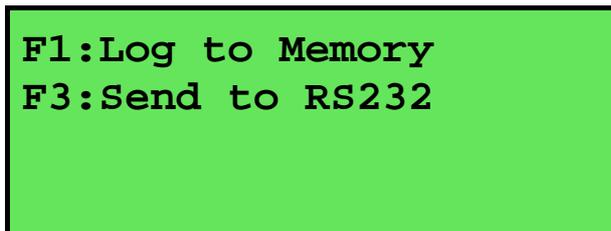
   Press (F1) to save the Logging/Printing Period as seconds.

   Press (F2) to save the Logging/Printing Period as minutes.

   Press (F3) to save the Logging/Printing Period as hours.

5. The **smart*CHEM*-CP** will ask if the records are to be logged into the instrument's memory, or sent directly to the RS232 port. The display will look like this…

```
F1:Log to Memory
F3:Send to RS232
```

Press $^{(F1)}$ to log records into the Logger (maximum of 2340 readings).

Press $^{(F3)}$ to send records directly to the RS232 port.

6. The automatic logging function is now programmed, and can be started and stopped as required.

7. To start automatic logging, press $^{(AutoLog)}$ in normal display mode.

When the **smart*CHEM*-CP** is logging into its own memory, the display will look like this…

```
2.76mS     25.0°C
7.00pH  31/12/02
Log#1       12:00:00
```

The log number will increment and the **smart*CHEM*-CP** will beep each time a reading is recorded.

If the **smart*CHEM*-CP** is sending records directly to the RS232 port, the display will look like this…

```
2.76mS     25.0°C
7.00pH  31/12/02
Sending     12:00:00
```

The **smart*CHEM*-CP** will beep each time a record is sent to the RS232 port.

8. Press $^{(AutoLog)}$ to stop automatic logging.

Hint : Press $^{(F5)}$ before starting automatic logging to make the **smart*CHEM*-CP** stop logging as soon as all the readings have become stable. See section 9 for more details on the Auto Stability Function.

Notes on Automatic Datalogging

1. The clock must be set before the **smart*CHEM*-CP** will allow automatic datalogging to start. The message "**Clock Not Set**" is displayed if the clock is not set. See section 16 for details on setting the clock.

2. Pressing ⬭Menu during automatic datalogging halts logging. Press ⬭AutoLog after returning to normal display mode to re-start automatic datalogging.
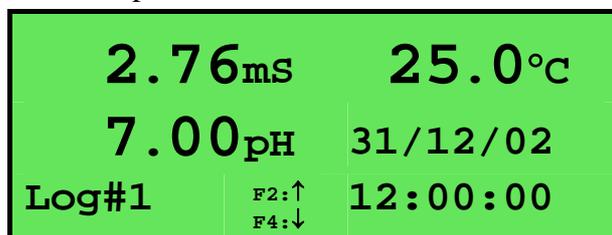
13.3 Recalling Readings from the Logger

To recall records from the Logger onto the **smart*CHEM*-CP** display…

1. Select the Logger menu (⬭Menu → **F2:Logger**)

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

    Record number 1 is now displayed.

    For example…

```
2.76mS     25.0°C
7.00pH  31/12/02
Log#1    F2:↑  12:00:00
         F4:↓
```

3. Press ⬭F2 and ⬭F4 to move forwards and backwards through the records.

    Press and hold ⬭F2 or ⬭F4 to scroll continuously through the readings. The rate is slow enough to allow the operator to see trends in the data as it is scrolling.

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

    Press ⬭F3 to send the displayed record to the RS232 port.

13.4 Erasing Records from the Logger

To erase records from the Logger…

1. Select the Erase Logger menu (⬭Menu → **F2:Logger** → **F2:Erase**)

2. The **smart*CHEM*-CP** now displays the Erase menu, for example…

```
Erase Logger,
2340 Readings
Select Option
Erase F1:All F2:Last
```
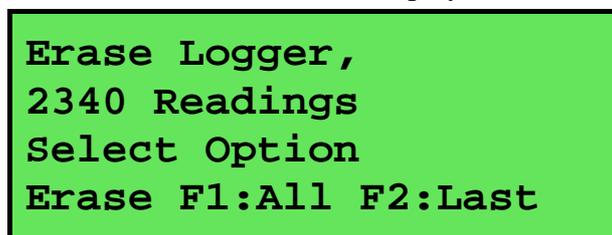
    The number of readings stored in the Logger is displayed. See the "**2340**" in the example above.

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.

13.5 Printing Records from the Logger to the RS232 Port

1. Connect one end of the RS232 cable to the **Power/RS232** socket of the **smart*CHEM*-CP**.

2. Connect the other end of the RS232 cable to an RS232 Printer, or to a Serial port of a PC.

3. Ensure that the baud rate for the printer or PC and the **smart*CHEM*-CP** are the same. If necessary, alter the baud rate of the **smart*CHEM*-CP** (see section 14.1).

    The **smart*CHEM*-CP** uses XON/XOFF protocol. Ensure that the printer is set accordingly.

4. Select the Logger menu. (Menu → **F2:Logger**).

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.

14. RS232 Port

14.1 Setting the Baud Rate

1. Select the Ports Set-up menu (Menu → **F4:Setup** → **F4:Ports**)

2. Select **F1:Baud Rate** from the menu. The available baud rates are listed, along with the RS232 port configuration…

```
 Baud Rate
 F1:1200  F2:9600
>F3:19200 F4:38400

8 bits, No Parity, 1 Stop bit, XON/XOFF
```

The arrow indicates the current selection.

3. Press F1 to select 1200 baud.

    Press F2 to select 9600 baud.

    Press F3 to select 19200 baud.

    Press F4 to select 38400 baud.

    Press Menu to quit and retain the current setting.

14.2 Sending Readings to the RS232 Port

Press Print to instantly send readings to the RS232 port whenever the **smart*CHEM*-CP** is in normal display mode.

Records can be sent directly to the RS232 port rather than stored in memory during automatic datalogging. See section 13.2 for details.

Press Print while recalling data on the display (see section 13.3) to send that record to the RS232 port.

14.3 RS232 Configuration

The **smart*CHEM*-CP** RS232 configuration is 8 Bits, No Parity, 1 Stop Bit, XON/XOFF Protocol.

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

14.4 Communication and Statistical Software

Communication between the **smart*CHEM*-CP** 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 **smart*CHEM*-CP** 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 14.8 and the "excel.txt" file in the folder where you installed the WinTPS program.

14.5 Commands

The following commands can be sent from a PC to the **smart*CHEM*-CP**. 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 **smart*CHEM*-CP**. The log number returned is set to Zero.
Request logged data	?R<cr>	Returns all logged records from the **smart*CHEM*-CP** memory. The data ends with the message **ENDS**<cr>
Erase logged data	?E<cr>	Erases all logged records from the **smart*CHEM*-CP** memory. Returns the message **ERASED**<cr> to confirm that the records have been erased.
Request status information	?S<cr>	Returns the model name, firmware version number, instrument serial number and number of logged readings in memory, for example… **smartCHEM-CP•V1.0•S1234•2340•%<cr>,** where • are spaces. Note that the number of logged readings is right-justified. The "**%**" is used internally by the WinTPS software.
Request GLP information	?G<cr>	Returns all calibration GLP information, plus the instrument model, serial number and current date (see section 14.7 for data format and hand-shaking).
Positions of Data Fields	?P<cr>	Returns the number of data fields, along with their position and length as follows… **6,1,10,12,8,21,4,26,7,37,8,49,5** 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.
Data Column Header	?H<cr>	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.

14.6 Data Format

Data is returned to the RS232 Port by the **smart*CHEM*-CP** in the following format.

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

`dd/mm/yyyy•hh:mm:ss•LLLL•CCCCCCCuuu•PPPPPPPPuuu•TTTTTuuu`

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 **smart*CHEM*-CP** sends a Zero for instant readings (see section 14.2).

`CCCCCCC`   is Conductivity or TDS data. 7 characters, right justified.

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

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

`PPPPPPPP`   is pH, mV or Relative mV data. 8 characters, right justified.

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

`pH•`	for pH readout.
`mV•`	for Absolute Millivolts readout.
`mVR`	for Relative Millivolts readout.

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

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

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

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

When the data is sent by the **smart*CHEM*-CP** using the Print function (section 13.5) or the Instant Send function (section 14.2), the data ends with a carriage return and a line feed.

14.7 GLP Data Format

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

For example…

```
smartCHEM-CP V1.0 S1234 @ 31/12/2002 15:00
Conductivity Zero=      0.01uS    @ 31/12/2002 12:20
Conductivity k=         1.01      @ 31/12/2002 12:30
TDS          Zero=      0.01ppM   @ 31/12/2002 12:40
TDS          k=         1.01      @ 31/12/2002 12:50
mV           Offset=      10mV    @ 31/12/2002 13:00
pH           Asy=       0.10pH    @ 31/12/2002 13:10
pH           SlopeA=    99.0%     @ 31/12/2002 13:20
pH           SlopeB=    99.0%     @ 31/12/2002 13:30
Temp. Probe  Offset=    -1.2oC    @ 31/12/2002 12:00
Cond. Temp.  Offset=     0.0oC    @ 31/12/2002 12:10
Ends
```

14.8 Importing Data into Microsoft Excel

The following procedure details the method for importing a **smart*CHEM*-CP** text data file into Microsoft® Excel®.

1. Start Microsoft® Excel® and select <u>F</u>ile → <u>O</u>pen

2. In the "Files of <u>t</u>ype:" 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 <u>w</u>idth", as per the sample screen below, then press "Next >".

    Note that the data column headers in row 1 appear only when the data is downloaded using the WinTPS software.
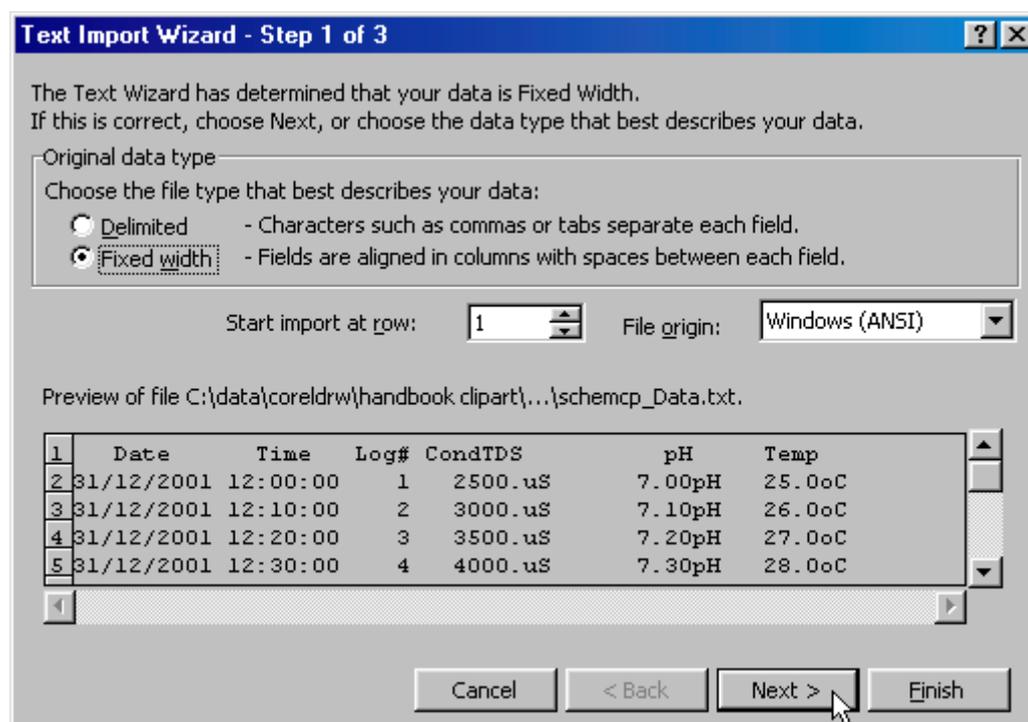

Continued over the page…

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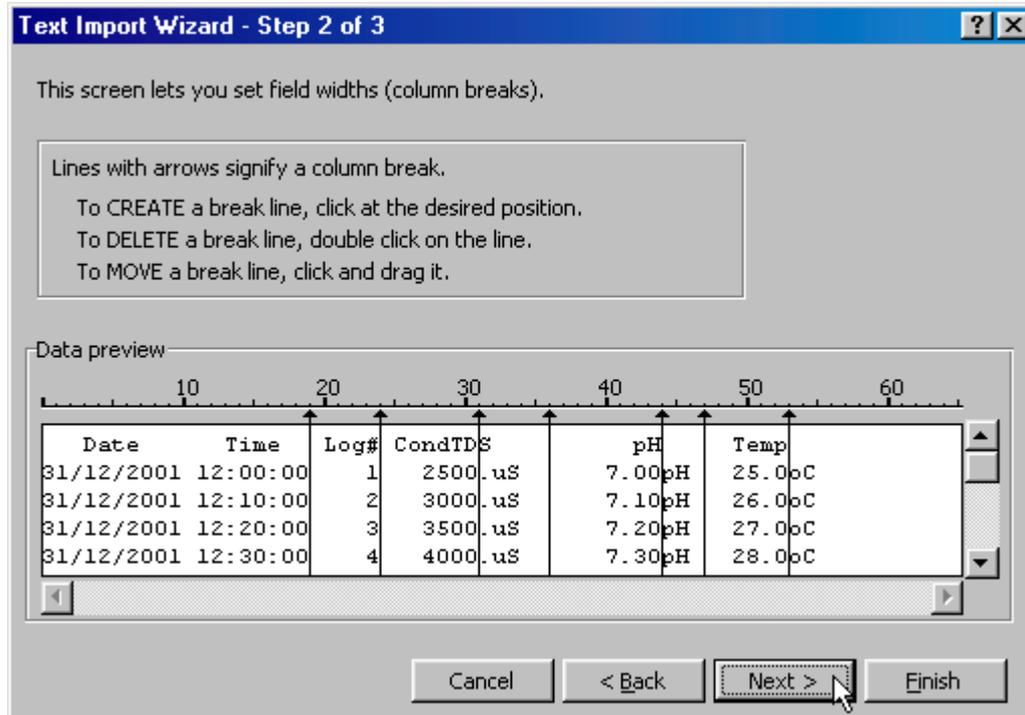
6. Simply press "Finish" at step 3 of the Text Import Wizard. TPS recommends that the data format for each column be set once the data is in spreadsheet format.

    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.

15. Recorder Port

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

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

15.1 Recorder Port Configuration

1. Select the Recorder set-up menu

    (Menu → **F4:Setup** → **F4:Ports** → **F3:Recorder**).

    The **smart*CHEM*-CP** will now display the Recorder Port configuration screen…

    ```
    RECORDER
     F1:Cond.        >F2:pH
     F3:Temperature
    ```
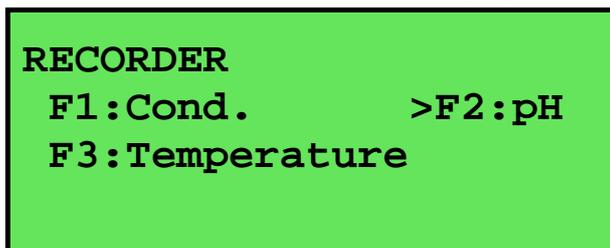
    The arrow indicates the current selection.

2. Press F1 to set the Recorder output to Conductivity or TDS data.

    Press F2 to set the Recorder output to pH or mV data.

    Press F3 to set the Recorder output to Temperature data.

    Press Menu to quit and retain the current setting.

15.2 Recorder Port Specifications

| Mode	Range	Output Range	Examples (Reading = mV Out)
Conductivity	0 to 3.000 µS/cm 0 to 30.00 µS/cm 0 to 300.0 µS/cm 0 to 3000 µS/cm 0 to 30.00 mS/cm 0 to 300.0 mS/cm	0 to 2000 mV for full scale of selected range.	0.000 µS/cm = 0 mV 2760 mS/cm = 1840 mV
TDS	0 to 2.000 ppM 0 to 20.00 ppM 0 to 200.0 ppM 0 to 2000 ppM 0 to 20.00 ppK 0 to 200.0 ppK	0 to 2000 mV for full scale of selected range.	0.00 ppM = 0 mV 1000 ppM = 1000 mV 36.0 ppK = 360 mV
pH	0 to 14.000 pH 0 to 14.00 pH	0 to 2000 mV (for all resolutions)	7.00 pH = 1000 mV
Absolute mV	–1500 to +1500 mV	0 to 2000 mV	0.0 mV = 1000 mV +750 mV = 1500 mV –600 mV = 600 mV
Relative mV	–1500 to +1500 mVR	0 to 2000 mV	0.0 mVR = 1000 mV +750 mVR = 1500 mV –600 mVR = 600 mV

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

Output Impedance : Approximately 1000 Ohms

Resolution : Approximately 2 mV

16. Setting the Clock

1. Select the Clock Set-up menu ((Menu) → **F4:Setup** → **F2:Clock**)

2. The display now shows the current time, for example…
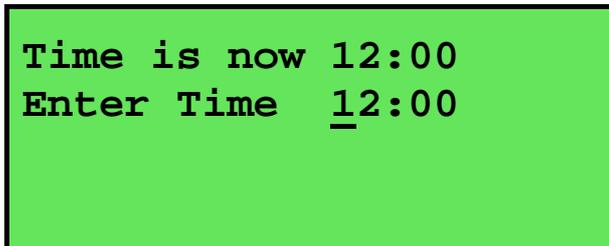
```
Time is now 12:00
Enter Time  12:00
```

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

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

4. If you pressed (Enter) above, the display will now show the current date, for example…

```
Date is now 31/12/02
Enter Date  31/12/02
            dd/mm/yy
```

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

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

Notes

1. The **smart*CHEM*-CP** tests that a valid day of the month is entered. If an invalid date is entered (eg. 31/02/2001), the **smart*CHEM*-CP** 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 **smart*CHEM*-CP** also tests for leap years.

17. Initialising the smart*CHEM*-CP

If the calibration settings of the **smart*CHEM*-CP** 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.

Initialising the unit will reset all user setups to their factory default values and erase all readings logged in memory. ***Ensure that any valuable data has been noted or downloaded and saved before proceeding.***

To initialise the **smart*CHEM*-CP**…

1. Select Initialise from the Setup menu ((Menu) → **F4:Setup** → **F5:Initialise**)

2. The **smart*CHEM*-CP** now asks if you are sure that you wish to initialise ALL parameters, or just the Slope B from a 3 point pH calibration. The latter is only offered when a 3 point pH calibration has actually been performed…

```
Initialise


F1:All    F2:pH SlopeB


```
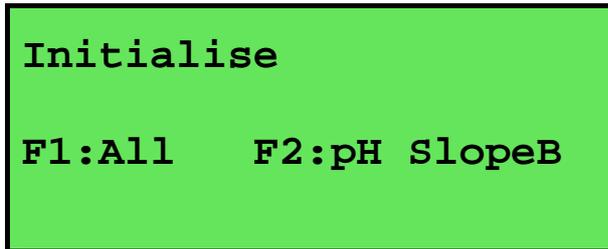
Press ⑨ to initialise ALL parameters, reset all factory default settings and clear the memory.

Press ⑩ to clear just the Slope B from a 3 point pH calibration.

3. When returning the meter to normal display mode, note that the decimal points have been replaced with a " * ", to indicate that each parameter requires re-calibration.

18. Instrument firmware version number

If you need to contact TPS for any further technical assistance, the version number of your **smart*CHEM*-CP** firmware may of benefit to us. The version number is displayed by the **smart*CHEM*-CP** at turn-on.

19. Troubleshooting

19.1 General Errors

Error Message	Possible Causes	Remedy
Factory Cal. Failure **Need Factory Service**	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service.
EEPROM Write Failure **Need Factory Service**	User calibration settings have been lost or corrupted.	Switch the meter OFF for 5 seconds and switch back ON. If the problem persists, return the unit to TPS for service.
Data Pointer Error **Logged Data Lost**	Data stored in memory has been lost or corrupted.	Switch the meter OFF for 5 seconds and switch back ON. If the problem persists, return the unit to TPS for service.

19.2 Conductivity / TDS Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new probe.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 17.
Unit attempts Span calibration instead of Zero calibration.	Sensor has Zero error.	Thoroughly rinse sensor in distilled water and allow to completely dry in air before attempting zero calibration. Clean the glass around the platinum plate area. DO NOT rub the black platinised surfaces.
Standard calibration fails, and k factor is greater than 25% *above* the nominal value.	1. Sensor is not immersed correctly. 2. Sensor may have a build-up of dirt or oily material on electrode plates. 3. Platinum-black coating has worn off. 4. Standard solution is inaccurate. 5. Sensor is faulty. 6. Faulty instrument.	Immerse sensor at least to the vent hole in the side of the sensor. Clean sensor as per the instructions detailed in section 20.1.1. Sensor requires replatinisation as per section 20.1.1. Alternatively, return to the factory for replatinisation. Replace standard solution. Return sensor to factory for repair or replacement. Return to factory for repair.
Standard calibration fails, and k factor is greater than 25% *below* the nominal value.	1. Standard solution is inaccurate. 2. Sensor may have a build-up of conductive material, such as salt. 3. Sensor is faulty. 4. Faulty instrument.	Replace standard solution. Clean sensor as per the instructions detailed in section 20.1.1. Return sensor to factory for repair or replacement. Return to factory for repair.
Inaccurate readings, even when calibration is successful.	1. Sensor may have a build-up of dirt or oily material on electrode plates. 2. Platinum-black coating has worn off.	Clean sensor as per the instructions detailed in section 20.1.1. Sensor requires replatinisation as per section 20.1.1. Alternatively, return to the factory for replatinisation.
Readings drift.	Sensor may have a build-up of dirt or oily material on electrode plates.	Clean sensor as per the instructions detailed in section 20.1.1.
Readings are low or near zero.	1. Sensor may have a build-up of dirt or oily material on electrode plates. 2. Sensor is not immersed correctly. 3. Sensor is faulty. 4. Faulty instrument.	Clean sensor as per the instructions detailed in section 20.1.1. Immerse sensor at least to the vent hole in the side of the sensor. Return sensor to factory for repair or replacement. Return to factory for repair.
Meter displays "**Probe**" instead of Conductivity/TDS data.	Meter was calibrated on a different k factor sensor than that which is connected.	Re-calibrate on the new k factor sensor.

Continued over the page…

Conductivity / TDS Troubleshooting, continued…

Meter displays "**No Probe**" when sensor is connected.	1. Sensor is faulty.	Return sensor to factory for repair or replacement.
	2. Faulty instrument.	Return to factory for repair.
Reading does not change in any sample being measured	Auto Stability Function has frozen display (notice the ✔).	Turn Auto Stability Function OFF or re-start sampling (see section 9).

19.3 pH and mV Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new probe.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 17.
1 Point calibration fails. (pH asymmetry is greater than ±1.00 pH, or mV offset is greater than ±60mV).	1. Reference junction blocked. 2. Reference electrolyte contaminated.	Clean reference junction as per instructions supplied with the pH or ORP electrode. Flush with distilled water and replace electrolyte.
2 Point calibration fails. (pH slope is less than 85.0%.) 3 Point pH calibration fails. (pH SlopeB is less than 85.0%).	1. pH Buffers not correctly set. 2. pH glass bulb not clean. 3. Electrode is aged. 4. Connector is damp. 5. pH Buffers are inaccurate.	For automatic pH buffer recognition, ensure that you are using buffers that match the selected buffer set (see section 5.2). Otherwise, ensure that the buffer value is entered correctly at pH calibration. Clean glass bulb as per instructions supplied with the electrode. Attempt rejuvenation as per instructions supplied with the electrode. If unsuccessful, replace electrode. Dry in a warm place. Replace buffers.
Unstable readings.	1. Reference Electrolyte chamber needs to be refilled. 2. Reference junction blocked. 3. pH glass bulb not clean. 4. Bubble in pH glass bulb. 5. Faulty connection to meter. 6. Reference junction not immersed. 7. KCl crystals around reference junction inside the electrolyte chamber.	Refill with saturated KCl filling solution. Clean reference junction as per instructions supplied with the electrode. Clean glass bulb as per instructions supplied with the electrode. Flick the electrode to remove bubble. Check connectors. Replace if necessary. Ensure that the reference junction is fully immersed. See diagrams in sections 5.4, 6.2 & 7.2. 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 0mV for all solutions.	Electrical short in connector.	1. Check connector. Replace if necessary. 2. Replace electrode.
Displays 4-5 pH for all solutions.	pH electrode glass bulb or internal stem cracked.	Replace pH electrode.
Reading does not change in any sample being measured	Auto Stability Function has frozen display (notice the ✔).	Turn Auto Stability Function OFF or re-start sampling (see section 9).

19.4 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Temperature inaccurate and cannot be calibrated.	1. Faulty connector. 2. Faulty Conductivity/TDS or Temperature sensor, whichever is being calibrated.	Check the connector and replace if necessary. Return Conductivity/TDS or Temperature sensor for repair, or replace sensor.
Displays flashing "^{o}M" when Temperature and/or Conductivity/TDS sensor plugged in.	1. Faulty instrument socket. 2. Faulty Conductivity/TDS or Temperature sensor, whichever is being calibrated.	Return the instrument to the TPS factory for service. Return Conductivity/TDS or Temperature sensor for repair, or replace sensor.
Reading does not change in any sample being measured	Auto Stability Function has frozen display (notice the ✔).	Turn Auto Stability Function OFF or re-start sampling (see section 9).

20. Appendices

20.1 Conductivity/TDS

20.1.1 Care, Cleaning and Maintenance of Conductivity Sensors

Care of Conductivity sensors

The conductivity section of the sensor supplied with your **smart*CHEM*-CP** consists of two platinum plates that are plated with a layer of "platinum-black". This is quite a soft layer and is required for stable, accurate measurements. In time, the platinum-black layer may wear off in some applications, at which time the sensor will require replatinising (see detail later in this section). You can help to maintain the platinum-black layer by following these simple rules:

1. **NEVER** touch or rub the electrode plates with your fingers, cloth etc.

2. Avoid using the sensor in solutions that contain a high concentration of suspended solids, such as sand or soil, which can abrade the electrode plates. Filter these types of solutions first if possible.

3. Avoid concentrated acids. If you must measure acids, remove the sensor immediately after taking the measurement and rinse well with distilled water.

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

Cleaning Conductivity of Sensors.

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

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

1. Rinsing in distilled water will remove most build-ups of material on the electrode plates.

2. Films of oils or fats on the electrode plates can usually be removed by rinsing the sensor in methylated spirits.

3. Stubborn contamination can be removed by soaking the sensor in a solution of 1 part Concentrated HCl and 10 parts distilled water. The sensor should not be soaked for more than approximately 5 minutes, otherwise the platinum-black layer may start to dissolve.

4. If all of these methods fail, then the last resort is to physically scrub the electrode plates, which will remove the contaminant and the layer of platinum-black. Use only a cloth or nylon scouring pad. DO NOT USE STEEL WOOL. The sensor will then need to be cleaned in HCl, as per step 3 and replatinised (see detail later in this section).

Replatinising Conductivity Sensors

There are several ways to replatinise Conductivity electrodes.

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

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

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

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

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

    (b) Rinse the electrode well in distilled water.

    (c) Immerse the electrode in platinising solution at least to the vent hole in the glass body. Platinising solution is available from TPS (part no 122300). Alternatively, platinising solution can be prepared by dissolving 1g of Hydrogen Chloroplatinate (H_2PtCl_{16}) in 30mL of distilled water, and including about 0.01g of Lead Acetate (($CH_3COO)_2Pb$) and a drop or two of concentrated HCl. **Caution : This is a dangerous solution and should be handled with the utmost care.**

    (d) Apply a direct current of 10mA between pins 1 and 7 of the electrode plug, as per the diagram below. Reverse the polarity every 30 seconds. After approximately 8 minutes (4 minutes per electrode plate), they should have an even "sooty" appearance. Avoid excess current as this will cause incorrect platinising.

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

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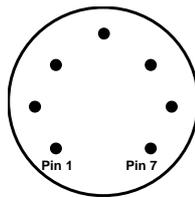
Sensor Connector

20.2 pH Electrode Fundamentals

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.

20.2.1 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.

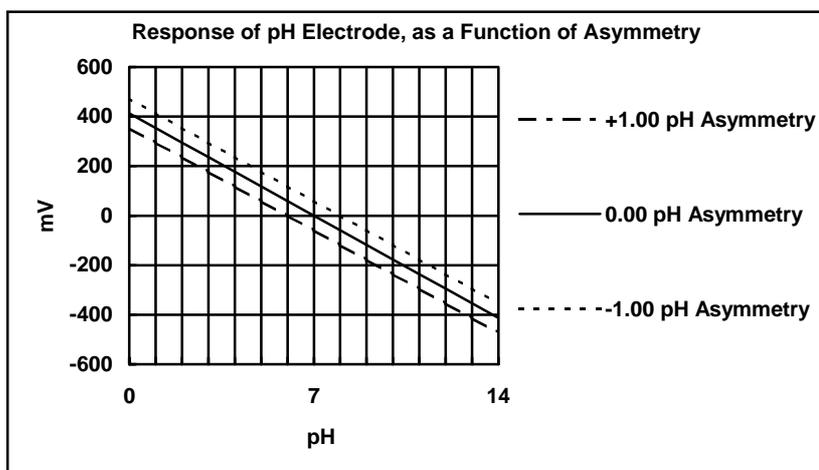Figure 20-1 illustrates how asymmetry is expressed for a pH electrode.

Figure 20-1

20.2.2 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".

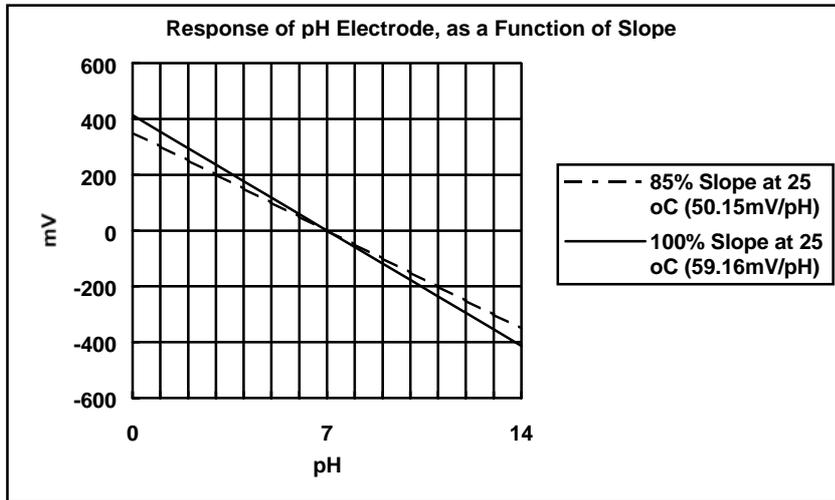Figure 20-2 illustrates the principle of pH electrode slope.

Figure 20-2

20.2.3 Temperature Compensation

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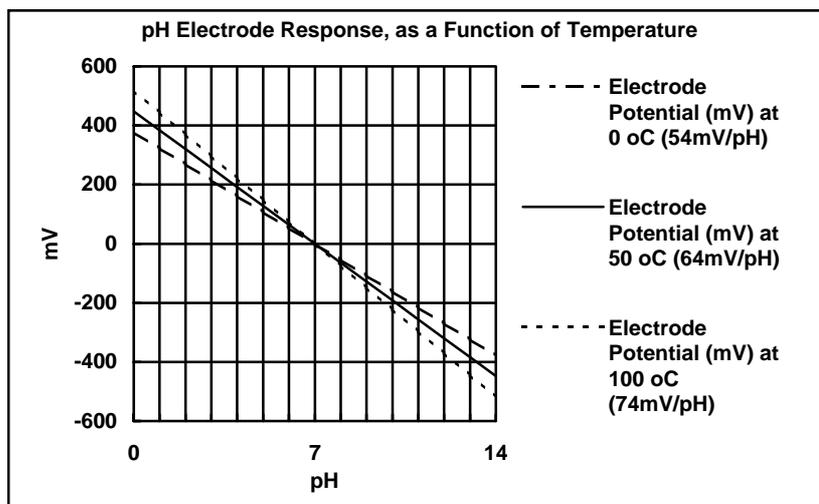
pH Electrode Response, as a Function of Temperature

— · — · — **Electrode Potential (mV) at 0 oC (54mV/pH)**

———— **Electrode Potential (mV) at 50 oC (64mV/pH)**

· · · · · · **Electrode Potential (mV) at 100 oC (74mV/pH)**

Figure 20-3

20.2.4 Polarisation Output

The **Accessories** connector on the rear panel of the **smart*CHEM*-CP** contains a polarisation output 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 122209) has two connectors. The bayonet type BNC connector fits to the **pH/mV/Ion** BNC socket and the black plastic connector fits to the **Accessories** socket.

When performing Karl Fischer titrations, ensure that the **smart*CHEM*-CP** is in mV mode.

20.2.5 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 **smart*CHEM*-CP**, as per section 5.4.

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 **smart*CHEM*-CP** and repeat the test.

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

20.2.6 Determining if an instrument or electrode is faulty

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

1. Initialise the **smart*CHEM*-CP** (see section 17).

2. Disconnect the pH, Redox or Ion electrode from the **pH/mV/Ion** BNC socket.

3. Connect the centre pin of the **pH/mV/Ion** BNC socket 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 **smart*CHEM*-CP** is operating correctly, the reading should be totally stable with the wire firmly in place. If not, the meter requires servicing.

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

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

21. Warranty

TPS Pty. Ltd. guarantees all instruments and electrodes to be free from defects in material and workmanship when subjected to normal use and service. This guarantee is expressly limited to the servicing and/or adjustment of an instrument returned to the Factory, or Authorised Service Centre, 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.

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.