Congratulations !
You have purchased the latest in benchtop Conductivity-TDS-pH-mV-Temperature instrumentation. We trust that your new **901-CP** will give you many years of reliable service.

The **901-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 **901-CP**. It also contains a full listing of all of the items that you should have received with your **901-CP**. 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 **901-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.

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Model 901-CP
Cond-TDS-pH-mV-Temp. Meter

Handbook Version : 1
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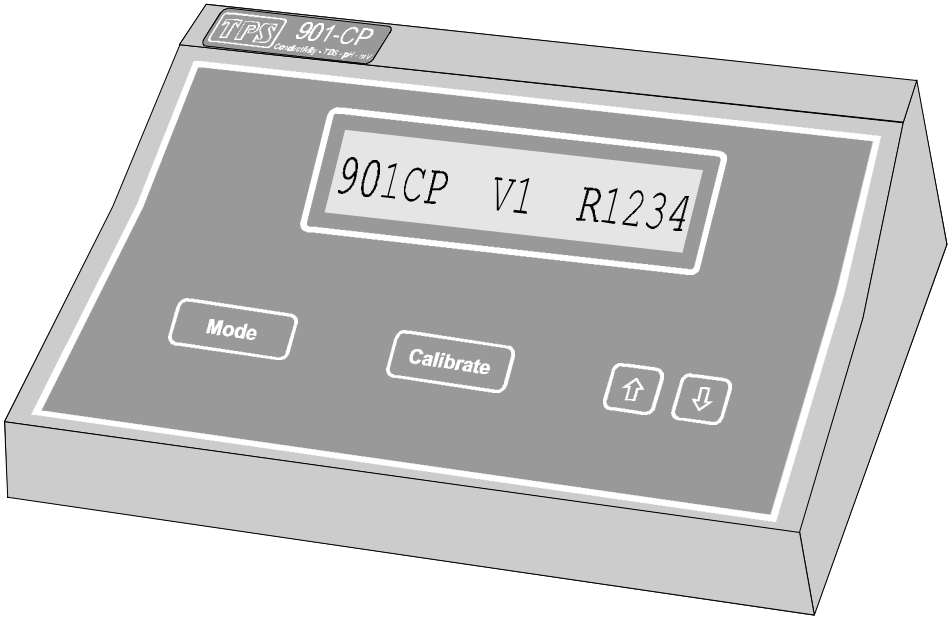
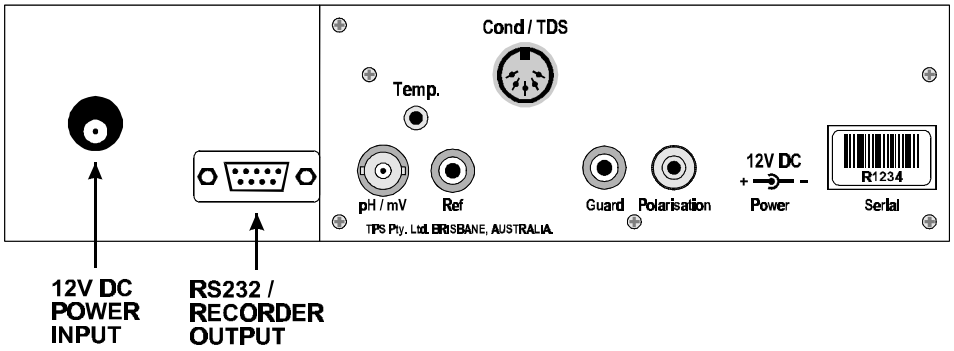
Contents

1. Introduction

1.1 901-CP Display and Controls



1.2 901-CP Rear Panel Connectors



1.3 901-CP Front Panel

Display

- 16 character alphanumeric LCD with 14.5 mm characters.
- The following combinations of parameters can be displayed simultaneously…
  - Conductivity and pH
  - Conductivity and mV
  - TDS and pH
  - TDS and mV
  - Conductivity & Temp
  - TDS and Temp
  - pH and Temp
  - mV and Temp
  - Temperature only
- User friendly text prompts and error messages.
- Serial number is displayed when the **901-CP** is switched on.

Mode Key

- Switches between the various display and optional RS232 modes. See section 2.
- Used to select k factor of Conductivity/TDS sensor. See section 11.

Calibrate Key

- Used to calibrate Conductivity, TDS, pH and Temperature. See sections 3, 4, 5 and 7.
- Used to select pH buffers for automatic buffer recognition. See section 10.

⇧ and ⇩ Keys

- Used for temperature calibration. See section 7.
- Used for setting the manual temperature compensation value if the temperature sensor is unplugged. See section 7.4.
- Press ⇧ to recall Zero value from last successful Conductivity or TDS calibration.
- Press ⇩ to recall k factor value from last successful Conductivity or TDS calibration.
- Press ⇧ to recall Asymmetry value from the last successful pH calibration.
- Press ⇩ to recall slope value from the last successful pH calibration.
- Used to select baud rate when optional RS232 port is fitted. See section 8.1.
- Used to select output "send" rate when optional RS232 port is fitted. See section 8.2
- Press ⇧ at turn-on to initialise the unit. See section 12.

1.4 Unpacking Information

Before using your new **901-CP**, please check that the following accessories have been included:

		Part No
1.	**901-CP** Conductivity-TDS-pH-mV-Temp Meter	126125
2.	K=1/ATC Conductivity Sensor	122226
3.	Combination pH Sensor	121207
4.	Temperature/ATC Sensor	121245
5.	2.76mS/cm Conductivity Standard, 200mL	122306
6.	2.0 ppK TDS Standard, 200mL	122307
7.	pH6.88 Buffer, 200mL	121306
8.	pH4.00 Buffer, 200mL	121381
9.	AC/DC Power Adaptor	130044
10.	**901-CP** Handbook	130050

Options that may have been ordered with your **901-CP**:

1.	K=10/ATC Conductivity Sensor	122222
2.	K=0.1/ATC Conductivity Sensor	122224
3.	Solution Guard Rod	121360
4.	Double Platinum Electrode for Karl Fischer Titrations	122207
5.	Flexible arm type sensor holder	130088
6.	RS232 option (includes cable)	130029
7.	RS232 Communication software for Windows	130086
8.	Recorder output option (includes cable)	130028
9.	Recorder PLUS RS232 option (includes cable)	130049

1.5 Specifications

	Ranges	Resolution	Accuracy
Conductivity	**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 **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 **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	 0.001 µS/cm 0.01 µS/cm 0.1 µS/cm 1 µS/cm 0.01 µS/cm 0.1 µS/cm 1 µS/cm 0.01 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 ^{0}C
TDS	**k=0.1 Sensor** 0 to 1.000 ppM 0 to 10.00 ppM 0 to 100.0 ppM 0 to 1000 ppM **k=1.0 Sensor** 0 to 10.00 ppM 0 to 100.0 ppM 0 to 1000 ppM 0 to 10.00 ppK **k=10 Sensor** 0 to 100.0 ppM 0 to 1000 ppM 0 to 10.00 ppK 0 to 100.0 ppK	 0.001 ppM 0.01 ppM 0.1 ppM 1 ppM 0.01 ppM 0.1 ppM 1 ppM 0.01 ppK 0.1 ppM 1 ppM 0.01 ppK 0.1 ppK	±0.5% of full scale of selected range at 25 ^{0}C
pH	0 to 14.00 pH	0.01 pH	±0.01 pH
mV	0 to ±600.0 mV 0 to ±1500 mV (auto-ranging)	0.1 & 1 mV	±0.15 & ±1 mV
Temperature	-10.0 to 120.0 ^{0}C	0.1 ^{0}C	±0.2 ^{0}C

Additional Conductivity and TDS Specifications

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

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

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

Standard Recognition.....**Conductivity**
14.94 µS/cm, 73.90 µS/cm, 150.0 µS/cm, 717.8 µS/cm, 1,413 µS/cm, 2.76 mS/cm, 6.67 mS/cm, 12.9 mS/cm, 24.8 mS/cm, 58.0 mS/cm, 111.9 mS/cm

TDS
69.5 ppM, 2.00 ppK, 8.0 ppK, 36.0 ppK

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

Additional pH Specifications

Buffer Recognition.....pH4.00, pH6.88, pH7.00, pH9.23, pH10.06

Input Impedance.....>3 x 10^{12} Ω

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

Slope Range.....85.0 to 105.0%

Temperature Compensation.....0 to 100 ^{o}C, automatic or manual

Additional Temperature Specifications

Sensor Type.....Silicon Transistor

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

General Specifications

RS232 Output (optional)..... 300, 9600 or 19200 baud.
8 bits, No Parity, 1 stop bit, XON/XOFF Protocol.

Recorder Output (optional)..... Cond : 0 to 2000 Counts for 0 to 2000 mV
ie. 2.76 mS/cm = 276 mV

TDS : 0 to 1000 Counts for 0 to 1000 mV
ie. 36.0 ppK = 360 mV

pH : 0 to 14.00 pH for 0 to 2000 mV
ie. pH7.00 = 1000 mV

mV : -1500 to +1500 mV for 0 to 2000 mV
ie. 0 mV = 1000 mV

Temp : -10.0 to 120.0 ^{O}C for 0 to 2000 mV
ie. 0.0 ^{O}C = 153.8 mV

Output impedance approx 1000 Ohms.

Power..... 12V DC by AC/DC power adaptor.

Dimensions..... 270 x 210 x 75 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. Operating Modes

Press the Mode key to select the desired operating mode. The sequence is shown in the following table…

Conductivity/TDS plus pH/mV Mode	**2.76mS 7.00pH**
Conductivity or TDS data is shown on the left and pH or mV data is shown on the right. Calibration is not available in this mode.	

↓ Mode

Conductivity/TDS plus Temperature Mode	**2.76mS 25.0°c**
Conductivity or TDS data is shown on the left and Temperature data is shown on the right. Manual Temperature setting is not shown when Temperature sensor is unplugged. Select this mode to calibrate Conductivity or TDS.	

↓ Mode

pH/mV plus Temperature Mode	**7.00pH 25.0°c**
pH or mV data is shown on the left and Temperature data is shown on the right. Manual Temperature setting with an “m” is shown if Temperature sensor is unplugged. Select this mode to calibrate pH.	

↓ Mode

Temperature Mode	**25.0°c**
Temperature data only is shown on the left. Manual Temperature setting with an “m” is shown if Temperature sensor is unplugged. Select this mode to calibrate Temperature.	

↓ Mode

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Mode Selection	**Mode: Cond+pH ↑↓**

Allows selection of readout modes. Choose from…

- Conductivity + pH
- Conductivity + mV
- TDS + pH
- TDS + mV

Press ⇧ or ⇩ to select the required combination.

↓ Mode

Back to Conductivity/TDS plus pH/mV mode

The following modes are added when the optional RS232 port is fitted…

RS232 Send Rate	**Send Rate ↑ 0↓**

Sets the Data output rate, in seconds.

Press ⇧ or ⇩ to set this value from 0 to 9999 seconds.

↓ Mode

RS232 Baud Rate	**Baud Rate↑19200↓**

Allows selection of the RS232 Baud Rate.

Press ⇧ or ⇩ to select 300, 9600 or 19200 baud.

↓ Mode

Back to Conductivity/TDS plus pH/mV mode

3. Conductivity Calibration

3.1 Calibration Procedure

1. Switch the **901-CP** on and select Conductivity plus Temperature mode (section 2).
2. Plug the Conductivity sensor into the **Cond / TDS** socket. If a k=10 or k=0.1 sensor is being used, ensure that it has been correctly selected (see section 11). The Temperature sensor is not required, as Automatic Temperature Compensation for Conductivity is done via the Conductivity Sensor.
3. Rinse the Conductivity electrode in distilled water. Shake off as much water as possible. Blot the outside of the electrode dry. DO NOT BLOT THE ELECTRODE SURFACES.
4. ***Zero Calibration***

   Allow the Conductivity sensor to dry in air.

   When the reading has stabilised at or near Zero, press and hold the Calibrate for 1 second.

   The ∗ will not be removed after a zero calibration.
5. ***Standard Calibration***

   Allowable Conductivity standards are listed in the specifications in section 1.5, and should be selected according to your range of interest.

   Place the electrode into a sample of Conductivity standard so that it is immersed at least to the vent hole in the body.

   DO NOT place the electrode directly into the bottle of standard. Discard the used sample of standard after use. It is advisable to use a narrow sample vessel to minimise the use of standard solution.

   When the reading has stabilised, press and hold the Calibrate key for 1 second to calibrate.

   The ∗ will now be replaced by a decimal point if calibration was successful.
6. The **901-CP** is now calibrated for Conductivity and is ready for use in this mode.

   Discard the used samples of standard.

3.2 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 **901-CP** has been correctly calibrated for the mode in which it will be used. The **901-CP** does not require re-calibration when alternating between Conductivity and TDS modes, providing the instrument has been correctly calibrated for both.
4. All calibration information is retained in memory when the **901-CP** is switched off, even when the power supply is removed.

3.3 Calibration Messages

1. If a Zero calibration has been successfully performed, the **901-CP** will display the Zero of the sensor and then return to Conductivity mode. For example…

   ```
   Zero OK, 0.1%
   ```

2. If a Span calibration has been successfully performed, the **901-CP** will display the k factor of the sensor and then return to Conductivity mode. For example…

   ```
   Cal OK, k=1.00
   ```

   Note that " * " in the Conductivity reading has now been replaced by a decimal point, due to the successful calibration.

3. If a Span calibration has failed, the **901-CP** will display the following messages and then the failed k factor of the sensor before returning to Conductivity mode. For example…

   ```
   Calibrate Failed
   ```

   then:

   ```
   STD=2760uS   ?
   ```

   then:

   ```
   k=0.70, Fails
   ```

   Note that a " * " replaces the decimal point in the Conductivity reading to indicate that Conductivity is not correctly calibrated.

   Check that the sensor is immersed at least to the vent hole in the body, and that the standard is correct before attempting calibration again.

4. TDS Calibration

4.1 Calibration Procedure

1. Switch the **901-CP** on and select TDS plus Temperature mode (section 2).
2. Plug the TDS sensor into the **Cond / TDS** socket. If a k=10 or k=0.1 sensor is being used, ensure that it has been correctly selected (see section 11). The Temperature sensor is not required, as Automatic Temperature Compensation for TDS is done via the TDS Sensor.
3. Rinse the TDS electrode in distilled water. Shake off as much water as possible. Blot the outside of the electrode dry. DO NOT BLOT THE ELECTRODE SURFACES.
4. ***Zero Calibration***

   Allow the TDS sensor to dry in air.

   When the reading has stabilised at or near Zero, press and hold the Calibrate for 1 second.

   The ∗ will not be removed after a zero calibration.
5. ***Standard Calibration***

   Allowable TDS standards are listed in the specifications in section 1.5, and should be selected according to your range of interest.

   Place the electrode into a sample of TDS standard so that it is immersed at least to the vent hole in the body.

   DO NOT place the electrode directly into the bottle of standard. Discard the used sample of standard after use. It is advisable to use a narrow sample vessel to minimise the use of standard solution.

   When the reading has stabilised, press and hold the Calibrate key for 1 second to calibrate.

   The ∗ will now be replaced by a decimal point if calibration was successful.
6. The **901-CP** is now calibrated for TDS and is ready for use in this mode.

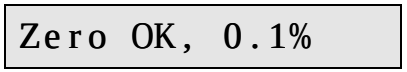
   Discard the used samples of standard.

4.2 Calibration Notes

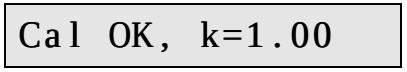
1. A Zero calibration should be performed at least monthly. In low TDS applications (where a zero error is particularly significant) a zero calibration may have to be done weekly.
2. A Standard calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.
3. Conductivity and TDS calibration data is stored separately in memory. Ensure that the **901-CP** has been correctly calibrated for the mode in which it will be used. The **901-CP** does not require re-calibration when alternating between Conductivity and TDS modes, providing the instrument has been correctly calibrated for both.
5. All calibration information is retained in memory when the **901-CP** is switched off, even when the power supply is removed.

4.3 Calibration Messages

1. If a Zero calibration has been successfully performed, the **901-CP** will display the Zero of the sensor and then return to TDS mode. For example…

2. If a Span calibration has been successfully performed, the **901-CP** will display the k factor of the sensor and then return to TDS mode. For example…

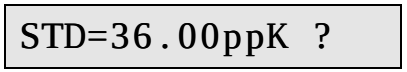
   

   Note that " * " in the TDS reading has now been replaced by a decimal point, due to the successful calibration.

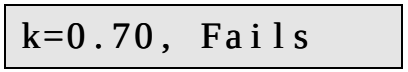
3. If a Span calibration has failed, the **901-CP** will display the following messages and then the failed k factor of the sensor before returning to TDS mode. For example…

   then:

   then:

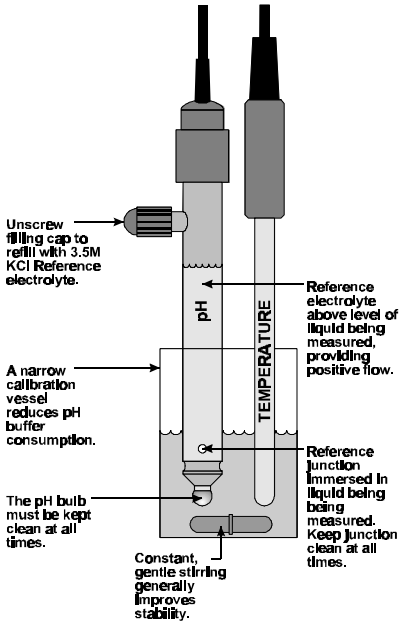
   Note that a " * " replaces the decimal point in the TDS reading to indicate that TDS is not correctly calibrated.

   Check that the sensor is immersed at least to the vent hole in the body, and that the standard is correct before attempting calibration again.

5. pH Calibration

5.1 Calibration Procedure

1. Switch the **901-CP** on and select pH plus Temperature mode (section 2).
2. Plug the pH sensor into the **pH/mV** socket and the temperature sensor into the **Temp.** socket.
3. Ensure that temperature has already been calibrated or manually set (see sections 7.1 and 7.4). NOTE: A " ∗ " in place of the decimal point in the temperature readout indicates that temperature is not calibrated.
4. Ensure that the primary and secondary buffers to be used have been correctly selected for automatic buffer recognition. See section 10.
5. Remove the wetting cap from the pH sensor.
6. Rinse the pH and Temperature sensors in distilled water and blot them dry.
7. Place both sensors into a small sample of primary buffer (pH6.88 or pH7.00) so that the bulb and reference junction are both covered, as per the diagram below.



DO NOT place the sensors directly into the buffer bottle.

8. When the reading has stabilised, press and hold the Calibrate key for 1 second to calibrate. If a 1 point calibration has been performed, a " ∗ " in place of the decimal point will not be removed until a full 2 point calibration has been performed.

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

10. Place both sensors into a small sample of secondary buffer (pH4.00, pH9.23 or pH10.01) so that the bulb and reference junction are both covered, as per the diagram in step 7 above.

    DO NOT place the sensor directly into the buffer bottle.

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

    When the reading has stabilised, press and hold the Calibrate key for 1 second to calibrate.

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

11. The **901-CP** is now calibrated for pH and is ready for use in this mode.

    Discard the used samples of buffer.

5.2 Calibration Notes

1. A 1-point calibration should be performed at least weekly. In applications where the sensor junction can become blocked (eg. wines, dairy products, mining slurries etc), a 1-point calibration may have to be done daily.

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

3. All calibration information is retained in memory when the **901-CP** is switched off, even when the power supply is removed.

5.3 Calibration Messages

1. If a 1-point calibration has been successfully performed, the **901-CP** will display the asymmetry of the sensor and then go back to pH mode. For example…

1 Point Cal. OK	then:	Asym=0.10pH

   The " * " in place of the decimal point in the pH reading is not removed unless a full 2 point calibration has been previously performed.

2. If a 1-point calibration has failed, the **901-CP** will display the failed asymmetry value of the sensor before returning to pH mode. For example…

1 Point Cal.Fail	then:	Asym=1.10pH

   The decimal point in the pH reading is replaced by a " * " to indicate that pH is not correctly calibrated.

3. If a 2-point calibration has been successfully performed, the **901-CP** will display the asymmetry and slope of the sensor and then go back to pH mode. For example…

2 Point Cal. OK

   then:

Asym=0.10pH	then:	Slope=99.0%

   Note that " * " in the pH reading has now been replaced by a decimal point, due to the successful calibration.

4. If a 2-point calibration has failed, the **901-CP** will display the following message and then the failed slope value of the sensor before returning to pH mode. For example…

2 Point Cal.Fail	then:	Slope=85.0%

   Note that " * " replaces the decimal point in the pH reading to indicate that pH is not correctly calibrated.

6. mV Calibration

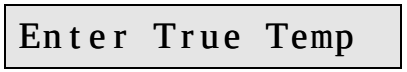
The mV section is factory calibrated. There is no user-calibration facility for this mode.

7. Temperature Calibration

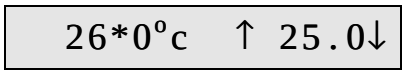
The temperature readout must be calibrated or manually set before attempting pH calibration. The decimal point in the temperature reading is replaced by a " * " if the reading is not calibrated.

7.1 Calibration Procedure

1. Switch the **901-CP** on and select Temperature mode (see section 2).
2. Plug the temperature sensor (Part No 121245) into the **Temp.** socket.
3. Place the sensor alongside a good quality mercury thermometer into a beaker of room temperature water. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.
4. When the reading has stabilised, press the Calibrate key.
5. The **901-CP** now enters temperature calibration. For example…

   then:

6. Press the ⇧ and ⇩ keys until the display shows the same temperature as the mercury thermometer.
7. Press the Calibrate key to calibrate the temperature readout.

   Alternatively, press the Mode key to abort temperature calibration.

7.2 Calibration Notes

1. Temperature calibration information is stored in memory when the meter is switched off, even when the power supply is removed.
2. Temperature does not need to be re-calibrated unless the Temperature sensor is replaced or the meter is initialised.

7.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **901-CP** will display the offset value of the sensor and then return to Temperature mode. For example…

Temp Cal. OK	then:	Offset=1.0°c

   The " * " is replaced by a decimal point in the Temperature reading to indicate that Temperature is correctly calibrated.

2. If a temperature calibration has failed, the **901-CP** will display the failed offset value of the sensor before returning to Temperature mode. For example…

Temp Cal. Fail	then:	Offset=11.0°c

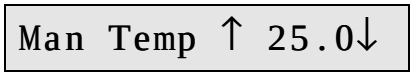
   Note that " * " replaces the decimal point in the Temperature reading to indicate that Temperature is not correctly calibrated.

7.4 Manual Temperature Setting

Manual temperature setting is only available if the temperature sensor is not plugged in. The manual temperature setting is only displayed in pH plus Temperature mode and Temperature only mode.

An "m" is added to the Temperature display when the **901-CP** is using a manual Temperature setting. For example…

1. Switch the **901-CP** on and select Temperature mode (see section 2).
2. Measure the temperature of the sample solution.
3. Press the Calibrate key.
4. The **901-CP** now enters manual temperature setting. For example…



5. Press the ⇧ and ⇩ keys until the display shows the temperature of sample solution.
6. Press the Calibrate key to save the manual temperature setting.

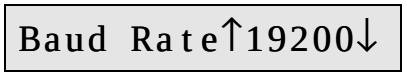
   Alternatively, press the Mode key to quit and retain the current setting.

8. RS232 Port

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

8.1 Setting the Baud Rate

1. Select RS232 Baud Rate mode (see section 2).
2. The currently selected Baud Rate is displayed. For example…

   Press the ⇧ and ⇩ keys to scroll through the available Baud Rates of 300, 9600 or 19200 baud.

   Ensure that the displayed baud rate matches the Baud Rate set on the printer or PC with which the **901-CP** is communicating.

3. Press the Mode key to return to any of the normal display modes as required.

8.2 Sending Readings to the RS232 Port

The **901-CP** can send readings to the RS232 port at a pre-set rate, in seconds.

To set this Send Rate…

1. Select RS232 Send Rate mode (see section 2).
2. The currently selected Send Rate is displayed. For example…

   Press the ⇧ key to increase the Send Rate.

   Press the ⇩ key to decrease the Send Rate.

   The Send Rate can be set from 0 to 9999 seconds.

   Set the Send Rate to Zero to allow the **901-CP** to accept commands from a remote computer.

3. Press the Mode key to return to any of the normal display modes as required.

8.3 RS232 Configuration

The **901-CP** RS232 configuration is 8 bits, No Parity, 1 Stop Bit, XON/XOFF Protocol.

8.4 Communication and Statistical Software

Communication between the **901-CP** and a PC can be handled with any RS232 communication software. A Windows communication package is optionally available from TPS (part number 130086).

Once the data is saved to disk, the next problem is how to use it. The data sent by the **901-CP** is formatted in columns that can be imported by programs such as Microsoft® Excel® and Lotus 123®.

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

8.5 Commands

The following commands can be sent from a PC to the **901-CP**. Note that <cr> denotes carriage return and <lf> denotes a line feed.

Action	Command	Notes
Request current data	?D<cr>	Returns the current Conductivity/TDS pH/mV and Temperature data from the **901-CP**. The print rate must be set to zero (see section 8.2).
Request status information	?S<cr>	Returns the instrument model, firmware version and serial number. For example… **901CP♦♦V1♦♦R1234**<cr> where "♦" are spaces

8.5.1.1 Data Format

A. Data is returned to the RS232 port by the **901-CP** in the following format when requested by a PC with the ?D command (section 8.5):

CCCCCCUUU♦PPPPPPUU♦♦TTTTTTUUU<cr>

or B. Data is sent to the RS232 port by the **901-CP** in the following format when it is sent by the **901-CP** using the Send function (section 8.2):

CCCCCCUUU♦PPPPPPUU♦♦TTTTTTUUU<cr><lf>

where:

CCCCCC is the Conductivity or TDS data. maximum 6 characters, right justified. A " * " is sent instead of the decimal point if the reading is not calibrated.

UUU is the unit description, left justified. Either "**uS♦**", "**mS♦**", "**ppM**" or "**ppK**". ("**♦**" is one space.)

♦ is one space.

PPPPPP is the pH or mV data. Maximum 6 characters, right justified. A " * " is sent instead of the decimal point if the reading is not calibrated.

UU is the unit description, either pH or mV, left justified.

♦♦ is two spaces.

TTTTTT is the Temperature data. Maximum 6 characters, right justified. A " * " is sent instead of the decimal point if the reading is not calibrated.

UUU is the Temperature unit description, left justified.
- **oC** is sent for real temperature data.
- **oCm** is sent for manual temperature compensation data.

Notes:

1. **+OVR** or **–OVR** is sent when the Data is over-range.
2. **BUSY**<cr> is sent when the **901-CP** is Busy (ie in calibration, Baud Rate mode, Send Rate mode, Mode Selection etc.) or when data is not available.

9. Recorder Output Option

This section is applicable when the optional analogue recorder output is fitted. The recorder output depends on the currently selected display mode, as detailed below…

Display Mode	Parameter sent to Recorder Port
Conductivity and pH	Conductivity
Conductivity and mV	Conductivity
TDS and pH	TDS
TDS and mV	TDS
Conductivity & Temperature	Conductivity
TDS and Temperature	TDS
pH and Temperature	pH
mV and Temperature	mV
Temperature only	Temperature
Mode Selection	No Output
RS232 Send Rate	No Output
RS232 Baud Rate	No Output

The output voltages are as follows:

Cond.....0 to 2000 Counts for 0 to 2000 mV
ie. 2.76 mS/cm = 276 mV

TDS.....0 to 1000 Counts for 0 to 1000 mV
ie. 36.0 ppK = 360 mV

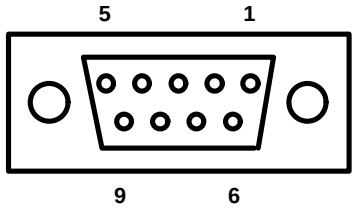
pH .....0 to 14.00 pH for 0 to 2000 mV
i.e. pH7.00 = 1000 mV Output

mV .....-1500 to +1500 mV for 0 to 2000 mV
i.e. 0 mV Reading = 1000 mV Output

Temperature ....-10.0 to 120.0 ^{O}C for 0 to 2000 mV
i.e. 0.0 ^{O}C = 152 mV Output

Output impedance approx 1000 Ohms.

9.1 RS232 / Recorder Output Socket Connections



Pin No	Connection
1	Chassis
2	Receive RS232 Data
3	Transmit RS232 Data
4	+10 V DC Power Output
5	Ground
6	Recorder Output Signal
7	Recorder Output Common
8	No Connection
9	No Connection

10. Selecting Buffers for Automatic Buffer Recognition

The **901-CP** is factory set to automatically recognise pH4.00, pH6.88 and pH9.23 buffers. There is also the option of using pH7.00 instead of pH6.88 and pH10.01 instead of pH9.23. The following procedure describes how to set which of these buffers are automatically recognised at calibration.

1. Switch the meter **OFF** and wait for 10 seconds.
2. Press and HOLD the Calibrate key while switching the meter back on.
3. The display will now show the currently selected primary buffer. For example…

Buffer 1 Select	then:	Buffer 1=6.88pH

   Press the ⇧ or ⇩ keys to alternate between pH6.88 and pH7.00 buffers.
4. Press the Mode key to go on when the desired primary buffer has been selected. The display will now show the currently selected high buffer. For example…

Buffer 2 Select	then:	Buffer 2=9.23pH

   Press the ⇧ or ⇩ keys to alternate between pH9.23 and pH10.01 buffers. The display shows 10.0 for the latter, but this buffer is stored in memory as 10.01.
4. Press the Mode key to exit when the desired high buffer has been selected.

   The 901-CP will now display its Model, Firmware Version and Serial Number for approximately 4 seconds, before going on to Conductivity/TDS plus pH/mV mode.

Notes

1. The buffer selection is kept in memory when the meter is switched off, even when the power supply is removed. The buffers are re-set to pH6.88 and pH9.23 during initialisation.
2. pH6.88 buffer is a DIN 19266 and NBS Primary-standard pH solution. Its use is highly recommended for the most accurate possible results. If pH7.00 buffer is used, ensure that it is manufactured to 0.01pH accuracy. pH7.00 buffer has a buffer capacity less than half that of pH6.88 buffer and is therefore much less stable.

11. Selecting k=10 or k=0.1 Sensors

The **901-CP** automatically recognises a k=1.0 sensor. The **901-CP does not** automatically recognise k=0.1 or k=10 sensors. When a k=0.1 or k=10 sensor is used, the **901-CP** must be manually set to the correct k factor before use. The following procedure describes how to select a k=0.1 or k=10 sensor.

1. Switch the meter **OFF** and wait for 10 seconds.
2. Press and HOLD the Mode key while switching the meter back on.
3. The meter now displays the current manual k factor. For example…

k factor, k=10.0

   Press the ⇧ or ⇩ keys to roll through the choice of k=10 or k=0.1 sensors.
5. Press the Mode key to exit when the desired k factor sensor has been selected.

   The 901-CP will now display its Model, Firmware Version and Serial Number for approximately 4 seconds, before going on to Conductivity plus pH mode.

Notes

The manual k factor selection is kept in memory when the meter is switched off, even when the power supply is removed.

If a k=0.1 sensor is being used, this must be manually selected again when the unit is initialised (see section 12).

The **901-CP** will always automatically recognise a k=1.0 sensor, regardless of the manual k factor selection.

Calibration settings for k=0.1, k=1.0 and k=10 sensors are **NOT** stored separately. The **901-CP** requires re-calibration when any new sensor is connected.

12. Initialising the 901-CP

If the calibration settings of the **901-CP** exceed the allowable limits, the unit may need to be initialised to factory default values. This action may be required if the sensor is replaced, or when the unit repeatedly fails to calibrate.

To initialise the **901-CP**…

1. Switch the **901-CP OFF** and wait for 10 seconds.
2. Press and hold the ⇧ key while switching the **901-CP** back on.
3. The following messages are now displayed…

   `Initializing` then: `901CPs V1 R1234`

   (The "s" after "901CP" is shown when the optional RS232 port is fitted.)
4. The **901-CP** now goes on to Conductivity plus pH mode. Note that a " * " replaces each of the decimal points in the Conductivity, pH and Temperature readings, indicating that the unit requires calibration.

Notes

When the **901-CP** is initialised, automatic buffer recognition is re-set to pH4.00, pH6.88 and pH9.23. See section 10 if you wish to select pH7.00 buffer instead of pH6.88 and pH10.01 instead of pH9.23.

When the optional RS232 port is fitted, the Baud Rate is set to 9600 and the Send Rate is set to zero. See sections 8.1 and 8.2 for details if these settings need to be altered.

If a k=0.1 Conductivity/TDS sensor is being used, the manual k factor selection must be re-set to k=0.1 before use.

13. Troubleshooting

13.1 General Error Messages

Error Message	Possible Causes	Remedy
`Not Factory Cal.` (displayed at turn-on)	The EEPROM chip which contains the factory calibration information has failed.	Switch the **901-CP** off, wait 10 seconds, and try switching on again. If message persists, then the unit must be returned to TPS for service.
`EEPROM WriteFail` then: **`Contact Factory`** (displayed at calibration or set-up).	Storage of user calibration settings to the EEPROM has failed.	Switch the **901-CP** off, wait 10 seconds, and then switch the unit on again. Attempt calibration/setup again. If message persists, then the unit must be returned to TPS for service.

13.2 Conductivity and TDS Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new electrode.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 12.
Unit attempts Span calibration instead of Zero calibration.	Electrode has Zero error.	Thoroughly rinse electrode in distilled water and allow to completely dry in air before attempting zero calibration. If instrument does not calibrate at Zero with electrode disconnected, then the instrument is faulty.
Standard calibration fails, and k factor is greater than 0.133, 1.33 or 13.3 (depending on k factor of sensor).	1. Electrode is not immersed deeply enough.	Immerse electrode at least to the vent hole in the glass body.
	2. Electrode may have a build-up of dirt or oily material on electrode plates.	Clean electrode, as per the instructions detailed in section 14.1.
	3. Platinum-black coating has worn off.	Electrode requires replatinisation. Return to the factory, or see details in section 14.2.
	4. Standard solution is inaccurate.	Replace standard solution.
	5. Electrode is faulty.	Return electrode to factory for repair or replacement.
	6. Faulty instrument.	Return instrument to factory for repair.
	7. k-factor incorrectly set if using k=0.1 or k=10 sensor.	Set the correct k-factor, as per section 11.
Standard calibration fails, and k factor is less than 0.075, 0.75 or 7.5 (depending on k factor of sensor).	1. Standard solution is inaccurate.	Replace standard solution.
	2. Electrode may have a build-up of conductive material, such as salt.	Clean electrode, as per the instructions detailed in section 14.1.
	3. Electrode is faulty.	Return electrode to factory for repair or replacement.
	4. Faulty instrument.	Return instrument to factory for repair.
	5. k-factor incorrectly set if using k=0.1 or k=10 sensor.	Set the correct k-factor, as per section 11.

Continued next page…

Conductivity and TDS Troubleshooting, continued…

Inaccurate readings, even when calibration is successful.	1. Electrode may have a build-up of dirt or oily material on electrode plates. 2. Platinum-black coating has worn off.	Clean electrode, as per the instructions detailed in section 14.1. Electrode requires replatinisation. Return to the factory, or see details in section 14.2.
Readings drift.	1. Electrode may have a build-up of dirt or oily material on electrode plates.	Clean electrode, as per the instructions detailed in section 14.1.
Readings are low or near zero.	1. Electrode may have a build-up of dirt or oily material on electrode wires. 2. Electrode is not immersed deeply enough. 3. Electrode is faulty. 4. Faulty instrument. 5. k-factor incorrectly set if using k=0.1 or k=10 sensor.	Clean electrode, as per the instructions detailed in section 14.1. Immerse electrode at least to the vent hole in the glass body. Return electrode to factory for repair or replacement. Return instrument to factory for repair. Set the correct k-factor, as per section 11.

13.3 pH and mV Troubleshooting

Symptom	Possible Causes	Remedy
Meter displays "**OverR**" as a pH reading.	pH reading is over-ranged.	pH sensor not connected or faulty. Replace sensor if necessary.
Unit fails to calibrate, even with new sensor.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 12.
1 Point calibration fails (Asymmetry is greater than +/-1.00 pH).	1. Reference junction blocked.	Clean reference junction as per instructions supplied with the sensor.
	2. Reference electrolyte contaminated.	Flush with distilled water and replace electrolyte.
2 Point calibration fails (Slope is less than 85.0%).	1. Buffer set incorrectly.	Ensure that you are using buffers that match the selected buffer set. See section 10.
	2. Glass bulb not clean.	Clean glass bulb as per instructions supplied with the sensor.
	3. Sensor is aged.	Attempt rejuvenation, as per instructions supplied with the sensor. If not successful, replace sensor.
	4. Connector is damp.	Dry in a warm place.
	5. Buffers are inaccurate.	Replace buffers.
Inaccurate readings, even when calibration is successful.	Reference junction blocked.	Clean reference junction as per instructions supplied with the sensor.
Displays 7.00 for all solutions.	Electrical short in connector.	1. Check connector. Replace if necessary. 2. Replace sensor.
Displays 4-5 pH for all solutions.	Glass bulb or internal stem cracked.	Replace sensor.

pH and mV Troubleshooting, continued…

Unstable readings.	1. Static charge or electrical noise from near electrical equipment causing interference.	Fit a solution earth rod to the **Guard** connector.
	2. Reference junction blocked.	Clean reference junction as per instructions supplied with the sensor.
	3. Glass bulb not clean.	Clean glass bulb as per instructions supplied with the sensor.
	4. Bubble in glass bulb.	Flick the sensor to remove bubble.
	5. Faulty connection to meter.	Check connectors. Replace if necessary.
	6. Reference junction not immersed.	Ensure that the bulb AND the reference junction are fully immersed.
	7. KCl crystals around reference junction, inside the electrolyte chamber.	Rinse electrolyte chamber with warm distilled water until dissolved. Replace electrolyte.

13.4 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Meter reads "**OverR**" in Temperature mode.	Temperature sensor is connected, but is faulty.	Check the temperature sensor connector, and replace if necessary. Replace temperature sensor (part no 121245) if problem persists.
Meter displays Temperature with an "**m**", even when temperature sensor is plugged in.	1. Faulty connector.	Check the connector and replace if necessary.
	2. Incorrect temperature sensor.	Fit new temperature sensor, part number 121245.
	3. Faulty temperature sensor.	Fit new temperature sensor, part number 121245.
Temperature inaccurate and cannot be calibrated.	1. Faulty connector.	Check the connector and replace if necessary.
	2. Faulty temperature sensor.	Fit new temperature sensor, part number 121245.

14. Appendices

14.1 Care, Cleaning and Maintenance of Conductivity Sensors

14.1.1 Care of Conductivity Sensors

The conductivity section of the electrode supplied with your **901-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 electrode will require replatinising (see section 14.2). You can help to maintain the platinum-black layer by following these simple rules:

1. **NEVER** touch or rub the electrode wires with your fingers, cloth etc.
2. Avoid using the electrode in solutions that contain a high concentration of suspended solids, such as sand or soil, which can abrade the electrode wires. Filter these types of solutions first, if possible.
3. Avoid concentrated acids. If you must measure acids, remove the electrode immediately after taking the measurement and rinse well with distilled water.

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

14.1.2 Cleaning of Conductivity Sensors

Platinised platinum Conductivity electrodes 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 wires.
2. Films of oils or fats on the electrode wires can usually be removed by rinsing the electrode in methylated spirits.
3. Stubborn contamination can be removed by soaking the electrode in a solution of 10 parts distilled water TO 1 part Concentrated HCl. The electrode 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 electrode will then need to be cleaned in HCl, as per step 3 and replatinised, as per section 14.2.

14.2 Replatinising Conductivity Sensors

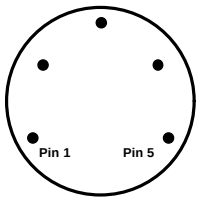
There are several ways to replatinise Conductivity electrodes.

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.
   (d) Apply a direct current of 10mA between pins 1 and 5 of the electrode plug, as per the diagram below. Reverse the polarity every 30 seconds. After approximately 8 minutes (4 minutes per electrode plate), they should have an even “sooty” appearance. Avoid excess current as this will cause incorrect platinising.
   (e) After platinising, rinse the electrode well in distilled water.
   (f) If you have any doubts about any of these steps, then you should consider returning the electrode to the factory. The cost of replatinising is quite low, and you will be guaranteed of the best possible result.



Sensor Connector

14.3 pH Sensor Fundamentals

A combination pH sensor is two sensors in one. The sensing membrane is the round or spear shaped bulb at the tip of the sensor. This produces a voltage that changes with the pH of the Solution. This voltage is measured with respect to the second part of the sensor, 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.

14.3.1 Asymmetry of a pH Sensor

An “ideal” pH sensor produces 0 mV output at 7.00 pH. In practice, pH sensors 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 14-1 illustrates how asymmetry is expressed.

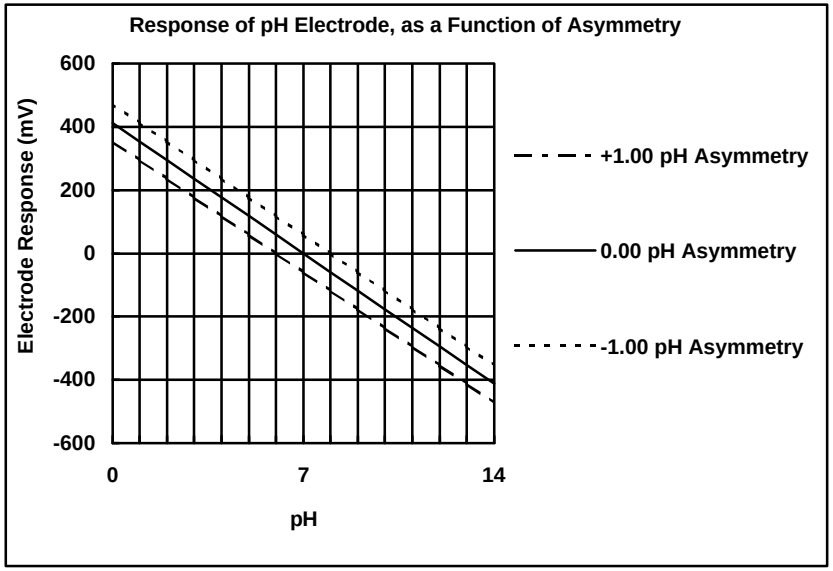


Figure 14-1

14.3.2 The Slope of a pH Sensor

As mentioned above, a pH sensor produces 0 mV output at around 7.00 pH. As the pH goes up, an "ideal" pH sensor produces -59mV/pH unit at 25 ^{o}C As the pH goes down, an ideal pH sensor produces +59mV/pH unit. In practice, pH sensors usually produce slightly less than this. The output of a pH sensor is expressed as a percentage of an ideal sensor. For example, an ideal sensor that produces 59mV/pH unit has "100% Slope". An sensor that produces 50.15mV/pH unit has "85% Slope" (see Figure 14-2).

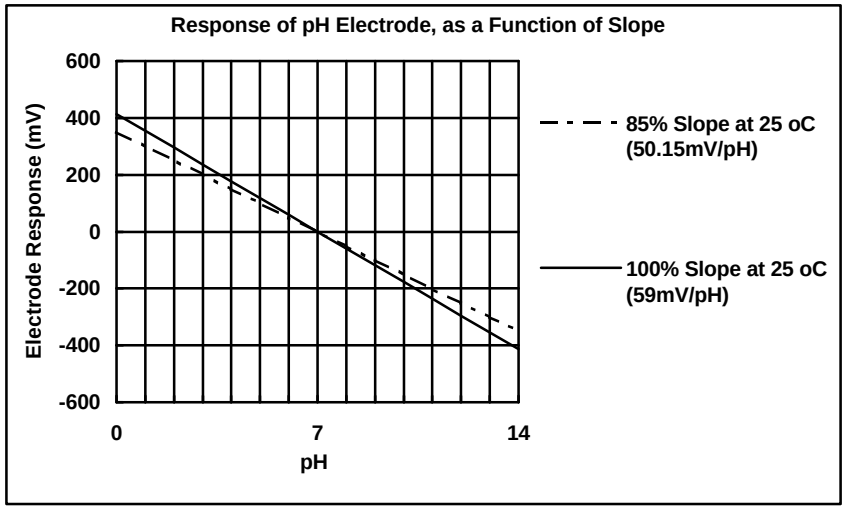


Figure 14-2

14.3.3 Temperature Compensation

The slope of a pH sensor (section 14.3.2) is affected by temperature. This effect is compensated for either by using an Automatic Temperature Compensation (ATC) sensor or by entering the sample temperature manually. Figure 14-3 shows the slope of a pH sensor at various temperatures.

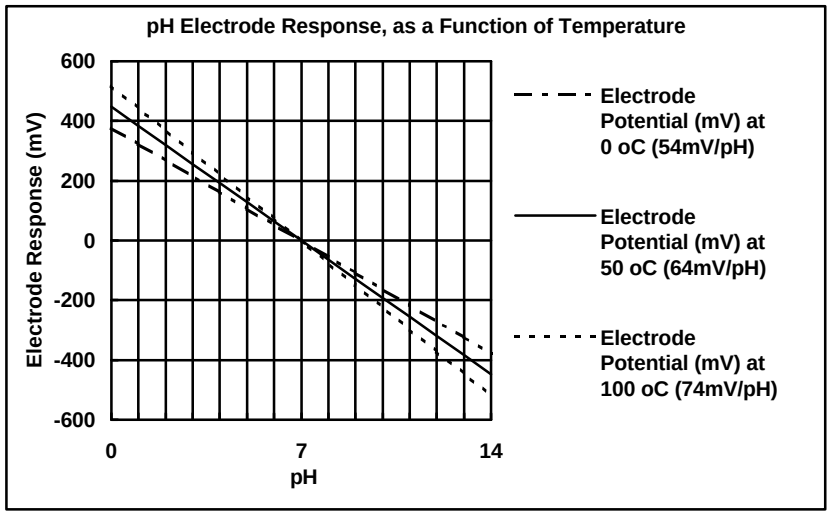


Figure 14-3

14.4 Polarisation Output Connector

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

The TPS Double Platinum electrode (part no 122207) has two connectors. The larger BNC connector fits to the **Sensor** socket and the smaller 3.5mm phono plug fits to the **Polarisation** socket.

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

When performing Karl Fischer titrations, ensure that the **901-CP** is in mV mode.

14.5 Guard Connector

In some circumstances, the pH or mV readings may become unstable. This may be due to static charge in the sample vessel, or electrical noise from nearby electrical equipment. In these cases, a solution guard may eliminate the problem.
A solution earth rod is available from TPS (part no 121360). This connects directly to the **Guard** socket. Alternatively, run a wire from the **Guard** socket to a stainless steel fitting in contact with the sample.

14.6 Checking the reference junction of a pH sensor.

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

1. Calibrate the **901-CP**, as per section 5.
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 sensor.
5. Re-calibrate the **901-CP** and repeat the test.
6. If the value obtained is still outside 7.06 +/-0.05 pH, then the sensor should be replaced.

14.7 Determining if an instrument or pH sensor is faulty

The following test can be performed to help determine if the **901-CP** or the pH sensor is faulty.

1. Initialise the **901-CP** (see section 12).
2. Select pH plus Temperature mode (see section 2).
3. Disconnect the pH sensor.
4. Connect the centre pin of the **Sensor** connector with the outside frame of the connector, using a short piece of wire or a paper clip etc.
5. The meter should read approximately 7.00. If you press the Calibrate key, the **901-CP** will calibrate to around 6.88 pH, depending upon the temperature readout.
6. If the **901-CP** is operating correctly, the reading should be totally stable with the wire firmly in place. If not, the meter requires servicing.
7. Now carefully disconnect the wire from the centre pin only (make sure the other end of the wire remains connected to the outside frame of the connector).
8. The reading should steadily drift away from 7.00 (either up or down) at a rate of approximately 1 pH or less every 3 seconds. If the drift rate is faster than this, then input circuitry of the **901-CP** may be faulty and could require servicing.

15. Warranty

TPS Pty. Ltd. guarantees all instruments and sensors 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 sensors 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 sensor. 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 sensor 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 labor 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.

- **Always describe the fault in writing.**
- **Always return the sensors with the meter.**