

# LAND



## ***Cyclops 160B***

### *User Guide*

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### Important Health and Safety Information

#### Equipment Operation

Use of this instrument in a manner not specified by Land Instruments International may be hazardous.

#### Electrical Power Supply

Before working on the electrical connections all of the electrical power lines to the equipment must be isolated. All the electrical cables and signal cables must be connected exactly as indicated in these operating instructions. If in doubt contact Land Instruments International.

#### Face and Eye Protection

Suitable face and eye protection must be worn when working on hot vessels and ducts! Special safety measures must be taken when working on a high-pressure duct.

#### Protective Clothing

Protective clothing must always be worn when working in the vicinity of hot vessels or ducts.

#### Storage

The instrument should be stored in its packaging, in a dry sheltered area.

#### Unpacking

Check all packages for external signs of damage. Check the contents against the packing note.

#### Return of Damaged Goods

##### IMPORTANT

If any item has been damaged in transit, this should be reported to the carrier and to the supplier immediately. Damage caused in transit is the responsibility of the carrier not the supplier.

DO NOT RETURN a damaged instrument to the sender as the carrier will not then consider a claim. Save the packing with the damaged article for inspection by the carrier.

#### Return of Goods for Repair

If you need to return goods for repair please contact our Customer Service Department. They will be able to advise you on the correct returns procedure.

Any item returned to Land Instruments International should be adequately packaged to prevent damage during transit.

You must include a written report of the problem together with your own name and contact information, address, telephone number, email address etc.

Return of Goods for Repair Form is available for download from our websites.

#### Lifting Instructions

Where items are too heavy to be lifted manually, use suitably rated lifting equipment. Refer to the Technical Specification for weights. All lifting should be done as stated in local regulations.

### Design and Manufacturing Standards



The Quality Management System of Land Instruments International is approved to BS EN ISO 9001 for the design, manufacture and on-site servicing of combustion, environmental monitoring and non-contact temperature measuring instrumentation.



Approvals apply in the USA



This instrument complies with current European directives relating to Electromagnetic Compatibility 89/336/EEC and Low Voltage Directive 73/23/EEC.

Operation of radio transmitters, telephones or other electrical/electronic devices in close proximity to the equipment while the enclosure doors of the instrument or its peripherals are open, may cause interference and possible failure where the radiated emissions exceed the EMC directive.

The protection provided by both CE and IP classifications to this product may be invalidated if alterations or additions are made to the structural, electrical, mechanical or pneumatic parts of this system. Such changes may also invalidate the standard terms of warranty.

#### Dimensions

Unless otherwise stated, all measurements are given in millimetres and inches.

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### Office Locations

#### UK - Dronfield

Tel: +44 (0) 1246 417691

E-Mail: [land.infrared@ametek.co.uk](mailto:land.infrared@ametek.co.uk)

Web: [www.landinst.com](http://www.landinst.com)

#### USA - Pittsburgh

AMETEK Land, Inc.

Tel: +1 412 826 4444

E-Mail: [irsales@ametek.com](mailto:irsales@ametek.com)

Web: [www.ametek-land.com](http://www.ametek-land.com)

**For further details on all LAND/Ametek offices, distributors and representatives, please visit our websites.**

### Signs and Symbols Used on Equipment and Documentation



Caution, risk of electric shock.



Caution, attention to possibility of risk of damage to the product, process or surroundings. Refer to instruction manual.



Caution, hot surface.



This item or material can be recycled.



This item or material must be disposed of in accordance with the Waste Electrical and Electronic Equipment directive as applied by local regulations.



Protective Conductor Terminal.



Observe precautions for handling electrostatic discharge sensitive devices.



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Fig. 1-1 Land **Cyclops 160B** portable infrared thermometer

# 1 Introduction

## 1.1 General Introduction

This publication gives you the information required to safely operate Land **Cyclops 160B** portable thermometers.

It is important to check all equipment with which you have been supplied, and read all the literature provided with the Land **Cyclops 160B** before using the thermometer for the first time. Additionally, keep all supplied literature readily available, for reference when the equipment is in general use.

The equipment must only be used and maintained by suitably trained personnel, capable of following the procedures and guidelines given in this User Guide and the **Cyclops 160B** Quick-Start Guide.

## 1.2 About Cyclops 160B Portable Thermometers

The Land **Cyclops 160B** is a highly accurate, portable, short wavelength infrared thermometer, designed to measure and display temperatures in the range 200 to 1400°C/392 to 2552°F. The thermometer can also measure and display these temperatures in Kelvin and °Rankine.

The target temperature is measured and displayed in four simultaneous measurement types: 'Peak', 'Continuous', 'Average' and 'Valley'. You can choose which of these measurements is displayed in the internal viewfinder display.

The wide angle (9°) field of view and the small (1/3°) measurement point ensure that the target is defined clearly and accurately. The focus is continuously variable from one metre to infinity. Auxiliary lenses are available, which provide close focus capability.

The emissivity compensation setting can be controlled digitally, via the simple to use, icon-based menu system, which is available at the touch of a button.

The operating waveband has been chosen specifically to minimise errors due to uncertainty in emissivity, whilst eliminating the effects of atmospheric absorption.

The **Cyclops 160B** features user-friendly 'Bluetooth' communications.

### 1.3 Nomenclature

The instrument detail label is positioned centrally, on the right-hand side of the **Cyclops 160B** casing. The **Instrument Type** specifies the thermometer variant and the **Serial Number** is a unique identification number, incorporating the manufacture date code (see Fig. 1-2)

Upon receipt of the instrument, make a note of the **Instrument Type** and **Serial Number** in the spaces provided below.

Instrument Type: 

1	6	0	B
---	---	---	---

Serial Number: 

--	--	--	--	--	--	--	--

--	--

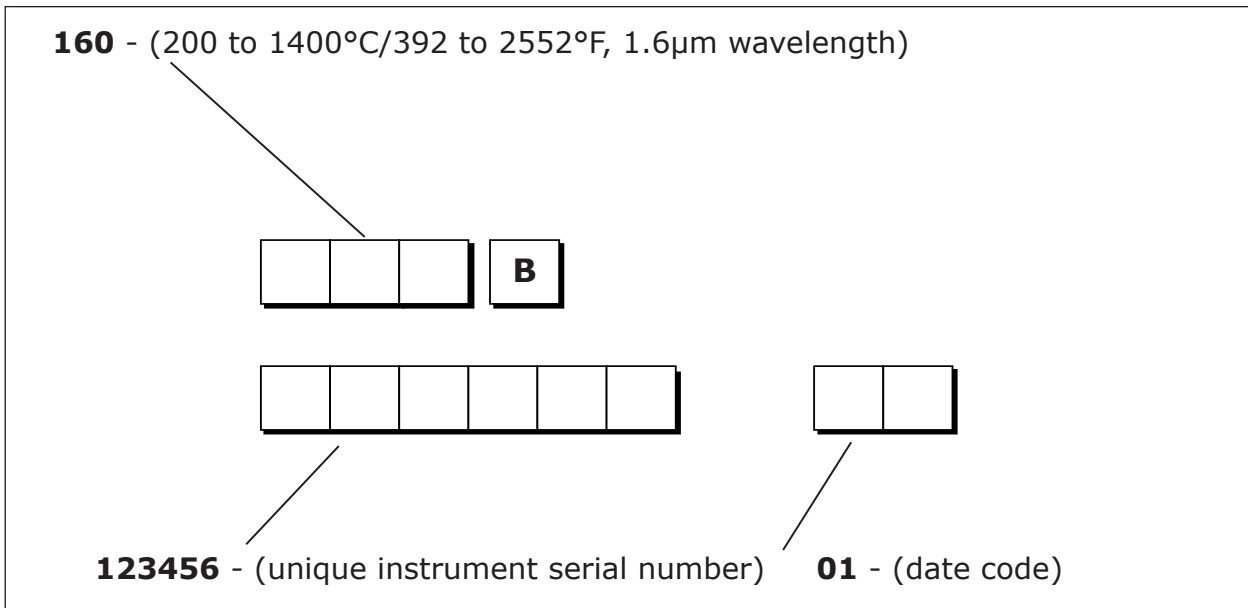


Fig. 1-2 Land **Cyclops 160B** portable thermometer nomenclature

A second instrument label is positioned on the instrument chassis, in the battery compartment. This label displays the instrument serial number, the unique 'Bluetooth' address and the recommended battery details.



## 2 Specifications

Temperature range:	200 to 1400°C / 392 to 2552°F (operating) 200 to 1300°C / 392 to 2372°F (specified)
Viewfinder display:	4-digit temperature in 1° steps
External display:	Peak, Continuous, Average and Valley temperatures on LCD display panel
Optical system:	9° field of view with 1/3° measuring circle; single-lens-reflex system; with eyepiece adjustment from -3.75 to +2.5 diopters
Focusing:	1m/39.4in. to infinity (standard) from body datum nominally 460 to 630mm/18.1 to 24.8in. (135 c.u.lens) nominally 217mm/8.5in. fixed focus (110 c.u. lens)
Minimum target diameter:	4.8mm/0.19in at 101.4cm/39.9in (standard) 2.0mm/0.08in (135 close-up lens) 0.5mm/0.02in (110 close-up lens)
Detector:	InGaAs photocell
Spectral response:	nominally 1.6µm
Emissivity adjustment:	0.10 to 1.20, in 0.01 steps
Response time:	digital display update: 0.5 seconds (approx.); peak and valley operation: acquisition time 30ms (approx.)
Operating temperature range:	0 to 50°C (32 to 122°F)
Storage temperature range:	-20 to 60°C (-4 to 140°F)
Accuracy:	<(±0.25% /C) +2°C
Repeatability:	<1°C
Drift with ambient temperature:	<0.15%(C)/10°C, <0.10%(F)/10°F
Power source:	one 9V dry battery (Duracell 6LR61/MN1604 or equivalent); typical alkaline battery life: >100hrs in 'from-factory' configuration
IP rating:	IP51
Dimensions:	210 x 70 x 140mm / 8¼ x 2¾ x 5½in.
Weight:	800g/1lb12oz (without battery)
Standard accessories:	lens cap; 9V alkaline battery; protective window; wrist strap
Optional accessories:	type 135 and 110 close-up lenses; protective hard carrycase; DL-1000 datalogging kit/ interface cables; thermal glove; LER adapter

### 3 Thermometer description

#### 3.1 Cyclops 160B



- |   |                       |    |                                       |
|---|-----------------------|----|---------------------------------------|
| 1 | LCD display panel     | 7  | Trigger switch (2 position)           |
| 2 | Keypad                | 8  | Tripod mounting hole                  |
| 3 | Optical focusing ring | 9  | Adjustable wrist strap (in packaging) |
| 4 | Protective window     | 10 | Adjustable eyepiece                   |
| 5 | Lens cap              | 11 | Battery compartment cover             |
| 6 | ON/OFF switch         |    |                                       |

Fig. 3-1 Land **Cyclops 160B** portable infrared thermometer description

## 4 Thermometer Power Supply

### 4.1 Fitting and changing the Battery

The **Cyclops 160B** portable thermometer is designed to be powered by a 9V dry cell battery. A Duracell 6LR61/MN1604 (or equivalent) battery is supplied with the thermometer. The battery is fitted as follows:



Fig. 4-1



Fig. 4-2



Fig. 4-3



Fig. 4-4

- 1) Before inserting or changing the battery, ensure that the thermometer is switched OFF.
- 2) The battery cover is on the top surface of the thermometer body (see Fig. 4-1).
- 3) Press down on the finger grip of the battery cover to disengage the cover catch and slide the cover back to fully expose the battery compartment (see Fig. 4-2).
- 4) Align the battery such that the terminals correspond with the label in the battery compartment (see Fig. 4-3).
- 5) Insert the battery, ensuring that the contact springs engage centrally into the battery terminals. Slide the battery cover back into place and ensure that the cover catch engages with the thermometer chassis (see Fig. 4-4).
- 6) With the battery fitted, switch the instrument on and check for correct operation (see Section 7.0). When switched on, a battery power indicator appears in the LCD display panel, which gives an indication of how much power is left in the battery.

When the battery needs replacing, the battery indicator on the LCD display panel will flash. To prolong the remaining battery life, the display backlight and 'Bluetooth' should be switched off. The battery should be changed as soon as possible in order to ensure that the readings from the instrument remain within specification.

#### Note

It is recommended that a fully charged spare battery is kept with the thermometer at all times.

To preserve battery lifetime, the thermometer has the following power saving features:

- If the thermometer is in Menu Mode for over one minute without any key being pressed, the display returns to Measure Mode.
- If the thermometer is in Measure Mode for over two hours without any key being pressed, the instrument is switched off.

## 5 Thermometer controls

### 5.1 ON/OFF Switch

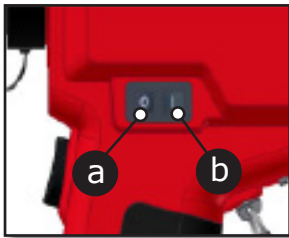


Fig. 5-1

The **On/Off** switch is on the left-hand side of the thermometer (see Fig. 3-1, item 6). The switch has two push buttons, **Off** (a) and **On** (b).

A single press of a switch will activate/de-activate the unit.

### 5.2 Trigger Operation

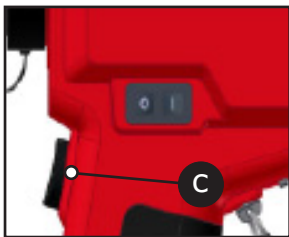


Fig. 5-2

The **Trigger** (c) is on the thermometer handle (see Fig. 3-1, item 7). The trigger function depends upon the chosen mode of operation: **Classic**, **History** or **Burst**. In **Classic** mode, the trigger has one function, to read and display temperature. In **History** and **Burst** modes, the trigger activates advanced functions within the thermometer (see Section 8).

### 5.3 LCD Display Panel & Keypad

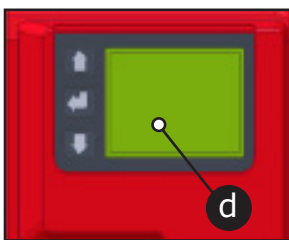





Fig. 5-3

The LCD display panel (d) is on the left-hand side of the thermometer body (see Fig. 3-1, item 1). It operates in two modes: **Measure Mode** and **Menu Mode**.

In **Measure Mode**, the scene temperature and thermometer setup information (including battery life indication) is displayed.

In **Menu Mode**, the function menus of the thermometer can be accessed. You can select functions and set the required parameters, as described in Section 7.

There are three action keys on the **Keypad** to the left of the main display:  (Scroll Up),  (Scroll Down) and  (Enter/select). These are used to navigate around the various menus and displays.

## 5.4 Adjustable Eyepiece

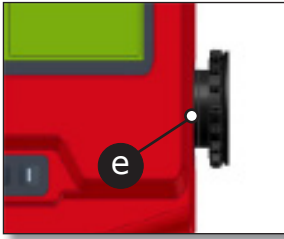


Fig. 5-4

The **Adjustable Eyepiece** (e) is on the rear face of the thermometer (see Fig. 3-1, item 10).

The eyepiece allows you to view the scene being measured by the thermometer. The eyepiece can be adjusted manually to match each user's eyesight characteristics (See section 6.3).

## 5.5 Optical Focus Ring

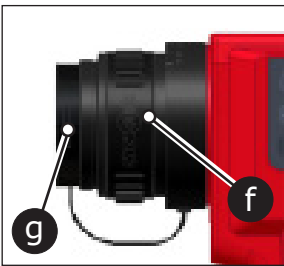


Fig. 5-5

The **Optical Focus Ring** (f) is on the lens assembly at the front of the thermometer (see Fig. 3, item 3). The focus ring allows you to manually adjust the lens assembly and sharpen the scene in view.

A protective lens cap (g) is supplied and should be fitted at all times when the thermometer is not in use.

The focal range is 1m/39.4in (as measured from the instrument datum) to infinity, which equates to approximately 90° of rotation. The datum mark (h) is on the instrument label on the right-hand side of the thermometer.

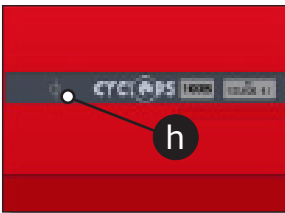


Fig. 5-6

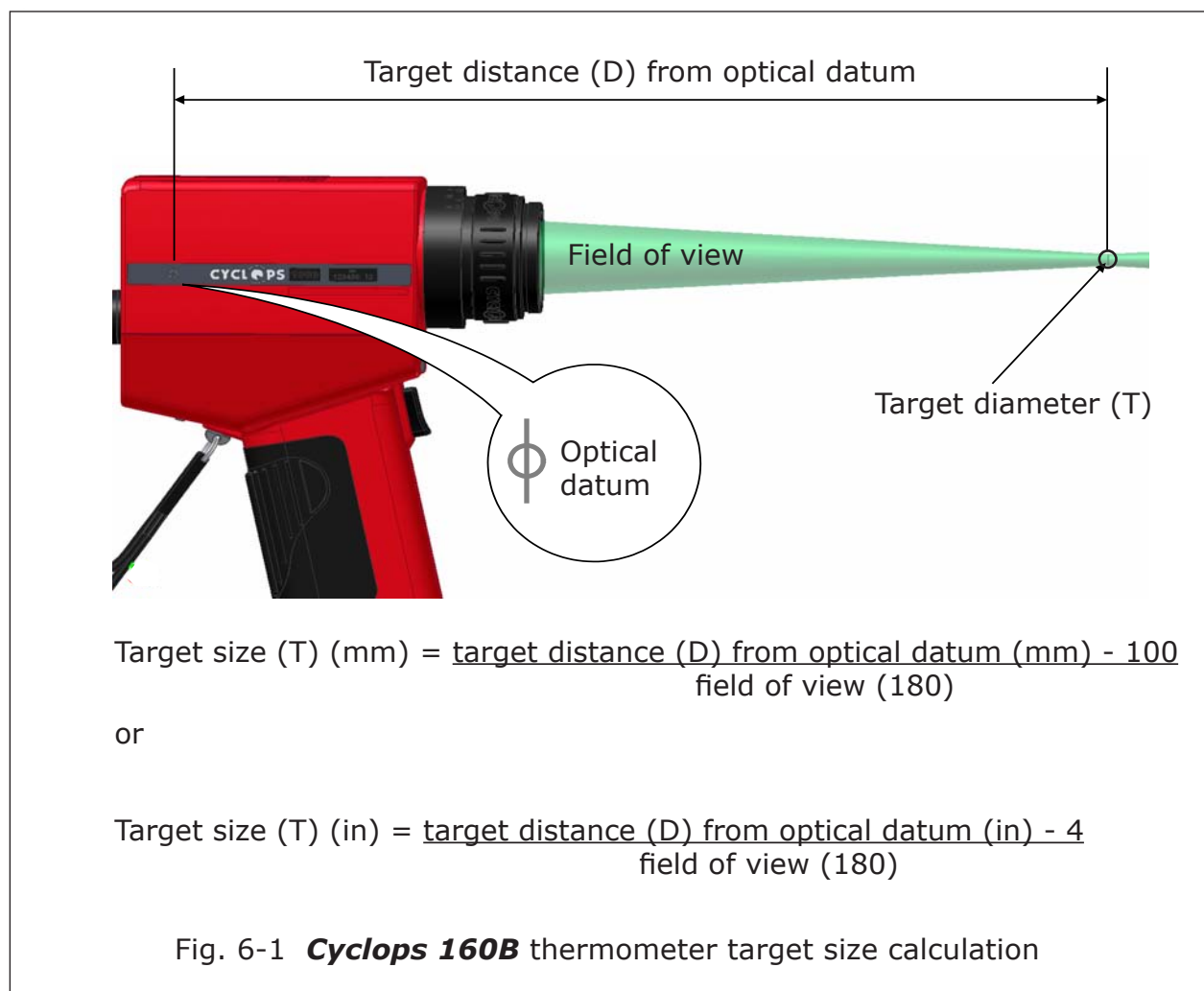
## 6 Optics

The **Cyclops 160B** has a precision reflex optical system, which provides user-focusable 'through the lens' sighting and gives precise definition of the target spot. The specified focal range is 1m/39.4in to infinity.

### 6.1 Target Size Calculation

The precision reflex optical system gives a narrow field of view (180:1 to 98% energy).

As the instrument is focusable, you can calculate an approximate target size from the information given in Fig. 6-1.



## 6.2 Lens protection window

The **Cyclops 160B** is supplied, as standard, with a protective window which covers and protects the instrument lens.

### CAUTION



**Never look at the sun through this instrument** - this could cause severe damage to the eye.

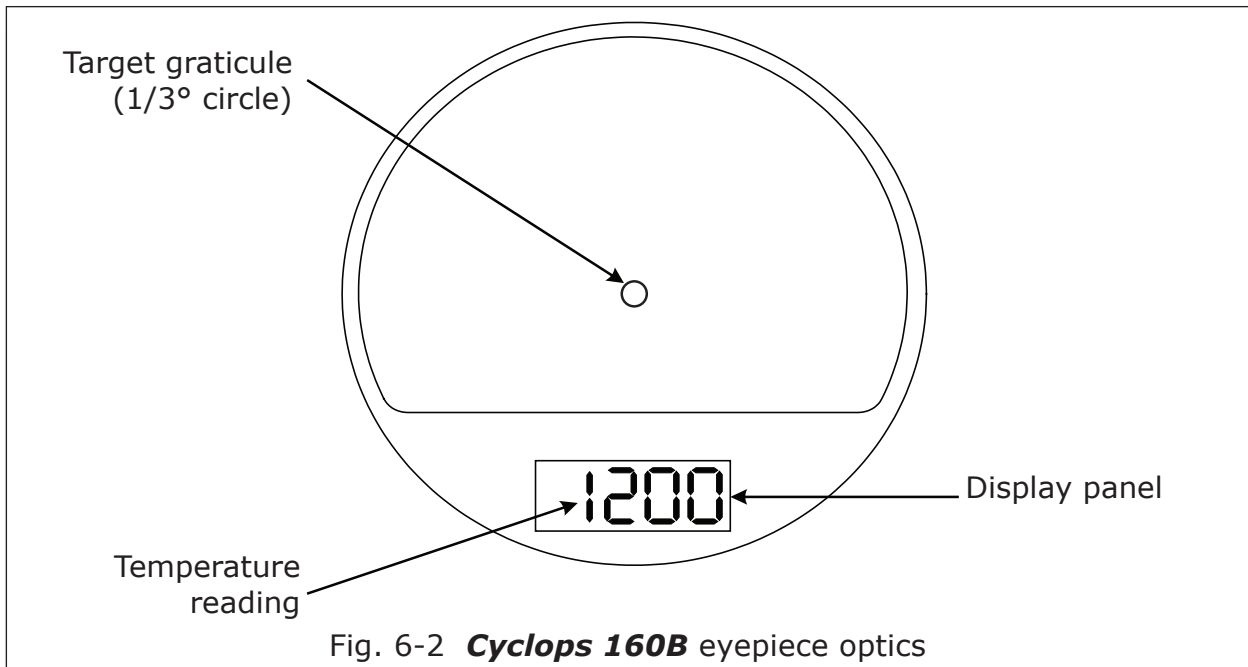
## 6.3 Fitting a Close-up Lens

To fit a close-up lens to the **Cyclops 160B** thermometer, unscrew the clear protection window from the lens assembly and replace it with the relevant close-up lens.

The optical transmission characteristics of the protection window and the Type 135 close-up lens are similar. Therefore, there will be no significant calibration error, so window compensation is not required. If a type 110 close-up lens is used, it will be necessary to set the window transmission function to a value as specified with the individual lens (See Section 7.4).



## 6.4 Eyepiece Optics



The eyepiece allows you to look into the thermometer and view the target scene. Accurate target definition is provided by the wide angle (9°) field of view and small, clearly defined (1/3°) target graticule.

The eyepiece can be focused manually to match each user's eyesight characteristics:

- 1) Use the viewfinder to view a plain, brightly lit background, such as a blank wall.
- 2) Rotate the rubber eye cup to bring the graticule circle to the sharpest possible focus. The eyepiece is now adjusted to your eye.
- 3) Adjust the main focusing ring to bring the target scene to the sharpest possible focus on the graticule circle.

When a temperature reading is taken (the trigger pressed), the measured value is displayed in the eyepiece display panel. The temperature is displayed in the units selected from the Main Menu.

## 7 Display Panel Modes

### 7.1 Introduction

The LCD display panel has two basic modes of operation:

- Measure Mode
- Menu Mode

When the thermometer is switched on, an introduction screen is displayed. This screen times-out automatically and is replaced by the **Measure Mode** display.



To access the **Menu Mode** from the Measure Mode, press the  (Enter/select) key on the keypad.

#### Note

In the event of a fault causing loss of on-board memory, an error message will be displayed near the bottom of the screen. For a list of error codes and their meanings, see Appendix 2

### 7.2 Measure Mode

When the unit is in Measure Mode, the display indicates the Peak, Continuous, Average, and Valley temperature values simultaneously.

Scroll using the  and  keys to select and highlight the required measurement type. This measurement type is then displayed in the viewfinder.

On the side LCD display panel, the selected measurement type is displayed larger and bolder than the three non-selected measurement types. Note that the thermometer measures in all four measurement types continuously.

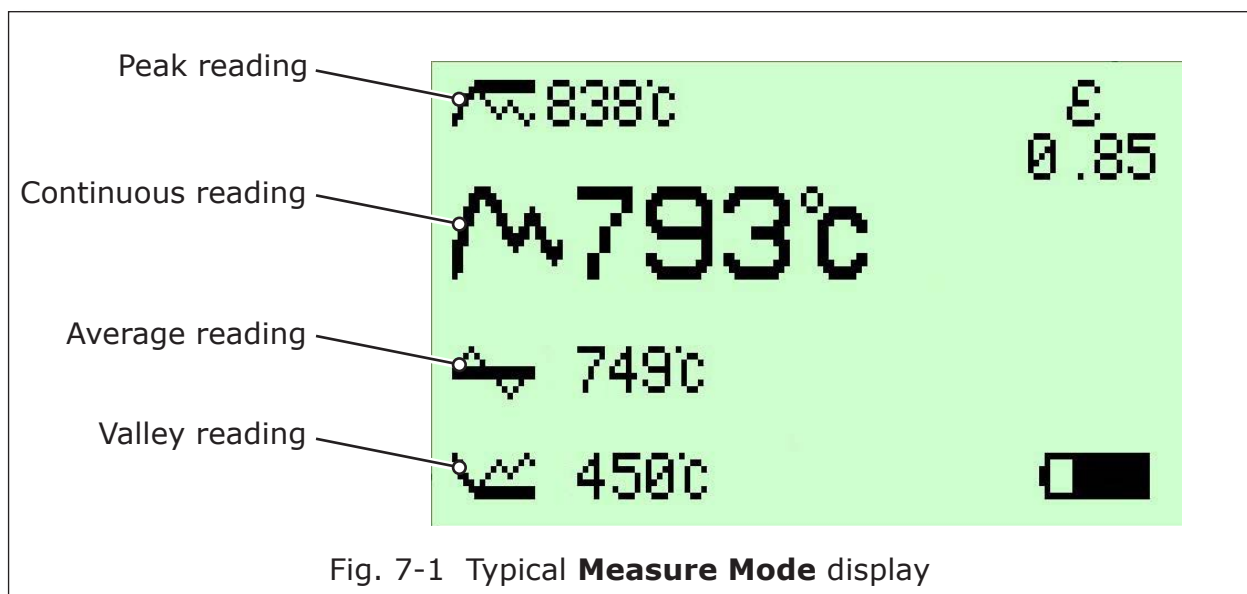
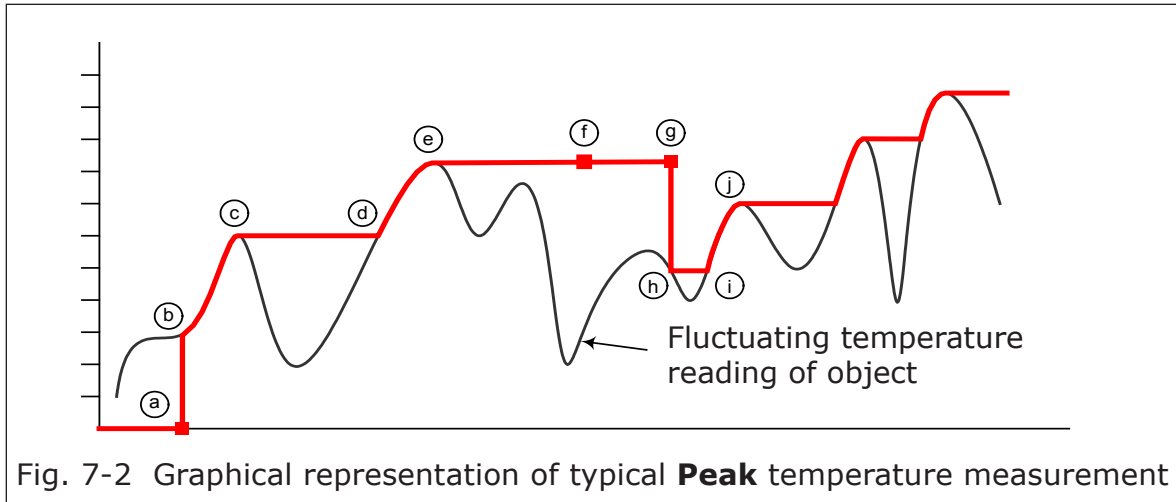


Fig. 7-1 Typical **Measure Mode** display

### 7.2.1 Peak temperature measurement

The Peak temperature measurement mode is used to measure and display information about the highest temperatures recorded by the thermometer.

The peak temperature values can be viewed in the instrument eyepiece and streamed to the Bluetooth output.



- (a) Thermometer trigger pressed
- (b) **Peak** temperature value on display jumps to instantaneous temperature value and rises with rise in object temperature
- (c) Object temperature falls, last **Peak** temperature value held on display
- (d) New **Peak** temperature value reached, display updated
- (e) Object temperature falls, last **Peak** temperature value held on display
- (f) Trigger released, last **Peak** temperature value frozen on display
- (g) Thermometer trigger pressed
- (h) Peak temperature value on display jumps to instantaneous temperature value (even if lower than last **Peak** value held before trigger release). Peak temperature value held on display
- (i) New **Peak** temperature value reached, display updated as object temperature rises
- (j) Object temperature falls, last **Peak** temperature value held on display



### 7.2.2 Continuous temperature measurement

Continuous temperature measurement provides the real-time observed temperature value. The temperature is updated continuously and the value is viewed in the instrument eyepiece.

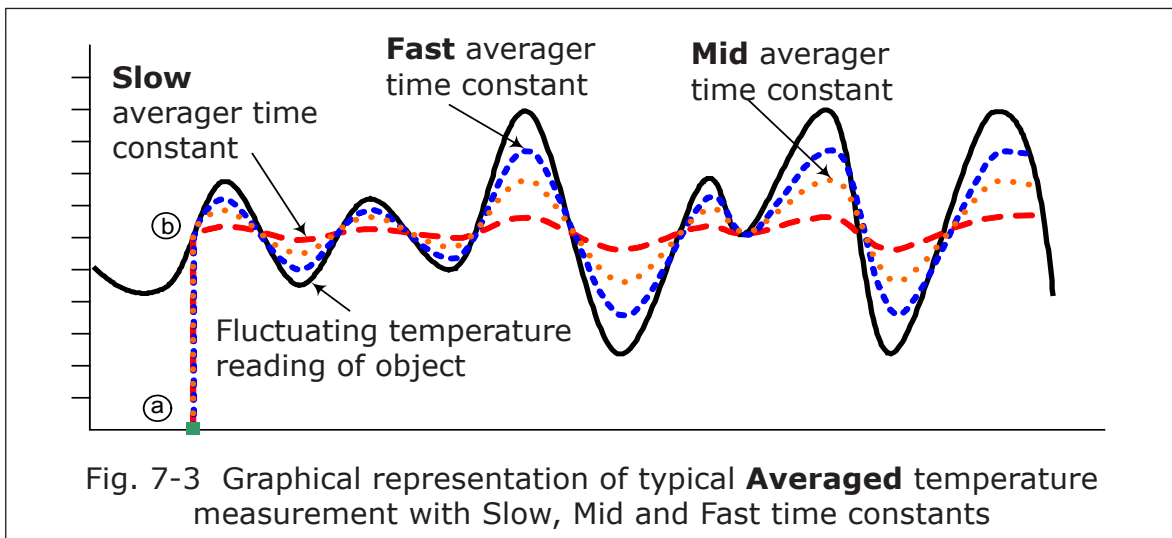
### 7.2.3 Averaged temperature measurement

Averaged temperature measurement gives a 'smoothed' temperature value.

To use the averaging function, **press and hold down** the trigger. The averaging function operates for the period during which the trigger is held down. Averaging stops when the trigger is released.

The response time of the averaging is controlled by the **Averager Time Constant** setting in **Menu Mode**. The options are **Slow**, **Mid** and **Fast**. Use the  and  keys to select the required option from the menu.

With a **Fast** time constant selected, the temperature reading closely matches the object temperature. Only the most rapid fluctuations in the input are smoothed in the output. With a **Slow** time constant selected, the temperature reading is much smoother, displaying more of a 'trend' value rather than showing any rapid changes. With a **Mid** time constant selected, the temperature reading is calculated somewhere between the fast and slow time constant values.

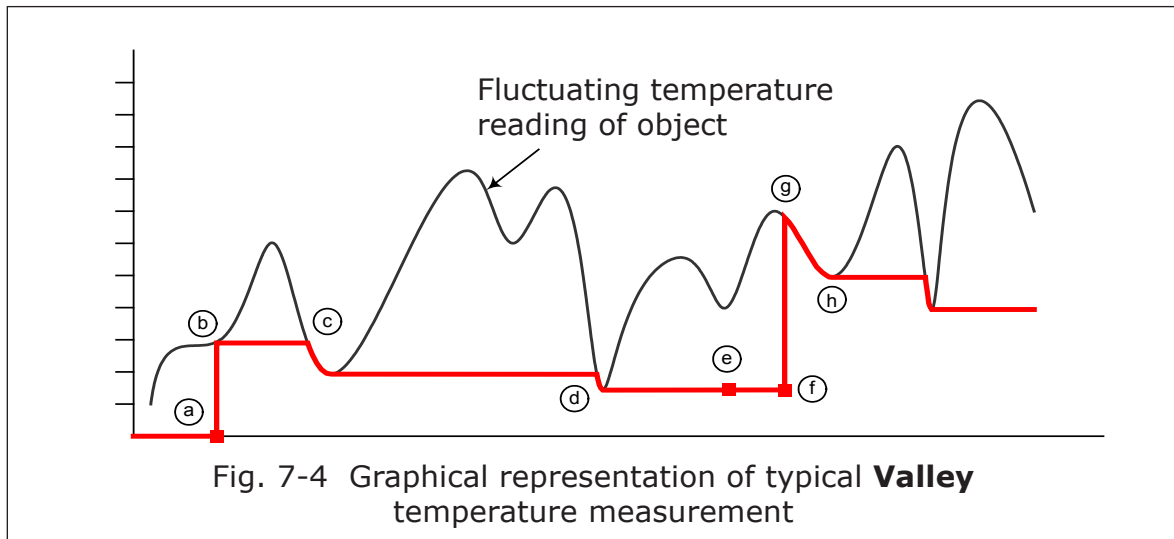


- (a) Thermometer trigger pressed
- (b) Averaging is initiated at the first instantaneous temperature value. Averaged temperature values are calculated, displayed and updated every half second whilst the trigger remains depressed. The final averaged value is held on the side display when the trigger is released.

### 7.2.4 Valley temperature measurement

**Valley** temperature measurement is the inverse of Peak temperature measurement, in that it allows you to monitor the lowest temperature value rather than the highest. Temperature measurement starts when the trigger is pressed in and continues until the trigger is released (See Fig. 7-4).

The temperature is updated instantaneously and the value is viewed in the instrument eyepiece. It is also streamed to the Bluetooth output.



- (a) Thermometer trigger pressed
- (b) Valley temperature value on display jumps to instantaneous temperature value and is held on display with rise in object temperature
- (c) Object temperature falls, new Valley temperature value reached, display updated as object temperature falls. Object temperature rises, last Valley temperature value held on display
- (d) Object temperature falls, new Valley temperature value reached, display updated as object temperature falls. Object temperature rises, last Valley temperature value held on display
- (e) Trigger released, last Valley temperature value frozen on display
- (f) Trigger pressed
- (g) Valley temperature value on display jumps to instantaneous temperature value (even if higher than last Valley value held before trigger release). Display updated as object temperature falls
- (h) Object temperature rises, last Valley temperature value held on display




### 7.3 Menu Mode

When the thermometer is in **Menu Mode**, the menu options available in the **Cyclops 160B** thermometer can be accessed. This allows you to view and configure the setup of the thermometer and select the options that best suit your temperature measurement requirements.







At start-up and during normal operation, the thermometer is in Measure Mode.

- 1) To access **Menu Mode** press the  key.

The main menu options are displayed as icons. There are 11 main menu options, although only 8 icons are displayed within the screen at any one time (See Fig. 7-5).

- 2) Use the  and  keys to scroll through the menu options. The currently selectable menu item is highlighted by a 'flashing' frame.
- 3) To select a menu option, press the  key.

When a main menu option is selected, the available sub-options are displayed.

- 4) Use the  and  keys to highlight the required sub-option in the menu. Press the  key to select it.
- 5) For sub-options where a numeric value is required, use the scroll keys to select the required numeric value, then click on the  key to set this value. For example, to change the emissivity from 1.00 to 0.78, select the **Emissivity** menu, then press and hold in the  key to change the value from 1.00 to 0.78. If you 'overshoot' the value, use the  key to return to the required value

When changing numeric values, a key accelerator is used. The longer an arrow key is held down, the bigger the size of step change becomes. On the display panel, the digit being incremented is highlighted to indicate the size of step being made.



- 6) When you have set a required parameter value, press the  key to return to the main menu options.









Fig. 7-5 Typical **Menu Mode** screen display

## 7.4 Menu Mode - Icon Descriptions

The information in this chapter should be used in conjunction with the navigational flow chart (see Fig. 7-6).



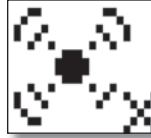
- (a)  **Exit**  
When in Menu Mode, clicking on the exit icon (a) will return you to Measure Mode. The icon is also used in History Mode setup, to return back to Trigger Mode.

- (b)  **Emissivity**  
Clicking on the emissivity icon (b) will open a screen in which the emissivity value can be set. Use the  and  keys to enter the required value. For information on emissivity values, see Section 11 - Emissivity. The default value is 1.00.



- (c)  (d)  (e) 



### Trigger Mode

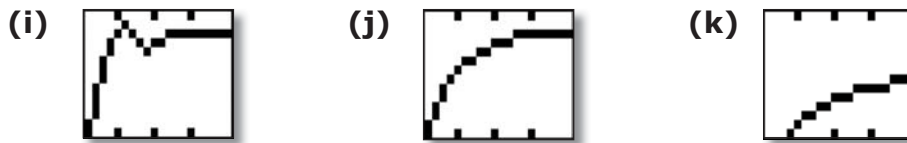
Trigger mode determines the way in which the thermometer operates, and what happens to the readings taken by the instrument. There are three trigger modes: **Classic** (c), **Burst** (d) and **History** (e). See Section 8 - Operational (Trigger) Modes. The default trigger mode is Classic.

- (f)  (g)  (h) 

### Alarms

The alarms function allows you to specify alarm values for the scene under observation. The function has three sub-options: **High Alarm** (f), **Low Alarm** (g) and **Alarm Off** (h). When high or low alarms are selected, a value setting screen appears. Use the  and  keys to enter the alarm trigger temperature. The default setting for High and Low alarm is the thermometer mid-range value.

When an alarm threshold value is set and the measured temperature is past the set point in the alarm direction, a visual indication is provided alongside the highlighted Measure Mode value on the side display (  = above high alarm value ;  = below low alarm value). An audible warning (fast beep) is also provided if the sounder setting is 'On'.



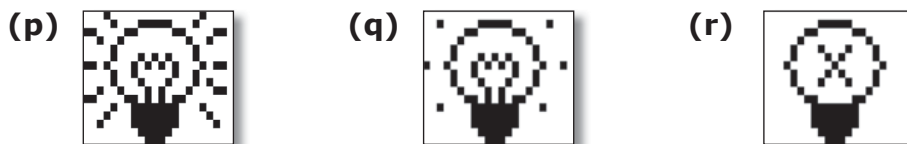
### Averager time constant

The averager time constant function allows you to set the rate of averaging of the temperature values taken. There are three options: **Fast** (i), **Mid** (j) and **Slow** (k). The default setting is **Mid**.



### Units

This menu allows you to select the unit of measurement. There are four options: **°Celsius** (l), **°Fahrenheit** (m), **°Rankine** (n) and **Kelvin** (o). The default setting is **°C**.



### Backlight

This option allows you to control the brightness of the side display backlight. There are three backlight options available: **High** (p), **Low** (q) and **Off** (r). When High or Low are selected, a sub-menu appears in which you can specify a time limit (in seconds) after which the backlight turns off if the thermometer is inactive. The default setting is **Off**.

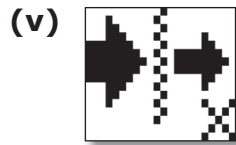
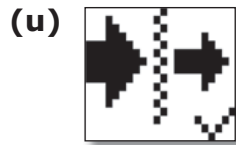
**Note:** Use of the backlight will reduce the life of the battery. It is recommended that the backlight is switched off when not required.



### Sounder



This option allows you to either switch on or mute the sounder. When switched on, the sounder indicates trigger operation, alarm trip, active communications response, and lost communications response (Bluetooth). The available sounder options are: **Sounder On** (s), or **Sounder Off** (t). The default setting is **On**.





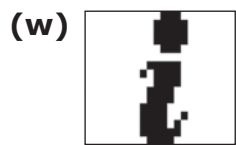
**Window compensation**

This function allows you to manually incorporate a known compensation value into the temperature calculation, which allows for the reflectivity of unusual combinations of viewing windows. This function can be selected **On** (u) or **Off** (v).

If you switch the function On, a screen is displayed in which you can set the required window compensation. Use the  and  keys to adjust the value. The default setting is **1.000**. See example in Section 9.2.

Examples:

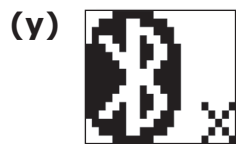
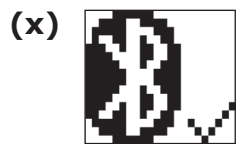
- |   |   |
|---|---|
| Clear protection window fitted :  | Window compensation <b>Off</b>  |
| Type 135 close-up lens fitted :   | Window compensation <b>Off</b>  |
| Type 110 close-up lens fitted :   | Window compensation <b>On</b>   |
|   | Value set to as shown on close-up lens instruction sheet (typically 0.90) |
| Any combination of the above and an external viewing window into the customer process : | Window compensation On value to be determined practically                 |



**About**

This function (w) accesses general information about the product. The details displayed include: calibration information, thermometer serial number, Bluetooth identifier, software version, Tmax and Tmin ambient temperature readings since last calibration and a link to the Land Instruments website.

Note that it is necessary to use the arrow keys to scroll up and down the screen to see the full list of information available.



**Bluetooth**

Bluetooth communications allow wireless streaming of information from the thermometer to a remote facility. The Bluetooth communication function can be set to **On** (x) or **Off** (y). The default is **Off**.

Note that with Bluetooth switched **On**, the life of the battery will be reduced. It is recommended that this function is switched **Off** when not required.

The complete set of menu options is shown in the flowchart (Fig. 7-6).

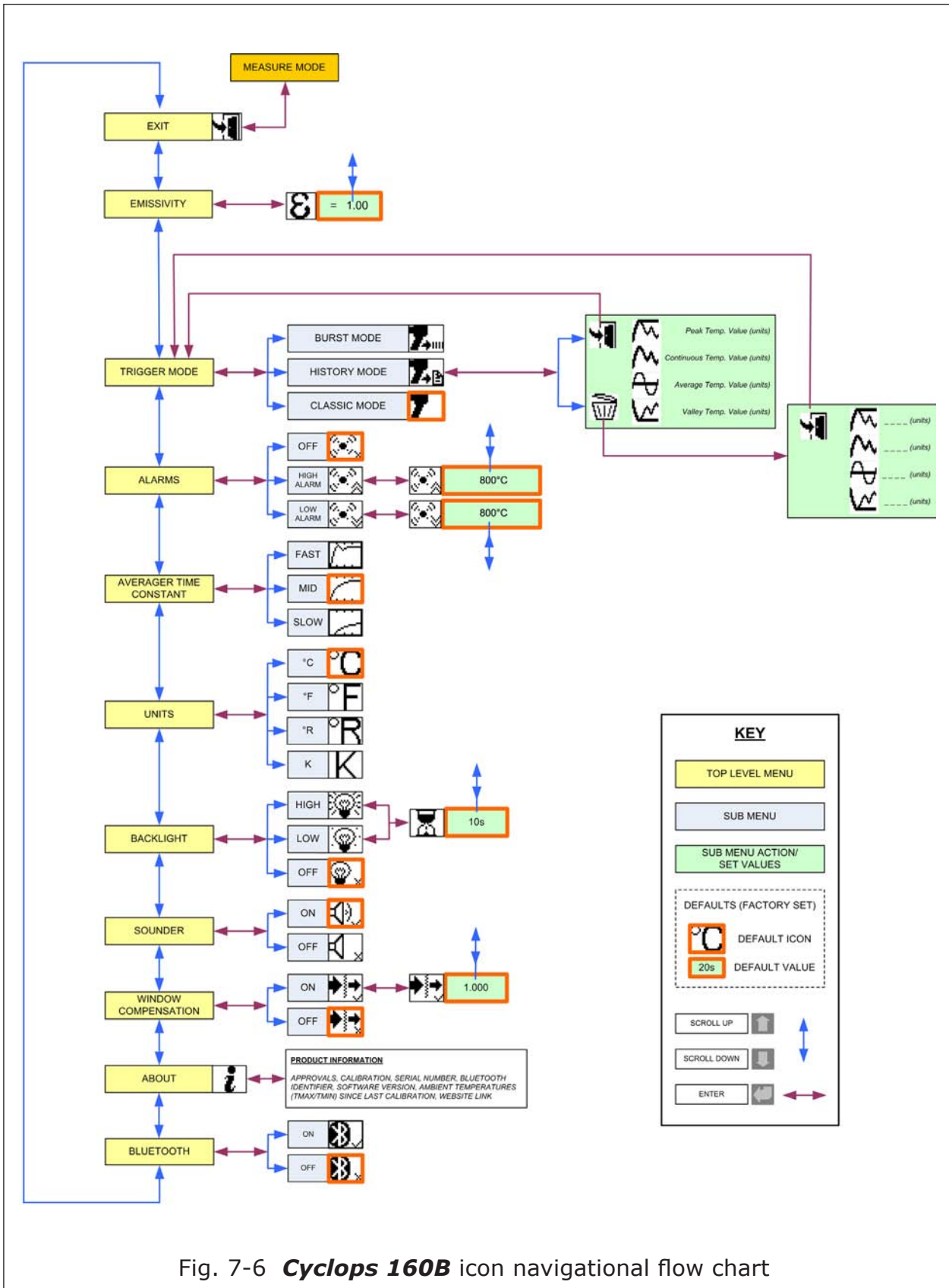


Fig. 7-6 **Cyclops 160B** icon navigational flow chart

## 8 Operational (Trigger) Modes

### 8.1 Introduction

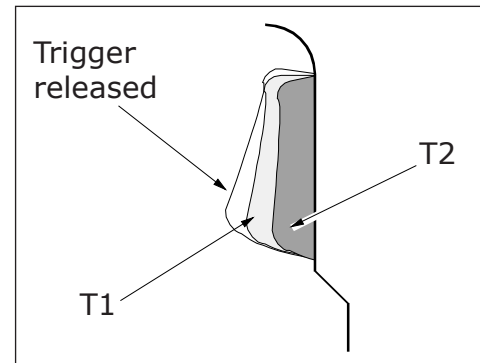
The **Cyclops 160B** thermometer has three operating modes:

- **Classic**
- **History**
- **Burst**

The thermometer trigger is used to control the operation of the thermometer in each mode. The trigger has two stages: **T1** and **T2** (See inset).

A light press on the trigger will move it to position **T1**, at which point a stronger press will be required to move the trigger a small, further distance to the second position **T2**.

This section of the user guide describes the measurement and data collection options available by using the two-stage trigger functions.



### 8.2 Classic Mode

Classic Mode is the simplest operating mode and the one that most closely resembles the operation of earlier Cyclops portable thermometers.

In Classic Mode, the trigger operation is single stage (**T1**) only. However, note that in Classic Mode, moving the trigger to the **T2** position has no further effect.

All four measured temperature types (**Peak, Continuous, Average** and **Valley**) are displayed on the side LCD panel, although only the highlighted temperature type is displayed in the viewfinder and streamed serially, via Bluetooth, to the DL-1000 datalogging software. Data is streamed in 0.5s intervals when the trigger is pressed in. When the trigger is released, streaming stops and the temperature is logged.

### 8.3 History Mode

In History mode all data collection and transfer is controlled by the dual stage trigger operation. In summary, the **T1** position is used to align the instrument on the chosen target and the **T2** position is used to generate the logged data.

With the trigger pulled to the **T1** position, operation is exactly the same as in Classic mode. All four temperature types (Peak, Continuous, Average and Valley) are displayed with the selected (highlighted) type being displayed internally within the viewfinder as well as being streamed at 0.5 second intervals to the Bluetooth output.

If the trigger is pulled to the **T2** position, this is confirmed by a single 'blink' on the internal viewfinder, coupled with a single 'beep' on the sounder (if switched on). When the trigger is pulled to the **T2** position, both the viewfinder and side displays are 'frozen' and a 'packet' of data is generated and sent out for data logging. This packet of data comprises the overall peak, last continuous, overall average and overall valley temperature measurements taken during the time that the trigger was pressed to the **T1** position. The emissivity set point and window compensation indicator value in use are also output, as part of the data packet.

The temperature components of this data packet are also retained within the instruments memory and may be viewed on the side display by going into Menu mode and re-selecting twice on the History mode icon.

Note that further data packets will only be added after each press of the trigger to the **T2** position and the data added will be the measurements made at the **T1** position during the time preceding the press to **T2**. Any measurement made at the **T1** position without going to the **T2** position will not be stored.

If additional data is added, any higher peak (or lower valley) temperature recorded will overwrite the earlier stored value. The new average value will then become the average over all stored data and the continuous value displayed will become an average of the last continuous values for each data packet within the overall stored sets.

When the stored data set has been inspected the user has the option of deleting the data by selecting the 'waste basket' icon, or exiting the data set without deletion (exit icon) in which case further data may be added to the stored set.

#### Note

If the instrument is switched off, all stored data will be lost.

## 8.4 Burst Mode

Burst mode is only intended for use when data logging via the Bluetooth connection to an IPAQ or laptop computer.

It can be used for monitoring rapid fluctuations of temperature or recording a temperature profile, such as a long strip of material.

Burst mode requires dual stage trigger operation. With the trigger pulled to the **T1** position, the instrument operates as per Classic mode (See Section 8.2). However, note that in burst mode, the instantaneous readings (only) are always highlighted on the side screen and displayed internally within the viewfinder.

When the trigger is pulled to the **T2** position, live temperature data (only) is streamed at the maximum collection rate (approximately 33 readings per second) to the Bluetooth module. This mode of operation is denoted by the internal display 'blinking' in unison with the sounder 'beeping' (if switched on) at approximately 0.5 second intervals.

When the trigger is released, a 2-piece data packet is added, giving the emissivity and window transmission factor values.

Note that when logging to the **DL 1000** software, the maximum number of consecutive readings that can be stored in each file is limited to **999** - equating to 30 seconds of Burst mode output.

If the trigger is released back to the **T1** position, Classic mode operation is resumed.

## 9 Thermometer Operation

### CAUTION

**Never look at the sun through this instrument** - this could cause severe damage to the eye.

Prior to temperature measurement, the thermometer must be set up as dictated by the chosen application.





The setup procedure can be split into three different setup groups:

- Data Output Setup
- User Interface Setup
- Measurement Setup

The following list details the setup groups and the available selections.

Setup Group	Function	Selection Options
<b>Data Output Setup</b>	Trigger Mode	Classic / History / Burst
	Bluetooth	On / Off
<b>User Interface Setup</b>	Trigger Mode	Classic / History / Burst
	Backlight	High (enter timer value) Low (enter timer value) Off
	Sounder	On / Off
	Alarms	High Alarm (enter set point Low Alarm values) Off
<b>Measurement Setup</b>	Units	°C / °F / K / °R
	Emissivity	(0.10 to 1.20)
	Averager Time Constant	Fast / Mid / Slow
	Window Compensation	On (0.80 to 1.20) / Off

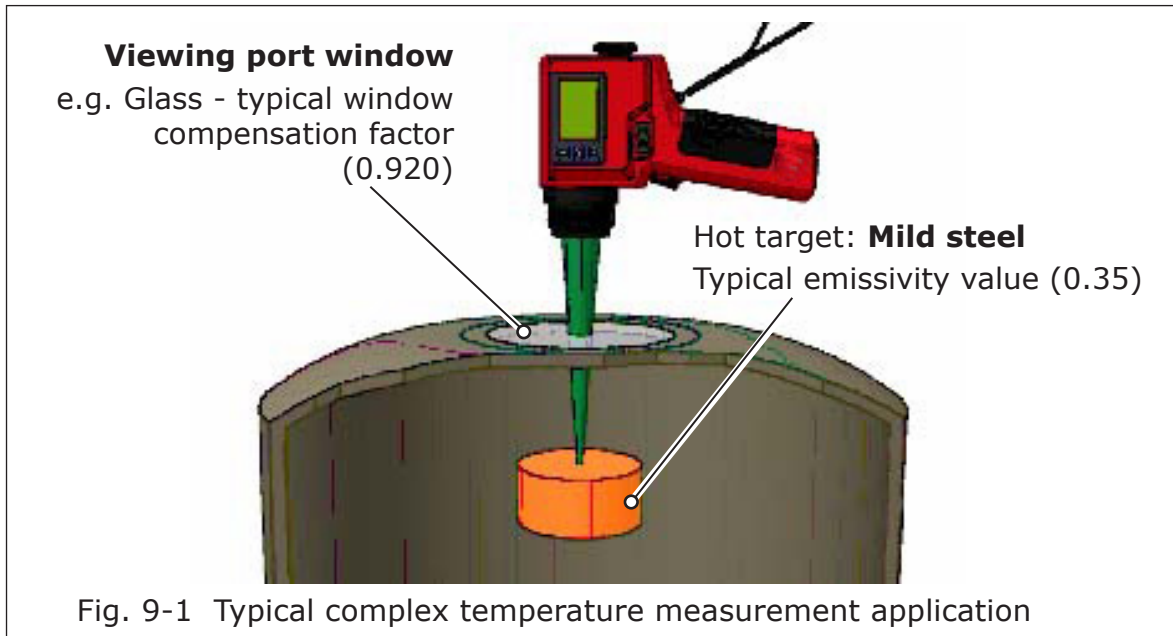
## 9.1 Operation (Example 1: simple temperature measurement)

- 1) Switch the thermometer on via the On/Off switch. The initialisation screen will appear and, after a few seconds, the screen will change to show the measurement mode display.
- 2) Check the battery status, ensure that there is sufficient battery life remaining.
- 3) If the trigger mode is not already set to **Classic Mode**, go into **Menu Mode**, open the **Trigger Mode** menu and select **Classic Mode**.
- 4) Enter the **Emissivity** value for the material under observation (refer to the information in Section 11).
- 5) Ensure that **Window Compensation** is **Off**.
- 6) Ensure that the **Alarms** function is set to **Off**.
- 7) Ensure the **Bluetooth** option is set to **Off**.
- 8) On the side display, select the **Continuous** temperature measurement option (see Section 7.2).
- 9) Adjust the eyepiece to suit the user (See Section 6.3), then aim the thermometer at the target and, using the lens focus adjustment (See Section 5.5), focus the graticule onto the area under observation. Check that the graticule is fully filled by the target, re-position if necessary.
- 10) Press the trigger to start measurement. The main display and eyepiece display are updated with the reading
- 11) Release the trigger to stop measurement and freeze the last recorded value on the main display.

## 9.2 Operation (Example 2 : complex temperature measurement)



In some industrial applications, a window or viewing port may be situated between the thermometer and the target object. This can lead to a reduction in the amount of radiant energy reaching the thermometer from the target.

The following instructions detail the operation of a **Cyclops 160B** in a typical complex temperature measurement application (as in Fig. 9-1).



- 1) Check the battery status, ensure that there is sufficient battery life remaining.
- 2) Go into **Menu Mode**, open the **Trigger Mode** menu and select **Classic Mode**.
- 3) Enter the **Emissivity** value for the material under observation (0.35).  
*If the window compensation factor of the viewing window/port is known:*
- 4) Set **Window Compensation** to **On**.
- 5) Enter the known compensation factor (e.g 0.920 for Glass, 0.880 for Sapphire)
- If the 'Window Compensation' factor of the viewing window/port is not known:*
- 6) Take and record a reading with the thermometer of a known temperature value, with the emissivity set to correspond and the **Window Compensation** factor set to default (i.e. blackbody heat source, emissivity set to 1.00 and **Window Compensation** set to 1.000).
- 7) Place a spare viewing window/port between the thermometer and the blackbody heat source and take a new temperature reading.



- 8) Enter the **Window Compensation** > **On** sub-menu and amend the Window Compensation factor value with the  and  keys until the display temperature reads the same as the recorded value taken from the known value source. You must now use this **Window Compensation** value, as it is correct for the chosen viewing window/port material (e.g. 0.880).
- 9) Select the **Continuous** temperature measurement option.
- 10) Aim the thermometer through the viewing window/port at the target and focus the graticule onto the area under observation. Check that the graticule is fully filled by the target, re-position if necessary
- 11) Press the trigger to start measurement. The main display and eyepiece display are updated with the reading.
- 12) Release the trigger to stop measurement and freeze the last recorded value on the main display.

## 10 Bluetooth wireless communication

Data streaming provides flexibility in the retention of information captured by the thermometer.

To capture information by **Bluetooth** communication from the **Cyclops 160B** to a laptop/PC/Pocket PC, you must use a DL-1000 v2 Datalogging kit (800505 or 800509). For full operating instructions, see the DL-1000 v2 User Guide.

- 1) Ensure that the datalogging software has been loaded to the PC/laptop or Pocket PC (see DL-1000 v2 User Guide) as required
- 2) Establish **Bluetooth** communications from the **Cyclops 160B** to a laptop/PC/Pocket PC (see DL-1000 v2 User Guide). The **Cyclops 160B** requires a passkey of **0000**.
- 3) When **Bluetooth** communications is active, the **Bluetooth** logo on the thermometer side display holds steady and a **IOIOI** icon appears (a flashing logo indicates lost **Bluetooth** communications).
- 4) Select the required **Trigger Mode** on the **Cyclops 160B**.
- 5) Press the trigger to capture and stream data, release the trigger to stop.

## 11 Emissivity

### 11.1 Emissivity values

In order to obtain accurate temperature measurements, the emissivity value of the target surface must be known. This section of the User Guide contains typical emissivity values of the most commonly measured materials for each thermometer variant.

Where no emissivity value is quoted, this means that the thermometer may be unsuitable for the measurement application, the temperature of the target is outside the thermometer's measurement span, or that the emissivity value cannot be accurately specified and should be determined in-situ (See Section 11.2). If you have a query regarding the emissivity of the target in your measurement application, contact Land Instruments International for assistance.

#### Refractories

Material	Cyclops 160B	
Alumina	0.30	
Brick	<i>Red</i>	0.80
	<i>White refractory</i>	0.35
	<i>Silica</i>	0.60
	<i>Sillimanite</i>	0.60
Ceramics	0.50	
Magnesite	-	

#### Alloys

Material	Cyclops 160B
Brass	0.18
	Oxidised
Chromel & Alumel	0.30
	Oxidised
Constantin & Manganin	0.22
	Oxidised
Inconel	0.30
	Oxidised
Monel	0.22
	Oxidised
Nichrome	0.28
	Oxidised

**Metals**

<b>Material</b>	<b>Cyclops 160B</b>
Aluminium	0.09
Oxidised	0.40
Chromium	0.34
Oxidised	0.80
Cobalt	0.28
Oxidised	0.65
Copper	0.05
Oxidised	0.85
Gold	0.02
Iron & Steel	0.30
Oxidised	0.85
Lead	0.28
Oxidised	0.65
Magnesium	0.24
Oxidised	0.75
Molybdenum	0.25
Oxidised	0.80
Nickel	0.25
Oxidised	0.85
Palladium	0.23
Platinum	0.22
Rhodium	0.18
Silver	0.04
Oxidised	0.10
Tin	0.28
Oxidised	0.60
Titanium	0.50
Oxidised	0.80
Tungsten	0.30
Zinc	0.32
Oxidised	0.55









**Miscellaneous**

<b>Material</b>		<b>Cyclops 160B</b>
Asbestos	<i>Board/paper/cloth</i>	0.90
Asphalt		0.85
Carbon	<i>Graphite</i>	0.85
	<i>Soot</i>	0.95
Cement & Concrete		0.70
Cloth	<i>All types - close weave</i> (Open weave reduces emissivity)	0.80
Glass	<i>3mm thick</i>	-
	<i>6mm thick</i>	-
	<i>12mm thick</i>	-
	<i>20mm thick</i>	-

## 11.2 Practical determination of Emissivity value

For many applications, such as metal alloys, it is not possible to specify a fixed emissivity value. In such instances, it is possible to make an in-situ, practical determination of the required emissivity setting by comparison with a reference measurement such as a thermocouple reading.

The procedure for doing this is as follows:

- 1) Sight the thermometer onto the target surface at the chosen measurement point. Allow the reading to stabilise and release the trigger to freeze the readings on the side display.  
**Note:** Do not touch the trigger again until the procedure has been finished.
- 2) Using a thermocouple or reference instrument, measure the temperature at the target location.
- 3) Press the **Select** key  to go into the **Menu** mode, press the **Down** arrow key  to select the  $\epsilon$  setting and press the **Select** key  to select this option.
- 4) The screen will display the current emissivity value.
- 5) Use the **Up**  and **Down**  keys to change the emissivity value. The temperature reading will change to indicate the value that would have been obtained at the new emissivity setting.
- 6) Continue adjusting the emissivity value up or down until the displayed temperature agrees as closely as possible to the reference temperature.
- 7) Press the **Select** key  to store the new emissivity value, press the **Up**  arrow key to return to the **Exit** icon and press the **Select** key  to return to **Measure** mode.

All subsequent readings will now use the new emissivity set point.

Note that the new emissivity value will be stored at switch-off.

## 12 Maintenance

The **Cyclops 160B** thermometer has been designed specifically to require very little maintenance. There are several processes that are recommended to help ensure that the instrument remains serviceable.

- Ensure that the lens cover is fitted when the thermometer is not in use.
- Ensure that the lens assembly, eyepiece and display panel are kept clean and free from contaminants. On a regular basis, clean these components carefully with a soft lens cloth and proprietary lens cleaner.
- Check the thermometer for damage regularly. Pay particular attention to the lens assembly, eyepiece, display panel, trigger and on/off switch.
- Ensure that a spare, fully charged battery is kept with the thermometer at all times.

In the unlikely event of an instrument fault, do not attempt to investigate or repair the fault on-site. Contact Land Instruments to arrange a repair.

## 13 Accessories and Spare Parts

### 13.1 Accessories

#### Type 110 & Type 135 Close-up Lenses

Type 110 (802007) and Type 135 (802008) close-up lenses enable the Cyclops 160B to focus on targets at distances that are too close to measure with the standard lens.

The Type 110 lens has a fixed focus at 215mm/8.5in, with a minimum target size of 0.5mm/0.02in. A typical application for this lens is hot filament/wire observation.

The Type 135 lens has a focus range of 450mm/17.7in to 620mm/24.4in, with a minimum target size of 2mm/0.08in. A typical application for this lens is calibration on small aperture furnaces.



Fig. 13-1 Type 110 and Type 135 close-up lenses

#### Protective Hard Carrycase

The Hard Carrycase (801777) is a rugged, lightweight, waterproof and shockproof injection-moulded box, giving full environmental protection. It is supplied with custom-cut foam cushioning, with cut-outs for the thermometer and any supplied accessories, allowing all items of the 'kit' to be kept together for convenience.

Dimensions: 360 x 290 x 165mm/14.2 x 11.4 x 6.5in (width x length x depth)



Fig. 13-2 Hard carrycase (open & closed views)



### DL-1000 Datalogger Kit

The DL-1000 Datalogger Kit allows you to externally log streamed data from the **Cyclops 160B** thermometer, whilst retaining full portability. The kit includes an HP iPAQ Pocket PC with companion software CD, Cyclops DL-1000 v.3 software CD (including communication software), and System User Guide.

For users who do not require an HP iPAQ or have their own, a part product version is available (800509).



Fig. 13-3 DL-1000 Datalogger Kit

### Protective thermal cover

The protective thermal cover (802958) is strongly recommended for use in harsh environments. Its primary function is to protect the instrument from excessive radiant heat and reduce thermal shocks, however it also forms a highly effective barrier against the ingress of dust.

The large window area enables a clear view of the side display and provides access to the control keys to enable menu operation.



Fig. 13-4 Protective thermal cover

### Cyclops Long Eye Relief (LER) adaptor

The Cyclops Long Eye Relief (LER) adaptor (804685) is an accessory to enable Cyclops thermometer users wearing helmets, goggles or other eye protection devices, to be able to see the full field of view, the measurement circle and the internal temperature display, whilst the rear of the instrument is being held away from the eye.



Fig. 13-5 LER Adaptor

## 13.2 Spare Parts

<b><i>Part</i></b>	<b><i>Material Code</i></b>
Eyepiece hood	802211
Lens cover	802083
Wrist strap	801994
Battery cover	804090
Lens protection window	802061
Rubber Tripod Pad	802311
Protective thermal cover	802598
Spare HP iPAQ for DL-1000 Datalogger	800511

## 14 User Configuration Record

The **Cyclops 160B** can be configured to suit your measurement requirements. Your chosen parameter settings and values are stored in the thermometer's memory.

If the thermometer is returned to Land Instruments for repair or recalibration, it is possible that your stored user settings may be overwritten and the thermometer returned to you with the factory default settings.

Therefore, it is recommended that once you have set up the thermometer to match your measurement requirements, you use the User Configuration Record to make a note of your chosen parameter settings and values, so that these can be re-entered into the thermometer and used again.

Serial N<sup>o</sup> .....

Date: .....

Measurement Mode: Peak  Instantaneous

Averaged  Valley

Menu Mode: Emissivity (value) .....

Data Output Mode: Classic  Historic

Burst

Alarm Settings: Alarm off

High alarm  (value) .....

Low alarm  (value) .....

Averager setting: Slow  Mid  Fast

Temperature units: °C  °F  K  °R

Backlight Setting: Off

Dim  (timer) .....

Bright  (timer) .....

Sounder Setting: Off  On

Window transmission: Off

On  (value) .....

Bluetooth: Off  On

# Appendix 1

## Serial Communications Data Logging Protocol

The logging protocol given below applies to data streamed serially via the BLUETOOTH module.

### UART Settings

BAUD 57600 fixed  
 START DATA PARITY STOP 1,8,N,1

### Classic Mode stream

When the trigger is pressed to the T1 position, a continuous stream of lines of data of fixed (12 character) length is output every 0.5 ±0.1 seconds.

EXAMPLE:	Q	C	C	I	972.0	CR LF
(i) Identifier	B = C100					
	D = C055					
	J = C390					
	<b>Q = C160</b>					
(ii) Packet	C	Classic – while key pressed				
	H	Hold – when key released				
(iii) Units	C	°Celsius				
(iv) Mode		P	Peak			
		I	Instantaneous			
		A	Average			
		V	Valley			
(v) Data					In tenths up to ±999.9	
					In degrees after ±1000	
					Over-range is _ _ _	
					Under-range is _ _ _	
(vi) Termination					0x0D,0x0A	

The receiving device sends a \* handshake to indicate 'H' hold – i.e. key released and data logged.

**Advanced Mode - data stream**

When the trigger is pressed to the **T1** position, a continuous stream of lines of data is produced every  $0.5 \pm 0.1$  seconds:

EXAMPLE:     **Q 1 C I 972.0 CR LF**

As per *Classic Mode stream* except

(ii) Packet   **1**   Advanced mode - trigger 1 pressed

There is no handshaking of the advanced data stream.

**Advanced – History mode packet**

When the trigger is pressed to the **T2** position, a 6 line packet of calculated data is output.

EXAMPLE:     **Q 2 C I 972.0 CR LF**  
                   **Q 2 C P 1030 CR LF**  
                   **Q 2 C V 812.0 CR LF**  
                   **Q 2 C A 900.0 CR LF**  
                   **Q 2 C E 1.000 CR LF**  
                   { **Q 2 C T 1.000 CR LF**  
 or if disabled { **Q 2 C T OFF CR LF**

As per *Advanced Mode - data stream* except:

(i) Packet               **2**   Advanced – History mode packet

(ii) Mode                       **E**   Emissivity

**T**   Window Transmission

(iii) Data                               In thousandths for emissivity/transmission

The receiving device should send a \* handshake to indicate packet reception.

**Advanced – Burst Mode packet**

When **T2** is pressed in burst mode, a continuous stream of lines of data is output every  $30 \pm 5$ ms. Example:

**Q 3 C I 972.0 CR LF**

As above except:

(i) Packet               **3**   Advanced - Burst mode packet

When **T2** is released in burst mode, a 2-line termination packet is output:

**Q 3 C E 1.000 CR LF**  
                   { **Q 3 C T 1.000 CR LF**  
 or if disabled { **Q 3 C T OFF CR LF**

The receiving device should send a \* handshake to indicate termination packet reception.

***Advanced – Bluetooth Heartbeat***

To maintain the Bluetooth link, and to establish that the logger program is running, the following dummy data is sent:

**Q 0 C x xxxxxx CR LF**

The receiving device should send a \* handshake to indicate heartbeat reception.

## Appendix 2

### Error Codes

At switch-on, the **Cyclops** instrument will check all stored data in its non-volatile memory and any detected errors will be shown near the bottom of the side display screen.

#### Error Code 1

Description: Unknown Cyclops Type

If this code is displayed the instrument will be unable to perform any further any function.

If the error persists, return the **Cyclops** to Land Instruments for repair.

#### Error Code 2

Description: Lost Calibration Data

The **Cyclops** will continue to work, but with the display inverted (i.e. white on black). However, the calibration of the instrument will be incorrect and readings will only be approximate. It will not meet the temperature accuracy specifications. If this error persists, return the **Cyclops** to Land Instruments for repair.

#### Error Code 3

Description: Lost User Setting

The **Cyclops** normally stores user settings (accessed via the menu) in non-volatile memory. If these are inconsistent, the user settings will revert to factory defaults. The operator can re-enter the desired user settings to allow the **Cyclops** to work as intended.





# LAND

An **AMETEK**® Company

## PRODUCT WARRANTY

Thank you for purchasing your new product from Land Instruments International. This Land manufacturer's 'back-to-base' warranty covers product malfunctions arising from defects in design or manufacture. The warranty period commences on the instrument despatch date from the Land Instruments International Ltd. factory in Dronfield, UK.

### 36 MONTHS WARRANTY



Building upon the reputation for reliability and longevity that System 4 and UNO thermometers have earned, Land are delighted to be able to provide our customers with an industry-leading 36 month warranty for the following products:-

- System 4 thermometers, processors, accessories and mountings and special instruments based on System 4.
- UNO thermometers, accessories and mountings and special instruments based on UNO.
- Application-dedicated processors based on LANDMARK® Graphic.
- ABTS/S and ABTS/U.
- FTS.
- VDT/S and VDT/U.
- DTT.
- FLT5/A.

This 36 month warranty is provided as standard for all orders for the products listed above received from 1st May 2002.

We believe that our customers expect us to set the standard in terms of performance, quality, reliability and value for money. This 36 months warranty, as a part of an on-going program of continuous improvement, is just one way in which Land strive to maintain our position as the temperature measurement partner of choice.

### 12 MONTHS WARRANTY

All Land Instruments International products not provided with 36 months warranty (see list above), are provided with a 12 months warranty.

# PRODUCT WARRANTY

## EXCLUSIONS FROM WARRANTY

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It should be noted that costs associated with calibration checks which may be requested during the warranty period are not covered within the warranty.

Land reserve the right to charge for service/calibration checks undertaken during the warranty period if the cause is deemed to fall outside the terms of the warranty.

This Land manufacturer's warranty does not cover product malfunction arising from:-

- incorrect electrical wiring.
- connection to electrical power sources outside the rating of the product.
- physical shock (being dropped, etc.) and impact damage.
- inappropriate routing, support, physical shock & strain protection, etc. of the lightguide (Fiberoptic thermometers only).
- environmental conditions exceeding the IP / NEMA rating of the product.
- environmental conditions outside the Ambient Temperature, Humidity and Vibration rating of the product.
- environmental contamination (solvent vapours, deposition of airborne contamination, cooling liquids of non-neutral pH, etc.).
- overheating as a result of interruption of water/air flow through cooling jackets or of incorrect installation.
- inappropriate modification of product (drilling holes in thermometer bodies, etc.).
- inappropriate recalibration which results in product calibration being taken outside specification.
- improper resealing of thermometer following parameter adjustment (UNO, FLT5/A, etc.).
- attempted repair by a non-Land-authorized repair centre.

Land Instruments International Ltd • Dronfield S18 1DJ • England • Tel: +44 (0) 1246 417691 • Fax: +44 (0) 1246 410585  
Email: [land.infrared@ametek.co.uk](mailto:land.infrared@ametek.co.uk) • [www.landinst.com](http://www.landinst.com)

AMETEK Land, Inc. • 150 Freeport Rd. • Pittsburgh, PA 15238 • U.S.A. • Tel: +1 (412) 826 4444  
Email: [irsales@ametek.com](mailto:irsales@ametek.com) • [www.ametek-land.com](http://www.ametek-land.com)

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