



Wahl Heat Spy®
DHS520/520B
Portable Infrared Thermometer

User Manual

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The Quality Management System of Wahl Instruments Inc. is approved for the design, manufacture, and sales of temperature and pressure measuring devices for a variety of industries.














This product complies with current European directives relating to electromagnetic compatibility and safety (**EMC directive 89/336/EEC; Low voltage directive 73/23/EEC**).










All packaging material used for this product can be recycled.

SAFETY INFORMATION

SYMBOL	PUBLICATION	DESCRIPTION
	IEC 417, No.5031	Direct Current
	IEC 417, No.5032	Alternating Current
	IEC 417, No.5033	Both direct and alternating current
	IEC 617-2, No.02-02-06	Three-phase alternating Current
	IEC 417, No.5017	Earth (ground) terminal
	IEC 417, No.5019	Protective conductor terminal
	IEC 417, No.5020	Frame or chassis terminal
	IEC 417, No.5021	Equipotentiality
	IEC 417, No.5007	On (supply)
	IEC 417, No.5008	Off (supply)
	IEC 417, No.5172	Equipment protected throughout by double insulation or reinforced insulation (equivalent to Class II of IEC 536)

SAFETY INFORMATION (CONTINUED)

SYMBOL	PUBLICATION	DESCRIPTION
	ISO 3864, No. B.3.6	WARNING Risk of electric shock
	ISO 3864, No. B.3.1	Caution
	BS EN 100015	Observe precautions for handling electrostatic discharge sensitive devices
	BS EN 60825-1	WARNING Laser Radiation
		Refer to the operating instructions
		Note
		Do not dispose of this product together with your household waste. Please refer to the information of your local community or contact our distributors regarding the proper handling of end-of-life electric and electronic equipment. Recycling of this product will help to conserve natural resources and prevent potential negative consequences for the environment and human health caused by inappropriate waste handling

TECHNICAL SUPPORT

Technical support for the Wahl DHS520 portable infrared thermometer can be obtained by using the contact details given on the cover of this User Guide or by e-mail at the following address: **info@palmerwahl.com**.

PRODUCT WARRANTY**12 MONTH WARRANTY**

Thank you for purchasing your new product from Palmer Wahl. This warranty covers product malfunctions arising from defects in design or manufacture. The warranty period begins on the date product is shipped from the factory in Asheville, NC.

EXCLUSIONS FROM WARRANTY

It should be noted that costs associated with calibration checks which may be requested during the warranty period are not covered within the warranty. Wahl reserves 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 Wahl 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.
- 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 vapors, 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 (drilling holes in thermometer bodies, etc.).
- inappropriate recalibration resulting in calibration outside specification.
- attempted repair by a non-Wahl-authorized repair center.

CONTENTS

	QUALITY ASSURANCE	
	SAFETY INFORMATION	
	TECHNICAL SUPPORT	
	PRODUCT WARRANTY	
1.0	INTRODUCTION	1
	1.1 General Introduction	1
	1.2 About Wahl DHS520/520B Portable Thermometers	1
	1.3 Nomenclature	3
2.0	SPECIFICATIONS	4
3.0	THERMOMETER DESCRIPTION	5
	3.1 Wahl DHS520/520B	5
4.0	THERMOMETER POWER SUPPLY OPTIONS	6
	4.1 Using a Battery	6
	4.2 Using an External Power Source	7
5.0	THERMOMETER CONTROLS	8
	5.1 ON/OFF Switch	8
	5.2 Trigger Operation	8
	5.3 LCD Display Panel & Keypad	8
	5.4 Adjustable Eyepiece	9
	5.5 Optical Focus Ring	9
	5.6 External Connection Socket	9
6.0	OPTICS	10
	6.1 Target Size Calculation	10
	6.2 Lens Options	11
	6.3 Fitting a Close-up Lens	11
	6.4 Fitting a Dark Filter	11
	6.5 Fitting a Dark Filter to a Close-up Lens	11
	6.6 Eyepiece Optics	12

CONTENTS (CONTINUED)

7.0	DISPLAY PANEL MODES	13
	7.1 Introduction	13
	7.2 Measure Mode	13
	7.3 Menu Mode	17
	7.4 Menu Mode - Icon Descriptions	18
8.0	OPERATIONAL (TRIGGER) MODES	25
	8.1 Introduction	25
	8.2 Classic Mode	25
	8.3 History Mode	26
	8.4 Burst Mode	27
9.0	THERMOMETER OPERATION	28
	9.1 Simple temperature measurement	29
	9.2 Complex temperature measurement	29
10.0	DATA STREAMING	32
	10.1 Serial Communications	32
	10.2 'Bluetooth' Wireless Comms (Wahl DHS520B)	33
11.0	EMISSIVITY	34
	11.1 Refractories	34
	11.2 Alloys	35
	11.3 Metals	36
	11.4 Miscellaneous	37
12.0	MAINTENANCE	38
13.0	ACCESSORIES AND SPARE PARTS	39
	13.1 Accessories	39
14	USER CONFIGURATION RECORD	42
	APPENDIX	
	Serial Communications Data Logging Protocol	

1.0 INTRODUCTION

1.1 General Introduction

This publication gives you the information required to safely operate **Wahl DHS520/520B** portable thermometers.

It is important to check all equipment with which you have been supplied, and read all the literature provided with the **Wahl DHS520/520B** 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 **Wahl DHS520/520B** Quick-Start Guide.

1.2 About Wahl DHS520/520B Portable Thermometers

The **Wahl DHS520/520B** is a highly accurate, portable, short wavelength infrared thermometer, designed to measure and display temperatures in the range 550 to 3000°C/1022 to 5432°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 meter 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 minimize errors due to uncertainty in emissivity, while eliminating the effects of atmospheric absorption.

Both models feature RS232 serial communications, with simple configuration of the available data output formats. The **Wahl DHS520B** variant also features user-friendly 'Bluetooth' communications.



Fig. 1 *Wahl DHS520/520B* portable infrared thermometer

1.3 Nomenclature

The instrument detail label is positioned centrally, on the right-hand side of the **Wahl DHS520/520B** casing. The **Instrument Type** specifies the thermometer variant and the **Serial Number** is a unique identification number, incorporating the manufacture date code (see Fig. 2)

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

Instrument Type:

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Serial Number:

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

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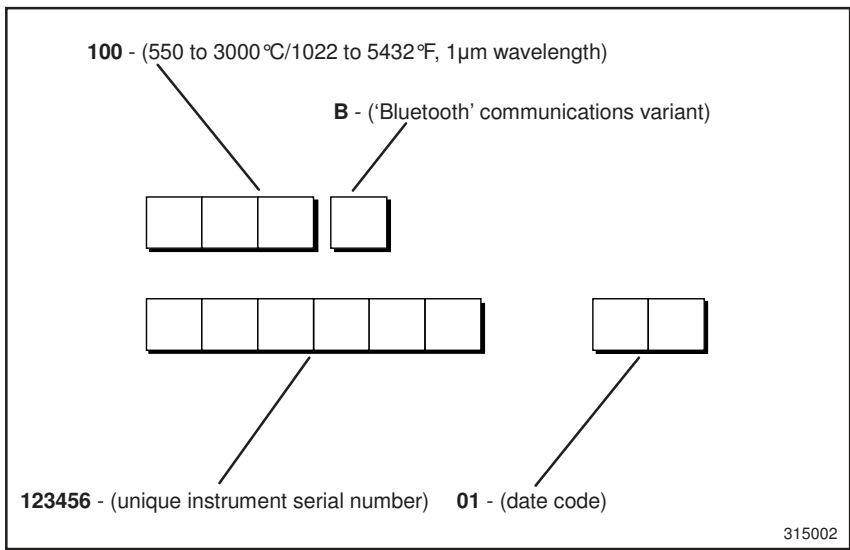


Fig. 2 **Wahl DHS520/520B** portable thermometer nomenclature

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 (**Wahl DHS520B** variants only) and the recommended battery details.

2.0 SPECIFICATIONS

Temperature range:	550 to 3000 °C / 1022 to 5432 °F (actual) 600 to 3000 °C / 1112 to 5432 °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 450 to 620mm/17.7 to 24.5in. (135 c.u.lens) nominally 215mm/8.5in. fixed focus (110 c.u. lens)
Minimum target diameter:	4.8mm/0.19in. at 101.4cm/39.9in. (standard) 1.8mm/0.07in. (135 close-up lens) 0.4mm/0.02in. (110 close-up lens)
Detector:	silicon photocell
Spectral response:	nominally 0.85 to 1.10µm
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% of reading (K or °R)
Repeatability:	<1 °C
Drift with ambient temperature:	<0.15%(C)/10 °C, <0.10%(F)/10 °F
Power source:	one 9V dry battery (Duracell 6LR61/12232 or equivalent); typical alkaline battery life: >100hrs in 'from-factory' configuration
Digital outputs:	ASCII code; RS232 serial out
IP rating:	IP40
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; dark glass eye protection filter; wrist strap
Optional accessories:	type 135 and 110 close-up lenses; protective hard carry case.

3.0 THERMOMETER DESCRIPTION

3.1 Wahl DHS520/520B



Fig. 3 **Wahl DHS520/520B** portable infrared thermometer description

4.0 THERMOMETER POWER SUPPLY OPTIONS

4.1 Using a Battery

The **Wahl DHS520/520B** portable thermometer is designed to be powered by a 9V dry cell battery. A Duracell 6LR61/12232 (or equivalent) battery is supplied with the thermometer. The battery is fitted as follows:



Fig. 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).
- 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. 5).



Fig. 5

- 4) Align the battery so that the terminals correspond with the label in the battery compartment (see Fig. 6).
- 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. 7).



Fig. 6

- 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.



Fig. 7

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' (**DHS520B** only) 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.

i 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.

4.2 Using an External Power Source

Although the **Wahl DHS520/520B** portable thermometer is designed to be powered by an internal battery, it can be powered by a suitable external power source (9 to 12V d.c./100mA rated).

i Note

If the thermometer is to be used with an external power source, ensure that the internal battery is removed before applying external power.

To connect an external power source:

- 1) Switch off the thermometer and remove the battery.
- 2) Connect the external power source (9 to 12V d.c./100mA rated) to a 'HIROSE' connector (HR10-10P-12P). Connect the 'positive' to pin 5 and the '0V' to pin 7.
- 3) Remove the rubber cover from the external connection socket, located near the base of the thermometer (see Fig. 3, item 8).
- 4) Connect the 'HIROSE' plug to the external connection socket.
- 5) Switch the thermometer 'ON' and check for correct operation.

5.0 THERMOMETER CONTROLS

5.1 ON/OFF Switch

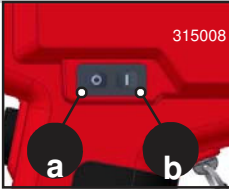


Fig. 8

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

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

5.2 Trigger Operation

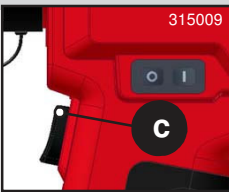


Fig. 9

The **Trigger** (c) is on the thermometer handle (see Fig. 3, 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 8.0).

5.3 LCD Display Panel & Keypad

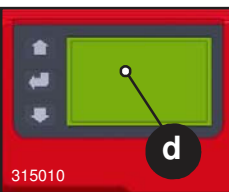





Fig. 10

The **LCD display panel** (d) is on the left-hand side of the thermometer body (see Fig. 3, 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 7.0.

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

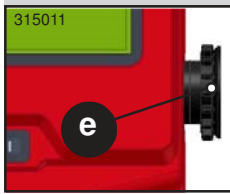


Fig. 11

The **Adjustable Eyepiece** (e) is on the rear face of the thermometer (see Fig. 3, item 11).

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 6.6).

5.5 Optical Focus Ring



Fig. 12

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.

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.

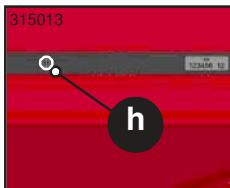


Fig. 13

As standard, the thermometer is supplied with two protective windows. The clear window is for general use, and the dark window is for use where temperatures in the scene are likely to exceed 1200°C/2192°F.

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

5.6 External Connection Socket



Fig. 14

The **External Connection Socket** (i) is on the left-hand side of the thermometer handle (see Fig. 3, item 8).

The socket has two main functions: it allows an external power source to be connected to the thermometer, and it enables the thermometer to interface with an IPAQ or laptop, giving datalogging facilities via serial RS232 communications.

The protective rubber cover should be fitted at all times when the socket is not in use.

6.0 OPTICS

The **Wahl DHS520/520B** 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. 15.

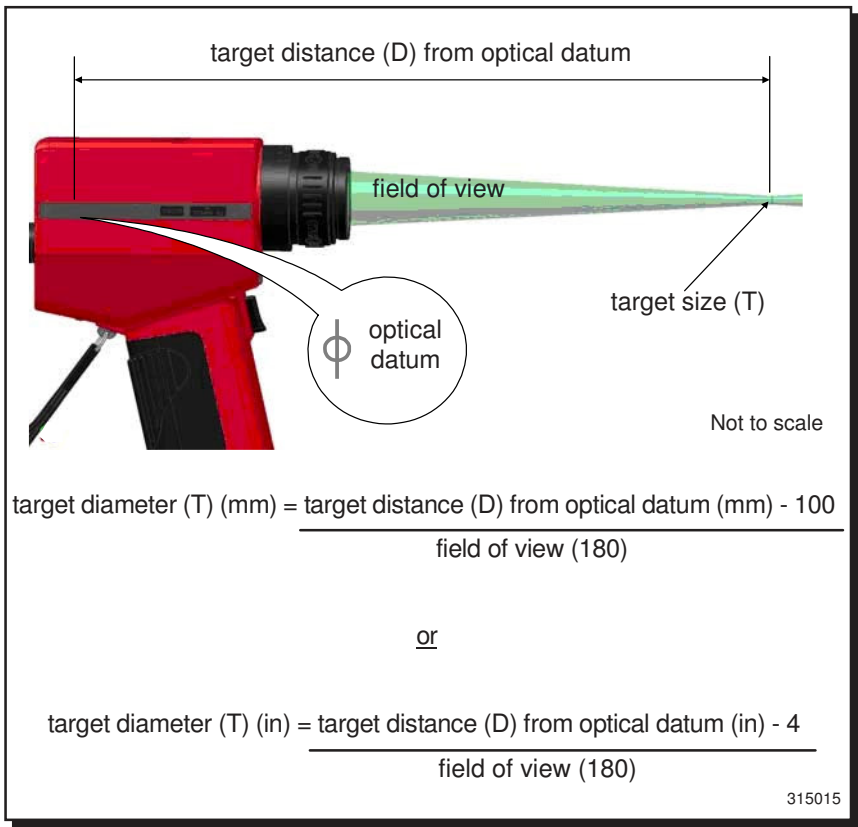


Fig. 15 **Wahl DHS520/520B** thermometer target size calculation

6.2 Lens Options

The **Wahl DHS520/520B** is supplied, as standard, with a protective window which covers and protects the instrument lens.

Palmer Wahl can supply optional close-up lenses, which enable smaller targets to be measured.



CAUTION

Never look at the sun through this instrument - this could cause severe damage to the eye. When measuring temperatures above 1200°C/2192°F, a dark filter **must** be fitted to the lens assembly.

6.3 Fitting a Close-up Lens

To fit a close-up lens to the **Wahl DHS520/520B** 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 close-up lens are similar. Therefore, there will be no significant calibration error, so window compensation is not required.

6.4 Fitting a Dark Filter

When measuring temperatures above 1200°C/2192°F, the image through the viewfinder is uncomfortably bright on the eye. To counter this effect, a dark filter must be fitted in place of the clear protection window.

To fit a dark filter to the **Wahl DHS520/520B** thermometer, unscrew the clear protection window from the lens assembly and replace it with the dark filter.

The optical transmission characteristics of the protection window and the dark filter are similar. Therefore, there will be no significant calibration error, so window compensation is not required.

6.5 Fitting a Dark Filter to a Close-up Lens

When measuring a small target where the temperature rises above 1200°C/2192°F, the image through the viewfinder becomes uncomfortably bright on the eye. A close-up lens and a dark filter combination must be fitted in place of the clear protection window. (Continued...)

To fit a dark filter and close-up lens combination, unscrew the protection window from the lens assembly and replace it with a close-up lens (first), followed by a dark filter. As there is now an extra optical element in the sight path of the instrument, a window compensation factor of 0.93 must be entered to allow for the associated energy losses.

6.6 Eyepiece Optics

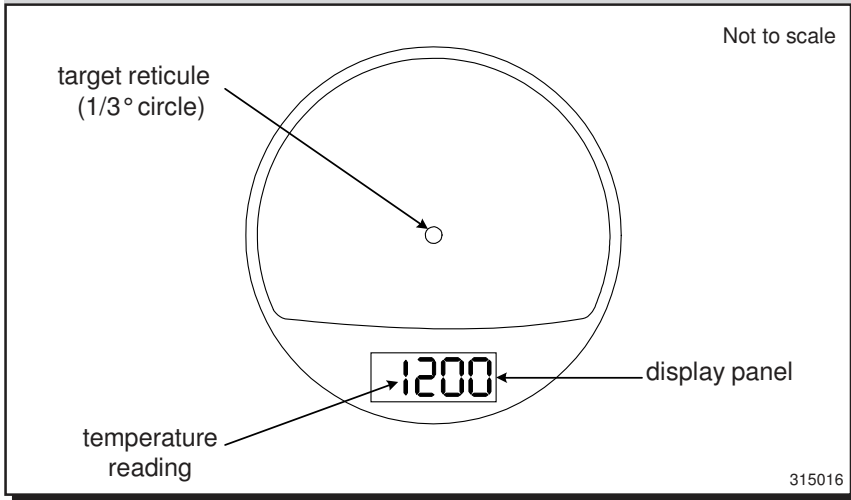


Fig. 16 *Wahl DHS520/520B* Eyepiece Optics

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 reticule.

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 reticule 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 reticule 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.


7.0 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.

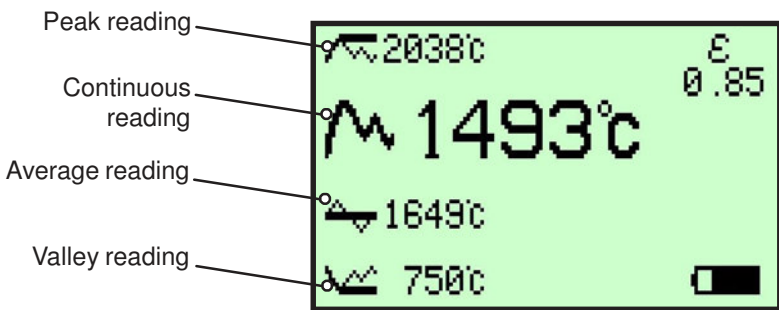
To access the **Menu Mode** from the Measure Mode, press the  (Enter/select) key on the keypad.

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.



315017

Fig. 17 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 serial or 'Bluetooth' outputs.

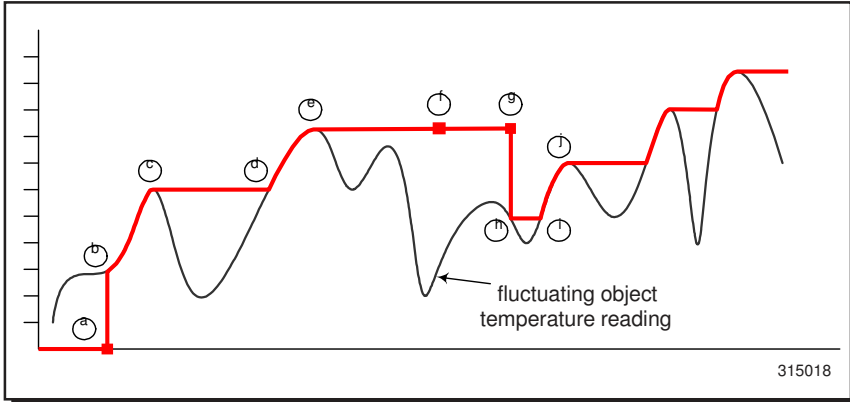


Fig. 18 Graphical representation of typical **Peak** temperature measurement

- (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.

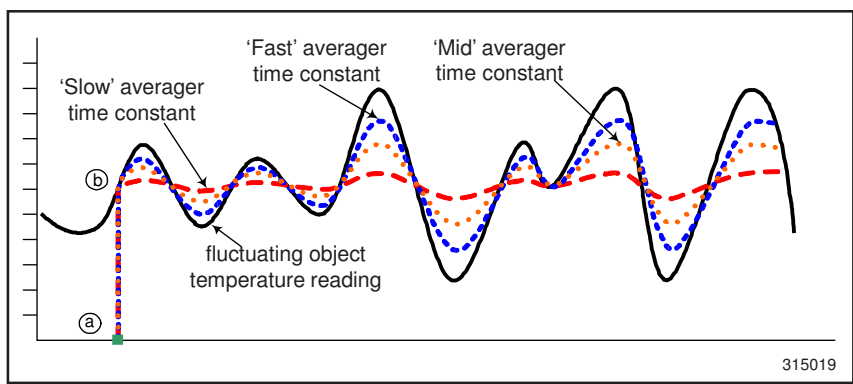


Fig. 19 Graphical representation of typical **Averaged** temperature measurement with **Slow**, **Mid** and **Fast** time constants

- (a) Thermometer trigger pressed
- (b) Averaging is initiated at the instantaneous temperature value. **Averaged** temperature values are calculated, displayed and updated

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. 20).

The temperature is updated instantaneously and the value is viewed in the instrument eyepiece. It is also streamed to the serial or 'Bluetooth' outputs (if fitted).

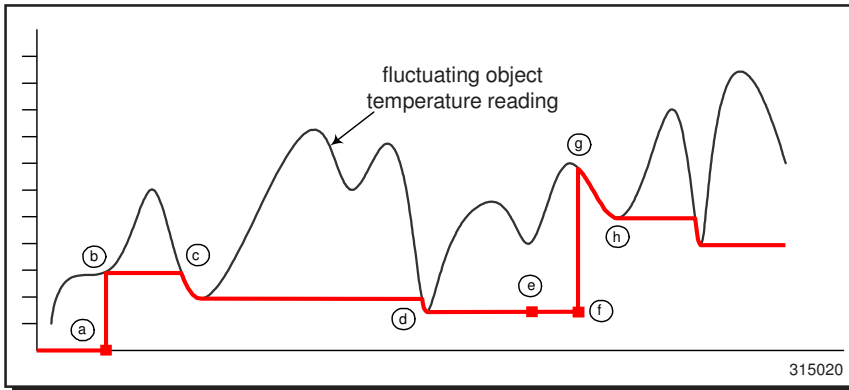













Fig. 20 Graphical representation of typical **Valley** temperature measurement

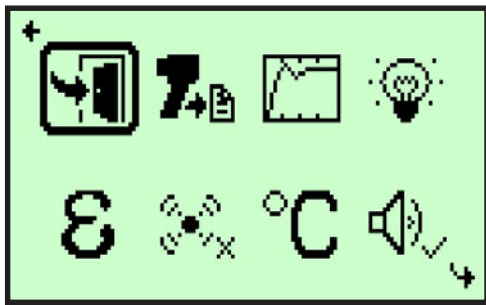
- (a) Thermometer trigger pressed
- (b) **Valley** temperature value on display jumps to instantaneous temperature value and is held on display with rise in object temperature
- (c) Object temperature falls, new **Valley** temperature value reached, display updated as object temperature falls. Object 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 **Wahl DHS520/520B** 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. 21).
- 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
- 6) When you have set a required parameter value, press the  key to return to the main menu options.




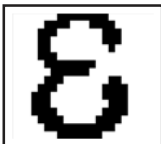


315021

Fig. 21 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. 22).




- (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 a comprehensive list of emissivity values, see Section 11.0 - Emissivity. The default value is 1.00.



- (c)  (d)  (e) 

Trigger Mode

The 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 8.0 - Operational (Trigger) Modes. The default trigger mode is **Classic**.

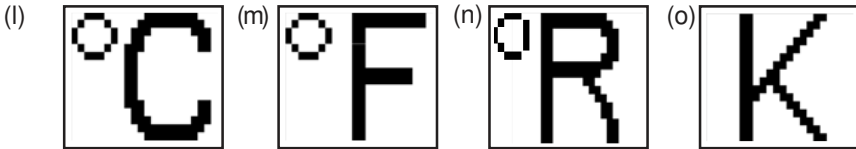
- (f)  (g)  (h) 

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.

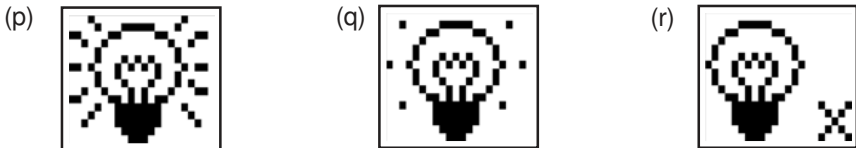


Averager time constant : the averager time constant function allows you to set the rate of averaging of the temperature values taken. There are three options: **Fast** (i), **Mid** (j) and **Slow** (k). The default setting is **Mid**.



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.

(s)



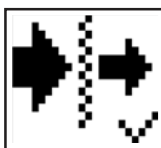
(t)



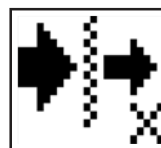
Sounder

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**.

(u)





(v)



Window compensation

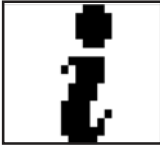
This function allows you to manually incorporate a known compensation value into the temperature calculation, which allows for the reflectivity of unusual combinations of thermometer windows. This function can be selected **On** (u) or **Off** (v).

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.

Examples:

Clear protection window fitted :	Window compensation Off
Dark eye comfort filter fitted :	Window compensation Off
Close-up lens fitted :	Window compensation Off
Eye comfort filter and close-up lens fitted :	Window compensation On Value set to 0.93
Any combination of the above and an external viewing window into the customer process :	Window compensation On value to be determined practically

(w)



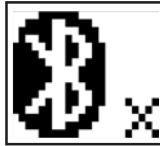
About

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

(x)



(y)



Bluetooth

Bluetooth communications allow wireless streaming of information from the thermometer to a remote facility. This function is only available in Bluetooth enabled models. 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 indicated as a flowchart shown in Fig. 22.



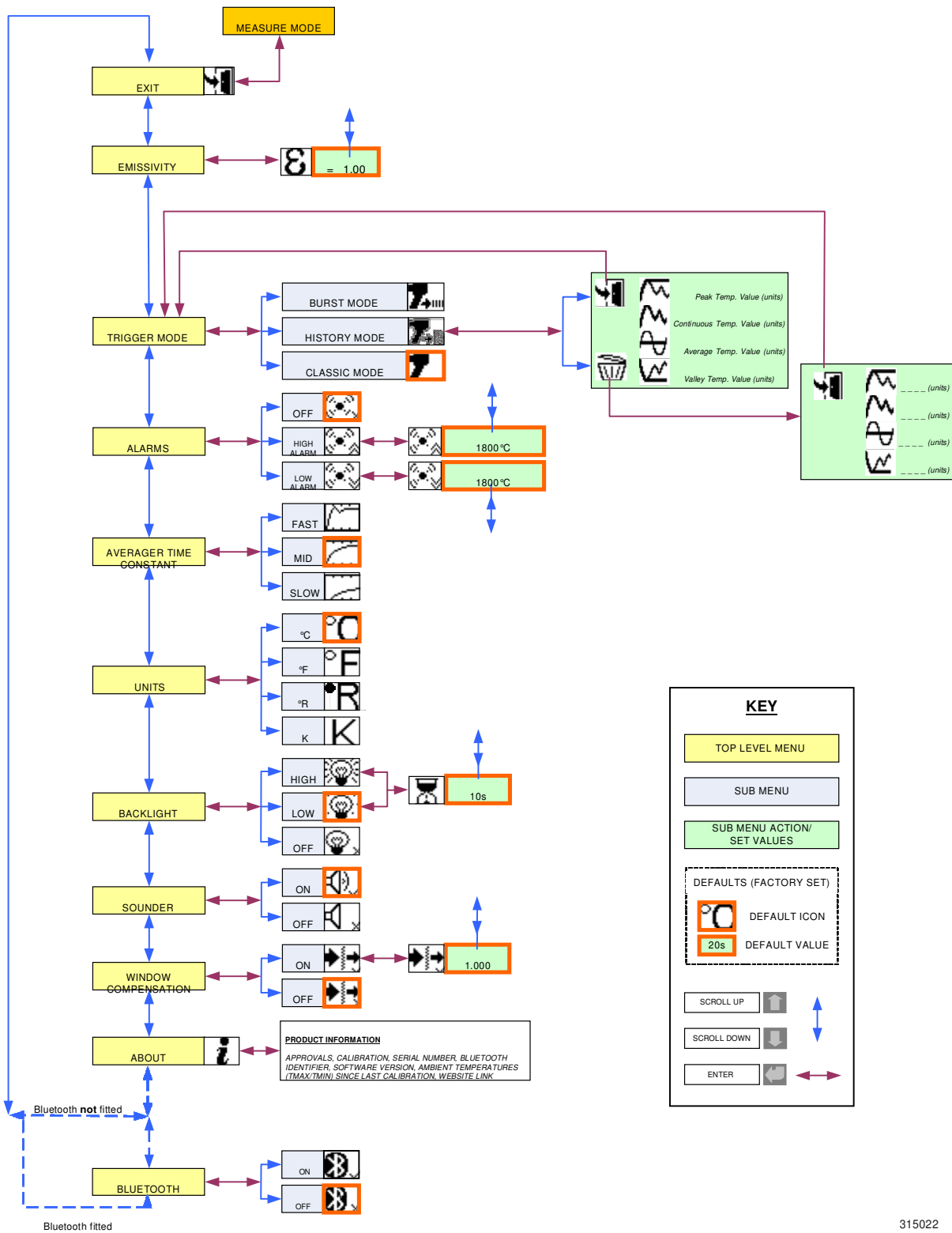


Fig. 22 - Wahl DHS520/520B Icon navigational flow chart

8.0 OPERATIONAL (TRIGGER) MODES

8.1 Introduction

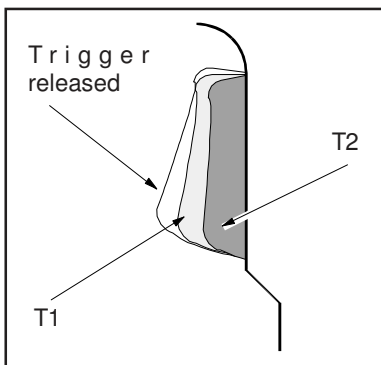
The **Wahl DHS520/520B** thermometer has three operating modes:

- **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 Wahl 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 to the **DA-LOG** datalogging software (wired connection or via Bluetooth). 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 serially in 0.5 second intervals (wired connection or Bluetooth).

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 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 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 serial port and 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 **DA-LOG** 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.

9.0 THERMOMETER OPERATION



CAUTION

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

When measuring temperatures above 1200 °C/2192 °F, a dark filter **must** be fitted to the lens assembly.

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
Data Output Setup	Trigger Mode	Classic / History / Burst
	Bluetooth	On / Off
User Interface Setup	Trigger Mode	Classic / History / Burst
	Backlight	High (enter timer value) Low (enter timer value) Off
	Sounder	On / Off
	Alarms	High Alarm (enter set-point values) Low Alarm Off
Measurement Setup	Units	°C / °F / K / °R
	Emissivity	(0.01 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 initialization 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) Assess the intended target. If the target temperature is likely to be above 1200°C/2192°F, fit the dark window (supplied as a standard accessory). Refer to Section 6.4.
- 4) If the trigger mode is not already set to **Classic Mode**, go into **Menu Mode**, open the **Trigger Mode** menu and select **Classic Mode** 
- 5) Enter the **Emissivity** value for the material under observation (refer to the tables in Section 11.0).
- 6) Ensure that **Window Compensation** is **Off**.
- 7) Ensure that the **Alarms** function is set to **Off**.
- 8) Ensure the **Bluetooth** option is set to **Off** (*Wahl DHS520B* variants only).
- 9) On the side display, select the **Continuous** temperature measurement option (see Section 7.2).
- 10) Adjust the eyepiece to suit the user (See Section 6.6), then aim the thermometer at the target and, using the lens focus adjustment (See Section 5.5), focus the reticule onto the area under observation. Check that the reticule 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.

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 **Wahl DHS520/520B** in a typical complex temperature measurement application (as in Fig. 23).

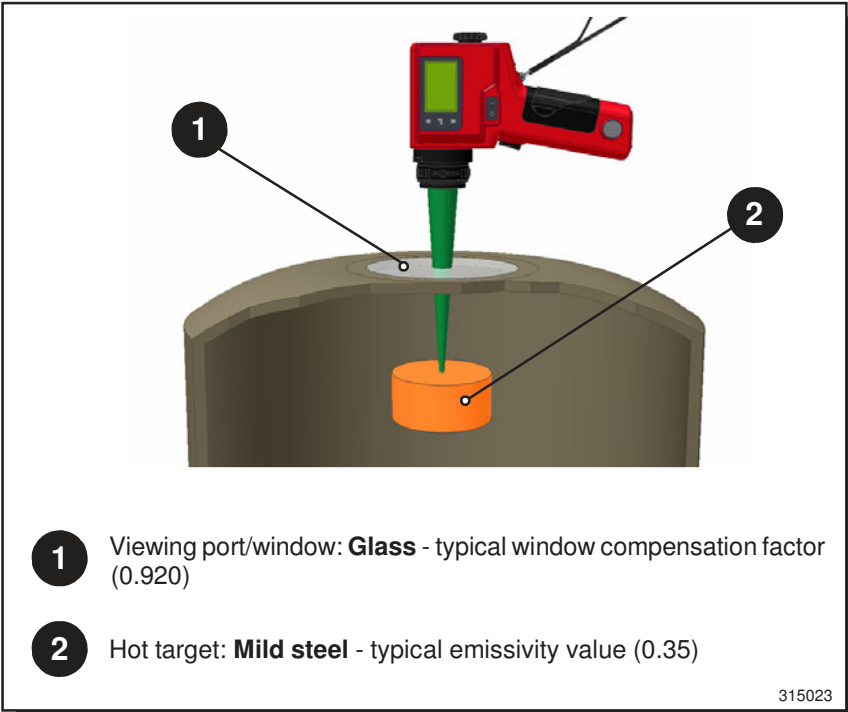




Fig. 23 Typical complex temperature measurement application

- 1) Check the battery status, ensure that there is sufficient battery life remaining
- 2) Assess the intended target. If the target temperature is likely to be above 1200°C/2192°F, fit the dark window (supplied as a standard accessory)
- 3) Go into **Menu Mode**, open the **Trigger Mode** menu and select **Classic Mode**
- 4) Enter the 'Emissivity' value for the material under observation (0.35)

If the window compensation factor of the viewing window/port is known:

- 5) Set **Window Compensation** to **On**.
- 6) Enter the known compensation factor (0.920)

If the 'Window Compensation' factor of the viewing window/port is not known:

- 7) 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).
- 8) Place a spare viewing window/port between the thermometer and the blackbody heat source and take a new temperature reading.
- 9) 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 (0.920)
- 10) Ensure that the **Alarms** function is set to **Off**.
- 11) Ensure the **Bluetooth** option is set to **Off** (*Wahl DHS520B* variants only)
- 12) Select the **Continuous** temperature measurement option.
- 13) Aim the thermometer through the viewing window/port at the target and focus the reticule onto the area under observation. Check that the reticule is fully filled by the target, re-position if necessary
- 14) Press the trigger to start measurement. The main display and eyepiece display are updated with the reading.
- 15) Release the trigger to stop measurement and freeze the last recorded value on the main display.

10.0 DATA STREAMING

Data streaming provides flexibility in the retention of information captured by the thermometer. It can be used in two separate ways: serially or wireless.

10.1 Serial Communications

To capture information from the **Wahl DHS520** to a laptop/PC/Pocket PC, **DA-LOG Datalogger Software** must be used.

Note

The 'Bluetooth' option must be disabled prior to using wired serial communications from a **Wahl DHS520B** thermometer variant.

- 1) Switch off **Bluetooth** communication (**Wahl DHS520B** variants only).
 - 2) Ensure that the datalogging software has been loaded to the PC/laptop or Pocket PC as required.
 - 3) From the **Wahl DHS520/520B**, connect the serial cable to the PC/laptop, or the Pocket PC as required.
 - 4) Select the required **Trigger Mode** on the **Wahl DHS520/520B**.
 - 5) Press the trigger to capture and stream data, release the trigger to stop.
-

Note

To prolong battery life, always disconnect the serial communications cable when not in use.

10.2 'Bluetooth' Wireless Comms (Wahl DHS520B variants only)

To capture information by **Bluetooth** communication from the **Wahl DHS520B** to a laptop/PC/Pocket PC, you must use **DA-LOG** Datalogger Software.

- 1) Ensure that the datalogging software has been loaded to the PC/laptop or Pocket PC as required.
- 2) Establish **Bluetooth** communications from the **Wahl DHS520B** to a laptop/PC/Pocket PC.
- 3) When **Bluetooth** communications is active, the **Bluetooth** logo on the thermometer side display holds steady and a **I0I0I** icon appears (a flashing logo indicates lost **Bluetooth** communications).
- 4) Select the required **Trigger Mode** on the **Wahl DHS520/520B**.
- 5) Press the trigger to capture and stream data, release the trigger to stop.



Note

To prolong battery life, always disconnect the serial communications cable when not in use.

11.0 EMISSIVITY

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 either the thermometer is not suitable for the measurement application, or the temperature of the target is outside the thermometer's measurement span. If you have a query regarding the emissivity of the target in your measurement application, contact Palmer Wahl for assistance.

11.1 Refractories

Material	Wahl DHS520/520B
Alumina	0.30
Brick	0.80
<i>Red</i>	
<i>White refractory</i>	0.30
<i>Silica</i>	0.30
<i>Sillimanite</i>	0.60
Ceramics	0.40
Magnesite	-

Fig. 24 Typical Emissivity Values for Refractories

315024

11.2 Alloys

Material	Wahl DHS520/520B
Brass	0.20
<i>Oxidized</i>	0.70
Chromel & Alumel	0.30
<i>Oxidized</i>	0.80
Constantin & Manganin	0.25
<i>Oxidized</i>	0.65
Inconel	0.30
<i>Oxidized</i>	0.85
Monel	0.25
<i>Oxidized</i>	0.70
Nichrome	0.30
<i>Oxidized</i>	0.85

Fig. 25 Typical Emissivity Values for Alloys

11.3 Metals

Material	Wahl DHS520/520B
Aluminum	0.13
<i>Oxidized</i>	0.40
Chromium	0.43
<i>Oxidized</i>	0.75
Cobalt	0.32
<i>Oxidized</i>	0.70
Copper	0.06
<i>Oxidized</i>	0.85
Gold	0.05
Iron & Steel	0.35
<i>Oxidized</i>	0.85
Lead	0.35
<i>Oxidized</i>	0.65
Magnesium	0.27
<i>Oxidized</i>	0.80
Molybdenum	0.33
<i>Oxidized</i>	0.80
Nickel	0.35
<i>Oxidized</i>	0.85
Palladium	0.28
Platinum	0.27
Rhodium	0.25
Silver	0.05
<i>Oxidized</i>	0.10
Tin	0.40
<i>Oxidized</i>	0.60
Titanium	0.55
<i>Oxidized</i>	0.80
Tungsten	0.39
Zinc	0.50
<i>Oxidized</i>	0.60

Fig. 26 Typical Emissivity Values for Metals

315026

11.4 Miscellaneous

Material		Wahl DHS520/520B
Asbestos	<i>Board/paper/cloth</i>	0.90
Asphalt		0.85
Carbon	<i>Graphite</i>	0.85
	<i>Soot</i>	0.95
Cement & Concrete		0.65
Cloth	<i>All types - close weave (Open weave reduces emissivity)</i>	0.75
Glass	<i>3mm thick</i>	-
	<i>6mm thick</i>	-
	<i>12mm thick</i>	-
	<i>20mm thick</i>	0.80

Fig. 27 Typical Emissivity Values for Miscellaneous Materials

315027

12.0 MAINTENANCE

The *Wahl DHS520/520B* 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 Palmer Wahl to arrange a repair.

13.0 ACCESSORIES

13.1 Accessories

Type 110 & Type 135 Close-up Lenses

Type 110 (**L-110**) and Type 135 (**L-135**) close-up lenses enable the **Wahl DHS520/520B** to focus on targets at distances that are too close to measure with the standard lens.

The **Type 110 (L-110)** lens has a fixed focus at 215mm/8.5in, with a minimum target size of 0.4mm/0.016in. A typical application for this lens is hot filament/wire observation.

The **Type 135 (L-135)** lens has a focus range of 450mm/17.7in to 620mm/24.4in, with a minimum target size of 1.8mm/0.07in. A typical application for this lens is calibration on small aperture furnaces.



Fig. 28 Type 110 and Type 135 close-up lenses

Protective Hard Carry Case

The Hard Carry Case (***DA-WPC***) is a rugged, lightweight, waterproof and shockproof injection-molded 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: 14.2 x 11.4 x 6.5in/360 x 290 x 165mm (width x length x depth)



Fig. 29 Hard carry case (closed)

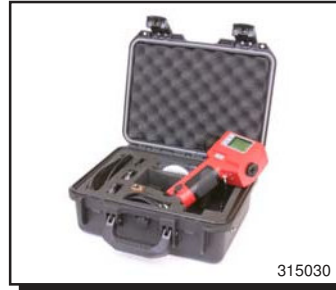


Fig. 30 Hard carry case (open)

14 USER CONFIGURATION RECORD

The *Wahl DHS520/520B* 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 Palmer Wahl 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 (overleaf) to make a note of your chosen parameter settings and values, so that these can be re-entered into the thermometer and used again.

USER CONFIGURATION RECORD

Serial N°

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)

APPENDIX

Serial Communications Data Logging Protocol

The logging protocol applies to both the SERIAL PORT and 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 ±0.1seconds.

EXAMPLE: **B C C I +972.0 CR LF**

- (i) Identifier **B** = C100
D = C055
- (ii) Packet **C** Classic – while key pressed
H Hold – when key released
- (iii) Units **C** °Celsius
F °Fahrenheit
R °Rankin
K Kelvin
- (iv) Mode **I** Instantaneous
P Peak
V Valley
A Average
- (v) Data In tenths up to ±999.9
 In degrees after ±1000
 Over-range is ± ___ i.e. 0xAF,SP, 0xAF,SP, 0xAF
 Under-range is ± ___ i.e. 0x5F,SP, 0x5F,SP, 0x5F
- (vi) Termination 0x0D,0x0A

The IPAQ 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 ±0.1seconds:

B 1 C I +972.0 CR LF

As per *Classic Mode stream* except

- (i) 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 **T1** position, a 6 line packet of calculated data is output.

EXAMPLE: **B 2 C I +972.0 CR LF**
 B 2 C P +1030 CR LF
 B 2 C V +812.0 CR LF
 B 2 C A +900.0 CR LF
 B 2 C E +1.000 CR LF
 { B 2 C T +1.000 CR LF
 or if disabled { B 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 IPAQ 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 ±5ms. Example:

B 3 C I +972.0CR 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:

B 3 C E +1.000CR LF
 { B 3 C T +1.000CR LF
 or if disabled { B 3 C T + OFF CR LF

The IPAQ 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 can be sent:

B 0 C x xxxxxx CR LF

The IPAQ should send a * handshake to indicate heartbeat reception.