

Congratulations !

You have purchased the latest in benchtop pH-mV-Temperature instrumentation. We trust that your new **labCHEM-pH** will give you many years of reliable service.

The **labCHEM-pH** 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 **labCHEM-pH**. It also contains a full listing of all of the items that you should have received with your **labCHEM-pH**. Please take the time to read this section, as it explains some of the items that are mentioned in subsequent sections.

3. Main Section

The main section of the handbook provides complete details of the **labCHEM-pH**, 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 labCHEM-pH
pH-mV-Temp. Meter**

Version : 1.1

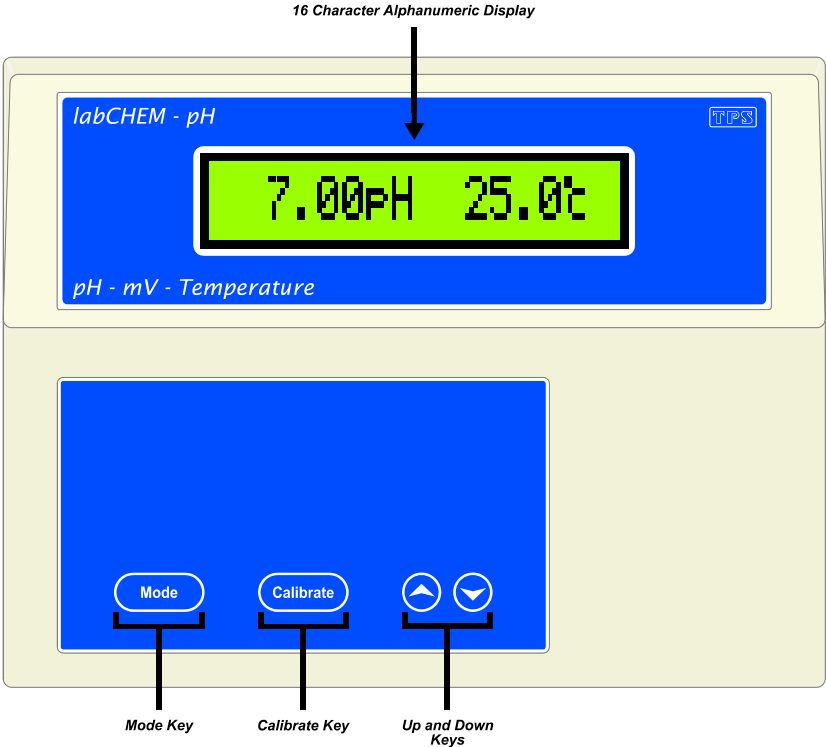
Date : 05-Jul-2010

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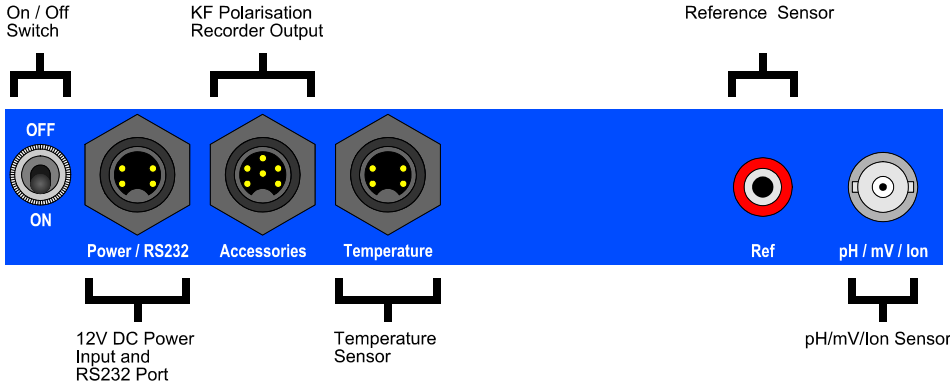
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1. Introduction

1.1 labCHEM-pH Display and Controls



1.2 labCHEM-pH Rear Panel Connectors



1.3 labCHEM-pH Front Panel

Display

- 16 character alphanumeric LCD with 14.5 mm characters.
- pH/mV and Temperature can be displayed simultaneously.
- User friendly text prompts and error messages.
- Serial number is displayed after the model name when the **labCHEM-pH** is switched on.



Mode Key

- Switches between pH, mV, Temperature and 2 optional RS232 modes. See section 2.

Calibrate Key

- Used to calibrate pH and Temperature. See sections 3 and 5.
- Also used to select buffers for automatic buffer recognition. See section 9.

and **Keys**

- Used for temperature calibration. See section 5.
- Used for setting the manual temperature compensation value if the temperature sensor is unplugged. See section 5.4.
- Press  to recall asymmetry and slope values from the last successful pH calibration.
- Press  to start and stop the Automatic Stability Function ("ASF"). See section 6.
- Used to select baud rate when optional RS232 port is fitted. See section 7.1.
- Used to select output "send" rate when optional RS232 port is fitted. See section 7.2.

1.4 Unpacking Information

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

	Part No
1. labCHEM-pH pH-mV-Temp Instrument	121104
2. Combination pH Sensor	121207
3. Temperature/ATC Sensor	121248
4. pH7.00 Buffer, 200mL	121387
5. pH4.01 Buffer, 200mL	121381
6. AC/DC Power Adaptor	130037
7. labCHEM-pH Handbook	130050

Options that may have been ordered with your **labCHEM-pH**:

1. Double Platinum Electrode for Karl Fischer.....	122209
Titrations	
2. Flexible arm type sensor holder	130088
3. RS232 option (includes cable).....	130029
4. RS232 Communication software for Windows	130086
5. Recorder output option (includes cable).....	130028
6. Recorder PLUS RS232 option (includes cable)	130049

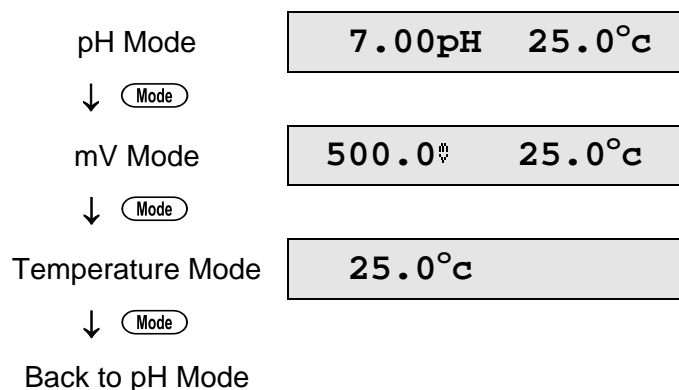
1.5 Specifications

	Ranges	Resolution	Accuracy
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 °C	0.1 °C	±0.2 °C

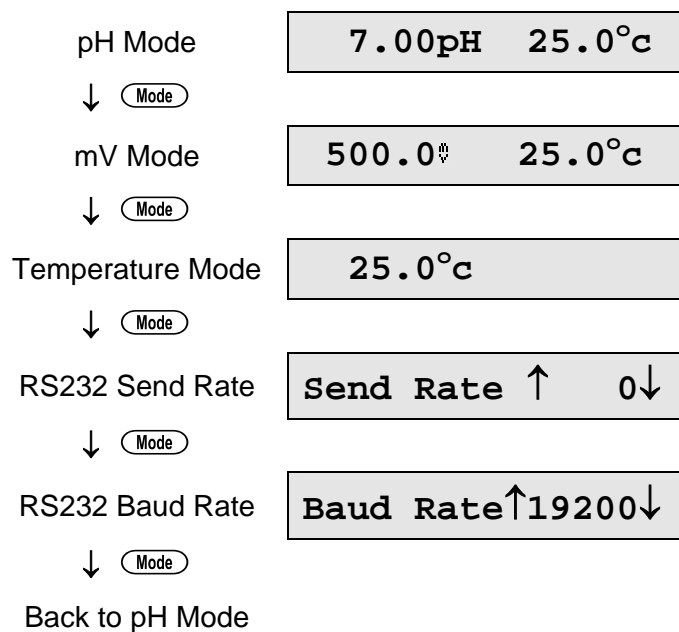
Waterproofing	: Case, keypad and connectors rated to IP65
Input Impedance	: >3 x 10 ¹² Ω
Asymmetry Range	: -1.00 to 1.00 pH
Slope Range	: 85.0 to 105.0%
Temperature Compensation	: 0 to 100.0 °C, automatic or manual
Recorder Output	: pH : 0 ~ 14.00 pH for 0 ~ 2000 mV ie. pH7.00 = 1000 mV mV : -1500 ~ 1500 mV for 0 ~ 2000 mV ie. 0 mV = 1000 mV Temp: -10.0 ~120.0 °C for 0 ~ 2000 mV ie. 0.0 °C = 152 mV Output impedance approx 1000 Ohms.
Power	: 12V DC by AC/DC power adaptor.
Dimensions	: 240 x 180 x 105 mm
Mass	: Instrument only : Approx 1.0 kg Full Kit : Approx 2.5 kg
Environment	: Temperature : 0 to 45 °C Humidity : 0 to 90 % R.H.

2. Operating Modes

If the **labCHEM-pH IS NOT** fitted with the RS232 option, press the **Mode** key to roll through the three operating modes as follows...



If the **labCHEM-pH IS** fitted with the RS232 option, press the **Mode** key to roll through the five operating modes as follows...



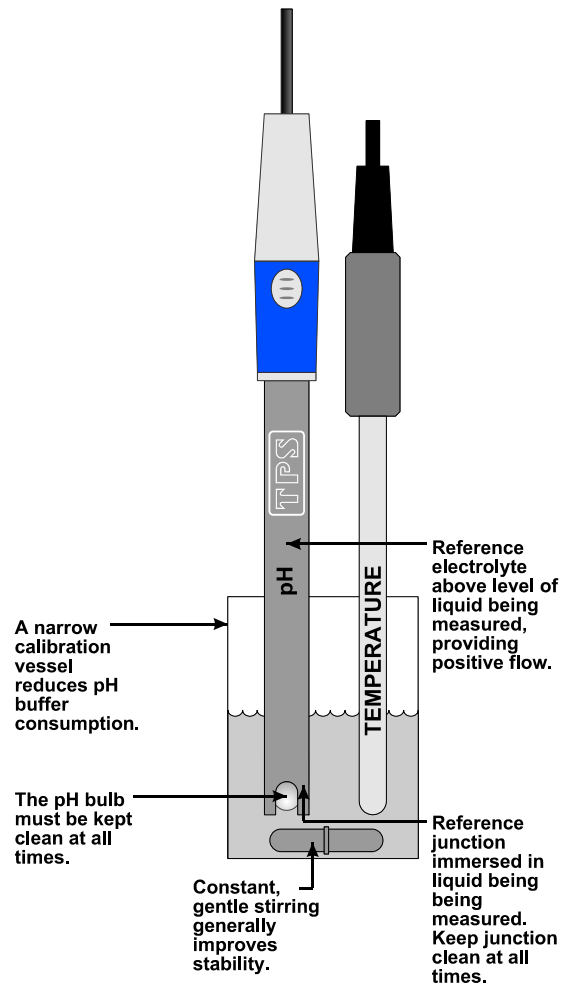
3. pH Calibration

A " * " in place of the decimal point indicates that the pH readout is not calibrated, or a past calibration has failed. The " * " will be removed once a full 2 point calibration has been successfully performed buffers.


3.1 Calibration Procedure

1. Switch the **labCHEM-pH** on and select pH mode (section 2).
2. Plug the pH sensor into the **pH/mV/Ion** socket and the temperature sensor into the **Temperature** socket.
3. Ensure that temperature has already been calibrated or manually set (see sections 5.1 and 5.4). 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 9.
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 (pH7.00 or pH6.86) 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. Press  to calibrate.

The Automatic Stability Function display now shows an \times on the display, along with the message "Wait" to indicate that the **labCHEM-pH** is waiting for the pH reading to stabilise before calibrating. For example...

6.98pH \times Wait

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

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

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 (pH4.01, pH9.18 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.

Press  to calibrate.

The Automatic Stability Function display now shows an \times on the display, along with the message "Wait" to indicate that the **labCHEM-pH** is waiting for the pH reading to stabilise before calibrating. For example...

4.10pH \times Wait

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

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

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

11. The **labCHEM-pH** is now calibrated for pH and is ready for use in this mode. Discard the used samples of buffer.

3.2 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 daily 1-point calibration may be necessary.
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 **labCHEM-pH** is switched off, even when the power supply is removed.
pH9.18 and pH10.01 buffers are unstable once the bottles have been opened. Discard immediately after use.

3.3 Calibration Messages

1. If a 1-point calibration has been successfully performed, the **labCHEM-pH** 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 **labCHEM-pH** 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 **labCHEM-pH** 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 **labCHEM-pH** 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.

4. mV Calibration

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

5. Temperature Calibration

The temperature readout must be calibrated or manually set before attempting pH calibration. A “ * ” in place of the decimal point indicates that the Temperature readout is not calibrated, or a past calibration has failed. The “ * ” will be removed once a Temperature calibration has been successfully performed.

5.1 Calibration Procedure

1. Switch the **labCHEM-pH** on and select Temperature mode (see section 2).
2. Plug the temperature sensor (Part No 121248) 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. Press **Calibrate** to calibrate. The **labCHEM-pH** now enters temperature calibration. For example...

Enter True Temp

then:

26*0°C ↑ 25.0↓

5. Press the **↶** and **↷** keys until the display shows the same temperature as the mercury thermometer.
6. Press the **Calibrate** key to calibrate the temperature readout.

The Automatic Stability Function display now shows an **X** on the display to indicate that the **labCHEM-pH** is waiting for the Temperature reading to stabilise before calibrating. For example...

24.0c X ↑ 25.0↓

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

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

Alternatively, press the **Mode** key to abort temperature calibration.

5.2 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.

5.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **labCHEM-pH** 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 **labCHEM-pH** 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.

5.4 Manual Temperature Setting

Manual temperature setting is only available if the temperature sensor is not plugged in.

An "m" is added to the Temperature display when the **labCHEM-pH** is using a manual Temperature setting. For example...

7.00pH 25.0^ocm

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

Man Temp ↑ 25.0↓

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.

6. Automatic Stability Function (ASF)

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

ASF can be used in the following ways...

6.1 ASF During Normal Measurement

1. Press \ominus in normal measurement mode. The \times symbol appears in the display. For example...

7.00pH \times 25.0 $^{\circ}$ C

2. When BOTH the pH AND Temperature readouts have stabilised, the \times will change to a \surd . Both readings are now frozen. For example...

7.00pH \surd 25.0 $^{\circ}$ C

3. The operator can now make a note of the reading as required.
4. **To unfreeze the display in order to take the next reading, press \ominus again to re-start the ASF sampling process.**
5. Press \ominus a second time, while the \times symbol is being displayed, to turn ASF off.

6.2 ASF During Calibration

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

Press \ominus while the \times symbol is being displayed during calibration to turn ASF off and calibrate immediately, before the reading has stabilised.

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

7. RS232 Port

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

7.1 Setting the Baud Rate

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

Baud Rate ↑ 19200 ↓

Press the ⤴ and ⤵ keys to scroll through the available baud rates of 1200, 9600, 19200 or 38400 baud.

Ensure that the displayed baud rate matches the baud rate set on the printer or PC with which the **labCHEM-pH** is communicating.

3. Press the Mode key to return to pH, mV or Temperature mode as required.

7.2 Sending Readings to the RS232 Port

The **labCHEM-pH** can send readings to the RS232 port at a pre-set rate.

To set this Send Rate...

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

Send Rate ↑ 0 ↓

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 3600 seconds.

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

3. Press the Mode key to return to pH, mV or Temperature mode as required.

7.3 RS232 Configuration

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

7.4 Communication and Statistical Software

Communication between the **labCHEM-pH** 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 **labCHEM-pH** is formatted in 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 7.7 and also the "excel.txt" file in the folder where you installed the WinTPS program.

7.5 Commands

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

Action	Command	Notes
Request current data	?D<cr>	Returns the current pH/mV and Temperature data from the labCHEM-pH . The print rate must be set to zero (see section 7.2).

7.6 Data Format

Data is returned to the RS232 Port by the **labCHEM-pH** in the following format. A “•” shown anywhere in this section denotes one space.

PPPPPPuuu•TTTTTuuu

PPPPPP is pH/mV data. 6 characters, right justified.

uuu is the pH/mV unit description, which can be either of the following...

pH•	for pH readout.
mV•	for Millivolts readout.

TTTTT is Temperature data, 5 characters, right justified.

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

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

When requested by a PC with the ?D command (section 7.5), the data is terminated with a carriage return.

When the data is sent by the **labCHEM-pH** using the Send function (section 7.2) the data ends with a carriage return and a line feed.

Notes:

1. Data corresponds to the Mode selected (ie. pH or mV).
2. pH or mV data and units are replaced by spaces in Temperature Mode.
3. **+OVR** or **-OVR** is sent when the Data is over-range.
4. **BUSY<cr>** is sent when the **labCHEM-pH** is Busy (eg. in calibration, Baud Rate mode, Send rate mode etc.) or when data is not available.

7.7 Importing Data into Microsoft Excel

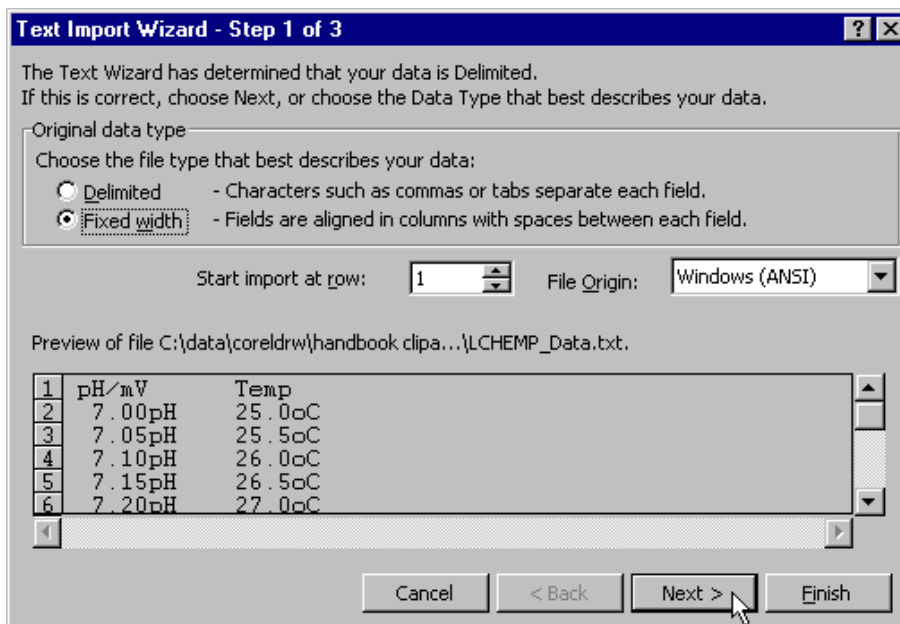
The following procedure details the method for importing a **labCHEM-pH** text data file into Microsoft® Excel®.

1. Start Microsoft® Excel® and select **F**ile → **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 >”.

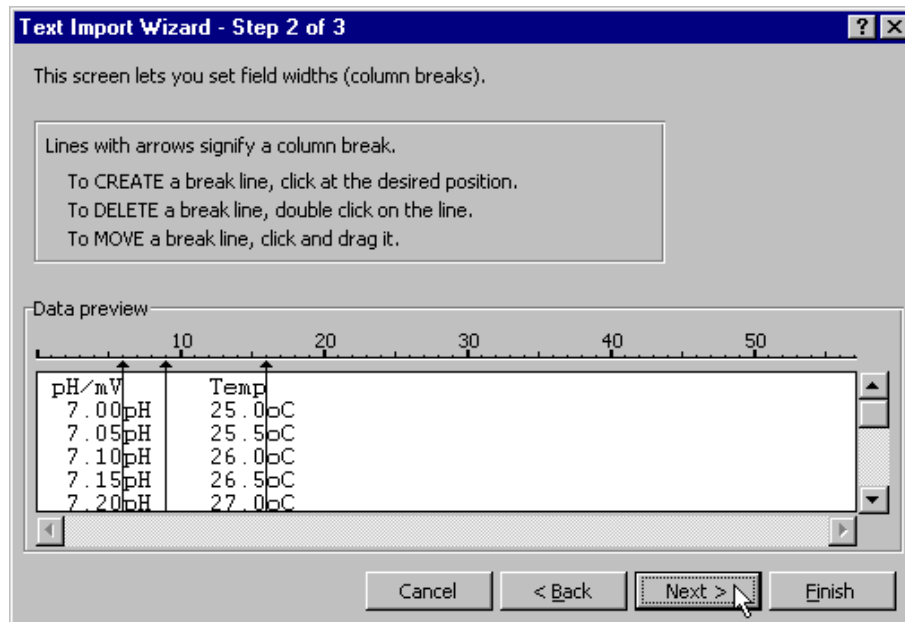
Note that the data column headers in the first row appear only when the data is downloaded using the WinTPS software.



Continued over the page...

- 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.

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



- 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.

8. Recorder Output Option

This section is applicable when the optional analogue recorder output is fitted. The recorder output corresponds to the currently selected display mode. There is no output in RS232 Send Rate or RS232 Baud Rate modes.

The output voltages are as follows:

pH	: 0 to 14.00 pH for 0 to 2000 mV ie. pH7.00 = 1000 mV Output
mV	: -1500 to +1500 mV for 0 to 2000 mV ie. 0 mV Reading = 1000 mV Output
Temperature	: -10.0 to 120.0 °C for 0 to 2000 mV ie. 0.0 °C = 152 mV Output
Output Impedance	: Approximately 1000 Ohms
Resolution	: Approximately 2 mV

9. Selecting Buffers for Automatic Buffer Recognition

The **labCHEM-pH** is factory set to automatically recognise pH4.01, pH7.00 and pH9.18 buffers. There are also the options of using pH6.86 instead of pH7.00 and pH10.01 instead of pH9.18. The following procedure describes how to set which of these buffers are automatically recognised at calibration.

1. Switch the meter **OFF** and wait for 5 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=7.00pH

Press the \odot or \ominus keys to alternate between pH7.00 and pH6.86 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 range buffer. For example...

Buffer 2 Select

then:

Buffer 2=9.18pH

Press the \odot or \ominus keys to alternate between pH9.18 and pH10.01 buffers. The display shows 10.0 for the latter, but this buffer is stored in memory as 10.01.

5. Press the **Mode** key to exit when the desired high buffer has been selected. The setting is kept in memory when the meter is switched off, even when the power supply is removed.

10. Initialising the labCHEM-pH

If the calibration settings of the **labCHEM-pH** 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.

To initialise the **labCHEM-pH**...

1. Switch the **labCHEM-pH OFF** and wait for 5 seconds.
2. Press and hold the \odot key while switching the **labCHEM-pH** back on.
3. The following messages are now displayed...

Initializing

then:

labCHEM-P V1.1s

then:

labCHEM-P S1234

(The "s" after "v1.1" is shown when the optional RS232 port is fitted.)

4. The **labCHEM-pH** now goes on to pH mode. Note that a " * " replaces each of the decimal points in the pH and Temperature readings, indicating that the unit requires calibration.
5. When the optional RS232 port is fitted, the Baud Rate is set to 19200 and the Send Rate is set to zero. See sections 7.1 and 7.2 for details if these settings need to be altered.

11. Troubleshooting

11.1 General Error Messages

Error Message	Possible Causes	Remedy
<p>Not Factory Cal. (displayed at turn-on)</p>	<p>The EEPROM chip which contains the factory calibration information has failed.</p>	<p>Switch the labCHEM-pH off, wait 5 seconds, and try switching on again.</p> <p>If message persists, then the unit must be returned to TPS for service.</p>
<p>EEPROM WriteFail then: Contact Factory (displayed at calibration or set-up).</p>	<p>Storage of user calibration settings to the EEPROM has failed.</p>	<p>Switch the labCHEM-pH off, wait 5 seconds, and then switch the unit on again.</p> <p>Attempt calibration/setup again.</p> <p>If message persists, then the unit must be returned to TPS for service.</p>

11.2 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 10.
1 Point calibration fails (Asymmetry is greater than +/- 1.00 pH).	<ol style="list-style-type: none"> Reference junction blocked. Reference electrolyte contaminated. 	<p>Clean reference junction as per instructions supplied with the sensor.</p> <p>Flush with distilled water and replace electrolyte.</p>
2 Point calibration fails (Slope is less than 85.0%).	<ol style="list-style-type: none"> Buffer set incorrectly. Glass bulb not clean. Sensor is aged. Connector is damp. Buffers are inaccurate. 	<p>Ensure that you are using buffers that match the selected buffer set. See section 9.</p> <p>Clean glass bulb as per instructions supplied with the sensor.</p> <p>Attempt rejuvenation, as per instructions supplied with the sensor. If not successful, replace sensor.</p> <p>Dry in a warm place.</p> <p>Replace buffers.</p>
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.	<ol style="list-style-type: none"> Check connector. Replace if necessary. Replace sensor.
Displays 4-5 pH for all solutions.	Glass bulb or internal stem cracked.	Replace sensor.

pH and mV Troubleshooting, continued...

Unstable readings.	<ol style="list-style-type: none"> 1. Static charge or electrical noise from near electrical equipment causing interference. 2. Reference junction blocked. 3. Glass bulb not clean. 4. Bubble in glass bulb. 5. Faulty connection to meter. 6. Reference junction not immersed. 7. KCl crystals around reference junction, inside the electrolyte chamber. 	<p>Ensure Temperature sensor is fitted. It acts as a solution earth rod to reduce interference.</p> <p>Clean reference junction as per instructions supplied with the sensor.</p> <p>Clean glass bulb as per instructions supplied with the sensor.</p> <p>Flick the sensor to remove bubble.</p> <p>Check connectors. Replace if necessary.</p> <p>Ensure that the bulb AND the reference junction are fully immersed.</p> <p>Rinse electrolyte chamber with warm distilled water until dissolved. Replace electrolyte.</p>
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11.3 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Meter reads "OverR" in Temperature mode.	Temperature sensor is connected, but is faulty.	<p>Check the temperature sensor connector, and replace if necessary.</p> <p>Replace temperature sensor (part no 121248), if problem persists.</p>
Meter displays Temperature with an "m", even when temperature sensor is plugged in.	<ol style="list-style-type: none"> 1. Faulty connector. 2. Incorrect temperature sensor. 3. Faulty temperature sensor. 	<p>Check the connector and replace if necessary.</p> <p>Fit new temperature sensor, part number 121248.</p> <p>Fit new temperature sensor, part number 121248.</p>
Temperature inaccurate and cannot be calibrated.	<ol style="list-style-type: none"> 1. Faulty connector. 2. Faulty temperature sensor. 	<p>Check the connector and replace if necessary.</p> <p>Fit new temperature sensor, part number 121248.</p>

12. Appendices

12.1 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.

12.1.1 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 12-1 illustrates how asymmetry is expressed.

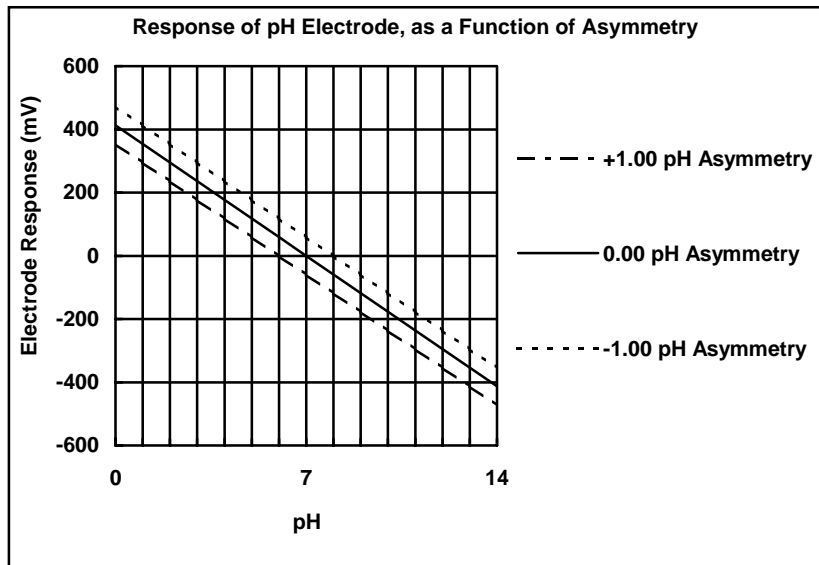


Figure 12-1

12.1.2 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 °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 12-2).

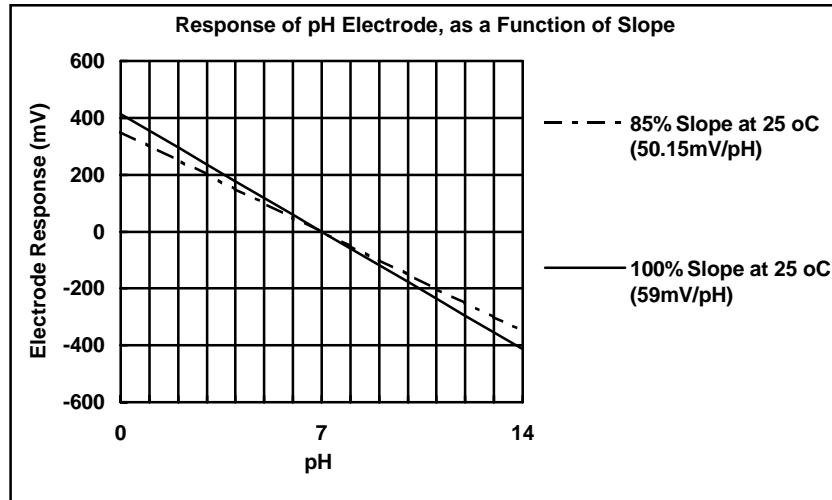


Figure 12-2

12.1.3 Temperature Compensation

The slope of a pH sensor (section 12.1.2) 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 12-3 shows the slope of a pH sensor at various temperatures.

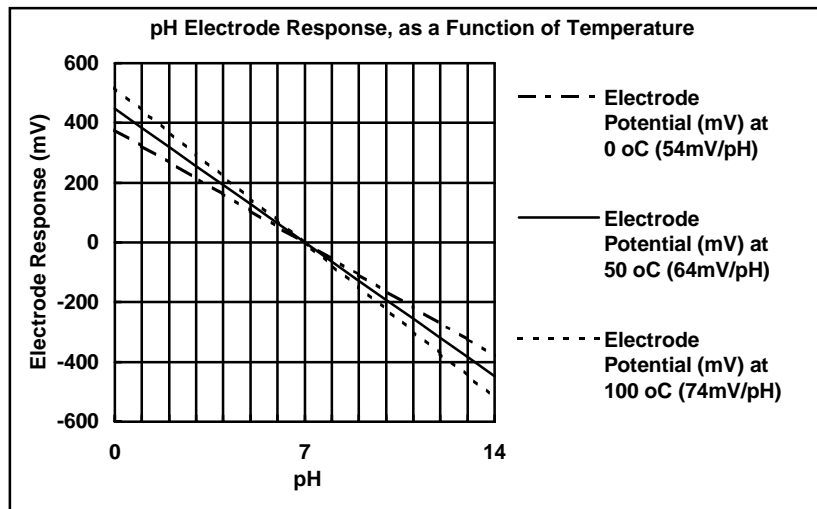


Figure 12-3

12.2 Karl Fischer Titrations

The **Accessories** connector on the rear panel is used to connect a TPS Double Platinum electrode (part no 122209) for Karl Fischer titrations. This titration is a method for determining minute quantities of water in non-aqueous liquids.

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

13. 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 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.

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