UNO THERMOMETER

USER GUIDE

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LANGUAGE: ENGLISH

Stand Alone Radiation Thermometer

LAND®
AMETEK®

QUALITY CUSTOMER SOLUTIONS

IMPORTANT INFORMATION - PLEASE READ

Health and Safety Information

Read all of the instructions in this booklet - including all the WARNINGS and CAUTIONS - *before* using this product. If there is any instruction which you do not understand, DO NOT USE THE PRODUCT.

Safety Signs

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or personal injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to the user or users, or result in damage to the product or to property.

NOTE

Indicates a potentially hazardous situation which, if not avoided, could result in damage or loss of data.

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.


Protective Conductor Terminal.


Observe precautions for handling electrostatic discharge sensitive devices.

Equipment Operation

Use of this instrument in a manner not specified by LAND may be hazardous. Read **and understand** the user documentation supplied **before** installing and operating the equipment.

The safety of any system incorporating this equipment is the responsibility of the assembler.

Protective Clothing, Face and Eye Protection

It is possible that this equipment is to be installed on, or near to, machinery or equipment operating at high temperatures and high pressures. Suitable protective clothing, along with face and eye protection must be worn. Refer to the health and safety guidelines for the machinery/equipment before installing this product. If in doubt, contact LAND.


Wear Protective Gloves


Wear Protective Clothing


Wear Eye Protection


Wear Ear Protection


Wear Safety Boots


Wear Face Protection

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.

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For further details on all AMETEK Land offices, distributors and representatives, please visit our website.

Storage

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

The maximum storage temperature is 10 °C (18 °F) higher than the maximum operating temperature.

The minimum storage temperature is 10 °C (18 °F) lower than the minimum operating temperature.

Refer to the Technical Specification for details of the operating temperature limits.

Unpacking

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

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 carried out in accordance with local and national regulations.

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 for details of the correct returns procedure.

Any item returned to LAND 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.

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.

Registered ISO 9001 Management System approvals apply in the USA.

UK Calibration Laboratory: UKAS 0034.

USA Calibration Laboratory: ANAB Accredited ISO/IEC 17025.

National Accreditation Board for Testing and Calibration Laboratories approvals apply in India.

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 this product may be invalidated if alterations or additions are made to the structural, electrical, mechanical, pneumatic, software or firmware components of this system. Such changes may also invalidate the standard terms of warranty.

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Fig. 1 LAND UNO thermometer S4970222

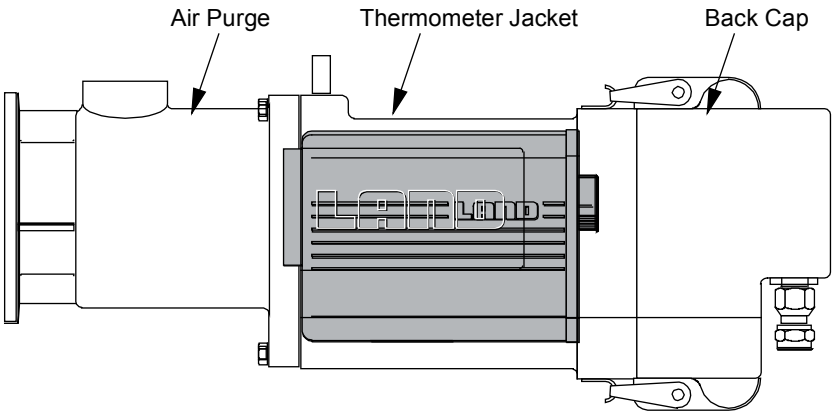


Fig. 2 Thermometer with Air Purge, Protection Jacket and Back Cap

S4970223

1 Introduction

1.1 About this guide

This guide gives the information necessary for you to operate a LAND UNO thermometer. Basic information regarding installation is contained within the Installation Guide.

1.2 About the thermometer

The LAND UNO thermometer is a highly accurate, focusable, non contact thermometer designed for independent or STAND ALONE use.

The thermometer features include:

- Stand Alone operation.
- Built in Averager or Peak Picker for signal conditioning.
- Focusable optical system with through-the-lens sighting to give precise target definition.
- 4 to 20mA output, linear over the temperature span of the thermometer.
- Built in Emissivity or Non Greyness controls.

1.3 About UNO

The LAND UNO range of high accuracy thermometers and rugged mounting accessories is designed to provide precise, non contact temperature measurement.

Internal controls for emissivity or non greyness, together with selectable time functions, allow the thermometer to be configured to suit a wide range of industrial applications. A comprehensive range of mountings is common to other LAND products maximising commonality and simplifying system upgrades.

1.4 Unpacking the thermometer

The package containing the thermometer will contain the following items:

- CD containing UNO User Documentation.
- UNO thermometer (fitted with protection caps on the lens and eyepiece).
- Eye comfort filter. Fitted only to instruments where the temperature range exceeds 1600°C/2900°F.
- The thermometer will be supplied pre-fitted with either a Standard lens (denoted VG/VC) or a Short Focus lens (denoted SG/SF).
- 2.5mm Hex screwdriver.

It is recommended that the front lens protection cap is kept attached until the thermometer is installed and that the eyepiece cap continues to be used after installation.

1.5 Nomenclature

The thermometer detail label is on the rear face of the thermometer above the eyepiece. The thermometer instrument type nomenclature is explained in Fig. 3.

Make a note of your thermometer's instrument type and serial number in the space provided below.

Instrument type: ☐☐ ☐☐☐☐/☐☐☐☐ ☐

Serial Number: ☐☐☐☐☐☐☐/☐☐/☐☐

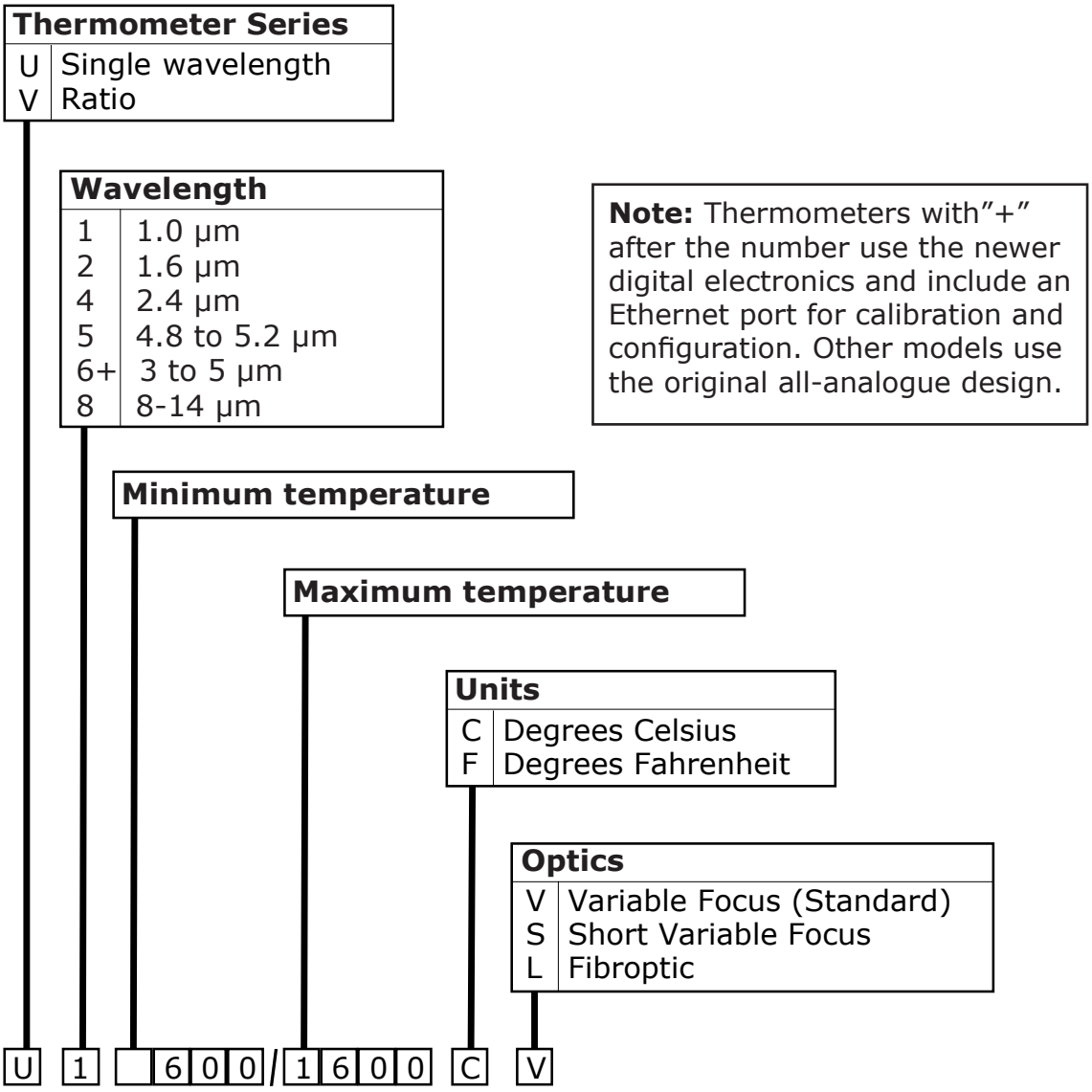


Fig. 3 UNO Thermometer Nomenclature UN970313

2 Specifications

2.1 U1 Series Thermometers

Thermometer Model	U1 600/1600C	U1 1100/2900F	U1 800/2600C	U1 1500/4700F
Temperature Range:	600 to 1600 °C	1100 to 2900 °F	800 to 2600 °C	1500 to 4700 °F
Wavelength:	1µm			
Averager Response:	Adjustable 5 ms to 5s (0 to 95%)			
Peak Picker:	1.5 to 30%/s decay			
Emissivity:	0.10 to 1.00			
Sighting:	6° through the lens			
Target Size:	>98% of energy within graticule			
Magnification:	1.8x			
Eye Relief:	30 mm (1.2 in)			
Field of View (Nominal):	100:1		200:1	
Focus Range Standard: Short Variable Focus:	 0.5 m (19.7 in) to infinity 0.35 m to 1.0 m (13.6 in to 39.3 in)			
Min. Target Diameter:	3.5 mm (0.13 in)		1.8 mm (0.07 in)	
Accuracy Repeatability: Absolute:	 ≤1 °C / 2 °F 0.75 %K		 ≤2 °C / 4 °F 0.75 %K	
Stability (Temperature):	0.2°/° ambient		0.3°/° ambient	
Stability (Time):	2 °C / 4 °F per year			
Vibration:	3G any axis 10 to 300 Hz			
Humidity:	0 to 99% non condensing			
Sealing:	To IP65			
Ambient Temperature Specified: Operating:	 0 to 70 °C / 32 to 158 °F -10 to 80 °C / 14 to 176 °F			
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)			

2.2 U2 Series Thermometers

Thermometer Model	U2 300/1100C	U2 600/2000F
Temperature Range:	300 to 1100 °C	600 to 2000 °F
Wavelength:	1.6 µm	
Averager Response:	Adjustable 5 ms to 5 s (0 to 95%)	
Peak Picker:	1.5 to 30 % /s decay	
Emissivity:	0.10 to 1.00	
Sighting:	6° through the lens	
Target Size:	>98% of energy within graticule	
Magnification:	1.8x	
Eye Relief:	30 mm / 1.2 in	
Field of View (Nominal):	100:1	
Focus Range Standard: Short Variable Focus:	 0.5 m / 19.7 in to infinity 0.35 m to 1.0 m / 13.6 in to 39.3 in	
Min. Target Diameter:	3.5 mm / 0.13 in	
Accuracy Repeatability: Absolute:	 1 °C / 2 °F <1 %K	
Stability (Temperature):	0.2°/° ambient	
Stability (Time):	<2 °C / 4 °F per year	
Vibration:	3g any axis 10 to 300 Hz	
Humidity:	0 to 99% non condensing	
Sealing:	IP65	
Ambient Temperature Specified: Operating:	 0 to 50 °C / 32 to 122 °F -10 to 60 °C / 14 to 140 °F	
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)	

2.3 U4 Series Thermometers

Thermometer Model	U4 50/250C	U4 150/500F	U4 150/550C	U4 300/1000F
Temperature Range:	50 to 250 °C	150 to 500 °F	150 to 550 °C	300 to 1000 °F
Wavelength:	2.4 µm			
Averager Response:	Adjustable 5 ms to 5 s (0 to 95%)			
Peak Picker:	1.5 to 30 % /s decay			
Emissivity:	0.10 to 1.00			
Sighting:	6° through the lens			
Target Size:	>98% of energy within graticule			
Magnification:	1.8x			
Eye Relief:	30 mm (1.2 in)			
Field of View (Nominal):	30:1		100:1	
Focus Range Standard: Short Variable Focus:	 0.5 m / 19.7 in to infinity 0.35 m to 1.0 m / 13.6 in to 39.3 in			
Min. Target Diameter:	11.7mm / 0.46in		3.5mm / 0.13in	
Accuracy Repeatability: Absolute:	 ≤1°C / 2°F 0.9%K		 ≤2°C / 4°F 1%K	
Stability (Temperature):	<0.1°/° ambient			
Stability (Time):	2 °C / 4 °F per year			
Vibration:	0.5mm from 10 to 60 Hz, 3G from 10 to 300 Hz, Any axis			
Humidity:	0 to 99% non condensing			
Sealing:	IP65			
Ambient Temperature Specified: Operating:	 5 to 45 °C / 41 to 113 °F 0 to 50 °C / 32 to 122 °F			
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)			

2.5 U6+ Series Thermometers

Thermometer Model	U6+ 0/300C-V	U6+ 100/700C-V
Temperature Range:	0 to 300 °C	100 to 700 °C
Wavelength:	3 to 5µm	
Averager Response:	Adjustable 5 ms to 5s (0 to 95%)	
Peak Picker:	1 to 300 °C/s decay	
Emissivity:	0.20 to 1.09	
Sighting:	6° through the lens	
Target Size:	>98% of energy within graticule	
Magnification:	1.8x	
Eye Relief:	30 mm / 1.2in	
Field of View (Nominal):	75:1	100:1
Focus Range		
Standard:	0.5 m / 19.7 in to infinity	
Short Variable Focus:	0.35 m to 1.0 m / 13.6 in to 39.3 in	
Min. Target Diameter:		
Standard:	6.7 mm / 0.26 in	5.0 mm / 0.20 in
Short Variable Focus:	4.7 mm / 0.19 in	3.5 mm / 0.13 in
Accuracy		
Repeatability:	1 °C / 2 °F	
Absolute:	0.3 %K + 2.5 K	0.3 %K + 2 K
Stability (Temperature):	<0.15 K/K	<0.2 K/K
Vibration:	3g any axis 10 to 300 Hz	
Humidity:	0 to 99% non condensing	
Sealing:	IP65	
Ambient Temperature		
Specified:	5 to 50 °C / 41 to 122 °F	
Operating:	0 to 60 °C / 32 to 140 °F	
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)	

* 0.2 K/K for target temperature < 30 °C / 86 °F

2.6 V1 Series Thermometers

Thermometer Model	V1 600/1600C	V1 1100/2900F	V1 1000/2600C	V1 1800/4700F
Temperature Range:	600 to 1600 °C	1100 to 2900 °F	1000 to 2600 °C	1800 to 4700 °F
Wavelength:	0.85 to 1.1 µm			
Averager Response:	Adjustable 15 ms to 5 s (0 to 95%)			
Peak Picker:	1.5 to 30%/s decay			
Non Greyness:	0.8 to 1.199			
Sighting:	6° through the lens			
Target Size:	>98% of energy within graticule			
Magnification:	1.8x			
Eye Relief:	30 mm (1.2 in)			
Field of View (Nominal):	50:1		200:1	
Focus Range Standard: Short Variable Focus:	0.5 m (19.7 in) to infinity 0.35 m to 1.0 m (13.6 in to 39.3 in)			
Min. Target Diameter:	7.0 mm / 0.27 in		1.8 mm / 0.07 in	
Accuracy Repeatability: Absolute:	≤1 °C / 2 °F 0.75 %K		≤2 °C / 4 °F 0.75 %K	
Stability (Temperature):	0.2 °/° ambient		0.3 °/° ambient	
Stability (Time):	2 °C / 4 °F per year			
Vibration:	3G any axis 10 to 300 Hz			
Humidity:	0 to 99% non condensing			
Sealing:	To IP65			
Ambient Temperature Specified: Operating:	0 to 50 °C / 32 to 122 °F -10 to 60 °C / 14 to 140 °F			
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)			

3 Installing the Thermometer

This section contains similar information to the thermometer Installation Guide.

If the thermometer is to be used in conjunction with a protection jacket and air purge, refer to the installation guides provided with those accessories.

If the thermometer is to be installed in a location where the ambient temperature is within the ranges specified for the thermometer, and no air purging is required to keep the lens clean, the thermometer can be mounted using the two tapped holes on the mounting pad. Either hole can be used for direct tripod mounting.

3.1 Choosing a location for the thermometer

If your thermometer is an 'U' series thermometer (e.g. U1 600/1600C), it must be positioned such that, at the chosen target distance, the target is large enough to completely fill the area covered by the graticule of the eyepiece (Refer to Section 3.1.1). The thermometer's view of the target area must not be obstructed.

If your thermometer is a 'V' series thermometer (e.g. V1 1000/2600C), it is not essential for the target to completely fill the area covered by the graticule.

The overall dimensions of the thermometer installation are given in Fig. 4.

3.1.1 Target size calculation

There are two types of lens available for use with the UNO thermometer.

Standard lens: Focusable from 500mm to infinity denoted [VG/VC]

Short focus lens: Focusable from 350mm to 1000mm denoted [SG/VF]

For both lenses, the target area is defined as the area covered by the graticule. To calculate the minimum target size at any distance, refer to Fig. 5.

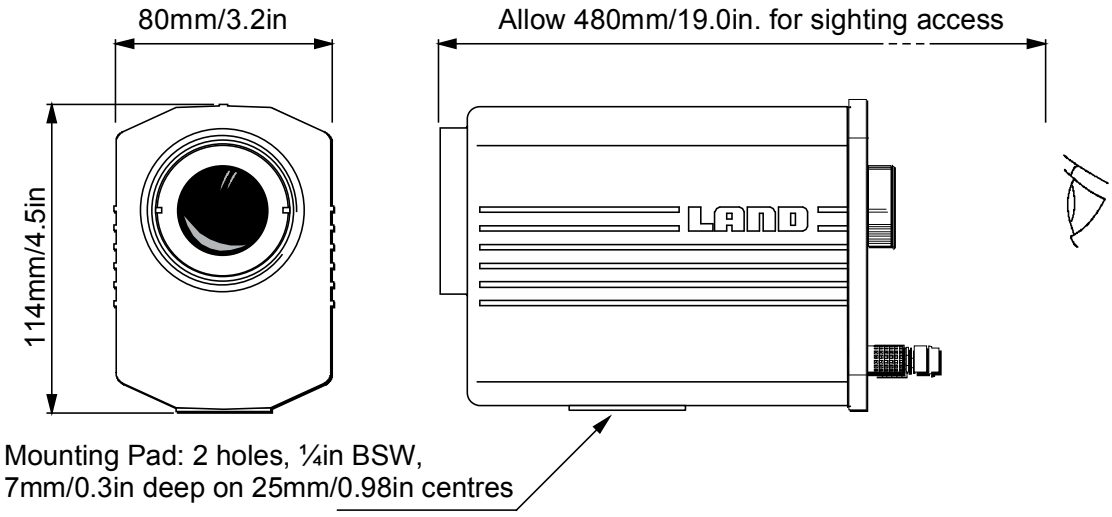
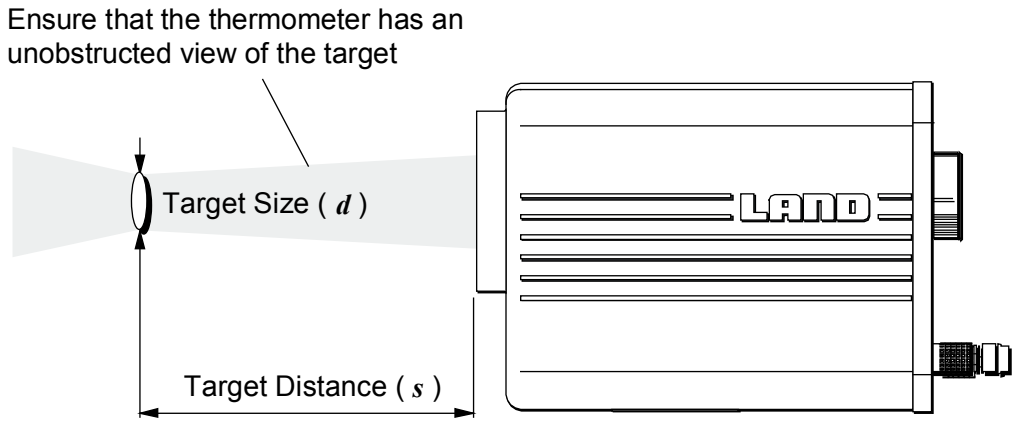


Fig. 4 Thermometer installation dimensions S4970225



$$\text{Target Size } (d) = \frac{\text{Target Distance } (s)}{\text{FOV*}}$$

* FOV - Refer to your thermometer's specification for this value.
i.e. If the Field of view is 100:1, use '100' for the FOV value.

Fig. 5 Target size calculation S4970226

4 Using the Thermometer (Analogue models)

Before final installation of the thermometer, the internal controls (i.e. Emissivity, Averager response speed or Peak picker decay rate) must be set to match the particular measurement location.

Refer to Sections 4.1 to 4.8 for analogue models U1, U2 U4 and V1. These thermometers must be configured before applying power.

Refer to Sections 4.8 and 4.9 for digital model U6+. This model must be powered before it can be configured.

WARNING
Do not remove the U6+ from its case

4.1 Removing the chassis from the thermometer cover

Caution

Ensure that the thermometer is disconnected from the power supply before removing the chassis from the cover.

Ensure that the thermometer is dismantled in a clean laboratory or office environment.

1) Refer to Fig. 6. Use the 2.5mm Hex screw driver to loosen each of the four captive screws (A) in turn, a little at a time, until they are out of the thermometer cover.
2) Slide the chassis out of the thermometer cover.

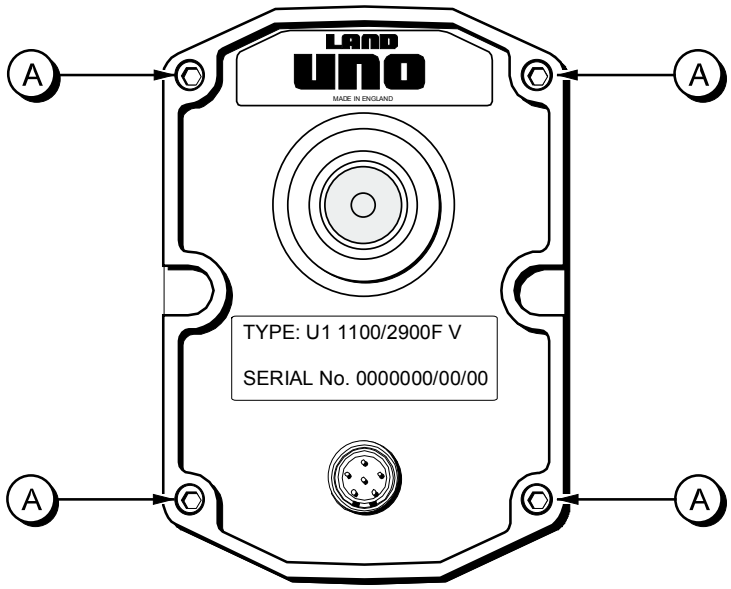


Fig. 6 Location of thermometer cover securing screws UN970314

4.2 Location of controls

The Emissivity/Non greyness and Peak Picker/Averager control switches are located on the left hand circuit board (When viewing the thermometer from the rear). See Fig. 7.

> **Note**
>
> The 4-way switch, SW1, is fitted in V series (i.e. ratio) thermometers only.

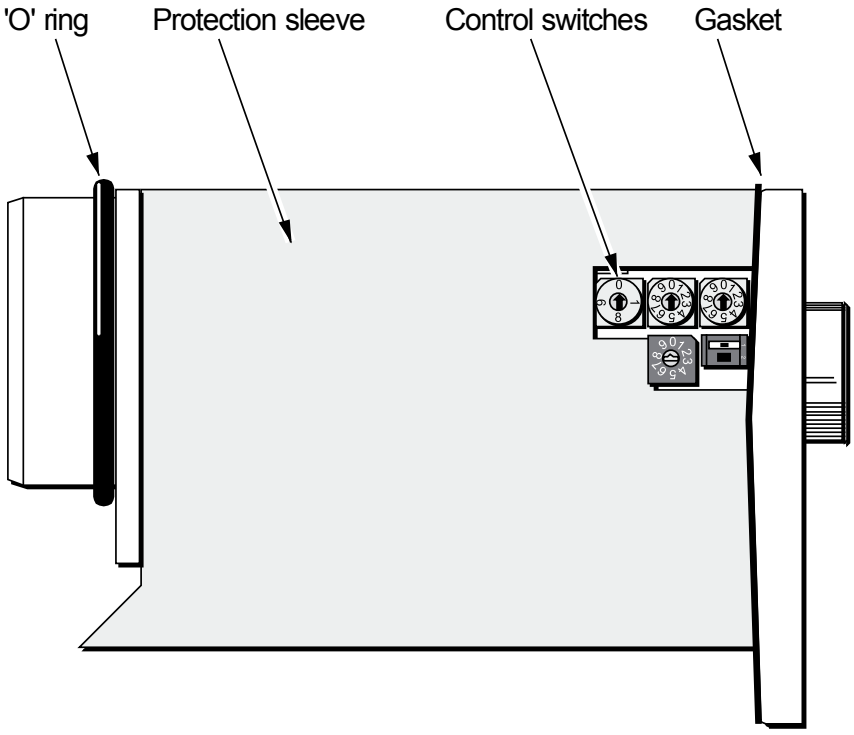


Fig. 7 Location of internal control switches UN970315

4.3 Setting the Emissivity/Non Greyness value

4.3.1 U series thermometers

In U series (i.e. single wavelength) thermometers, the emissivity value is set using switches SW2 and SW3. Refer to Fig. 8.

The emissivity can be set in the range 0.10 to 1.09 in steps of 0.01.

When switch SW2 is set from 1 to 9, this denotes the first figure after the decimal point of the emissivity value. e.g. for an emissivity value of '0.83', set SW2 to '8' and SW3 to'3'.

When switch SW2 is set to 0, this denotes a '1' before, and a '0' after, the decimal point of the emissivity value.

e.g. for an emissivity value of '1.00', set SW2 to '0' and SW3 to '0'.

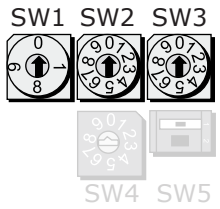
Switches	Emissivity	SW2	SW3
	0.10	1	0
	0.80	8	0
	0.83	8	3
	0.95	9	5
	1.00	0	0
	1.09	0	9

Fig. 8 Emissivity setting for ‘U’ series thermometers

Note

An emissivity value of above 1.00 is not common in the majority of measurement applications.

4.3.2 V series thermometers

In V series (i.e. ratio) thermometers, the non greyness value is set using switches SW1, SW2 and SW3. Refer to Fig. 9.

The non greyness can be set in the range 0.800 to 1.199 in steps of 0.001.

The setting of switch SW1 denotes the first figure **after** the decimal point of the non greyness value. However, if SW1 is set to either ‘0’ or ‘1’, this denotes a ‘1’ **before**, and either a ‘0’ or ‘1’ (respectively) after the decimal point of the non greyness value.

e.g. For a non greyness value of ‘0.995’:

set SW1 to ‘9’, SW2 to ‘9’ and SW3 to ’5’.

For a non greyness value of ‘1.199’:

set SW1 to ‘1’, SW2 to ‘9’ and SW3 to ’9’.

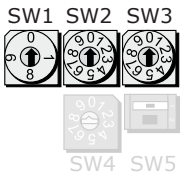
Switches	Non Greyness	SW1	SW2	SW3
	0.800	8	0	0
	0.995	9	9	5
	1.008	0	0	8
	1.100	1	0	0
	1.199	1	9	9

Fig. 9 Non greyness setting for 'V' series thermometers

4.4 Setting the Time Functions

The UNO thermometer is fitted with both Averager and Peak Picker time functions.

These functions are set using the switches SW4 and SW5. Refer to Fig. 10.

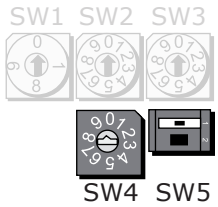
Switches	SW4	Averager	Peak Picker
	 SW4	 SW5	 SW5
	Setting	Response time to 95% (ms)	Decay rate (%/s)
	0	5	30
	1	10	29
	2	20	27
	3	50	24
	4	100	20
	5	200	15
	6	500	10
	7	1000	5
	8	2000	3
	9	5000	1.5

Fig. 10 Averager and Peak picker time function selection

4.4.1 Averager

The Averager time function is selected by setting switch, SW5, to position 1 (i.e. up). The Averager response time can be set, via switch SW4, to any one of the ten values shown in Fig. 10.

A graphical explanation of the Averager time function is given in Fig. 11.

Note

Setting the Averager response speed to a value faster than that quoted in the specification for your thermometer **will not** produce an increase in response speed beyond the specified value. e.g. Fastest possible response speed for a V1 UNO is 15ms.

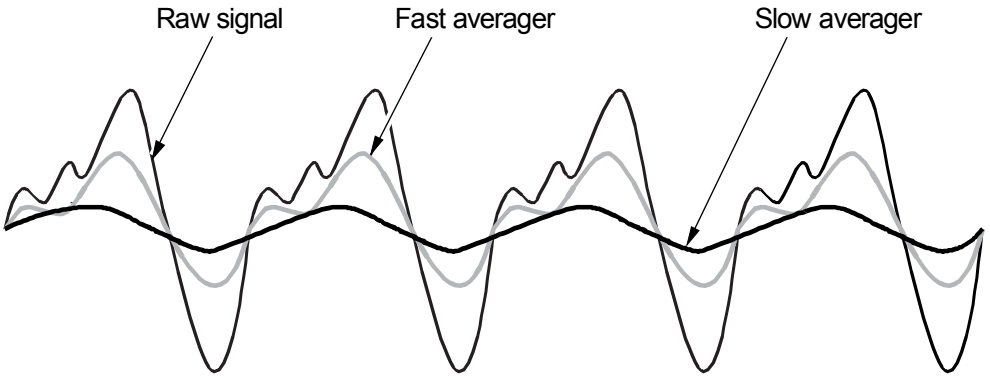


Fig. 11 Typical output of Averager time function UN970316

4.4.2 Peak Picker

The Peak picker time function is selected by setting switch, SW5, to position 2 (i.e. down). The Peak picker decay rate can be set, via switch SW4, to any one of the ten values shown in Fig. 10.

The CMD (Command) input, available between pins 3 and 7 of the thermometer electrical connector, enables remote resetting of the Peak picker time function. (Refer to Section 3.8.1). When the CMD input is open circuit, the Peak picker operates under the control of switches SW4 and SW5. When the CMD input is short circuit, the Peak picker function is RESET and the output signal reverts to tracking the input, regardless of the setting switches SW4 and SW5.

A graphical explanation of the Peak time function is given in Fig. 12.

Note

The CMD IN function operates differently in the analogue and + models. Check connections when replacing an analogue instrument with a +, and when replacing a + with an analogue.

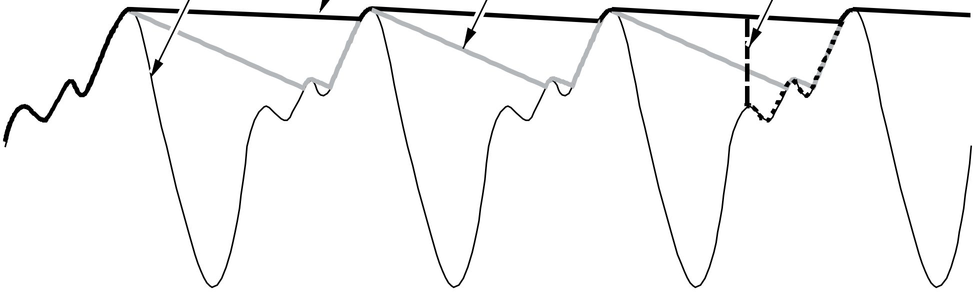


Fig. 12 Typical output of Peak Picker time function UN970317

4.5 Note your settings

This section is provided as a quick reference guide which enables you to look up the internal settings of your thermometer without having to remove it from the measurement location.

Each time you adjust the settings, make a note in the spaces provided in Fig. 13.

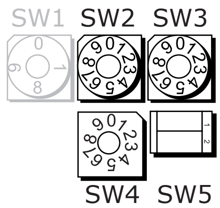
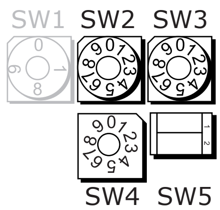
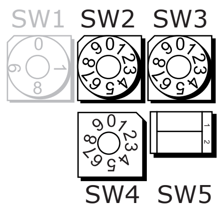
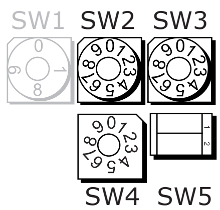
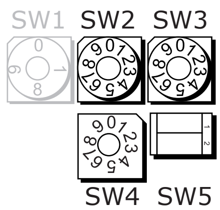
Serial Number	Date	Settings
		
		
		
		
		

Fig. 13 Record of internal switch settings

4.6 Refitting the chassis into the thermometer cover

When all internal controls have been set to suit your requirements, refit the thermometer chassis into the cover.

1) Ensure that the gasket is fitted correctly on the inner face of the thermometer rear panel. Slide the chassis into the thermometer cover.
2) Refer to Fig. 6. Use the 2.5mm Hex screwdriver to tighten the four captive screws (A), a little at a time in turn until the chassis is secured fully.

4.7 Focusing the lens on the target

Once a measurement location has been chosen and the thermometer installed, the lens must be focused on the target area.

Caution

If the object to be measured is suspected of being at a temperature higher than 1600°C ensure that the eye comfort filter is fitted before proceeding with installation.

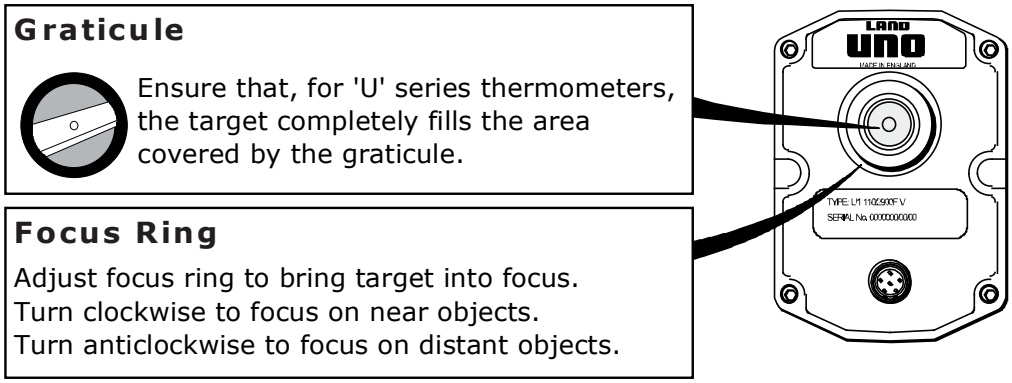


Fig. 14 Location of Focus Ring and Graticule on rear face of thermometer

UN970317

To focus on the target.

1) Remove the lens protection cap from the thermometer.
2) Remove the eyepiece protection cap on the rear face of the thermometer to reveal the Focus ring (See Fig. 6).
3) Look through the eyepiece. If you wear spectacles, you do not need to remove them, as the graticule image is positioned for viewing either with or without corrected vision.

   The target area is defined as the area within the graticule.

NOTE

The image in the viewfinder appears upside down.

4) If the required target is not within the graticule, adjust the thermometer mounting until the target fills the graticule.

> **NOTE**
>
> A range of thermometer mounting accessories, to suit all measurement locations, is available from LAND.

5) Turn the focus ring to bring the target into focus.

   To move the focus nearer to the thermometer turn the ring clockwise.

   To move the focus away from the thermometer turn the ring anticlockwise.

6) To check that the target is in focus, use the 'parallax' method. i.e. look through the eyepiece and make small side-to-side movements of your head. The target is in best focus when there is no apparent movement of the image with respect to the graticule.

7) Make any necessary adjustments to the thermometer's mounting to ensure that it is viewing the required target.

8) When the target is in focus and, for 'U' series thermometers, the target fills the graticule, replace the eyepiece protection cap and ensure that the thermometer is mounted securely.

4.8 Electrical Connections

> **NOTE**
>
> **Do not connect a UNO thermometer to a Landmark processor unless it is a + model set to Processor mode.**

The electrical connections for the thermometer power supply, Peak picker reset and temperature output are made via the 6-way socket on the rear of the thermometer. See Fig. 15.

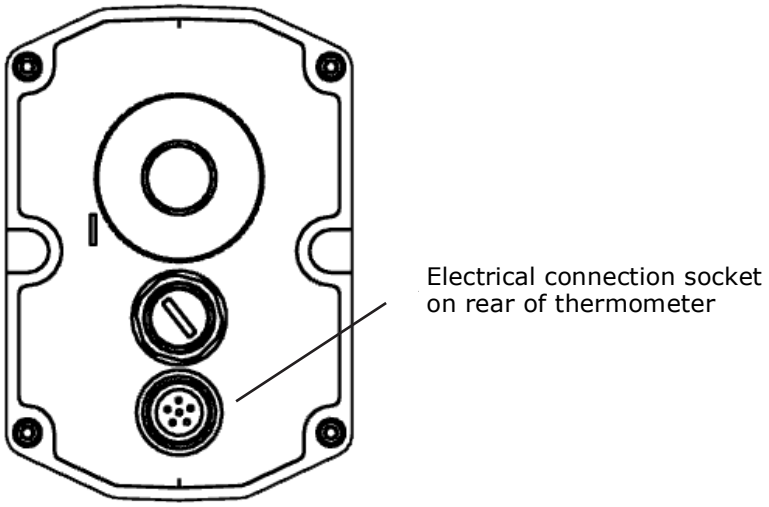


Fig. 15 Location of electrical connections UN970319

Electrical connection to the thermometer must be made by either the pre-wired plug (LAND Part Nº 029.673) or via the plug housed in the Back Cap (LAND Part Nº 091.562).

To connect the cable:

1) Refer to Fig. 16. Align the red marker near the lugs of the pre-wired plug with the red marker above the keyway in the socket on the thermometer.
2) Push the plug into the socket.

To disconnect the cable:

1) Grip the locking sleeve section of the plug.
2) Pull the plug outwards to release the locking mechanism and disconnect the cable.

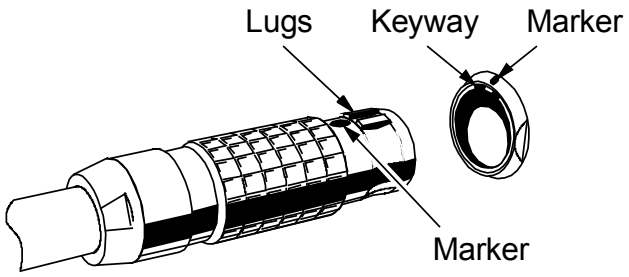


Fig. 16 Connection of the pre-wired cable to the thermometer S4970229

4.8.1 Cable connection schedule

UNO thermometers can be connected, via the 6-way socket, to any compatible power supply and display equipment. A description of the required connections is given in the cable connection schedule, Fig. 17.

Cable Colour	Function
Yellow	4 to 20mA linear temperature signal drive
Blue	4 to 20mA linear temperature signal return
White	CMD (Command) input
Screen	Screen
Red	23 to 48V, $\leq$200mA, dc power (positive)
Black	23 to 48V, $\leq$200mA, dc power (negative)
Green	CMD (Command) input
Recommended output load resistance:	100Ω
Maximum output load resistance:	400Ω
	Voltage-free switch closure
	Switch open = PEAK PICK
	Switch closed = TRACK (or RESET)

Fig. 17 UNO thermometer cable connection schedule

4.8.2 Recommended wiring scheme

To connect the thermometer, connect the 6-way cable from the thermometer as shown in Fig. 18. A description of each signal connection is given in the interconnection schedule, Fig. 19.

WARNING

Do not connect the thermometer output (or the command input of an analogue model) to the power supply rails (V+, V-) as this is likely to damage the thermometer.

If the wiring scheme illustrated in Fig. 18 is not followed, the thermometer is likely to be damaged. If in doubt, please contact LAND for advice.

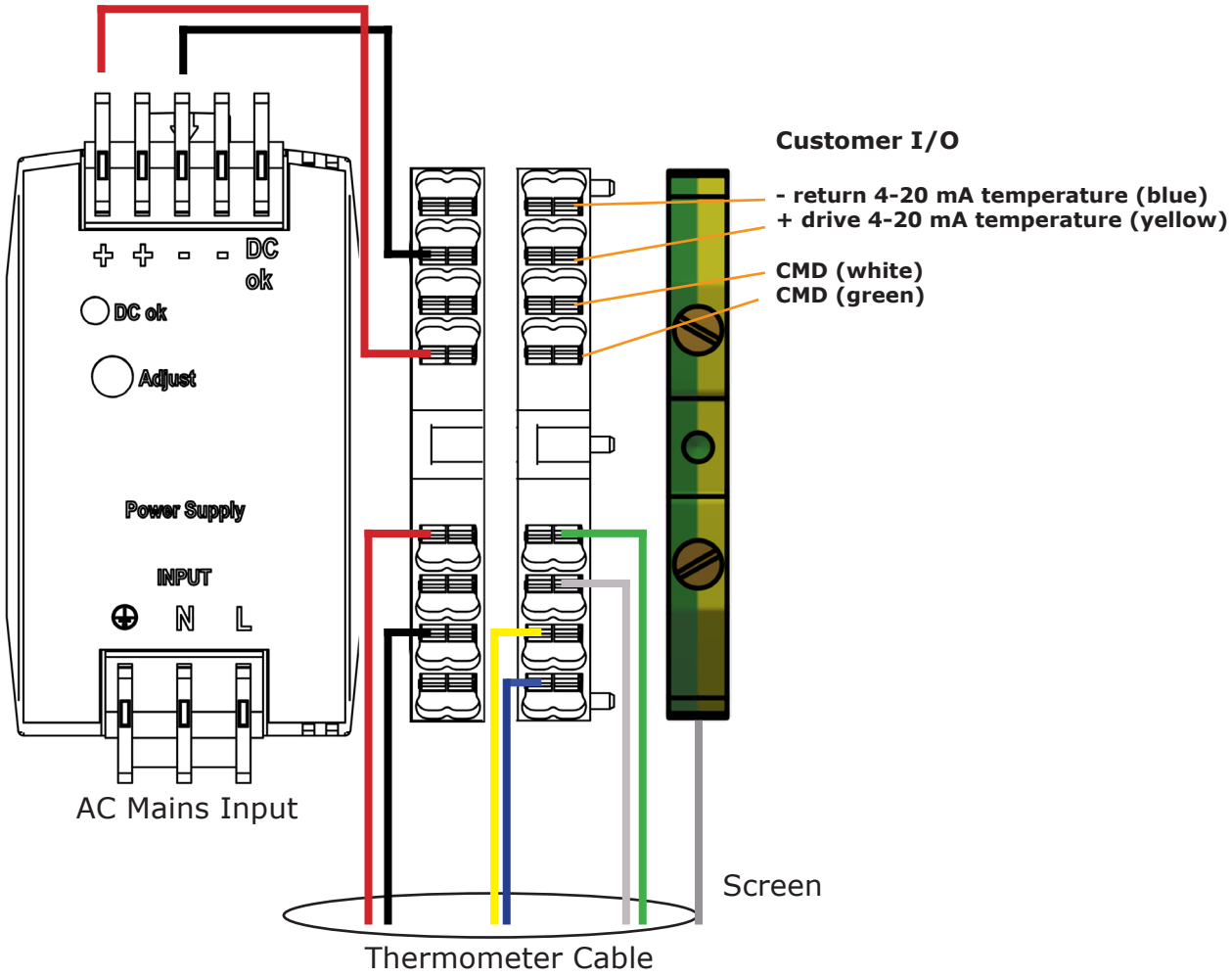


Fig. 18 Interconnections

NOTE

The screen is connected to the thermometer case. The case must be grounded at the installation using your preferred method.

	Cable Colour	Function
Thermometer Cable	Yellow	4 to 20mA linear temperature signal drive
	Blue	4 to 20mA linear temperature signal return
	White	CMD (Command) input
	Screen	Screen
	Red	23 to 48V, ≤200mA, dc power (positive)
	Black	23 to 48V, ≤200mA, dc power (negative)
	Green	CMD (Command) input
Mains Power	Refer to PULS instructions	AC Mains Live AC Mains Neutral Protective Earth
Customer I/O	0.5-1.5 mm2 (AWG24-16)	CMD (Command) input CMD (Command) input Voltage-free switch closure Switch open = PEAK PICK Switch closed = TRACK (or RESET)
		4 to 20 mA linear temperature signal drive 4 to 20 mA linear temperature signal return Recommended output load resistance: 100Ω Maximum output load resistance: 400Ω

Fig. 19 UNO to DPU Interconnection schedule

4.9 Configuration Using The Web Server (+ Models Only)

UNO U6+ has a web server which is used to configure the emissivity and other settings as well as to update its firmware. You can access the web server via a computer/device with an Ethernet port and a web browser. The following browsers are supported:

- Google Chrome
- Microsoft Edge
- Mozilla Firefox

4.9.1 Network Adapter Settings

To communicate with the UNO, you need to specify the correct Network Adapter Settings on your computer/device. The instructions below apply to

Windows 10 systems. If you have a different operating system, refer to the user guide/help files for your system.

1. Connect the computer to the pyrometer using the M12 to RJ45 4-pin D-coded Ethernet cable, LAND part number 816830, which is supplied. Then apply power to the UNO.
2. In your computer's search box (bottom left of screen), type Network Connections. The Network Connections window displays details of each network to which your computer is connected.
3. Right-click on the Network containing your UNO and select the Properties option.
4. Select the Internet Protocol option and click on Properties.
5. Select the Use the following IP address option and enter the values:

   IP address: 10.1.10.150**

   Subnet mask: 255.255.0.0

   ** the default IP address for the UNO is 10.1.10.50. For your computer, you can select any IP address from 10.1.10.1 to 10.1.10.255 apart from 10.1.10.50.
6. Click on OK to save these settings.
7. Open a web browser.
8. Type 10.1.10.50 in the browser's address bar. You will see the UNO web server interface.

4.9.2 Using the web server

The web server screen is shown in Fig 20. The default password is the first six digits of your instrument serial number. For example, if your serial number is 876543 21, the password is 876543.

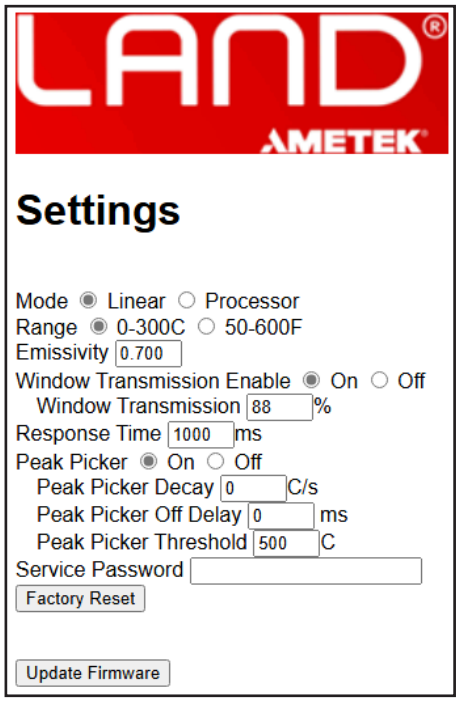


Fig. 20 Web server screen

Mode	Linear: Recommended. Gives a linear temperature output. Processor: Simulates a System 4 pyrometer and allows the UNO to be connected to a LAND LMG processor. Where Processor is selected, the emissivity is set via the pyrometer's CMD IN.
Range	Select Celsius or Fahrenheit. The minimum and maximum measurement values are determined by the instrument's hardware and cannot be changed.
Emissivity	Value between 0.200 and 1.090. Refer to emissivity tables in Section 5.
Window Transmission	Applies a correction where the pyrometer is viewing through a window. Window transmission is entered as a percentage.
Response Time	Value between 5 and 5000 ms. Increasing the response time reduces the noise in the measurement – refer to Fig. 11.
Peak Picker	The peak picker function is illustrated in Fig. 12. The reset function using CMD IN is not recommended for the + models as the Off Delay provides a similar function. See note below. On / Off: Enables or disables the peak picker Decay: Decay rate in °C per second Off Delay: Time period between the temperature falling below the threshold level and the Peak Picker function switching off. Threshold: Temperature above which the peak picker is active. It will not respond to temperatures below this value.
Factory Reset	Restarts the instrument and returns it to factory settings. Use with caution as the instrument may need to be reconfigured afterwards.
Update Firmware	Install new firmware from a file on your PC.

NOTE

The peak picker works slightly differently in the analogue and + models.

1. The decay rate is logarithmic in the analogue models and linear in the + models. If you are replacing an analogue UNO with a +, use the Fig. 21 to choose the decay rate that most closely matches your existing unit.

2. The CMD IN hardware on the analogue models is different to that on the + instruments. The two inputs are not compatible.

Analogue instrument: CMD IN requires a volt-free contact closure.

+ instrument: CMD in requires a voltage between 7 V and 24 V dc.

If a + instrument replaces an analogue instrument using the CMD IN function, a suitable signal can be produced using the 24 V dc from the DPU-UI power supply as shown in Fig. 22.

Do not apply a voltage to the CMD IN on an analogue UNO as this can cause permanent damage.

Switch Position	Measured Temperature									
	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	800 °C	900 °C	1000 °C
0	26	53	80	107	134	161	188	215	241	268
1	25	51	77	103	129	155	181	207	233	259
2	24	48	72	96	120	145	169	193	217	241
3	21	43	64	86	107	129	150	172	193	215
4	17	35	53	71	89	107	125	143	161	179
5	13	26	40	53	67	80	94	107	120	134
6	8	17	26	35	44	53	62	71	80	89
7	4	8	13	17	22	26	31	35	40	44
8	2	5	8	10	13	16	18	21	24	26
9	1	2	4	5	6	8	9	10	12	13

Fig. 21 Equivalent decay rates for + models

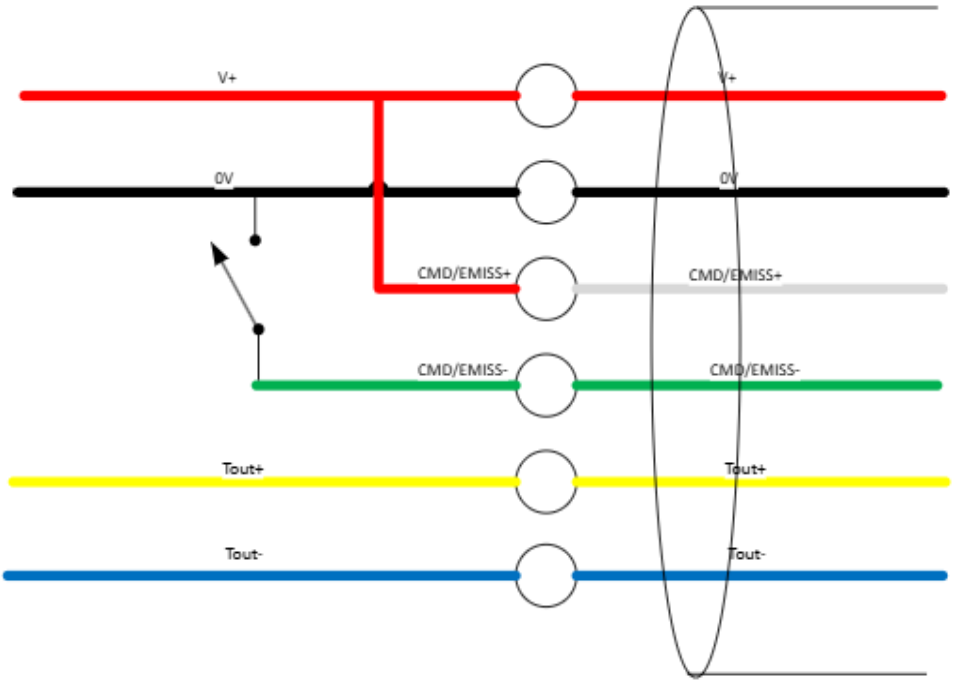
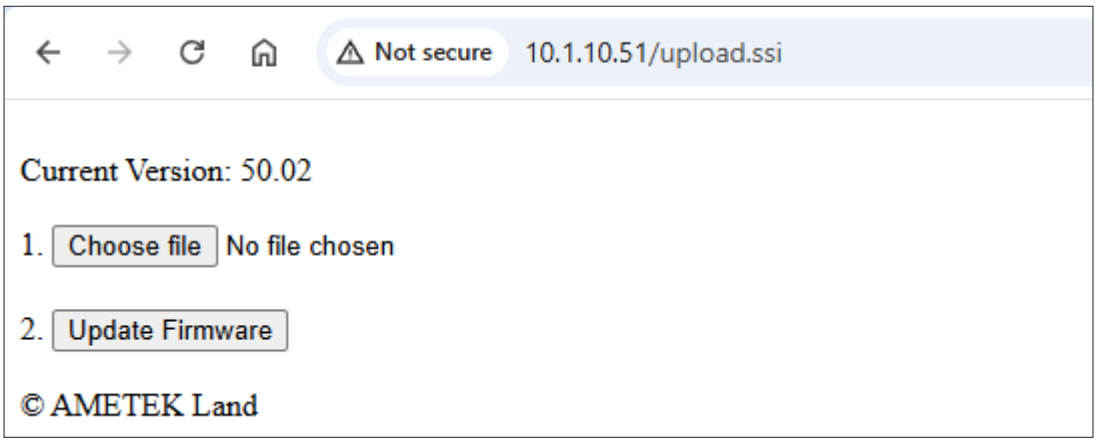


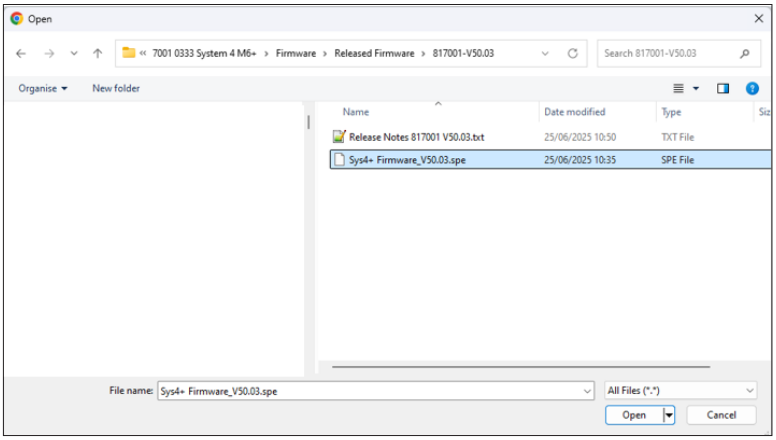
Fig. 22 DPU-UI power supply

4.10 Updating the Firmware via the Web Server

1. Download the latest System 4+ firmware from the following web address: https://www.ametek-land.com/products/software
2. Connect a PC to the instrument and open the web server by entering the device IP address into a web browser. This will show the main menu (see Fig. 20).
3. Enter the instrument password and click the Update Firmware button.

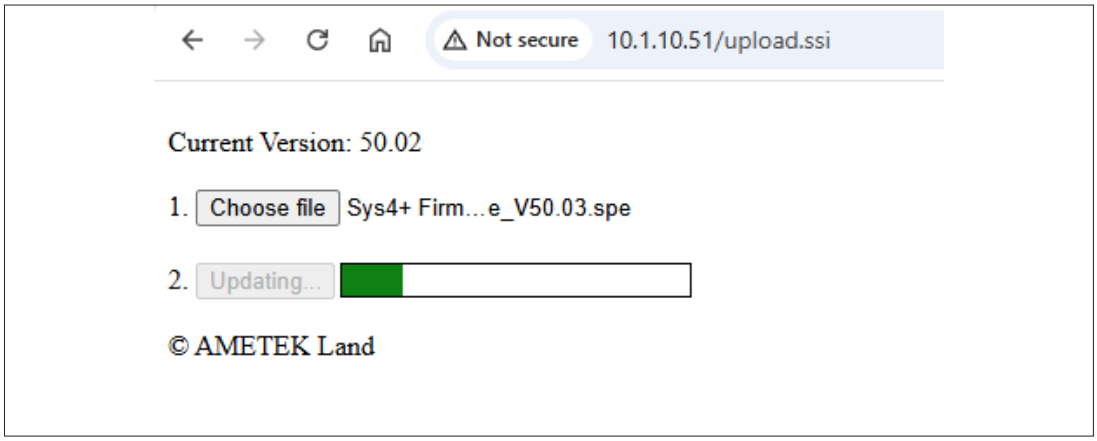


4. Click the Choose File button. Navigate to the downloaded firmware file and select it.

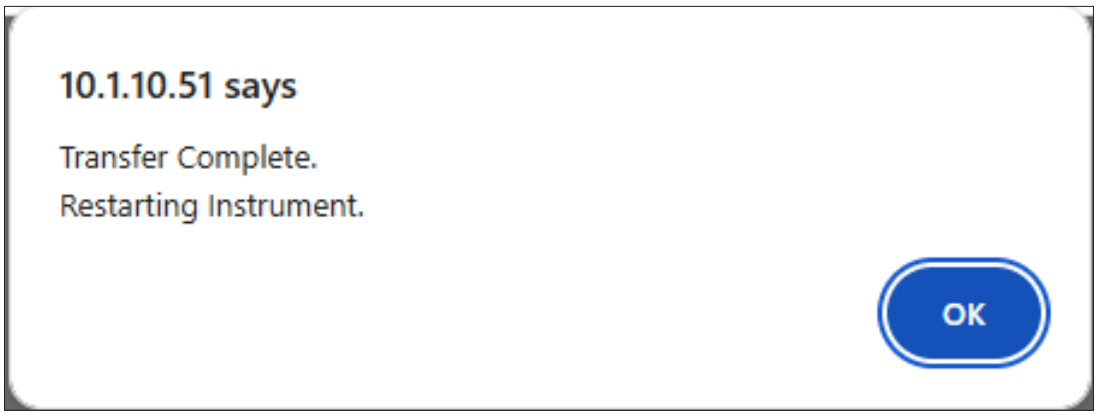


5. Click Update Firmware.

The Loading bar will show progress of the update.



When the update is complete, the device will reset, and the web browser will navigate back to the main Web Server screen.



5 Emissivity tables

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

5.1 Refractories

Refractories						
Material		Thermometer Series				
		U1	U2	U4	U6	U8
Alumina		0.30	0.30	0.30	0.40	0.60
Brick	red	0.80	0.80	0.80	0.93	0.90
	white refractory	0.30	0.35	-	-	0.80
	silica	0.55	0.60	-	-	0.80
	sillimanite	0.60	0.60	-	-	0.60
Ceramics		0.40	0.50	-	-	0.90
Magnesite		-	-	0.60	-	-

5.2 Alloys

Alloys						
Material		Thermometer Series				
		U1	U2	U4	U6	U8
Brass		0.20	0.18	-	0.10	0.03
	oxidised	0.70	0.70	0.70	0.61	0.60
Chromel & Alumel		0.30	0.30	0.30	-	0.30
	oxidised	0.80	0.80	0.80	-	0.80
Constantin & Manganin		0.25	0.22	0.20	-	0.05
	oxidised	0.65	0.60	0.60	-	0.35
Inconel		0.30	0.30	0.30	0.28	0.10
	oxidised	0.85	0.85	0.85	0.85	0.85
Monel		0.25	0.22	0.20	0.10	0.10
	oxidised	0.70	0.70	0.70	0.45	0.70
Nichrome		0.30	0.22	-	-	0.20
	oxidised	0.85	0.85	0.85	0.90	0.85

5.3 Metals

Metals					
Material	Thermometer Series				
	U1	U2	U4	U6	U8
Aluminium	0.13	0.09	0.08	0.05	0.03
oxidised	0.40	0.40	0.40	0.30	0.35
Chromium	0.43	0.34	-	0.15	0.07
oxidised	0.75	0.80	-	-	0.85
Cobalt	0.32	0.28	-	0.18	0.04
oxidised	0.70	0.65	-	-	0.35
Copper	0.06	0.05	0.04	0.04	0.03
oxidised	0.85	0.85	0.85	0.85	0.80
Gold	0.05	0.02	0.02	0.02	0.02
Iron & Steel	0.35	0.30	-	0.18	0.10
oxidised	0.85	0.85	0.85	0.85	0.80
Lead	0.35	0.28	-	0.16	0.13
oxidised	0.65	0.65	0.65	0.63	0.65
Magnesium	0.27	0.24	0.20	0.12	0.07
oxidised	0.75	0.75	0.75	-	0.75
Molybdenum	0.33	0.25	-	0.07	0.10
oxidised	0.80	0.80	0.80	0.80	0.80
Nickel	0.35	0.25	-	0.15	0.04
oxidised	0.85	0.85	-	-	0.85
Palladium	0.28	0.23	-	0.08	0.05
Platinum	0.27	0.22	0.18	0.10	0.07
Rhodium	0.25	0.18	-	0.07	0.05
Silver	0.05	0.04	0.04	0.03	0.02
oxidised	0.10	0.10	0.10	-	0.12
Tin	0.40	0.28	0.12	0.09	0.06
oxidised	0.60	0.60	0.60	-	0.60
Titanium	0.55	0.50	0.42	0.30	0.15
oxidised	0.80	0.80	-	-	0.60
Tungsten	0.39	0.30	0.20	0.13	0.06
Zinc	0.50	0.32	0.10	0.05	0.04
oxidised	0.60	0.55	-	0.11	0.30

5.4 Miscellaneous

Miscellaneous Materials						
Material		Thermometer Series				
		U1	U2	U4	U6	U8
Asbestos (board/paper/cloth)		0.90	0.90	-	0.90	0.90
Asphalt		0.85	0.85	-	0.90	0.85
Carbon	*graphite*	0.85	0.85	-	0.85	0.80
	soot	0.95	0.95	-	0.95	0.95
Cement & Concrete		0.65	0.70	-	0.90	0.90
Cloth - all types, close weave (Open weave reduces emissivity)		0.75	0.80	0.85	0.85	-
Glass	*3mm thick*	-	-	-	>0.90	-
	6mm thick	-	-	-	>0.90	-
	12mm thick	-	-	-	>0.90	-
	20mm thick	0.80	-	-	>0.90	-

6 Maintenance

Thermometer maintenance consists mainly of ensuring that the lens is clean. If the lens becomes dirty clean it with lens cleaning fluid and a soft cloth.

If it is found that the lens is repeatedly becoming dirty, it may be necessary to use the thermometer in conjunction with the System 4 air purge (LAND Part Nº 091.561). Contact LAND for more information.

If the thermometer is used in conjunction with a cooling jacket, ensure that there is an adequate supply of cooling water.

> **Warning**
>
> Never 'over-cool' the thermometer as this may result in condensation either on or inside the thermometer.

The flow rate required for cooling water is 1 litre per minute (0.035 cu. ft per minute).

If the thermometer is used in conjunction with an air purge, check that there is an adequate supply of clean air.

The flow rate required for purge air is 1 litre per second (2 cu. ft per minute).

APPENDIX A

1 UNO Target Orbiter

This section is gives the information necessary to understand the principle of operation of the Target Orbiting (TO) option fitted to your UNO Thermometer.

2 UNO Target Orbiting Thermometers

The UNO Thermometers fitted with the target orbiting option are listed below:

Thermometer	Field Of View
U1 600/1600 CV - TO	100:1
U1 600/1600 CS - TO	100:1
U1 1100/2900 FV - TO	100:1
U1 1100/2900 FS - TO	100:1
U1 800/2600 CV - TO	200:1
U2 300/1100 CV - TO	100:1

2.1 Supplementary Specification

The following specification is in addition to that quoted in the standard UNO Thermometer User Guide.

Half angle of conic of orbit:	2° (±10%)
Frequency of rotation:	3 Hz (±10%)
Ambient temperature limits:	10 to 50 °C / 50 to 122 °F (operation and storage)
Accuracy:	U1: 1.5 %K
	U2: 2 %K

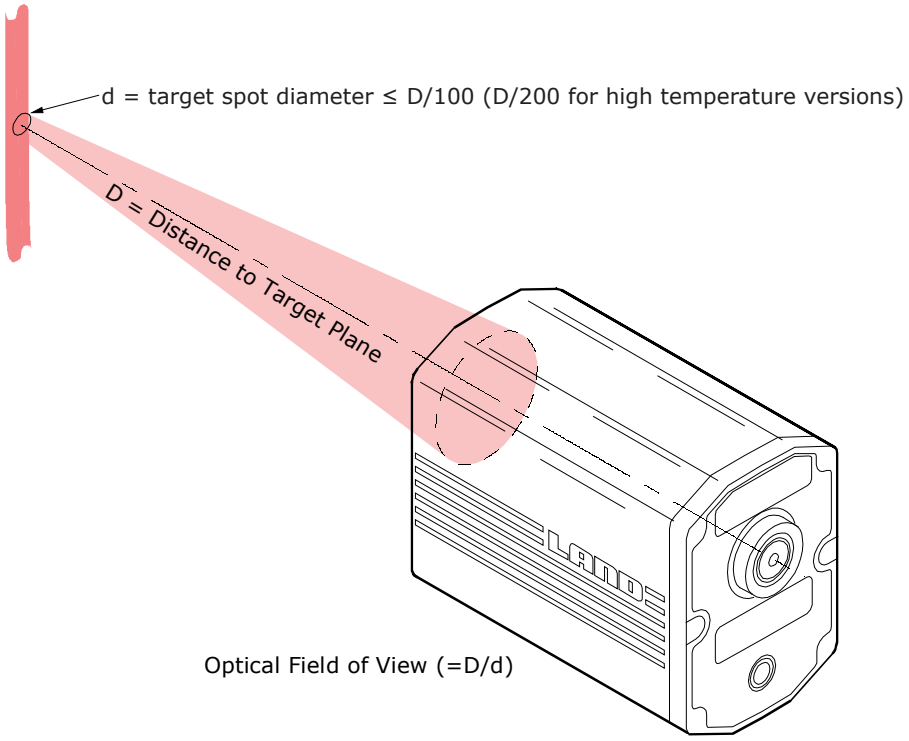


Fig. 1 Field of view of Standard UNO Thermometer S4980253

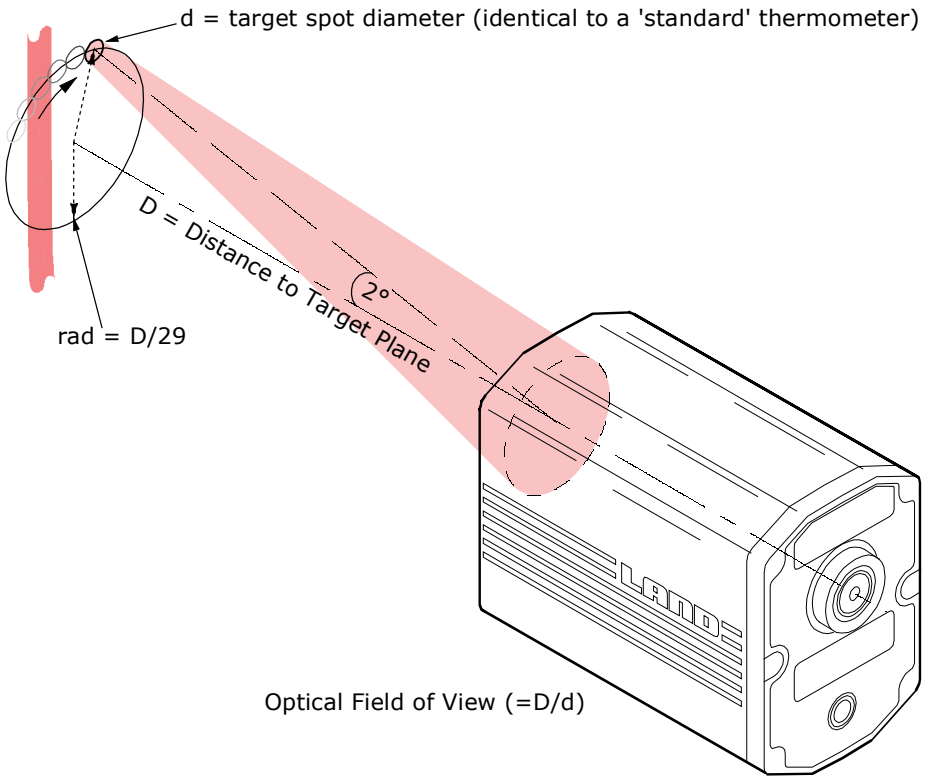


Fig. 2 Field of view of Target Orbiting Thermometer S4980254

3 Principle of Operation

Fig. 1 shows the field of view for a standard UNO Thermometer. The axis of the field of view is fixed at the centre of the thermometer lens and is at right angles to the front face of the thermometer.

Fig. 2 shows the field of view for a Thermometer fitted with the Target Orbiting (TO) option. The target spot diameter at any given distance is identical to that of the corresponding standard Thermometer. However, the field of view rotates about a 'cone' of half-angle 2°. This 'cone' is at right angles to the front face of the thermometer. The axis of the cone passes through the centre of the thermometer lens.

The field of view rotates three times per second.

The Target Orbiting option is designed for use on moving or intermittent targets. In a standard UNO Thermometer, the eyepiece graticule defines the target spot diameter. In a Target Orbiting Thermometer, the graticule defines the orbit of the centre of the target spot (refer to Fig. 3).

When viewing a narrow, moving object (e.g. wire) there may be some to lateral movement of the product with respect to the thermometer. This means that it is possible that the target may not be covered by the graticule for considerable periods.

A Target Orbiting Thermometer can be sighted so that the graticule covers the limits of lateral movement. This means that an accurate, valid temperature reading will be obtained by the thermometer at least three times per second.

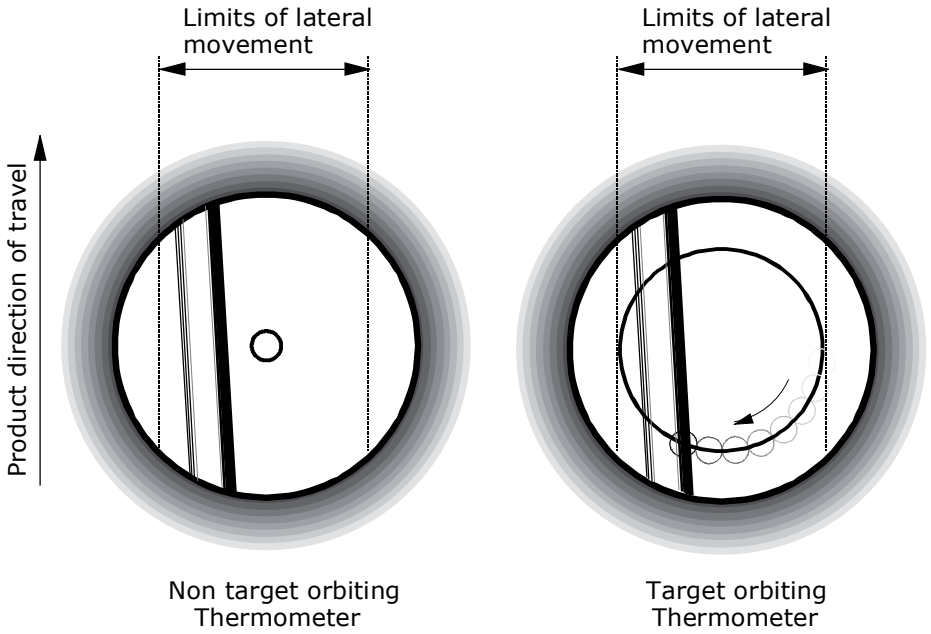


Fig. 3 Comparison of views through the eyepiece (Standard v Target Orbiting

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The target width required for accurate temperature measurement (>99.5% of value) with the Target Orbiting Thermometer is as follows:

Thermometer	Field of View	Minimum target required
U1 600/1600 CV - TO	100:1	1.2 x target spot diameter
U1 600/1600 CS	100:1	1.2 x target spot diameter
U1 1100/2900 FV	100:1	1.2 x target spot diameter
U1 1100/2900 FS	100:1	1.2 x target spot diameter
U1 800/2600 CV	200:1	1.5 x target spot diameter
U2 300/1100 CV	100:1	1.2 x target spot diameter

3.1 Suggested settings for use in 'Peak Picker' mode

1) For instructions on how to access the time function controls, refer to Section 3 of the User Guide.
2) Set the switch SW5 (Time function selector) to 2 i.e. Peak Picker.
3) Set the switch SW4 (Decay Rate %/s) to 9. This is recommended as an initial setting as it minimises the decay between peaks.
4) After initial setup, adjust the setting of SW4 to suit the requirements of your particular application.

APPENDIX B - Discontinued Thermometers

U5 Series Thermometers

Thermometer Model	U5 400/1300C	U5 750/2400F	U5 1000/2500C	U5 1800/4500F
Temperature Range:	400 to 1300°C	750 to 2400°F	1000 to 2500°C	1800 to 4500°F
Wavelength:	4.8 to 5.2µm			
Averager Response:	100ms to 5s (to 95%)			
Peak Picker:	1.5 to 30%/s decay			
Emissivity:	0.10 to 1.00			
Sighting:	6° through the lens			
Target Size:	>98% of energy within graticule			
Magnification:	1.8x			
Eye Relief:	30mm / 1.2in			
Field of View (Nominal):	100:1			
Focus Range Standard: Short Variable Focus:	 0.5m / 19.7in to infinity 0.35m to 1.0m / 13.6in to 39.3in			
Min. Target Diameter:	3.5mm (0.13in)			
Accuracy Repeatability: Absolute:	 ≤2°C / 4°F 0.6%K		 ≤1°C / 2°F 0.6%K	
Stability (Temperature):	0.025%°T(K)/°C ambient			
Stability (Time):	2°C / 4°F per year			
Vibration:	3G any axis 10 to 300 Hz			
Humidity:	0 to 99% non condensing			
Sealing:	IP65			
Ambient Temperature Specified: Operating:	 0 to 70°C / 32 to 158°F -10 to 80°C / 14 to 176°F			
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)			

U6 Series Thermometers

Thermometer Model	U6 0/300C-V	U6 100/700C-V
Temperature Range:	0 to 300°C	100 to 700°C
Wavelength:	3 to 5µm	
Averager Response:	Adjustable 100ms to 5s (0 to 95%)	
Peak Picker:	1.5 to 30% /s decay	
Emissivity:	0.10 to 1.00	
Sighting:	6° through the lens	
Target Size:	>98% of energy within graticule	
Magnification:	1.8x	
Eye Relief:	30mm / 1.2in	
Field of View (Nominal):	30:1	100:1
Focus Range Standard: Short Variable Focus:	 0.5m / 19.7in to infinity 0.35m to 1.0m / 13.6in to 39.3in	
Min. Target Diameter:	16.6mm / 0.65in	5mm / 0.2in
Accuracy Repeatability: Absolute:	 1°C / 2°F 0.3%K + 2.5K	 0.3%K + 2K
Stability (Temperature):	<0.15K/K	<0.2K/K
Stability (Time):	2°C / 4°F per year	
Vibration:	3G any axis 10 to 300 Hz	
Humidity:	0 to 99% non condensing	
Sealing:	IP65	
Ambient Temperature Specified: Operating:	 0 to 45°C / 32 to 113°F 5 to 45°C / 41 to 113°F	
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)	

U8 Series Thermometers

Thermometer Model	U8 0/1000C-V
Temperature Range:	0 to 1000°C
Wavelength:	8 to 14µm
Averager Response:	Adjustable 100ms to 5s (0 to 95%)
Peak Picker:	1.5 to 30% /s decay
Emissivity:	0.10 to 1.00
Sighting:	6° through the lens
Target Size:	>98% of energy within graticule
Magnification:	1.8x
Eye Relief:	30mm / 1.2in
Field of View (Nominal):	100:1
Focus Range Standard: Short Variable Focus:	 0.5m / 19.7in to infinity 0.35m to 1.0m / 13.6in to 39.3in
Min. Target Diameter:	5mm / 0.2in
Accuracy Repeatability: Absolute:	 1°C / 2°F 1%K + 1K
Stability (Temperature):	<0.3K/K
Stability (Time):	2°C / 4°F per year
Vibration:	3g any axis 10 to 300 Hz
Humidity:	0 to 99% non condensing
Sealing:	IP65
Ambient Temperature Specified: Operating:	 0 to 45°C / 32 to 113°F 5 to 45°C / 41 to 113°F
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)

UNO THERMOMETER

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