

Congratulations !

The **90-C** is a precision portable Conductivity, TDS and Temperature logger.

Despite its impressive list of features, the **90-C** 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 **90-C**. It also contains a full listing of all of the items that you should have received with unit. Please take the time to read this section, as it explains some of items that are mentioned in subsequent sections.

3. Main Section

The main section of the handbook provides complete details of the **90-C**, including operating modes, calibration, troubleshooting, specifications, and warranty terms.

4. Appendices

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

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

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

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

E-mail : tps@tps.com.au

Web Site : www.tps.com.au

90-C
Conductivity, TDS,
Temperature Logger

Date : 20-Mar-2008

Version : 6.03

Contents

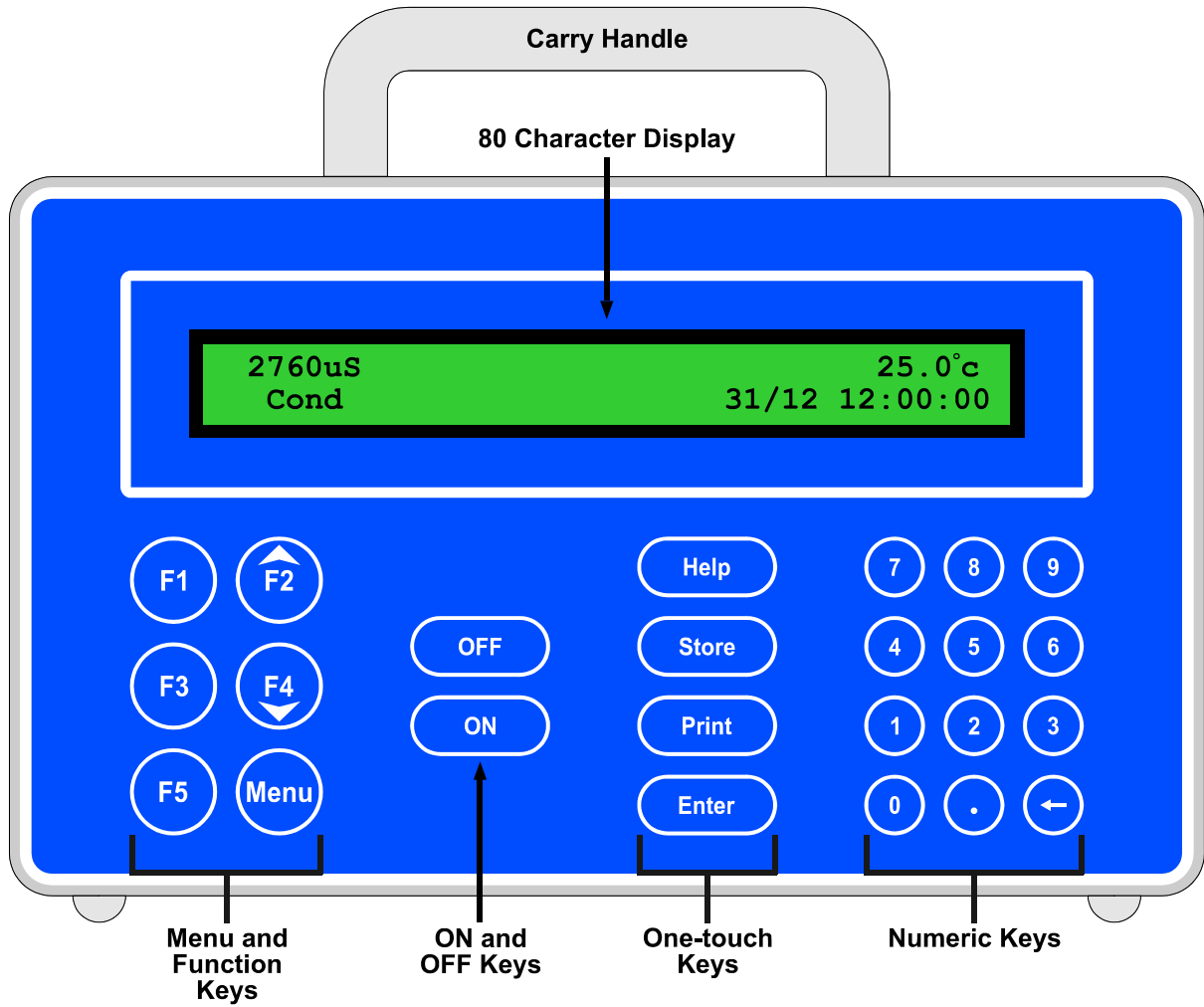
1

1. Introduction	4
1.1 90-C Display and Controls.....	4
1.2 90-C Rear Panel Connectors	4
1.3 Menu and Function Keys	5
1.4 One-touch Keys.....	5
1.5 Numeric Keys	5
1.6 Enter Key	5
1.7 Delete Key.....	5
1.8 ON and OFF Keys	5
1.9 80 Character Display.....	5
1.10 Unpacking Information	6
1.11 Specifications	7
2. 90-C Menu Structure	10
3. Conductivity Mode	11
3.1 Selecting Conductivity Mode.....	11
3.2 Setting the Conductivity calibration standard	11
3.3 Setting the Conductivity sensor k factor	12
3.4 Conductivity Calibration.....	13
3.5 Conductivity Calibration Notes.....	14
3.6 Conductivity Calibration Messages	14
4. TDS Mode	15
4.1 Selecting TDS Mode	15
4.2 Setting the TDS calibration standard	15
4.3 Setting the TDS sensor k factor	16
4.4 TDS Calibration	17
4.5 TDS Calibration Notes.....	18
4.6 TDS Calibration Messages.....	18
5. Temperature Mode	19
5.1 Temperature Calibration	19
5.2 Temperature Calibration Notes	20
5.3 Calibration Messages	20
6. Good Laboratory Practices (GLP)	21
6.1 To recall GLP information on the display.....	21
6.2 Failed Calibration.....	22
6.3 Printing GLP Information to the RS232 Port.....	22
6.4 Instrument Serial Number	23
6.5 Additional GLP Features.....	23
7. Datalogging	24
7.1 Setting the A & B Data Input Function.....	24
7.2 Manually Recording Readings into the Logger	24
7.3 Automatic Datalogging	27
7.4 Recalling Readings from the Logger	31
7.5 Erasing Records from the Logger	32
7.6 Printing Records from the Logger to the RS232 Port	32
8. RS232 Port	33
8.1 Setting the Baud Rate.....	33
8.2 Sending Readings to the RS232 Port	33
8.3 RS232 Configuration	33
8.4 Communication and Statistical Software	33
8.5 Commands	33
8.6 Data Format.....	35

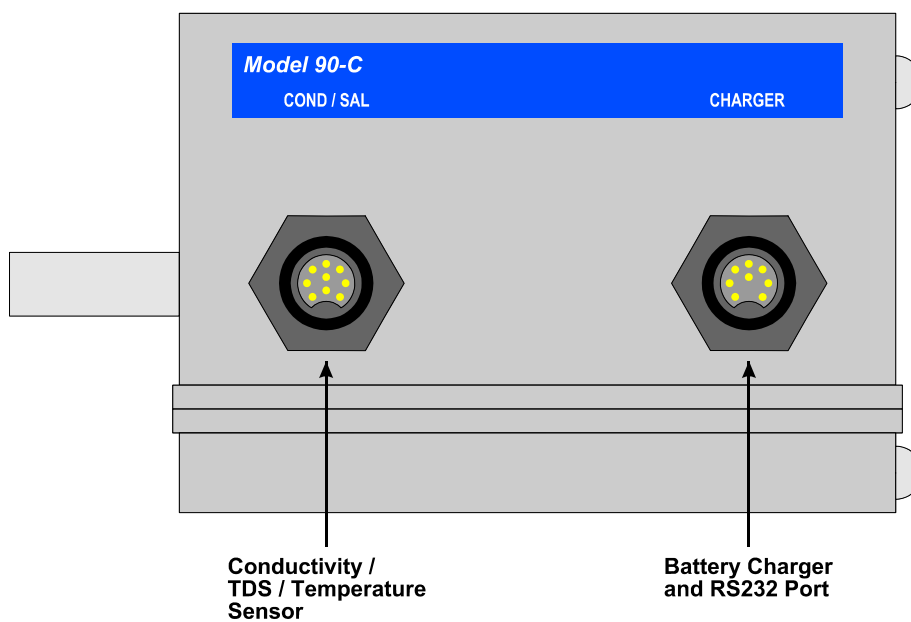
8.7	GLP Data Format	36
8.8	Importing Data into Microsoft Excel	36
9.	Setting the Clock.....	38
10.	Initialising the 90-C.....	39
11.	Instrument firmware version number	39
12.	Battery Saver Function	40
13.	Moisture Protection	41
13.1	Silica Gel Pack	41
13.2	Corrosion Inhibitor Tab	41
14.	Troubleshooting	42
14.1	General Errors	42
14.2	Conductivity / TDS Troubleshooting.....	43
14.3	Temperature Troubleshooting.....	44
15.	Appendices	45
15.1	Care, Cleaning and Maintenance of Conductivity Sensors.....	45
16.	Warranty	47

1. Introduction

1.1 90-C Display and Controls



1.2 90-C Rear Panel Connectors



1.3 Menu and Function Keys

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

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

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

1.4 One-touch Keys

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

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

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

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

1.5 Numeric Keys

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

1.6 Enter Key

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

1.7 Delete Key

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

1.8 **ON** and **OFF** Keys

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

1.9 80 Character Display

80 character alphanumeric display with user-friendly menu and context-sensitive help system. Shows Conductivity/TDS, Temperature, Date and Time simultaneously.

1.10 Unpacking Information

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

Part No

Standard Kit...

1. **90-C** Conductivity, TDS, Temperature Logger 122145
2. 2.76 mS/cm Conductivity Standard, 1 Litre 122305
3. 36.0ppK Salinity Standard, 1 Litre (for k=10)..... 122304
or 2.0 ppK TDS Standard, 1 Litre (for k=1.0)..... 122307
4. Plug-Pack Power Supply..... 130009
5. **90-C** Handbook..... 130050

Plastic body field sensors...

1. k=10/ATC/Temp Conductivity Sensor, 5m..... 122218
2. k=1/ATC/Temp Conductivity Sensor, 5m..... 122196
3. k=0.1/ATC/Temp Conductivity Sensor, 5m..... 112220/90

Glass body lab sensors...

1. k=10/ATC/Temp Conductivity Sensor, 1m 122212/90
2. k=1/ATC/Temp Conductivity Sensor, 1m 122217
3. k=0.1/ATC/Temp Conductivity Sensor, 1m 122229/90

Options...

1. Extended cable for sensors (order by the metre) 130040
2. RS232 Serial Interface Cable..... 130015
3. Communication software for Windows 3.1, 130086
95, 98 and NT
4. Solar Panel 130012
5. Clip lead for external 12V DC battery 130013
6. Hard Carry case for meter and accessories 130058

Spares...

1. 7.2V NiCad Battery Pack..... 130027
2. Senson[®] Vapaguard[™] Tab corrosion inhibitor NRP2

1.11 Specifications

1.11.1 Conductivity

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

Sensor TypeRyton[®] plastic body with two platinised platinum plates with in-built ATC.

Temperature CompensationAutomatic, 0 to 100 °C
(standard Conductivity sensor is limited to 60 °C)

Calibration.....Automatic zero and span calibration

Sensor Span Range±25% of nominal k factor

1.11.2 TDS

Ranges	Resolution	Accuracy	
<i>k=0.1 Sensor</i>			
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	
<i>k=1.0 Sensor</i>			
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
<i>k=10 Sensor</i>			
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 TypeRyton® plastic body with two platinised platinum plates with in-built ATC.

Temperature CompensationAutomatic, 0 to 100 °C
(standard Conductivity sensor is limited to 60 °C)

Calibration.....Automatic zero and span calibration.

Sensor Span Range±25% of nominal k factor.

1.11.3 Temperature

Range	Resolution	Accuracy
-30.0 to 110.0 °C	0.1 °C	±0.2 °C
Note : When using Conductivity/TDS sensor for Temperature readout, sensor is limited to 60 °C.		

Sensor TypeSilicon transistor built into tip of Conductivity/TDS sensor, or separate Temperature sensor if Conductivity / TDS sensor is not in use.

Calibration.....Automatic offset and span calibration

Sensor Offset Range.....-15.0 to 15.0 °C

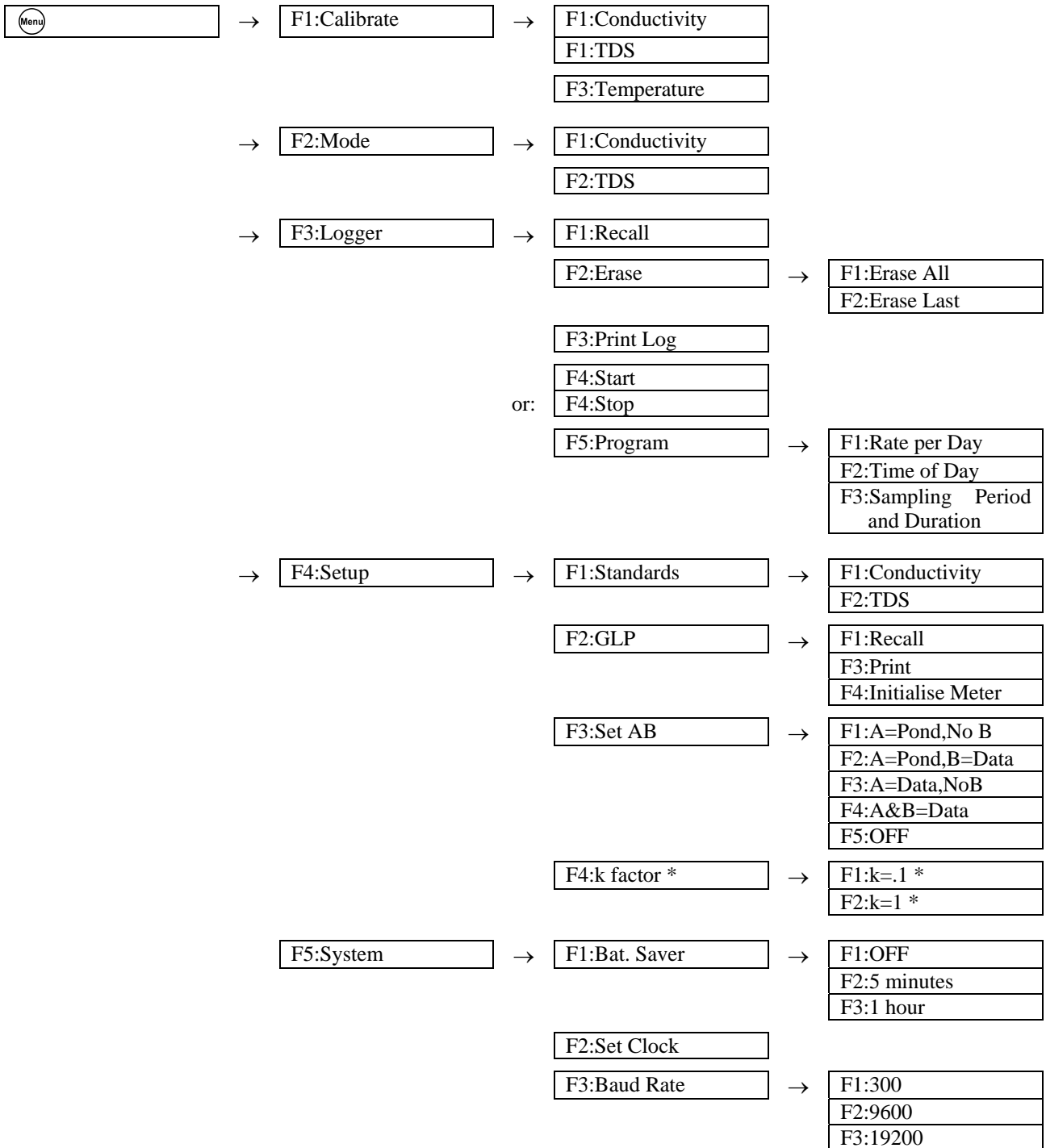
Sensor Span Range93 to 107 %

1.11.4 General Specifications

Memory	9990 readings including date and time with A&B function disabled. 8120 readings including date and time with A&B function enabled.
Automatic Logging	<p>Rate per Day 1 to 288 readings per day.</p> <p>Time of Day 1 to 12 discrete times of the day, in 24 hour format.</p> <p>Sampling Period and Duration One reading every 1 to 300 seconds for a duration of 1 to 720 minutes or continuous.</p>
RS232 Port	300, 9600 & 19200 baud. 8 bits, no parity, 1 stop bit, XON/XOFF Protocol.
Clock	Calendar clock displays date, month, hours, minutes & seconds. Year is Y2K compliant and is attached to all stored data.
Good Laboratory Practices	Date, time and results of last calibration for Conductivity, TDS and Temperature are stored. This information can be recalled or sent to the RS232 port at any time.
Power	7.2V, 1300mAH NiCad battery built in. Battery charger for country of destination is included. Solar panel and external battery clip lead optionally available.
Battery Saver	Auto switch-off after 5 minutes or 1 hour. Battery saver can be switched off to allow continuous use.
Dimensions	230 x 140 x 100 mm
Mass	Instrument only : Approx. 1.5 kg Full Kit : Approx. 5.0 kg
Environment	Temperature : 0 to 45 °C Humidity : 0 to 90 % R.H.

2. 90-C Menu Structure

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



* This function not available when a TPS k=10 sensor is connected.

3. Conductivity Mode

3.1 Selecting Conductivity Mode

1. Select Conductivity Mode (Menu) → **F2:Mode** → **F1:Conductivity**).
2. The **90-C** 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 (Menu) key to make any corrections.
3. Press (Menu) to save the value of the standard solution.
Alternatively, press (Menu) to quit without changing the current setting.
4. The **90-C** 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 $\mu\text{S/cm}$.

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

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

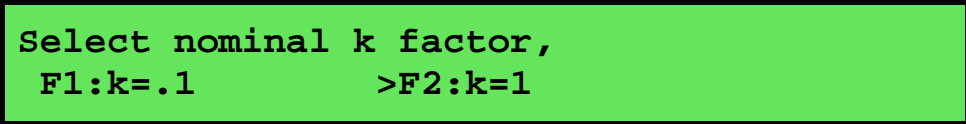
3.3 Setting the Conductivity sensor k factor

The **90-C** automatically recognises a k=10 sensor. If a k=10 sensor is being used, go directly to section 3.4.

The **90-C** **does not** automatically recognise k=0.1 or k=1 sensors. When a k=0.1 or k=1 sensor is used, the **90-C** must be set to the correct k factor before use.

To select a k=0.1 or k=1 sensor...

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



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

The arrow indicates the current selection.

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

Press (F2) if a k=1 sensor is being used.

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

Notes

1. The manual k factor selection is kept in memory when the meter is switched off.
2. The manual k factor selection is reset to k=1 during initialisation.
3. The **90-C** will always automatically recognise a k=10 sensor, regardless of the manual k factor selection.
4. Calibration settings for k=0.1, k=1 and k=10 sensors are NOT stored separately.
The **90-C** requires re-calibration when a new k factor sensor is connected.

3.4 Conductivity Calibration

Before attempting a Conductivity calibration, ensure that the **90-C** has been set up correctly according to sections 3.1 to 3.3.

1. Plug the Conductivity sensor into the **Cond/Sal** 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 WIRES.**

Zero Calibration

3. Let the sensor dry in air.
4. Select Conductivity Calibration (Menu → **F1:Calibrate** → **F1:Conductivity**).
5. The **90-C** will recognise the low conductivity signal and attempt a Zero calibration. For example...

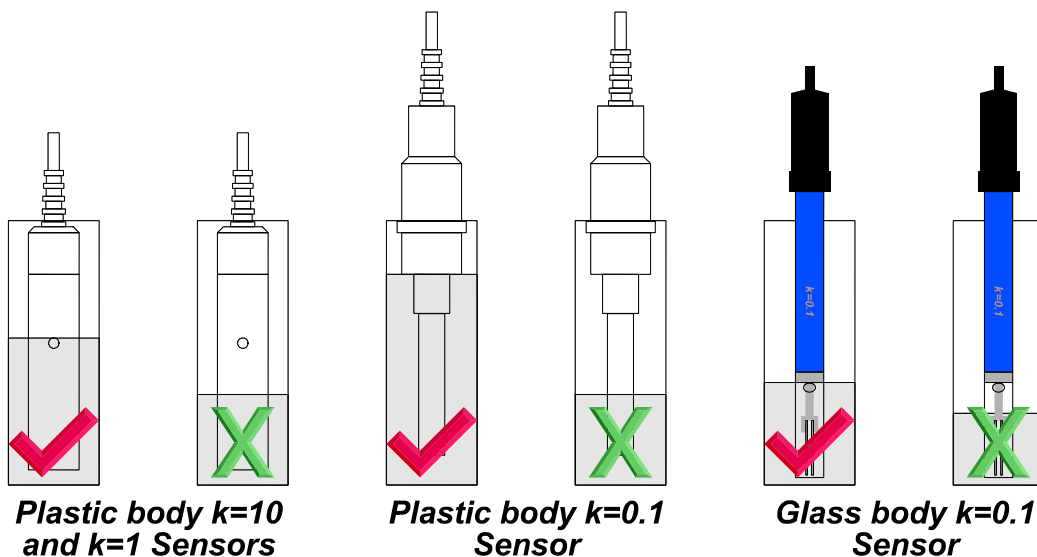
0*01uS	25.0°C
Cond. ZERO	Calibration, Press Enter

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

Standard Calibration

7. Place the Conductivity sensor into a sample of Conductivity standard. Ensure that it is immersed correctly, as per the diagram below.

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



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

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

9. When the reading has stabilised, press **Enter** to calibrate. The “*” will now be replaced by a decimal point if calibration was successful.
10. The **90-C** is now calibrated for Conductivity and is ready for use in this mode.

Ensure that the sensor is immersed at least as deeply as per the diagram in step 7 for all sample measurements.

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 **90-C** has been correctly calibrated for the mode in which it will be used. The **90-C** 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 **90-C** is switched off. This information can be recalled or printed later using the GLP function (see section 6).
5. The **90-C** 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 and k=10 sensors are NOT stored separately.
The **90-C** 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 **90-C** will display the following message...

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

2. If a Standard Calibration has been successfully performed, the **90-C** will display the following message and the calculated k factor of the sensor. For example...

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

3. If a Standard Calibration has failed, the **90-C** will display the following message and the calculated k factor of the sensor. For example...

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

Notes

1. The allowable k factor range is +/-25% of nominal. This range is ample to allow for correctly functioning Conductivity sensors. If calibration fails due to the k factor being outside these limits, then please consult the Troubleshooting guide (section 14.2) for possible remedies.

4. TDS Mode

4.1 Selecting TDS Mode

1. Select TDS Mode (Menu → **F2:Mode** → **F2:TDS**).
2. The **90-C** 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 36.00 ppK. If this is satisfactory, go directly to section 4.3.

1. Select the TDS Standard entry

(Menu) → **F4:Setup** → **F1:Standards** → **F2:TDS**).

The following screen is now displayed...

```
TDS Standard:36.00ppK
Range 20 ppm to 500 ppK
```

2. Type in the value of the TDS standard that is to be used for calibration, including the decimal point. Use the ← key to make any corrections.
3. Press (Enter) to save the value of the standard solution.
Alternatively, press (Menu) to quit without changing the current setting.
4. The **90-C** will now ask you to enter the units for the TDS standard...

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

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

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

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

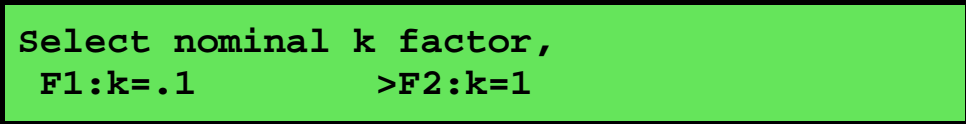
4.3 Setting the TDS sensor k factor

The **90-C** automatically recognises a k=10 sensor. If a k=10 sensor is being used, go directly to section 4.4.

The **90-C** **does not** automatically recognise k=0.1 or k=1 sensors. When a k=0.1 or k=1 sensor is used, the **90-C** must be set to the correct k factor before use.

To select a k=0.1 or k=1 sensor...

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



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

The arrow indicates the current selection.

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

Press (F2) if a k=1 sensor is being used.

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

Notes

1. The manual k factor selection is kept in memory when the meter is switched off.
2. The manual k factor selection is reset to k=1 during initialisation.
3. The **90-C** will always automatically recognise a k=10 sensor, regardless of the manual k factor selection.
4. Calibration settings for k=0.1, k=1 and k=10 sensors are NOT stored separately.
The **90-C** requires re-calibration when a new k factor sensor is connected.

4.4 TDS Calibration

Before attempting a TDS calibration, ensure that the **90-C** has been set up correctly according to sections 4.1 to 4.3.

1. Plug the TDS sensor into the **Cond/Sal** 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 **90-C** will recognise the low TDS signal and attempt a Zero calibration. For example...

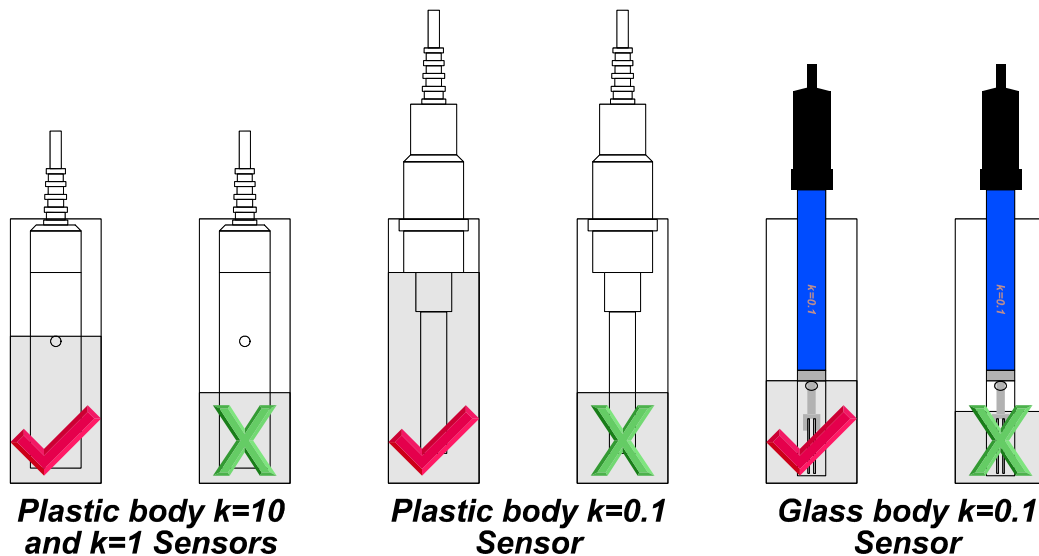
0*01ppM	25.0°C
TDS ZERO	Calibration, Press Enter

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

Standard Calibration

7. Place the TDS sensor into a sample of TDS standard. Ensure that it is immersed correctly, as per the diagram below.

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



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

36*10ppK	25.0°C
TDS 36.00ppK	Calibration, Press Enter

9. When the reading has stabilised, press (Enter) to calibrate. The “*” will now be replaced by a decimal point if calibration was successful.
10. The **90-C** is now calibrated for TDS and is ready for use in this mode.

Ensure that the sensor is immersed at least as deeply as per the diagram in step 7 for all sample measurements.

4.5 TDS Calibration Notes

1. A Zero calibration should be performed at least monthly. In low TDS applications (where a zero error is particularly significant), a zero calibration may have to be done weekly.
2. A Standard calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.
3. Conductivity and TDS calibration data is stored separately in memory. Ensure that the **90-C** has been correctly calibrated for the mode in which it will be used. The **90-C** 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 **90-C** is switched off. This information can be recalled or printed later using the GLP function (see section 6).
5. The **90-C** 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 and k=10 sensors are NOT stored separately.
The **90-C** 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 **90-C** will display the following message...

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

2. If a Standard Calibration has been successfully performed, the **90-C** will display the following message and the calculated k factor of the sensor. For example...

```
36.00ppK                25.0°C
Calibration OK, k=9.90
```

3. If a Standard Calibration has failed, the **90-C** will display the following message and the calculated k factor of the sensor. For example...

```
Calibrate Failure. Check STD=36.00ppK
k=15.0, 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, then please consult the Troubleshooting guide (section 14.2) for possible remedies.

5. Temperature Mode

There are two Temperature sensors built into the tip of the Conductivity/TDS sensor. The first is used for Automatic Temperature Compensation for Conductivity/TDS readings. The second is used for Temperature readout. It is therefore not necessary to calibrate Temperature before taking Conductivity/TDS measurements.

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

5.1 Temperature Calibration

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

The Temperature Calibration screen is now displayed...


```

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

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

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


6. Press the  key to calibrate the temperature readout.

Alternatively, press the  key to abort temperature calibration.

The **90-C** is now 1 point temperature calibrated. This will provide precision to approximately ± 0.5 °C. The following screen is displayed...

```

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

Press  if ± 0.5 °C is adequate for your application. The **90-C** will now return to normal measurement mode and the “ * ” in the Temperature readout will have been replaced by a decimal point.

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

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

```

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

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

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

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

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

- Press the **Enter** key to calibrate the temperature readout.

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

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

The full ± 0.2 °C accuracy specification will apply after a successful 2 point calibration.

5.2 Temperature Calibration Notes

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

5.3 Calibration Messages

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

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

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

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

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

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

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

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

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

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

6. Good Laboratory Practices (GLP)

The **90-C** keeps a record of the date and time of the last calibrations for Conductivity, TDS and Temperature as part of GLP guidelines.

6.1 To recall GLP information on the display

1. Switch the meter on.
2. Select the GLP menu (Menu → **F4:Setup** → **F2:GLP**).
3. Select **F1:Recall** from the menu.
4. The instrument model, firmware version number, and instrument serial number are displayed, along with a prompt describing how to scroll through the GLP information.

```
90C V6.0 S1234 @ 31/12/00 12:00
F4:Next
```

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

GLP Display sequence...

```
90C V6.0 S1234 @ 31/12/00 12:00
F4:Next
```

↑ **F2** ↓ **F4**

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

↑ **F2** ↓ **F4**

```
Cond. k=10.1 31/12/00 12:10
Cond Calibrated F2:Back F4:Next
```

↑ **F2** ↓ **F4**

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

↑ **F2** ↓ **F4**

```
TDS k=10.1 31/12/00 12:20
TDS Calibrated F2:Back F4:Next
```

↑ **F2** ↓ **F4**

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

↑ **F2** ↓ **F4**

```
Temperature Span=100.0% 31/12/00 12:40
Temp Probe Calibrated F2:Back F4:Ends
```

6.2 Failed Calibration

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

Cond. k=3.64	00/00/00 00:00
Cond. Un-Calibrated	F2:Back F4:Next

6.3 Printing GLP Information to the RS232 Port

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

1. Switch the meter on.
2. Connect one end of the RS232 cable to the **Charger** socket of the **90-C**. The battery charger, optional battery adaptor, or optional solar panel may be connected to the in-line socket on the RS232 cable, if required.
3. Connect the other end of the RS232 cable to an RS232 Printer, or to the COM1 or COM2 ports of a PC.
4. Send the GLP information to the RS232 port:

 → **F4:Setup** → **F2:GLP** → **F3:Print** (or )

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

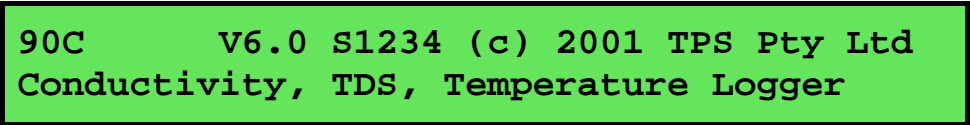
5. The GLP information is sent to the RS232 port in formatted ASCII text. For example...

```
90C V6.0 S1234 @ 31/12/2000 12:00
Conductivity Zero=      0.01uS      @ 31/12/2000 12:00
Conductivity k=         1.01        @ 31/12/2000 12:10
TDS                    Zero=      0.01ppM    @ 31/12/2000 12:00
TDS                    k=         1.01        @ 31/12/2000 12:20
Temperature Offset=    1.0oC      @ 31/12/2000 12:30
Temperature Span=     100.0%     @ 31/12/2000 12:40
Ends
```

6.4 Instrument Serial Number

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

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



90C V6.0 S1234 (c) 2001 TPS Pty Ltd
Conductivity, TDS, Temperature Logger

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

6.5 Additional GLP Features

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

7. Datalogging

7.1 Setting the A & B Data Input Function

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

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

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

To set the A & B Data Input function...

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

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

The arrow indicates the current selection.

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

7.2 Manually Recording Readings into the Logger

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

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

```
2.76mS                25.0°C
Log#1,   <Enter>      31/12 12:00:00
```

2. Press (Enter) to record all parameters plus Date and Time into the Logger memory. This will be labelled as reading number 1.
 Alternatively, press (Menu) to quit without recording the reading.
3. Repeat steps 1 & 2 as often as required. The maximum number of readings that can be stored in the Logger with the A & B Data Input function switched OFF is 9990.

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

1. Press **(Store)** in normal display mode. The display should now look like this...

2.76mS	25.0°C
Log#1, Pond# <u>1</u>	31/12 12:00:00

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

Alternatively, press **(Menu)** to quit without recording the reading.

3. Repeat steps 1 & 2 as often as required.

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

The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 8120.

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

1. Press **(Store)** in normal display mode. The display should now look like this...

2.76mS	25.0°C
Log#1, Pond# <u>1</u>	31/12 12:00:00

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

Alternatively, press **(Menu)** to quit without recording the reading.

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

Data Recorded, Now Input B or Press Menu
Enter Data B: <u>0</u>

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

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

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

The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 8120.

7.2.4 When A is set to Data with no B data

1. Press **(Store)** in normal display mode. The display should now look like this...

```

  2.76mS                25.0°C
Log#1,   <Enter>      31/12 12:00:00

```

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

Alternatively, press **(Menu)** to quit without recording the reading.

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

```

Enter Data A:0
Data Recorded, Now Input A or Press Menu

```

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

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

The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 8120.

7.2.5 When A and B are both set to Data

1. Press **(F1)** in normal display mode. The display should now look like this...

```

  2.76mS                25.0°C
Log#1,   <Enter>      31/12 12:00:00

```

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

Alternatively, press **(Menu)** to quit without recording the reading.

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

```

Enter Data A:0
Data Recorded, Now Input A or Press Menu

```

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

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

```

Enter Data A:1234
Enter Data B:0

```

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

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

The maximum number of readings that can be stored in the Logger with this A & B Data Input setting is 8120.

7.3 Automatic Datalogging

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

1. Rate Per Day
 - Logs from 1 to 288 readings per day, evenly spaced throughout each 24 hour period.
 - Unit is dormant between readings and “wakes up” when a reading is due.
 - Unit continues to log until automatic datalogging is disabled, or until the memory is full.
2. Time of Day
 - Logs at up to 12 discrete times of the day, which can be unevenly spaced throughout each 24 hour period.
 - Unit is dormant between readings and “wakes up” when a reading is due.
 - Unit continues to log until automatic datalogging is disabled, or until the memory is full.
3. Sampling Period and Duration
 - Logs a reading every 1 to 300 seconds for a duration of 1 to 720 minutes.
 - Duration can be set to log continuously until the memory is full.
 - Unit is turned on continuously in this logging mode.

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

7.3.1 Rate per Day Datalogging

Programming Rate per Day Datalogging

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

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

Number of Readings per Day : 24

3. Use the Numeric Keypad to set the number of readings per day which the **90-C** will automatically log into memory. This can be set from 1 to 288 (ie. 1 reading every 24 hours to 1 reading every 5 minutes).
Press (Enter) to save the Rate per Day.
Press (Menu) to quit without changing the current setting.
4. The Rate per Day datalogging is now programmed, and can be started and stopped as required.

Notes

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

Starting and Stopping Rate per Day Datalogging

Starting Rate per Day datalogging is a two step process...

1. Select the Logger menu (Menu) → **F3:Logger**)
Select **F4:Start** from the menu.
2. Switch the **90-C** OFF.
This step is essential, as the Rate per Day datalogging is only enabled when the **90-C** is switched OFF.

Stopping Rate per Day datalogging is a one step process...

1. Select the Logger menu (Menu) → **F3:Logger**)
Select **F4:Stop** from the menu.

Notes

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

7.3.2 Time of Day Datalogging

Programming Time of Day Datalogging

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

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

Log	00:00	00:00	00:00	00:00	00:00	00:00
Time	00:00	00:00	00:00	00:00	00:00	00:00

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

Notes

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

Starting and Stopping Time of Day Datalogging

Starting Time of Day datalogging is a two step process...

1. Select the Logger menu (Menu) → **F3:Logger**
Select **F4:Start** from the menu.
2. Switch the **90-C** OFF.
This step is essential, as the Time of Day datalogging is only enabled when the **90-C** is switched OFF.

Stopping Time of Day datalogging is a one step process...

1. Select the Logger menu (Menu) → **F3:Logger**
Select **F4:Stop** from the menu.

Notes

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

7.3.3 Sampling Period and Duration Datalogging

Programming Sampling Period and Duration Datalogging

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

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

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

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

Press (Menu) to retain the previous sampling period and move to setting the duration.

4. The **90-C** now prompts you to enter the duration in minutes. The current duration is displayed...

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

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

Press (Enter) to save the new duration.

Press (Menu) to quit and retain the previous duration.

5. The Sampling Period and Duration datalogging is now programmed, and can be started and stopped as required.

Starting and Stopping Sampling Period and Duration Datalogging

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

1. Press (F4) in normal measurement mode.
2. The **90-C** now prompts you to press (Enter) to begin logging. For example...

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

The time is shown to enable the user to synchronise the sampling times if required.

2. Press (Enter) to start logging.

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

Notes

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

7.4 Recalling Readings from the Logger

To recall records from the Logger onto the **90-C** display...

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

Record number 1 is now displayed.

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

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

The following example shows the display when “A” and “B” were both set to data during logging...

2.76mS			25.0°C
Log#1	A=1234	B=1234	31/12 12:00:00

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

7.5 Erasing Records from the Logger

To erase records from the Logger...

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

```

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

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

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

7.6 Printing Records from the Logger to the RS232 Port

1. Connect one end of the RS232 cable to the **Charger** socket of the **90-C**.
2. Connect the other end of the RS232 cable to an RS232 Printer, or to the COM1 or COM2 ports of a PC.
3. Ensure that the baud rate for the printer or PC and the **90-C** are the same. If necessary, alter the baud rate of the **90-C** (see section 8.1).

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

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

8. RS232 Port

8.1 Setting the Baud Rate

1. Select the Baud Rate menu (Menu) → **F5:System** → **F3:Baud Rate**)
2. The available baud rates are listed, along with the RS232 port configuration...

```

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

The arrow indicates the current selection.

3. Press (F1) to select 300 baud.
Press (F2) to select 9600 baud.
Press (F3) to select 19200 baud.
Press (Menu) to quit and retain the current setting.

8.2 Sending Readings to the RS232 Port

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

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

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

8.3 RS232 Configuration

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

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

8.4 Communication and Statistical Software

Communication between the **90-C** and a PC can be handled with any RS232 communication software. A TPS communication software package for Windows® is optionally available (part number 130086).

Once the data is saved to disk, the next problem is how to use it. The data sent by the **90-C** is formatted in fixed-width columns that can be imported by programs such as Microsoft® Excel® and Lotus 123®.

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

8.5 Commands

The following commands can be sent from a PC to the **90-C**. Note that <cr> denotes carriage return and <lf> denotes a line feed.

Action	Command	Notes
Request current data	?D<cr>	Returns the current data of all parameters plus date and time from the 90-C . The log number returned is set to Zero.
Request logged data	?R<cr>	Returns all logged records from the 90-C memory. The data ends with the message ENDS <cr> .
Erase logged data	?E<cr>	Erases all logged records from the 90-C memory. Returns the message ERASED <cr> to confirm that the records have been erased.

Continued over the page...

RS232 Commands, continued...

Request status information	?S<cr>	Returns the model name, firmware version number, instrument serial number and number of logged readings in memory, for example... 90C•V6.0•S1234•2032•ALB+v%<cr> where • are spaces. Note that the number of logged readings is right-justified. The meaning of the last group of characters is as follows...
		A or P A indicates A & B function is enabled. P indicates A is set to Pond Number.
		L Automatic datalogging is enabled.
		B Low Battery warning.
		+ Extended datalogging function is fitted.
		v Battery volts is available with ?V command.
		% Indicates new 90 series, V6.0 and up.
Request GLP information	?G<cr>	Returns all calibration GLP information, plus the instrument model, serial number and current date (see section 8.7 for data format and hand-shaking).
Enable Rate per Day or Time of Day automatic datalogging	?J<cr>	Starts automatic datalogging when the 90-C is set up for Rate per Day or Time of Day automatic datalogging (see sections 7.3.1 and 7.3.2). The meter must then be powered down with the OFF key or with the ?K command (see below).
Disable Rate per Day or Time of Day automatic datalogging	?F<cr>	Stops automatic datalogging when the 90-C is set up for Rate per Day or Time of Day automatic datalogging (see sections 7.3.1 and 7.3.2).
Power ON	Any 10 characters	Switches the 90-C ON. A specific command is not available while the 90-C is off, so RS232 activity caused by the 10 characters switches the unit ON.
Power OFF	?K<cr>	Switches the 90-C OFF. Use the command after the ?G command (above) to actually start rate per Day or Time of Day automatic datalogging.
Request battery volts	?V<cr>	Returns the current voltage level in the battery pack, for example... 7.20V<cr>
Positions of Data Fields	?P<cr>	Returns the number of data fields, along with their position and length. When the A&B Data Input function is disabled... 5,1,10,12,8,21,4,26,7,37,5 This denotes 7 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. When the A&B Data Input function is enabled... 7,1,10,12,8,21,4,26,7,37,5,45,4,51,4
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.

8.6 Data Format

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

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

dd/mm/yyyy•hh:mm:ss•LLLL•CCCCCCuuu•TTTTTuLaaaaA•bbbbB

where....

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

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

LLLL is the Log Number, 4 characters, right justified. The **90-C** sends a Zero for instant readings (see section 8.2).

CCCCCC is Conductivity or TDS data. 7 characters, right justified.

uuu is the Conductivity/TDS units description, which can be either of the following...

uS•	for $\mu\text{S}/\text{cm}$ Conductivity readout. All readings are converted to $\mu\text{S}/\text{cm}$ to ensure that the data is logical when analysed with other programs.
ppM	for parts per Million TDS readout. All readings are converted to ppM to ensure that the data is logical when analysed with other programs.

TTTTT is Temperature data, 5 characters, right justified.

uu is the Temperature unit description. Sent as “**oC**”.

L is the Low Battery indicator. Sent as “**L**” when the battery is below 5.60 volts.

Caution : Data recorded with a low battery may be unreliable.

The **90-C** sends a space when the battery is above 5.60 volts.

aaaa A-Data input, 4 characters, left justified.

A A-Data input identifier. Sent as “**A**” for A-Data or “**P**” for Pond number. See section 7.1 for further details on the A and B Data input function.

bbbb B-Data input, 4 characters, left justified.

B B-Data input identifier. Sent as “**B**”. See section 7.1 for further details on the A and B Data input function.

Notes

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

8.7 GLP Data Format

GLP information is returned as 12 lines terminated by a carriage return. When using the “?G” command (section 8.5), the computer must respond with a character after receiving each line.

For example...

```
90C V6.0 S1234 @ 31/12/2000 12:00
Conductivity Zero=      0.01uS      @ 31/12/2000 12:00
Conductivity k=        1.01        @ 31/12/2000 12:10
TDS                Zero=      0.01ppM  @ 31/12/2000 12:00
TDS                k=        1.01        @ 31/12/2000 12:20
Temperature  Offset=      1.0oC      @ 31/12/2000 12:30
Temperature  Span=      100.0%     @ 31/12/2000 12:40
Ends
```

8.8 Importing Data into Microsoft Excel

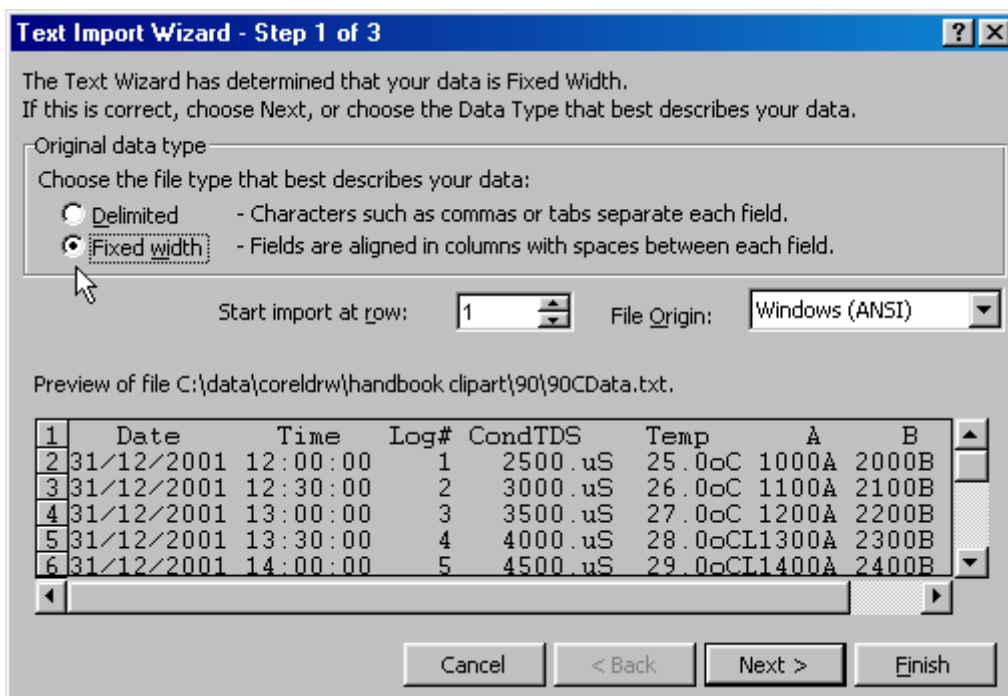
The following procedure details the method for importing a **90-C** text data file into Microsoft® Excel®.

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

Note : The default data folder for the WinTPS software is “C:\My Documents\WinTPS”.

4. In step 1 of the Text Import Wizard select “Fixed width”, as per the sample screen below, then press “Next >”.

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

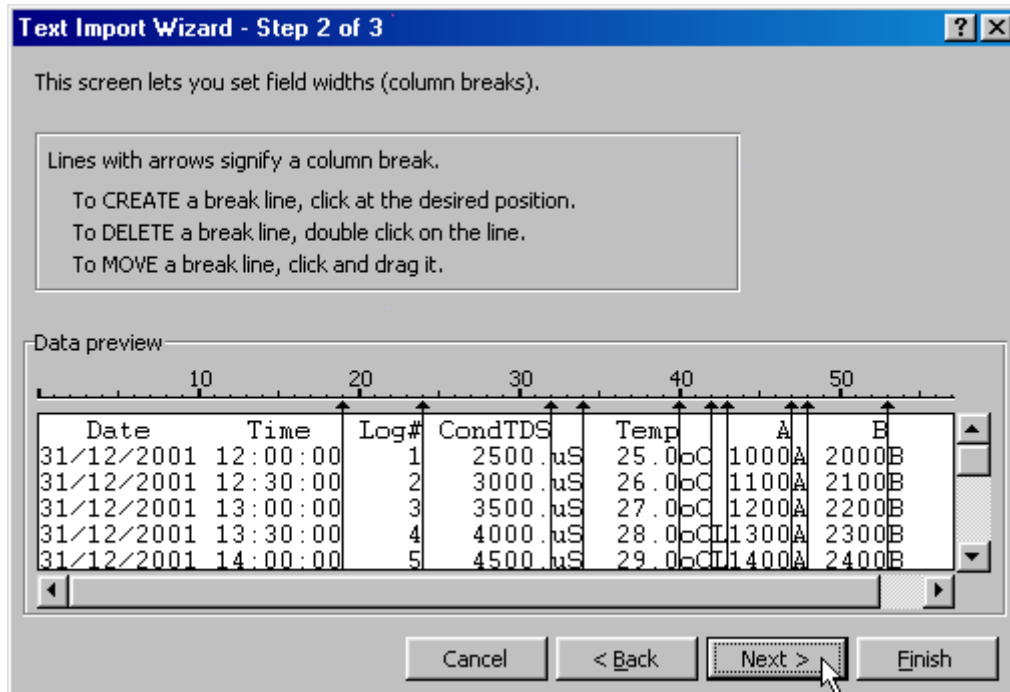


Continued over the page...

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.

9. Setting the Clock

1. Select the Clock Set-up menu (Menu) → **F5:System** → **F2:Set Clock**)
2. The display now shows the current time, for example...

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

3. Use the Numeric Keypad to enter the current time in 24 hour format, then press (Enter).
Alternatively, press (Menu) to quit and retain the current setting.
4. If you pressed (Enter) above, the display will now show the current date, for example...

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

5. Use the Numeric Keypad to enter the current date in dd/mm/yyyy format, then press (Enter).
Alternatively, press (Menu) to quit and retain the current setting.

Notes

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

10. Initialising the 90-C

If the calibration settings of the **90-C** exceed the allowable limits, the unit may need to be initialised to factory default values. This action may be required if a sensor is replaced or if the memory is corrupted.

To initialise the **90-C**...

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

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

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

Press **F2** to quit and retain the current calibration settings and logged readings.

4. If **F1:Yes** was selected above, the **90-C** will display the number of logged readings in memory and provide an additional warning that these will be erased. For example...

**Logger contains Data. 2032 readings
will be Erased. Continue ? F1:Yes F2:No**

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

Press **F2** to quit and retain the current calibration settings and logged readings.

5. If **F1:Yes** was selected above, the **90-C** will display the following messages to indicate that the unit has been successfully initialised.

Initialising

then...

**Initialised
Re-Calibrate unit before use.**

6. The meter then goes back to the GLP menu. When returning to display mode later, note that each of the decimal points has been replaced with a “ * ” to indicate that each parameter requires re-calibration.

11. Instrument firmware version number

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

12. Battery Saver Function

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

To program the battery saver function:




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

Battery Saver:	F1:OFF	>F2:5 minutes
Volts= 7.20V	F3:1 hour	

The arrow indicates the current selection.

3. Press (F1) to disable the battery saver function for continuous use.
Press (F2) to set the battery saver function to 5 minutes. The meter will switch itself off if no key has been pressed for five minutes.
Press (F3) to set the battery saver function to 1 hour. The meter will switch itself off if no key has been pressed for 1 hour.
Press (Menu) to quit the battery saver menu and retain the current setting.

Notes

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

13. Moisture Protection

13.1 Silica Gel Pack

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

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

To check the Silica gel pack...

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

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

Pink indicates that the Silica gel is moist (proceed to step 3).

3. Empty the Silica gel into a microwave proof dish and place it into a microwave oven.

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

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

CAUTION : THE SILICA GEL MAY BE VERY HOT AT THIS POINT.

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

13.2 Corrosion Inhibitor Tab




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

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

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

14. Troubleshooting

14.1 General Errors

Error Message	Possible Causes	Remedy
Factory Calibration Data Failure	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service.
EEPROM Write Failure Return to Factory for Service	User calibration settings have been lost or corrupted.	Switch the meter OFF and switch back ON. If the problem persists, return the unit to TPS for service.
Flashing  symbol.	Battery is below 5.60 volts.	Recharge the battery. A full charge will take approximately 18 hours. Note that the unit will switch itself off when the battery falls below 5.10 volts. Data obtained while the  is flashing may be unreliable. Do not take readings or calibrate while the  is flashing.
Meter displays the word OFF , and switches off.	Battery is below 5.10 volts.	Recharge the battery. If this fails, check the charger. If charger is OK, replace the battery.
Meter will not turn on.	Battery is exhausted.	Recharge the battery for approximately 18 hours. If this fails, check the charger. If charger is OK, replace the battery.
Battery does not charge up when charger is connected.	<ol style="list-style-type: none"> 1. Faulty battery charger. 2. Faulty battery. 	<ol style="list-style-type: none"> 1. Connect the charger and switch the power on. 2. Display the battery volts in the battery saver menu (see section 12). 3. If the battery volts are increasing then the charger is OK. If the battery volts do not increase, then the charger is faulty. 4. Replace the charger or the battery, as required.

14.2 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.	Check that the k factor is set correctly when not using a TPS k=10 sensor. Initialise the unit. See section 10.
Unit attempts Span calibration instead of Zero calibration.	Sensor has Zero error.	Thoroughly rinse sensor in distilled water and allow to completely dry in air before attempting zero calibration. DO NOT rub the platinised electrode surfaces. If instrument does not calibrate at Zero with sensor disconnected, then the instrument is faulty.
Standard calibration fails, and k factor is greater than 25% <i>above</i> the nominal value.	<ol style="list-style-type: none"> Sensor is not immersed correctly. Sensor may have a build-up of dirt or oily material on electrode plates. Platinum-black coating has worn off. Standard solution is inaccurate. Sensor is faulty. Faulty instrument. 	<p>Immerse sensor correctly as per diagrams in section 3.4.</p> <p>Clean sensor as per the instructions detailed in section 15.1.</p> <p>Sensor requires replatinization as per section 15.1. Alternatively, return to the factory for replatinization.</p> <p>Replace standard solution.</p> <p>Return sensor to factory for repair or replacement.</p> <p>Return to factory for repair.</p>
Standard calibration fails, and k factor is greater than 25% <i>below</i> the nominal value.	<ol style="list-style-type: none"> Standard solution is inaccurate. Sensor may have a build-up of conductive material, such as salt. Sensor is faulty. Faulty instrument. 	<p>Replace standard solution.</p> <p>Clean sensor as per the instructions detailed in section 15.1.</p> <p>Return sensor to factory for repair or replacement.</p> <p>Return to factory for repair.</p>
Inaccurate readings, even when calibration is successful.	<ol style="list-style-type: none"> Sensor may have a build-up of dirt or oily material on electrode plates. Platinum-black coating has worn off. 	<p>Clean sensor as per the instructions detailed in section 15.1.</p> <p>Sensor requires replatinization as per section 15.1. Alternatively, return to the factory for replatinization.</p>
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 15.1.
Readings are low or near zero.	<ol style="list-style-type: none"> Sensor may have a build-up of dirt or oily material on electrode plates. Sensor is not immersed correctly. Sensor is faulty. Faulty instrument. 	<p>Clean sensor as per the instructions detailed in section 15.1.</p> <p>Immerse sensor correctly as per diagrams in section 3.4.</p> <p>Return sensor to factory for repair or replacement.</p> <p>Return to factory for repair.</p>

14.3 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Temperature inaccurate and cannot be calibrated.	<ol style="list-style-type: none"> 1. Faulty connector. 2. Faulty sensor. 	<p>Check the connector and replace if necessary.</p> <p>Return Conductivity sensor for repair, or replace sensor.</p>
Displays OVR^{°C} when Conductivity sensor is plugged in.	<ol style="list-style-type: none"> 1. Faulty instrument socket. 2. Faulty sensor. 	<p>Return the instrument to the TPS factory for service.</p> <p>Return Conductivity sensor for repair, or replace sensor.</p> <p>NOTE Conductivity and TDS readings may still be accurate, as there is a separate temperature sensor to provide ATC for these parameters built into the Conductivity/TDS sensor.</p>

15. Appendices

15.1 Care, Cleaning and Maintenance of Conductivity Sensors

15.1.1 Care of Conductivity sensors

The conductivity section of the sensor supplied with your **90-C** 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.

15.1.2 Cleaning of Conductivity 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).

16. Warranty

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

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

Shipping damage is not covered by this warranty.

PLEASE NOTE:

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

PROCEDURE FOR SERVICE

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

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

To obtain this service, please follow this procedure:

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

Please check that the following is enclosed with your equipment:

- **Your Name and daytime phone number.**
- **Your company name, ORDER number, and return street address.**
- **A description of the fault. (Please be SPECIFIC.)**
(Note: "Please Repair" does NOT describe a fault.)

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

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