Congratulations !

You have purchased the latest in Handheld Temperature instrumentation. We trust that your new **WP-87T** will give you many years of reliable service.

The **WP-87T** 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 **WP-87T**. It also contains a full listing of all of the items that you should have received with your **WP-87T**. 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 **WP-87T**, 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 WP-87T
Thermocouple Digital
Thermometer

Handbook Version : 1.1
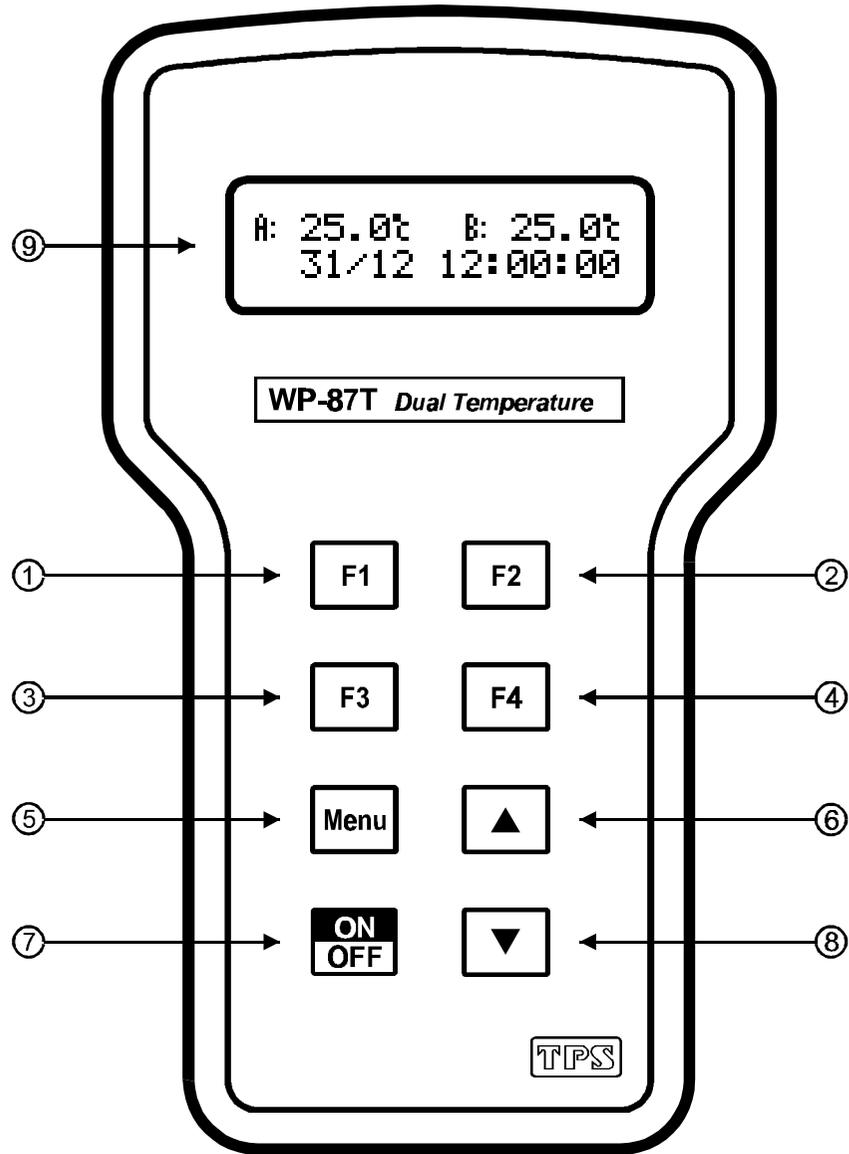Date   : 18 Jul 00
Author   : MS

Contents

1. Introduction

1.1 WP-87T Display and Controls

① F1

Press to record readings into the Notepad. See 10.1.

Also used to select readout units at turn-on. See section 3.

② F2

Press to show or hide the date and time. See section 14.2.

Also used at turn-on to select the number of channels to be displayed. See section 4.

③ F3

Press to start or stop automatic logging. See section 11.

Alternatively, press to transmit current reading plus date and time to the optional RS232 port, when Automatic Logging is disabled. See section 12.2.

④ F4

Press to select Difference Mode when the unit is in 2 channel readout. See section 6.

⑤ Menu

Press to access the user-friendly menu system which makes the **WP-87T** a breeze to operate.

⑥ ▲ and ⑧ ▼

The ▲ and ▼ keys are used when calibrating temperature readout (section 5), setting the clock (section 14.1), setting the automatic logging period (section 11), and displaying GLP information (section 9.1).

The ▲ key is also used to initialise the **WP-87T** at turn-on (section 15), and to toggle the Data Hold function on and off (section 8).

⑦ ON OFF

Switches the **WP-87T** on and off.

⑨ **Display**

32 character alpha-numeric display with user-friendly menu and prompting system. Shows all temperature channels simultaneously. Date and time can also be displayed.

1.2 Unpacking Information

Before using your new **WP-87T**, please check that the following accessories have been included:

	Part No
1. **WP-87T** Dual Channel Thermocouple Thermometer	124120
2. 3mm dia Temperature Sensor, Type K, 1m	124204
3. Battery charger	130037
4. **WP-87T** Handbook	130050

Optional sensors that may have been ordered with your **WP-87T**:

1. Bead sensor, Type K, for air/gas	124205
2. Sensor for flat surfaces, Type K	124203
3. Custom Type K sensor (specify requirements)	124206

Options that may have been ordered with your **WP-87T**:

1. RS232 Serial Interface Option	130039
(includes cables and communication software for DOS)	
2. Communication software for Windows ® 95 & 98	130086
3. Hard Carry Case	130059
4. Battery charger lead for 12V cigarette lighter socket	130046
5. Battery charger lead with clips for 12V DC source	130052
6. Solar Panel	130012

Other spares:

1. 6V NiMH Battery	130038
2. RS232 Interface Cable	130041

1.3 Specifications

Sensor Type......................... Type K Thermocouples, using standard mini plug.

Ranges................................ -99.9 to 200.0 ^{O}C
200 to 1200 ^{O}C
-99.9 to 390.0 ^{O}F
390 to 2000 ^{O}F
173.0 to 473.0 ^{O}Kelvin
473 to 1473 ^{O}Kelvin
Range is automatically selected, depending on reading.

Resolution .... 0.1 and 1 ^{O}C
0.1 and 1 ^{O}F
0.1 and 1 ^{O}Kelvin

Instrument Accuracy............ The **WP-87T** is accurate to the resolutions detailed above.

Sensor Accuracy .... Up to 200 ^{O}C .... ±0.2 ^{O}C
±0.3 ^{O}F
±0.2 ^{O}Kelvin
Above 200 ^{O}C...... ±1% of reading

Memory............................... 150 readings including date and time.

Automatic Logging .... User-set for one reading every 1 to 90 seconds, 1 to 90 minutes, or 1 to 24 hours.

Maximum/Minimum Mode .. Stores maximum and minimum values for all enabled channels.

Data Hold Function.............. Freezes current readings on the display.

Difference Mode.................. Displays difference between Channels A and B when 2 channel mode is selected.

RS232 Output (optional) ...... 300, 1200 & 9600 baud.
8 bits, no parity, 1 stop bit, XON/XOFF Protocol.

Clock .... Calendar clock displays date, month, hours, minutes & seconds.
Year is recorded in memory and transmitted to optional RS232 port, but is not displayed.

Battery Saver .... On .... Auto switch-off after 5 minutes.
Off .... Continuous use.
Bar Graph display of battery charge level.
Readout of battery voltage available for troubleshooting.

Good Laboratory Practices... Date, Time and Value of last successful offset and last span calibration are stored, and can be recalled or sent to the optional RS232 port at any time.

Offset Range .... $\pm 30.0\ ^{O}C$, $\pm 60.0\ ^{O}F$ and $\pm 30.0\ ^{O}Kelvin$

Span Range .... 90.0 to 110.0 %

Power .... 6V NiMH Rechargeable Battery for approx 50 hours operation.

Dimensions .... 187 x 110 x 51 mm

Mass .... Instrument only.... Approx 440g
Full Kit................ Approx 1.0kg

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

2. WP-87T Menu Structure

A detailed breakdown of the menu system of the **WP-87T** is shown below. This diagram provides a quick reference for the menu functions available for the **WP-87T**.

Menu → F1:Cal. → F1:Single Channel   This menu is skipped when 1 channel mode is selected.

F3:Both Channels

→ F2:Notepad → F1:Recall

F2:Erase

F3:Print *

F4:Prog → F1:Min

F2:Sec

F3:Hr

↑↓:Set Period

F3: MAX MIN → F1:Recall

F2:Erase

F3:Print *

F4:Start/Stop

F4:Setup → F1:Batt → F1:OFF
(Disable Battery Saver)

F2:ON
(Enable Battery Saver)

F2:Clock

F3:GLP → F1:Recall

F3:Print *

F4:Baud * → F1:300

F2:1200

F3:9600
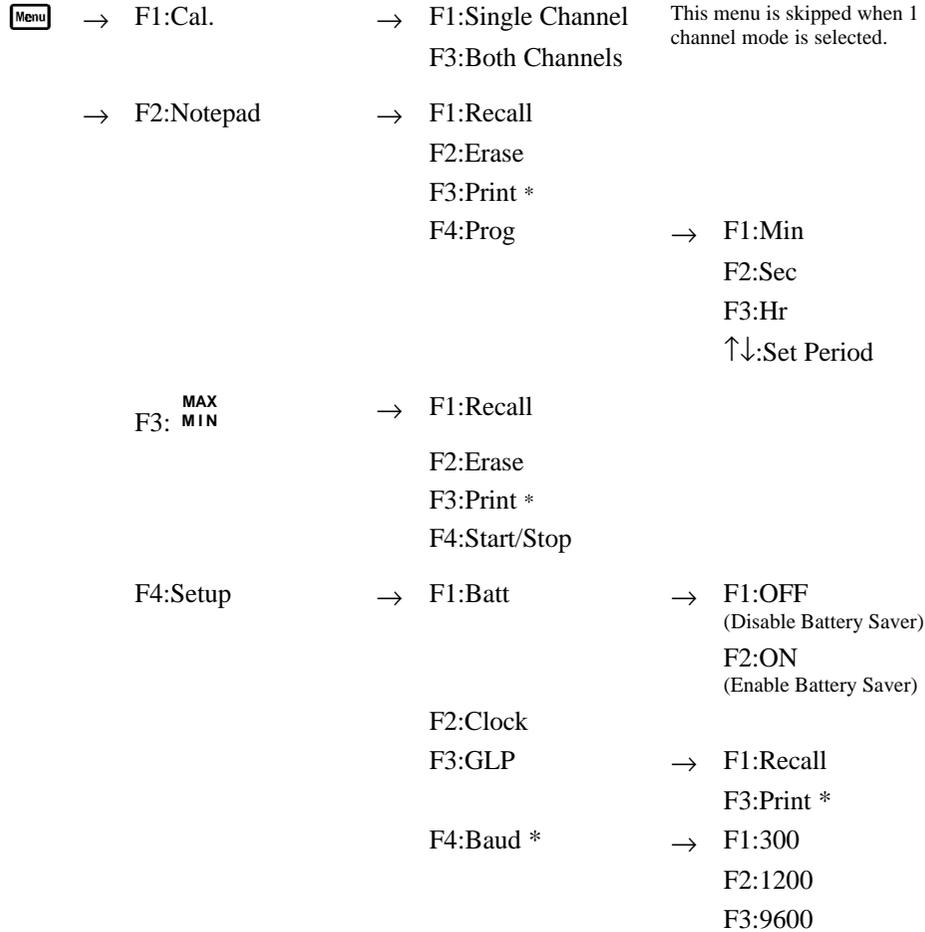
* These items available when the optional RS232 port is fitted.

3. Display Units

The **WP-87T** can display temperature in degrees Celsius, Fahrenheit or Kelvin.

To change the display units…

1. Make sure that all data stored in memory and Maximum/Minimum data has been noted, downloaded, or printed as required. This data must be erased before the display units are changed.

   See section 10.3 for details on how to erase the Notepad memory.

   See section 7.4 for details on how to erase the Maximum/Minimum data.

2. Switch the **WP-87T** OFF with the [ON/OFF] key.

3. Now press and hold the [F1] key while switching the **WP-87T** back on. The following message is displayed.

   ```
   Select F1:°C  F2:°F
   Units  F3:°K
   ```

   Press [F1] to select readout in degrees Celsius.

   Press [F2] to select readout in degrees Fahrenheit.

   Press [F3] to select readout in degrees Kelvin.

4. If the Notepad memory or Maximum/Minimum data have not yet been erased, then the **WP-87T** will ask you if you would like to erase them now…

   ```
   Must First Erase
   Notepad/Max/Min
   ```
   then:
   ```
   Erase, You Sure?
   F1:Yes  F2:No
   ```

   Press [F1] to Erase all stored readings and Maximum/Minimum data.

   Press [F2] to quit, and save all stored readings and Maximum/Minimum data.

Note

The **WP-87T** defaults to ^{O}C operation if the unit is initialised.

4. Number of Channels

The **WP-87T** can display 1 or 2 channels of temperature data simultaneously.

To select the number of channels to be displayed…

1. Make sure that all data stored in memory and Maximum/Minimum data has been noted, downloaded, or printed as required. This data must be erased before the number of channels is changed.

    See section 10.3 for details on how to erase the Notepad memory.

    See section 7.4 for details on how to erase the Maximum/Minimum data.

2. Switch the **WP-87T** OFF with the ⌨ key.

3. Now press and hold the F2 key while switching the **WP-87T** back on. The following message is displayed.

    ```
    Select    F1:1 F2:2
    Channels
    ```

    Press F1 to select 1 channel operation.

    Press F2 to select 2 channel operation.

4. If the Notepad memory or Maximum/Minimum data have not yet been erased, then the **WP-87T** will ask you if you would like to erase them now…

    ```
    Must First Erase
    Notepad/Max/Min
    ```
    then
    ```
    Erase, You Sure?
    F1:Yes   F2:No
    ```

    Press F1 to Erase all stored readings and Maximum/Minimum data.

    Press F2 to quit, and save all stored readings and Maximum/Minimum data.

Note

The **WP-87T** defaults to 1 channel operation if the unit is initialised.

5. Calibration

The **WP-87T** must be calibrated before use for the first time or if a temperature sensor is changed. A "∗ " is shown in place of the decimal point for any channels that are not calibrated.

5.1 Calibration Procedure for 1 Channel Operation
This calibration procedure is only applicable when the **WP-87T** has been set to single channel readout mode.
1. Plug the temperature sensor into the **A** socket. DO NOT plug the sensor into the **B** socket.
2. Press the 🔲 key to switch the **WP-87T** ON.

Offset Calibration
3. Place the sensor into a beaker of room temperature water alongside a good quality mercury thermometer. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.
4. Select Temperature Calibration (Menu → **F1:Cal.**).
5. The reading from the sensor is now displayed on the right of the display and the value you are going to set is shown on the left. For example…

```
→ 25.0←   A: 20*0°c
↑↓:Set      F1:Cal.
```

6. When the reading on the right has stabilised, press the ▲ and ▼ keys until the reading on the left shows the same temperature as the mercury thermometer.
7. Press the F1 key to perform a single point offset calibration.
    Alternatively, press the Menu key to abort temperature calibration.

Span Calibration (optional)
8. The offset calibration will suffice for most applications. For optimum precision, a second point span calibration can also be performed. After the offset calibration, the following message is displayed.

```
Press F1:Span Cal
or Menu to Quit
```

9. To perform a span calibration, place the sensor into a beaker of water that is at least 10 ^{O}C, 20 ^{O}F or 10 ^{O}Kelvin higher or lower than the first calibration point. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.

10. The reading from the sensor is now displayed on the right of the display, and the value you are going to set is shown on the left. For example…

```
→ 35.0←  A: 34*9°c
↑↓:Set    F1:Cal.
```

11. When the reading on the right has stabilised, press the ▲ and ▼ keys until the reading on the left shows the same temperature as the mercury thermometer.
12. Press the F1 key to perform a second point span calibration.
   Alternatively, press the Menu key to abort. Note that aborting at this point will still retain the offset calibration.

5.2 Calibration Notes
1. Calibration information is retained in memory when the **WP-87T** is switched off, even when the battery is removed. This information can be recalled later using the GLP function (see section 9). GLP information is only displayed for the currently selected number of channels.
2. Temperature does not need to be re-calibrated unless the Temperature sensor is replaced or the meter is initialised, even if the readout units are changed.
3. If Maximum/Minimum mode is active, the **WP-87T** stops it for calibration. This is done to preserve genuine Maximum/Minimum data. Maximum/Minimum mode must be restarted by the user after calibration. See section 7.

5.3 Calibration Messages
1. If a one point offset calibration has been successfully performed, the **WP-87T** will display the following message and the offset value of the sensor. For example…

```
Calibrate OK
A:Offset=   1.0°c
```

2. If a one point offset calibration has failed, the **WP-87T** will display the following message, and the failed offset value of the sensor.

```
Calibrate Failed
A:Offset=   10.5°c
```

3. If a span calibration has been successfully performed, the **WP-87T** will display the following message and the offset and span values of the sensor.

```
Calibrate OK
A:Offset=   1.0°c
```

then

```
Calibrate OK
A:Span=  100.0%
```

4. If a span calibration has failed, the **WP-87T** will display the following message and the failed span of the sensor. For example…

```
Calibrate Failed
A:Span=   85.0%
```

5. If the temperature of the water bath used for span calibration is less than 10 ^{O}C, 20 ^{O}F or 10 ^{O}Kelvin different to the first point, the following message will be displayed.

```
Temp Difference
Too Small
```

The **WP-87T** then gives the user the opportunity to try a span calibration again. Repeat the calibration procedure from step 9 onwards (section 5.1), ensuring that the temperature of the second calibration point is at least 10 ^{O}C, 20 ^{O}F or 10 ^{O}Kelvin higher or lower than the first point.

5.4 Calibration Procedure for 2 Channel Operation

This calibration procedure is applicable when the **WP-87T** has been set to 2 channel readout mode.

1. Plug the temperature sensors into the relevant sockets.
2. Press the ⬛ key to switch the **WP-87T** ON.

Offset Calibration

3. Place the sensor(s) to be calibrated into a beaker of room temperature water alongside a good quality mercury thermometer. Stir the sensor(s) and the thermometer gently to ensure an even temperature throughout the beaker.
4. Select Temperature Calibration (Menu → **F1:Cal.**)
5. The **WP-87T** now displays the following menu…

```
F1:Single Channel
F3:Both Channels
```

Press ▢F1 to calibrate a single channel of your choice. The **WP-87T** then prompts you to enter which channel is to be calibrated.

Press ▢F2 to calibrate both channels simultaneously.

6. The reading from Sensor A is now displayed on the right of the display, and the value you are going to set is shown on the left. For example…

```
→ 25.0←   A: 20*0°c
↑↓:Set     F1:Cal.
```

7. When the reading on the right has stabilised, press the ▲ and ▼ keys until the reading on the left shows the same temperature as the mercury thermometer.

   NOTE : When calibrating both channels, press the ▢F2 key to scroll through all of the currently selected channels to make sure that they are all stable before calibration.

8. Press the ▢F1 key to perform a single point offset calibration.
   Alternatively, press the Menu key to abort temperature calibration.

Span Calibration (optional)

9. The offset calibration will suffice for most applications. For optimum precision, a second point span calibration can also be performed. After the offset calibration, the following message is displayed.

```
Press  F1:Span  Cal
or Menu  to  Quit
```

10. To perform a span calibration, place the sensor(s) into a beaker of water that is at least 10 ^{O}C, 20 ^{O}F or 10 ^{O}Kelvin higher or lower than the first calibration point. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.

11. The reading from the Sensor A is now displayed on the right of the display, and the value you are going to set is shown on the left. For example…

```
→ 35.0←   A: 34*9°c
↑↓:Set      F1:Cal.
```

12. When the reading on the right has stabilised, press the ▲ and ▼ keys until the reading on the left shows the same temperature as the mercury thermometer.

    NOTE : When calibrating both channels, press the F2 key to scroll through all of the currently selected channels, to make sure that they are both stable before calibration.

13. Press the F1 key to perform a second point span calibration.

    Alternatively, press the Menu key to abort. Note that aborting at this point will still retain the offset calibration.

5.5 Calibration Notes

1. Calibration information is retained in memory when the **WP-87T** is switched off, even when the battery is removed. This information can be recalled later using the GLP function (see section 9).

    NOTE: GLP information is only displayed for the currently selected number of channels.

2. Temperature does not need to be re-calibrated unless the Temperature sensor is replaced or the meter is initialised, even if the readout units are changed.

3. If Maximum/Minimum mode is active, the **WP-87T** stops it for calibration. This is done to preserve genuine Maximum/Minimum data. Maximum/ Minimum mode must be restarted by the user after calibration. See section 7.

5.6 Calibration Messages

1. If a one point offset calibration has been successfully performed, the **WP-87T** will display the following message and the offset value of the sensors. The bottom line of the display shows each channel as it is calibrated (see example below). *Do not remove the sensors from the water bath until all channels have been displayed.*.

```
Calibrate OK
A:Offset=   1.0°c
```

2. If a one point offset calibration has failed, the **WP-87T** will display the following message, and the failed offset value of the sensor(s). The bottom line of the display shows each channel as it is calibrated (see example below). *Do not remove the sensors from the water bath until all channels have been displayed.*

```
Calibrate Failed
A:Offset= 10.5°c
```

3. If a span calibration has been successfully performed, the **WP-87T** will display the following message and the offset and span values of the sensors. The bottom line of the display shows each channel as it is calibrated (see example below). *Do not remove the sensors from the water bath until all channels have been displayed.*.

```
Calibrate OK
A:Offset=   1.0°c
```
then
```
Calibrate OK
A:Span= 100.0%
```

4. If the temperature of the water bath used for span calibration is less than 10 ^{O}C, 20 ^{O}F or 10 ^{O}Kelvin different to the first point, the following message will be displayed.

```
Temp Difference
Too Small
```

The **WP-87T** then gives the user the opportunity to try a span calibration again. Repeat the calibration procedure from step 10 onwards (section 5.4), ensuring that the temperature of the second calibration point is at least 10 ^{O}C, 20 ^{O}F or 10 ^{O}Kelvin higher or lower than the first point.

6. Difference Mode

The **WP-87T** can be set to display the difference between two channels. This function is available only in 2 channel operation.

To display the difference between the two channels, press the ⏚F4⏛ in normal display mode. Both channels plus the difference are now displayed simultaneously, as shown below…

```
A: 45.0°c  B: 35.0°c
   31/12 12:00:00
```
⏚F4⏛ →
```
A: 45.0°c  B: 35.0°c
Diff A:-B:   10.0°c
```

Press the ⏚F4⏛ key to turn Difference Mode on and off.

7. Maximum/Minimum Mode

A Maximum/Minimum function is provided on the **WP-87T**. The **WP-87T** stores maximum and minimum temperature separately for all active channels when this function is started. The Maximum/Minimum data can later be recalled on the display. The Maximum/Minimum data can also be printed when the optional RS232 interface is fitted.

7.1 Starting and Stopping Maximum/Minimum Mode

To start recording Maximum/Minimum data, press the following sequence of keys…

Menu → **F3:** MAX MIN → **F4:Start**

Once Maximum/Minimum mode has been started, a flashing "**m**" appears on the display in normal measurement mode.

To stop recording Maximum/Minimum data, press the following sequence of keys…

Menu → **F3:** MAX MIN → **F4:Stop**

The flashing "**m**" is now switched off.

Notes

1. When Maximum/Minimum recording is stopped, the current Maximum/ Minimum data is saved and will no longer be updated.

2. Maximum/Minimum data must be erased before changing the readout units or the number of channels.

3. Maximum/Minimum mode is automatically stopped during calibration, to ensure that genuine data is not over-written. The Maximum/Minimum mode must be re-started by the user after calibration, if required.

7.2 Recalling Maximum/Minimum Data

To recall Maximum/Minimum data on the display, press the following sequence of keys…

Menu → **F3:** $\substack{\text{MAX} \\ \text{MIN}}$ → **F1:Recall**

The display now shows the Maximum Data for channel A, and the date and time at which this occurred. Press the ▼ key to scroll to the Minimum Data for channel A. An example is shown below…

```
A:Max 120.0°c
   31/12 12:00:00
```
▼ →
```
A:Min  20.0°c
   31/12 12:10:00
```

If the **WP-87T** is in 2 channel operation, then pressing the ▼ key will sequentially scroll through each Maximum and Minimum value.

The ▲ key can be used to scroll back through previous data.

Press the Menu key to return to normal operation.

The Maximum/Minimum data can be recalled at any time without stopping Maximum/Minimum mode.

7.3 Printing Maximum/Minimum Data

7.3.1 Sending Maximum/Minimum to the RS232 Port

When the optional RS232 interface is fitted, the Maximum/Minimum data can be printed, or sent to a computer. Press the following sequence of keys to output the Maximum/Minimum data to the RS232 port…

Menu → **F3:** $\substack{\text{MAX} \\ \text{MIN}}$ → **F3:Print**

7.3.2 Data Format

The Maximum/Minimum data format in 1 Channel operation is…
```
A:Max 120.0oC  31/12/00 12:00:00
A:Min  20.0oC  31/12/00 12:10:00
ENDS
```

The Maximum/Minimum data format in 2 Channel operation is…
```
A:Max 120.0oC              31/12/00 12:00:00
A:Min  20.0oC              31/12/00 12:10:00
B:Max           120.0oC  31/12/00 12:00:00
B:Min            20.0oC  31/12/00 12:10:00
ENDS
```

The Maximum/Minimum can be printed at any time, without stopping Maximum/Minimum mode.

7.4 Erasing Maximum/Minimum Data

The Maximum/Minimum data must be erased to re-set the recorded values. To erase the Maximum/Minimum data, press the following sequence of keys…

$\boxed{\text{Menu}}$ → **F3:** $\overset{\text{MAX}}{\text{MIN}}$ → **F2:Erase**

As an added safeguard, the **WP-87T** will ask you if you are sure that you wish to erase the Maximum/Minimum data…

```
Erase, You Sure?
F1:Yes  F2:No
```

Press $\boxed{\text{F1}}$ to erase all Maximum/Minimum data.

Press $\boxed{\text{F2}}$ to quit, and keep all Maximum/Minimum data.

8. Data Hold Function
For hard to reach places or rapidly changing environments, a Data Hold function is provided. This function freezes the temperature value of all currently displayed channels. If the clock is currently displayed this is also frozen, although it is still running in the background.

Press the ▲ key during normal measurement to Hold the current data and time.

The channel labels (**A:** and **B:**) flash while the data is frozen.

Press the ▲ key again to return to continuously updated data.

The normal functions of the F2, F3, and F4 keys are still available while the Data Hold function is in use. These function keys operate as follows…

F2 : Show or hide the clock (section 14.2).

F3 : Transmit Data Hold reading(s) plus date and time to the RS232 port, if automatic logging is switched off (section 12.2).

F4 : Toggle normal readings and difference mode (section 6).

9. Good Laboratory Practices (GLP)

The **WP-87T** keeps a record of the date and time of the last offset and span calibrations as part of GLP guidelines. GLP information for each channel is stored separately.

9.1 To recall GLP information on the display

1. Switch the meter on.
2. Select the GLP menu (Menu → **F4:Setup** → **F3:GLP**).
3. Select **F1:Recall**
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.
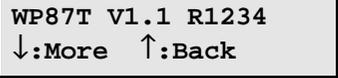
```
WP87T V1.1 R1234
↓:More  ↑:Back
```

5. Press the ▼ key to sequentially scroll through the GLP information for all channels. GLP information is only displayed for the currently selected number of channels. Press the ▲ key to scroll back to previous data. The sequence of information displayed is shown over the page. Press Menu to abort at any time.

GLP display sequence…

```
┌─────────────────────┐
│ WP87T V1.1 R1234    │
│ ↓:More   ↑:Back     │
└─────────────────────┘
          [▼]
┌─────────────────────┐
│ A:Offset=  1.0°c    │
│ @ 31/12/00 12:00    │
└─────────────────────┘
      [▼]     [▲]
┌─────────────────────┐
│ A:Span=    100.0%   │
│ @ 31/12/00 12:00    │
└─────────────────────┘
      [▼]     [▲]
┌─────────────────────┐
│ B:Offset=  1.0°c    │
│ @ 31/12/97 12:00    │
└─────────────────────┘
      [▼]     [▲]
┌─────────────────────┐
│ B:Span=    100.0%   │
│ @ 31/12/97 12:00    │
└─────────────────────┘
          [▼]
          Exit
```
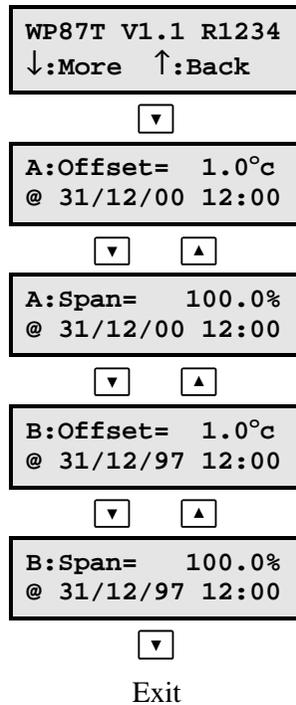
9.2 Failed Calibration

If calibration has failed, the GLP function will reset the date and time to zero. The **WP-87T** still shows the results of the last successful calibration. For example…

```
┌─────────────────────┐                    ┌─────────────────────┐
│ A:Offset=  1.0°c    │        or          │ A:Span=    100.0%   │
│ @ 00/00/00 00:00    │                    │ @ 00/00/00 00:00    │
└─────────────────────┘                    └─────────────────────┘
```

Note that these calibration values are still used if further measurements are taken without re-calibrating.

9.3 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. This function is available only when the optional RS232 port is fitted.

1. Switch the meter on.

2. Ensure that the **WP-87T** RS232 cable is connected to the instrument and to the printer or PC.

3. Send the GLP information to the RS232 port…

   Menu → **F4:Setup** → **F3:GLP** → **F3:Print**

4. The GLP information is sent to the RS232 port in formatted ASCII text, for example…

   ```
   WP87T  V1.1 R1234 @ 31/12/97 12:00
   Temperature A: Offset=   1.0oC @ 31/12/97 12:00
   Temperature A:   Span= 100.0%  @ 31/12/97 12:00
   Temperature B: Offset=   1.0oC @ 31/12/97 12:10
   Temperature B:   Span= 100.0%  @ 31/12/97 12:10
   ENDS
   ```

   Note : GLP information is only sent for the currently selected number of channels.

9.4 Instrument Serial Number

In case the serial number that is fitted to the rear of the **WP-87T** is removed or becomes illegible, it is also available on the **WP-87T** display.

- The serial number is displayed at turn-on,

  ```
  WP87T V1.1 R1234
  DualThermocouple
  ```

  where **R1234** is the serial number.

- The serial number is displayed when recalling the GLP information (section 9.1).

- The serial number is included on the print-out of GLP information (section 9.3).

9.5 Additional GLP Features

Another GLP requirement is to record the date and time of every reading. The **WP-87T** does this for you when readings are recorded either with the Notepad function (section 10) or the Automatic Logging function (section 11). Each reading is also stamped with its own log number.

10. Notepad Function

10.1 Recording Readings into the Notepad
To record readings into the Notepad memory:

1. Press F1 in normal display mode. The display should now look like this:

```
A: 25.0°c B: 25.0°c
F1:  1    12:00:00
```

2. If you now press F1, all channels of Temperature plus the Date and Time
    will be recorded into the notepad and labelled as reading number 1.
3. Repeat steps 1 & 2 as often as required. The maximum number of readings
    that can be stored in the Notepad is 150.

10.2 Recalling Records from the Notepad

10.2.1 To recall records from the Notepad onto the WP-87T display
1. Select the Notepad menu (Menu → **F2:Notepad**).
2. Select **F1:Recall** from the menu.
3. Record number 1 is now displayed.
4. Press ▲ to move forward through the records.
    Press ▼ to move backward through the records.
    Press and hold the ▲ or ▼ keys to roll rapidly through the readings.

10.2.2 Display format for recalling 1 Channel of data
Display format for recalling 1 channel of data is shown below.

Press F2 to alternate between the data and the clock.

```
A: 25.0°c               F2      31/12 12:00:00
#  1      F2:Clock      →    #  1      F2:TempA
```

10.2.3 Display format for recalling 2 Channels of data
Display format for recalling 2 channels of data is shown below.

Press [F2] to alternate between A&B data and the clock.

```
A: 30.0°c  B: 25.0°c      [F2]      31/12 12:00:00
#  1      F2:Clock         →   #  1      F2:A&B
```

Press [F4] to alternate between A&B data and A:–B: Difference data.

```
A: 30.0°c  B: 25.0°c      [F4]   Diff A:-B:     5.0°c
#  1      F2:Clock         →   #  1      F2:Clock
```

NOTE : Difference mode cannot be selected while the clock is being displayed.

10.3 Erasing Records from the Notepad

To erase all records from the Notepad:

1. Select the Notepad menu ([Menu] → **F2:Notepad**).

2. Select **F2:Erase** from the menu.

3. The **WP-87T** now asks if you are sure that you wish to erase all records.

```
Erase, You Sure?
F1:Yes  F2:No
```

4. Press [F1] to erase all records from the Notepad

    Press [F2] to quit without erasing the records from the Notepad.

10.4 Printing Records from the Notepad to the RS232 Port

This function is only available when the optional RS232 port is fitted.

1. Connect one end of the RS232 cable to the **Charger/RS232** socket of the **WP-87T**. The charger, optional solar panel, or optional car battery lead can be connected into the spare socket on the cable for long term use if required.

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 **WP-87T** are the same.

   If necessary, alter the baud rate of the **WP-87T** (see section 12.1).

   The **WP-87T** uses XON/XOFF protocol. Ensure that the printer is set accordingly.

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

5. Select **F3:Print** from the menu.

   Printing starts as soon as F3 is pressed. The display shows the word "**Printing**" until printing is completed.

Note

Difference data is not sent to the RS232 port. If difference data is required for data processing or statistical use, we suggest that you use a spreadsheet program such as Microsoft Excel® to calculate the value.

11. Automatic Datalogging

The **WP-87T** can automatically log records into the Notepad. First the logging period must be programmed, then automatic logging can be started and stopped as required.

1. Select the Program menu (Menu → **F4:Notepad** → **F4:Program**).

2. The display should now look like this:

    ```
    →00← F1:Min F2:Sec
    ↑↓:Period    F3:Hr
    ```

3. Use the ▲ and ▼ keys to set the period at which the **WP-87T** will automatically log records.

4. When the logging period has been correctly set, select whether this period is in minutes, seconds or hours.

    Press F1 to save the period as minutes.

    Press F2 to save the period as seconds.

    Press F3 to save the period as hours.

    For example, if the period was set to **05**, followed by F2, then the **WP-87T** will automatically log a record every 5 seconds, once started (see step 7, below).

5. If the optional RS232 port is fitted, the **WP-87T** will ask if the records are to be logged into the Notepad, or sent directly to the RS232 port.

    Press F1 to log records into the Notepad (maximum of 150 readings).

    Press F3 to send records directly to the RS232 port.

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

7. To start automatic logging, press ⌗F3⌗ in normal display mode.

When the **WP-87T** is logging into the Notepad, the display will look like this:

```
A: 25.0°c  B: 25.0°c
Log#  1 12:00:00
```

The log number will increment and the **WP-87T** will beep each time a reading is recorded.

If the **WP-87T** is sending records directly to the RS232 port, the display will look like this:

```
A: 25.0°c  B: 25.0°c
Sending 12:00:00
```

The **WP-87T** will beep each time a record is sent to the RS232 port.

8. Press ⌗F3⌗ to stop automatic logging.

Note:

The clock must be set before the **WP-87T** will allow automatic logging to start. The message "**Clock Not Set**" is displayed if the clock is not set. See section 14.1 for details on setting the clock.

12. RS232 Port

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

12.1 Setting the Baud Rate

1. Select the RS232 Set-up menu (Menu → **F4:Setup** → **F3:Baud**).

2. The available baud rates are listed on the display.

```
  F1:300   F2:1200
→F3:9600
```

The arrow shows the current selection.

1. Press F1 to select 300 baud

   Press F2 to select 1200 baud

   Press F3 to select 9600 baud.

   Press Menu to quit and retain the current setting.

12.2 Sending Readings to the RS232 Port

Press F3 to instantly send readings to the RS232 port whenever the **WP-87T** is in normal run mode. This function is disabled if the automatic logging period is set to greater than zero (see section 11).

Records can be sent directly to the RS232 port rather than stored in memory during automatic datalogging. See section 11 for details.

12.3 RS232 Configuration

The **WP-87T** RS232 configuration is 8 bits, No Parity, 1 Stop Bit, XON/XOFF Protocol.

12.4 Communication and Statistical Software

Communication between the **WP-87T** and a PC can be handled with any RS232 communication software. Communication software for Windows is optionally available (Part No 130086).

Once the data is saved to disk, the next problem is how to use it. The data 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.

12.5 Commands

The following commands can be sent from a PC to the **WP-87T**. Note that <cr> denotes carriage return and <lf> denotes a line feed.

Action	Command	Notes
Request current data	?D<cr>	Returns the current Temperature data, date and time from the **WP-87T**. The log number returned is set to Zero.
Request logged data	?R<cr>	Returns all logged records from the **WP-87T** memory. The data ends with the message **ENDS**<cr>.
Erase logged data	?E<cr>	Erases all logged records from the **WP-87T** memory. Returns the message **ERASED**<cr> to confirm that the records have been erased.
Request status information	?S<cr>	Returns the model name, firmware version number, instrument serial number and number of logged readings in memory, for example… **WP87T♦♦V1.1 ♦R1234♦♦150**<cr>, where ♦ are spaces. Note that the number of logged readings is right-justified.
Request GLP information	?G<cr>	Returns all calibration GLP information, plus the instrument model, serial number and current date (see section 12.7 for data format and handshaking).

12.6 Data Format

Data is returned to the RS232 port by the **WP-87T** in the following format…

```
LLLL•AAAAAAuuu•BBBBBBuuu•dd/mm/yy•hh:mm:ss
```

where: **LLLL**   is the Log Number. Maximum 4 characters, right justified.

                The **WP-87T** sends a Zero for instant readings (section 12.2)

       ♦   is one space.

       AAAAAA is the channel A data. Maximum 6 characters, right justified.

       uuu   is the unit description, either oC, oF or oK

       ♦   is one space.

       BBBBBB is the channel B data. Maximum 6 characters, right justified.

       uuu   is the unit description, either oC, oF or oK

       ♦   is one space.

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

       ♦   is one space.

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

When requested by a PC with the ?D or ?R commands (section 12.5), the data is terminated with a carriage return.

When it is sent by the **WP-87T** using the Print function (section 10.4) or the Instant Send function (section 12.2), the data ends with a carriage return and a line feed.

12.7 GLP Format

GLP information is returned as up to 6 lines terminated by a carriage return. When using the "?G" command (section 12.5), the computer must respond with a character after receiving each line.

For example…
```
WP87T  V1.1 R1234 @ 31/12/97 12:00
Temperature A: Offset=   1.0oC @ 31/12/97 12:00
Temperature A:   Span= 100.0%  @ 31/12/97 12:00
Temperature B: Offset=   1.0oC @ 31/12/97 12:10
Temperature B:   Span= 100.0%  @ 31/12/97 12:10
ENDS
```

NOTE: GLP information is only sent for the currently selected number of channels.

13. Battery Saver Function

The **WP-87T** is equipped with a battery saver function. If no button has been pressed for five minutes, the unit beeps and flashes the display for 20 seconds, and then shuts off. This function can be disabled for continuous use.

To enable or disable the battery saver function:

1. Switch the meter on.

2. Select Battery Saver Set-up (Menu → **F4:Setup** → **F1:Batt**).

3. The battery saver menu is now displayed.

```
Batt Saver   F1:OFF
🔋▇▇▇▇▇100% →F2:ON
```

The arrow indicates the current selection.

The bar graph and percentage indicate the approximate level of charge in the battery.

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

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

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

NOTE: For troubleshooting purposes, the battery volts can also be displayed in the battery saver menu. Press F3 to display battery volts.

The 🔋 symbol flashes when the battery volts drops below 5.60 volts. At 5.00 volts the meter turns itself off.

14. Clock Function

14.1 Setting the Clock

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

2. The display now shows the current date and time. The cursor starts at the day. For example…

```
31/12/96 12:00
F1:← F2:→   ↑↓:Set
```

3. Press the [▲] and [▼] keys until the day is correct.

4. Press [F2] to move to the month. Press the [▲] and [▼] keys until the month is correct.

5. Press [F2] to move to the year. Press the [▲] and [▼] keys until the year is correct.

6. Press [F2] to move to the hour. Press the [▲] and [▼] keys until the hour is correct.

7. Press [F2] to move the cursor to the minutes. Press the [▲] and [▼] keys until the minutes are correct.

8. Check that the date and time are correct.

    Press [F2] to save the settings.

    If any changes are needed, press the [F1] key to move left to the desired position.

    Press [Menu] to quit without resetting the clock.

Notes

1. The **WP-87T** tests that a valid day of the month is entered. If an invalid date is entered (e.g. 31/11/98), the **WP-87T** beeps and displays the message "**Invalid Date**". The meter then returns to the clock setting screen, so that the correct date can be entered.

2. The **WP-87T** also tests for leap years.

14.2 Displaying or Hiding the Clock

Depending on the number of currently selected channels, the date and time may be shown on the bottom line of the display, along with temperature data. Press the [F2] key to alternatively display the clock or any data that may occupy the bottom line.

15. Initialising the WP-87T

If the calibration settings of the **WP-87T** 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 **WP-87T**:

1. Switch the **WP-87T** off.

2. Press AND HOLD the ▲ key while switching the **WP-87T** back on.

3. The following messages should be displayed:

```
Initialized
MUST ReCalibrate
```
then
```
WP87TsV1.1 R1234
DualThermocouple
```

(The "s" after **WP-87T** is only shown when the RS232 serial port option is fitted)

4. The meter then displays one Temperature channel. Note that the decimal point has been replaced with a " ∗ " to indicate that the unit requires re-calibration.

16. Instrument firmware version number.

If you need to phone or fax TPS for any further technical assistance, the version number of your **WP-87T** firmware may of benefit to us. The version number is displayed by the **WP-87T** at turn-on.

17. Troubleshooting

17.1 General Errors

Error Message	Possible Causes	Remedy
Factory Cal. Failed **See** **Handbook**	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service. Temperature readings may be up to 10% incorrect.
Memory Failed Calibration Lost **Initialized** **MUST ReCalibrate**	User calibration settings have been lost or corrupted.	Re-calibrate the instrument (see section 5).
Flashing 🔋 symbol.	Battery is below 5.60 volts.	Recharge the battery. Note that the unit will switch itself off when the battery falls below 5.00 volts.
Meter displays the word **OFF**, and switches off.	Battery is below 5.00 volts.	Recharge the battery. If this fails, check the charger. If charger OK, replace the battery.
Meter will not turn on.	Battery is exhausted.	Recharge the battery. If this fails, check the charger. If charger OK, replace the battery.
Battery does not charge up when charger is connected.	1. Faulty battery charger. 2. Faulty battery.	1. Connect the charger and switch the power on. 2. Display the battery volts in the battery saver menu (see section 13). 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.

17.2 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Temperature inaccurate and cannot be calibrated.	1. Faulty connector. 2. Faulty temperature sensor.	Check the connector and replace if necessary. Fit new temperature sensor

18. 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.**