RT8B THERMOMETER
USER GUIDE

PUBLICATION Nº 815692
LANGUAGE: ENGLISH

ISSUE: 4
DATE: 02 MARCH 2026

Low Temperature Standalone 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 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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1 INTRODUCTION

1.1 General Introduction

This publication provides the necessary information required to safely operate the LAND ***RT8B*** Thermometer.

It is important to fully check all equipment with which you have been supplied.

The equipment must only be used, maintained and serviced by suitably trained personnel, capable of carefully following the procedures and guidelines given in this User Guide.

This User Guide should be read thoroughly before proceeding with any operations detailed within it and it is advisable that it is kept readily available, for reference when the equipment is in general use.

1.2 About the *RT8B* thermometer

The LAND ***RT8B*** Thermometer is a highly accurate, non-contact infrared thermometer, designed for independent or 'stand alone' applications.

The thermometer features include:

- stand alone operation
- adjustable response speed
- 4 to 20mA loop powered output, linear over the temperature span of the instrument
- built-in emissivity controls

Fig. 1 LAND ***RT8B*** thermometer

2 INSTRUMENT SPECIFICATIONS

2.1 Specification Table

Operating Temperature Range: (focused at infinity)	RT80B RT81B RT82B RT83B	0 to 250°C 0 to 500°F 0 to 500°C 0 to 1000°F
Specified Temperature Range:	RT80B RT81B RT82B RT83B	0 to 250°C 30 to 500°F 0 to 500°C 30 to 1000°F
Output:	Linear 4 to 20mA over temperature range	
Field of view:	See section 2.3	
Emissivity:	0.1 to 1.09 adjustable in steps of 0.01	
Waveband:	8 to 14µm (nominal)	
Response time(3t):	1 to 10s (adjustable)	
Resolution:	<0.2°C	
Accuracy:	2°C or 0.5% of range	
Ambient temperature limits:	-5 to 50°C/23 to 122°F (specified) -5 to 70°C/23 to 158°F (storage)	
Drift with ambient temperature:	<1.5° per 10° change in ambient temperature	
Drift with time:	<1°C (2°F) per year	
Power supply voltage limits:	11 to 45V d.c. (26V d.c. nominal)	
Maximum load resistance:	1KΩ	
EMC:	EN 50 082-2 (immunity) EN 50 081-1 (emission) IEC 61010 (electrical safety)	
Sealing:	Designed to meet IP65/NEMA4 requirements	
Vibration:	3g any axis (10 to 300Hz)	
Weight:	0.5kg/1.1lb	

2.2 Thermometer Dimensions

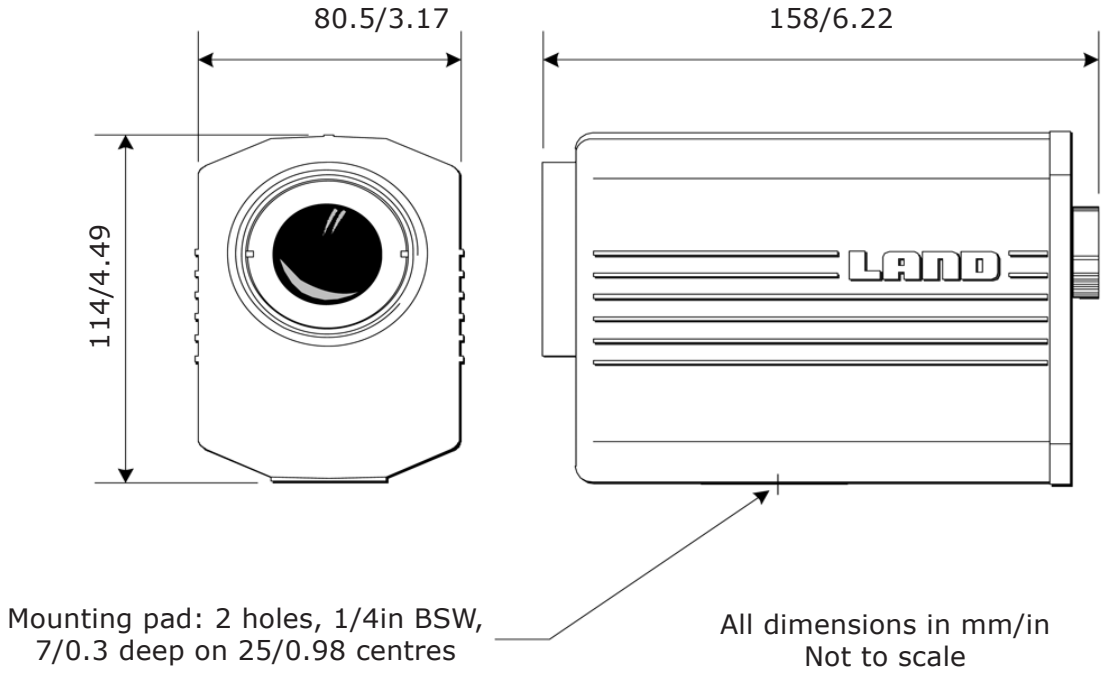


Fig. 2 ***RT8B*** thermometer dimensions

2.3 Target Spot Size

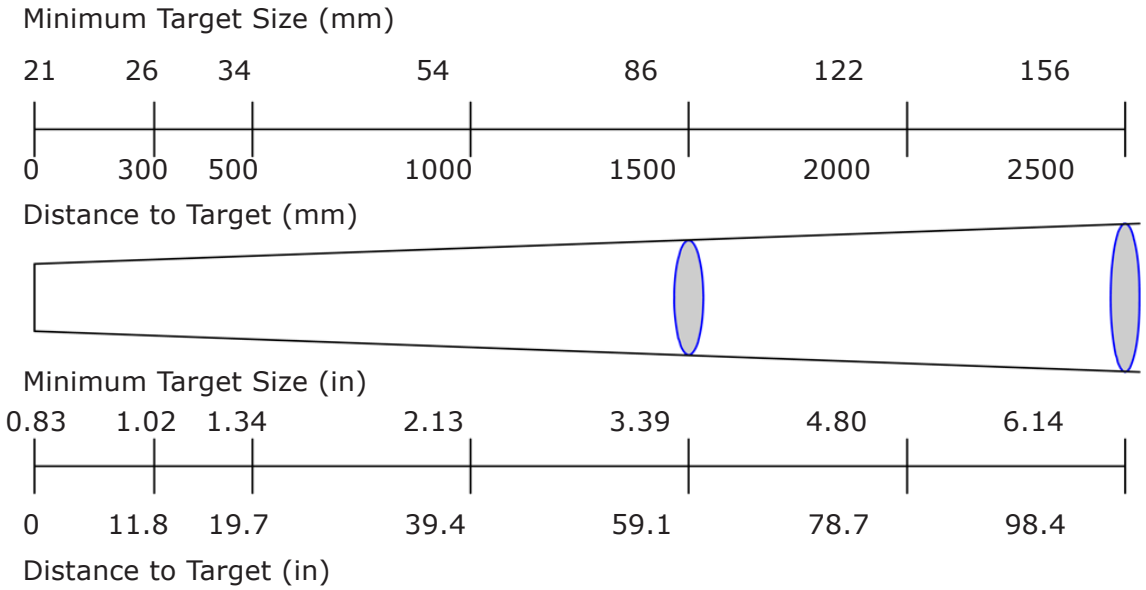


Fig. 3 RT8B thermometer target spot size table

The LAND ***RT8B*** thermometer operates by sensing radiation from within a well defined 'field of view'. The intersection of this field of view with the intended target, determines the 'target spot', the area where the temperature is measured. Fig. 3 shows the ***RT8B*** thermometer target spot size table.

2.4 Thermometer Installation

The location of the ***RT8B*** thermometer should be carefully chosen, such that it is easily accessible and in a position not unnecessarily exposed to heat, fumes or liquid spray. The sight path between the thermometer and the target, should be as free as possible from smoke, liquid spray and from the intrusion of machinery. The axis of the thermometer should be at right angles to the target surface, however, an angle of up to 45° from the normal is acceptable. It is also important that the intended target **completely** fills the thermometer field of view at the selected installed distance and that no part of the sight path is obstructed.

NOTE

In some ***RT8B*** applications, a sighting tube may be required to eliminate any unwanted reflections from entering the thermometer and to keep the sight path clear from obstructions. Sighting tubes can also be used to create a 'stand-off', between the thermometer and the process under observation.

When selecting a suitable sighting tube, it is important to ensure that the internal bore of the tube is at least 25% greater than the largest target spot size over the tubes length. All distances must be measured from the thermometer datum, which is located at the front of the thermometer.

When choosing a suitable location for mounting the ***RT8B*** thermometer, the following criteria should be considered:

- If the installation area is not clean or free from dust, smoke or water spray, then an LAND air purge system **must** be utilised to ensure that the thermometer lens is kept free from such airborne contaminants. Ensure that a suitably conditioned air supply is available.
- If the surrounding ambient temperatures of the installation area are outside the thermometer specification, then an LAND water cooled protective jacket **must** be utilised to ensure that the thermometer operates at the specified ambient temperature. Ensure that a suitably conditioned water supply is available.

3 ELECTRICAL CONNECTIONS

3.1 General Connections

The electrical connections for the ***RT8B*** thermometer power supply and temperature output are made via the 6-way socket on the rear of the thermometer (see Fig. 6).

The connection to the thermometer can be made via any of the following:

- Pre-wired 4m cable (LAND Part No. 029.673)
- 6-way plug (LAND Part No. 206.551)
- 6-way plug housed in protective jacket end cap (LAND Part No. 091.562)

Thermometer Pin	Function	Cable Colour	End Cap Pin No.
1	-	-	-
2	-	-	-
3	V+, 4 to 20mA	Red	5
4	-	-	-
5	-	-	-
6	V-, 4 to 20mA	Black	6

To connect the 6-way plug to the ***RT8B*** thermometer (see Fig. 4):

- Align the red marker near the lugs of the plug, with the red marker located above the keyway in the thermometer socket.
- Push the plug into the socket, ensuring that the locking sleeve slides forwards, locking the plug to the socket.

To disconnect the 6-way plug to the ***RT8B*** thermometer:

- Grip the locking sleeve portion of the plug.
- Slide the locking sleeve rearwards to release the locking mechanism and disconnect the plug from the thermometer socket.

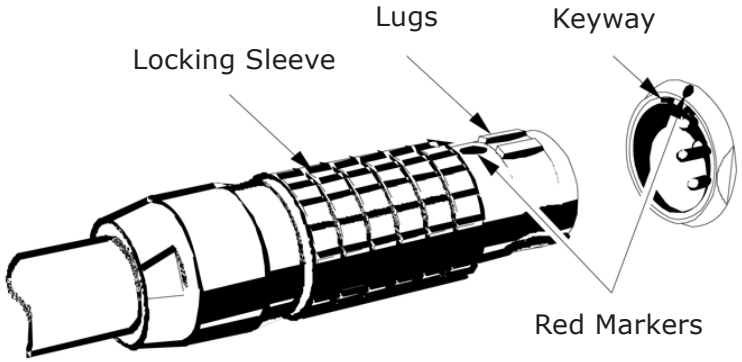


Fig. 4 Connecting the 6-way plug to the ***RT8B*** Thermometer

3.2 Loop Resistance

The maximum allowable loop resistance in the ***RT8B*** thermometer current loop, for a given power supply voltage, is illustrated in Fig. 5.

NOTE

The system load resistance includes the cable resistance and the indicator resistance.

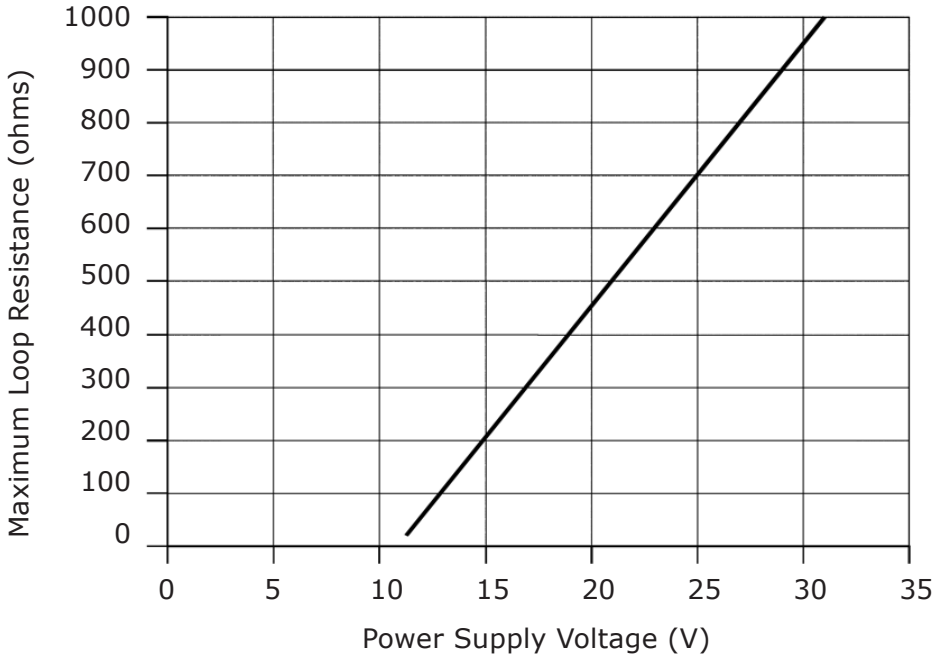


Fig. 5 Graph showing load resistance versus power supply voltage

4 THERMOMETER OPERATION

4.1 General

It is recommended that the 'Emissivity' and 'Response Speed' controls are set to match the requirements of the specific application and measurement location, before installation. This is particularly relevant if the thermometer is to be used in a location which is difficult to access and/or is used in conjunction with a protective jacket and back cap.

4.2 Location of Controls

The 'Emissivity' and 'Response Speed' control switches are located on the rear face of the thermometer. The controls are protected by a screw-on cap (see Fig. 6).

NOTE

To ensure that the electronics of the thermometer are fully sealed against the ingress of moisture and dirt, the screw-on cap covering the thermometer controls must be replaced immediately after making any settings or adjustments.

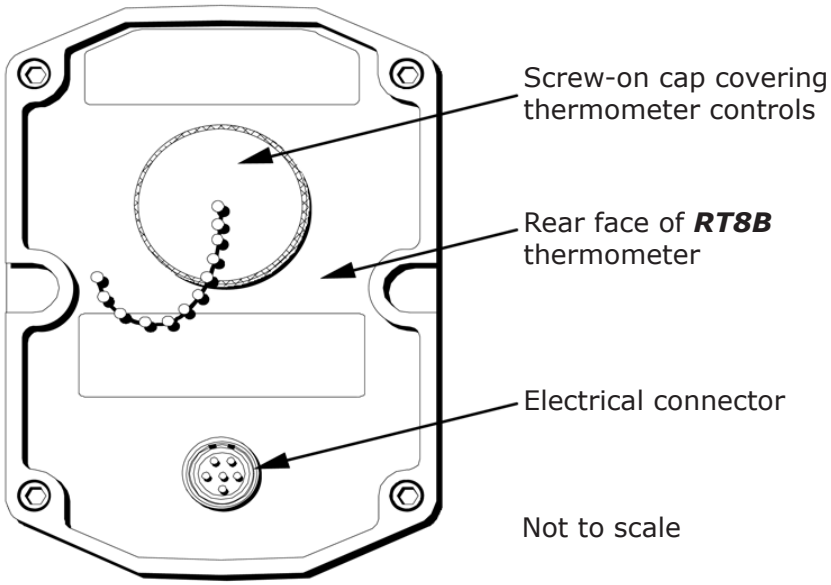


Fig. 6 Location of ***RT8B*** thermometer controls screw-on cap

4.3 Adjusting the 'Emissivity' Setting

To ensure that the LAND ***RT8B*** thermometer makes consistent accurate temperature measurements, an emissivity correction value must be set in the thermometer which accurately corresponds with the target under observation.

The emissivity value can be set in the range 0.1 to 1.09 in adjustable increments of 0.01. The thermometer is supplied with the emissivity value pre-set to 1.00.

To set the emissivity value:

- Remove the screw-on cap covering the control switches.
- Set the emissivity value using the 'SW1' and 'SW2' switches (see Fig. 7).

Switch 'SW1' denotes the **first figure after the decimal point** of the emissivity value.

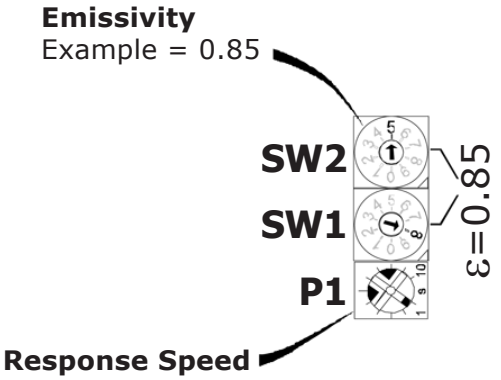
Switch 'SW2' denotes the **second figure after the decimal point** of the emissivity value.

e.g. for an emissivity value of '0.87', 'SW1' should be set to '8' and 'SW2' should be set to '7'.

When switch 'SW1' 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, 'SW1' should be set to '0' and 'SW2' should be set to '0'.

- Refit the screw-on cap covering the control switches.



Emissivity	SW1	SW2
0.10	1	0
0.80	8	0
0.85	**8**	**5**
0.92	9	2
1.00	0	0

Example settings

Fig. 7 ***RT8B*** Thermometer 'Emissivity' and 'Response Speed' Control

4.4 Adjusting the Averager 'Response Speed' Setting

The response speed setting allows the time constant of the LAND ***RT8B*** thermometer to be adjusted to suit the application. The response speed relates to the signal output rate and gives an average reading over the duration of the response speed time value and can be set via potentiometer P1 (see Fig. 7).

The averager response speed can be set to any value between 1 and 10 seconds (for 0 to 95% of the final reading).

To increase the response speed value (i.e. make the response faster):

- Remove the screw-on cap covering the control switches.
- Turn the potentiometer 'P1' anti-clockwise. When 'P1' is turned fully anti-clockwise, the response speed is 1 second (3τ)

To decrease the response speed value (i.e. make the response slower):

- Remove the screw-on cap covering the control switches.
- Turn the potentiometer 'P1' clockwise. When 'P1' is turned fully clockwise, the response speed is 10 seconds (3τ).
- Refit the screw-on cap covering the control switches.

4.5 Settings Archive

It is recommended that any emissivity or response speed settings made, are recorded and saved to archive. This allows future reference and quick traceability of settings without having to access the instrument to check switch settings. When values for emissivity and response speed are set, enter the information and values in the table below:

Serial Number	Date	Emissivity	Response Speed

5 MOUNTINGS AND ACCESSORIES

5.1 General

A comprehensive range of mountings and accessories is available for the ***RT8B*** thermometer, ensuring it is environmentally protected when utilised in hostile or challenging applications.

NOTE

If the thermometer is to be used in an area of ambient temperature higher than that specified, then the thermometer must be housed in a protective cooling jacket. If the thermometer is to be used in an area where the atmosphere contains a high proportion of dust/smoke/steam etc, then the thermometer must be used in conjunction with an air purge system, to keep the thermometer lens clean and free from contamination.

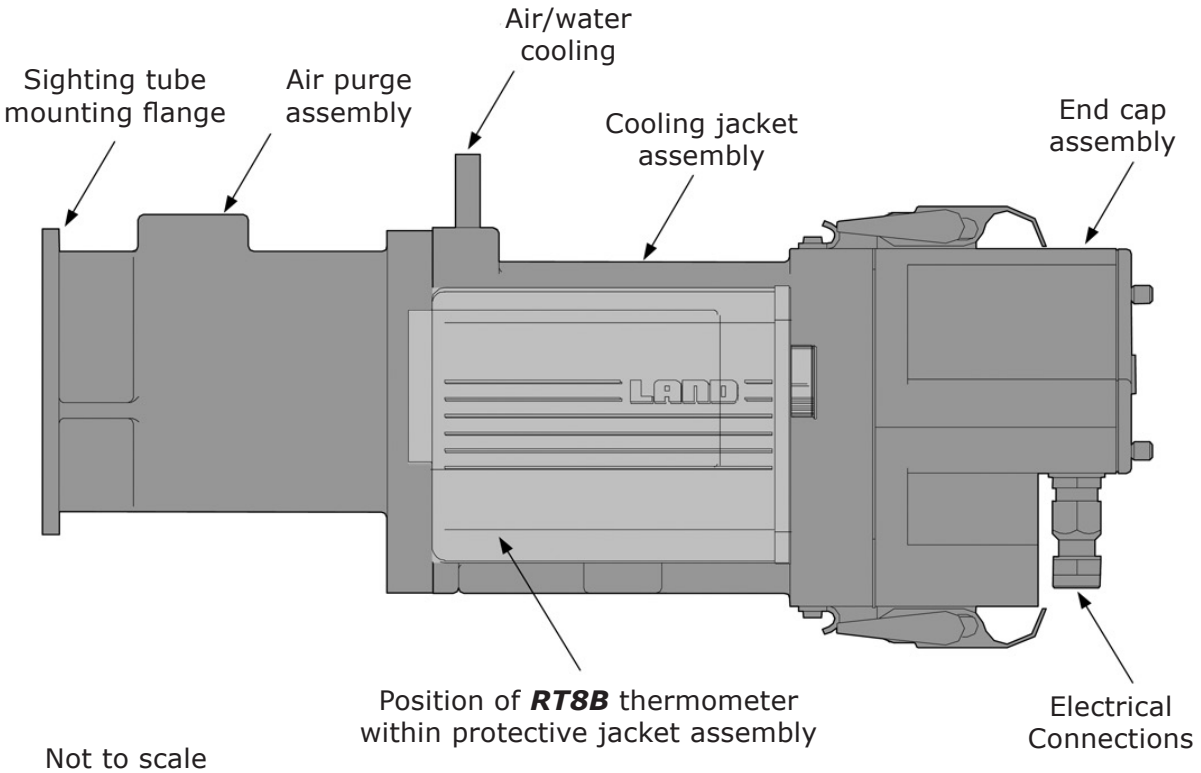


Fig. 8 Location of ***RT8B*** thermometer in protective jacket assembly

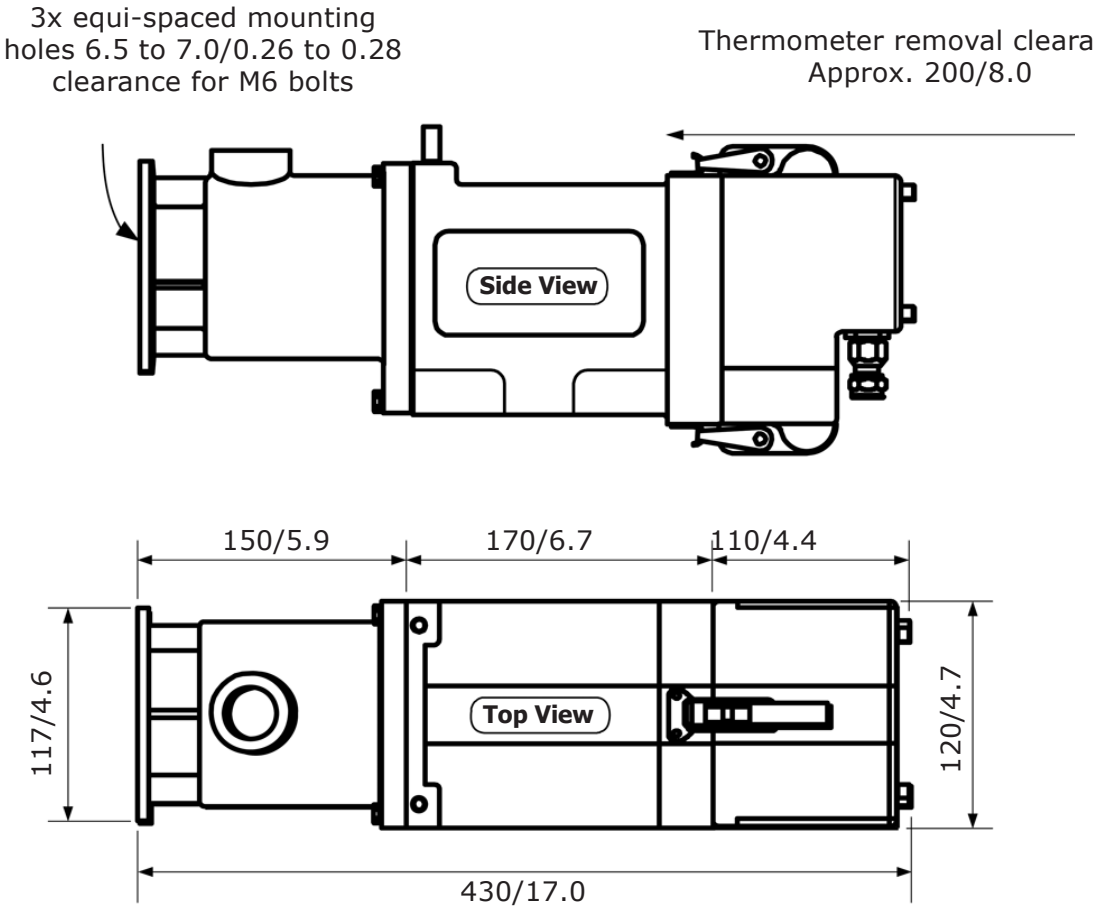


Fig. 9 RT8B thermometer protective assembly dimensions

5.2 Services

When any cooling or purging accessories are utilised, it is important that the air and water supply to these facilities are fully conditioned and supplied at the recommended flow rates. The following information details the specified flow rates:

S4-J Cooling Jacket Assembly

Requirement: Conditioned water supply (clean and free from any contaminants) Flow rate: 1ltr/min or 0.035cu.ft/min

S4-P Air Purge Assembly

Requirement: Conditioned air supply (clean and dry, free from any contaminants) Flow rate: 1ltr/sec or 2cu.ft/min.

CAUTION

"Over-cooling" of the thermometer may cause a build-up of condensation on or inside the instrument.

To prevent this, ensure that the water supply temperature is not lower than the local dewpoint temperature.

6 MAINTENANCE

6.1 General

RT8B thermometer maintenance consists mainly of ensuring that the thermometer lens is kept clean and free from contaminants and that all services to the system (water and air supplies) are set correctly and are routinely checked.

It is recommended that routine checks of the ***RT8B*** thermometer system, are incorporated into any local maintenance schedules.

7 EMISSIVITY

In order to obtain accurate temperature measurements, the emissivity value of the target surface must be known. This section of the ***RT8B*** Thermometer User Guide contains typical emissivity values of the most commonly measured materials. 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 for assistance.

7.1 Refractories

Refractories		
Material		**Emissivity Value**
Magnesite oxidised		0.60 0.85
Brick	Red	0.90
	White Refractory	0.80
	Silica	0.80
	Sillimanite	0.60
Ceramics		0.90
Alumina		0.60

Fig. 10 Typical Emissivity Values for Refractories

7.2 Alloys

Alloys	
Material	**Emissivity Value**
Brass Oxidised	0.30 0.60
Chromel & Alumel Oxidised	0.30 0.80
Constantin & Manganin Oxidised	0.05 0.35
Inconel Oxidised	0.10 0.85
Monel Oxidised	0.10 0.70
Nichrome Oxidised	0.20 0.85

Fig. 11 - Typical Emissivity Values for Alloys

7.3 Miscellaneous

Miscellaneous		
Material		**Emissivity Value**
Asphalt		0.95
Asbestos (board/paper/cloth)		0.90
Brick	Graphite soot	0.85 0.80 0.95
Cement & Concrete		0.90
Cloth (all types - close weave) [Open weave reduces emissivity]		0.85
Paper & Cardboard		0.80 to 0.95
Plastics	opaque transmission 0.1 transmission 0.4	0.85 0.75 0.45
Paints	oils & enamels lacquers aluminium	0.90 0.85 0.30 to 0.60
Water	depth > 50mm	0.95
Wood		0.85

Fig. 12 Typical Emissivity Values for Miscellaneous Materials

7.4 Metals

Metals	
Material	**Emissivity Value**
Aluminium Oxidised	0.03 0.35
Chromium Oxidised	0.07 0.85
Cobalt Oxidised	0.04 0.35
Copper Oxidised	0.03 0.80
Gold	0.02
Iron & Steel Oxidised	0.10 0.80
Lead Oxidised	0.13 0.65
Magnesium Oxidised	0.07 0.75
Molybdenum Oxidised	0.10 0.80
Nickel Oxidised	0.04 0.85
Palladium	0.05
Platinum	0.07
Rhodium	0.05
Silver Oxidised	0.02 0.12
Tin Oxidised	0.06 0.60
Titanium Oxidised	0.15 0.60
Tungsten	0.06
Zinc	0.04

Fig. 13 Typical Emissivity Values for Metals

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RT8B Thermometer User Guide, Issue 4, 02 March 2026