

Incinerator Thermometer
CDB

User Guide

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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 AMETEK 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 AMETEK 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 AMETEK 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 AMETEK 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 ISO9001 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 information required to safely and correctly operate the LAND **CDB Incinerator Thermometer**.

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 and associated publications. Detailed information regarding installation is contained within the LAND **CDB Incinerator Thermometer** Installation Guide.

All User Guides, Installation Guides and Instruction Leaflets supplied, should be read thoroughly before proceeding with any operations detailed within them.

1.2 About the CDB Incinerator Thermometer

The LAND **CDB Incinerator Thermometer** is a highly accurate, non contact thermometer designed for independent or "STAND ALONE" use.

Thermometer features include:

- Stand Alone operation
- Adjustable response speed
- 4 to 20mA loop powered output, linear over the temperature span of the thermometer
- Built in Emissivity controls



Fig. 1 - Land **CDB Incinerator Thermometer**

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1.3 Application

The LAND **CDB Incinerator Thermometer** is designed for taking measurements of the atmospheric temperature within waste incinerators. It can be used for gas or flame temperature measurement in a variety of plant applications, provided that there is sufficient CO₂ concentration at a high temperature and an effective measurement sight path depth. The measurement is unaffected by a cold CO₂ atmosphere, therefore it “sees through” cold combustion atmospheres, measuring any hot atmosphere beyond.

In a typical incinerator application, the **CDB** is mounted externally onto the incinerator wall, positioned approximately 2 metres above the bed. It is fixed to a protective flanged sight tube which penetrates through the incinerator wall. The thermometer sight path acts as an “invisible thermocouple”, extending into the incinerator atmosphere (penetration depth depends upon atmosphere conditions), where atmospheric temperature measurements are taken.

The **CDB** thermometer is fully protected from the harsh environments encountered in incinerator applications by utilising the Land protective jacket assembly which is air or water-cooled and an air-purged sighting tube.

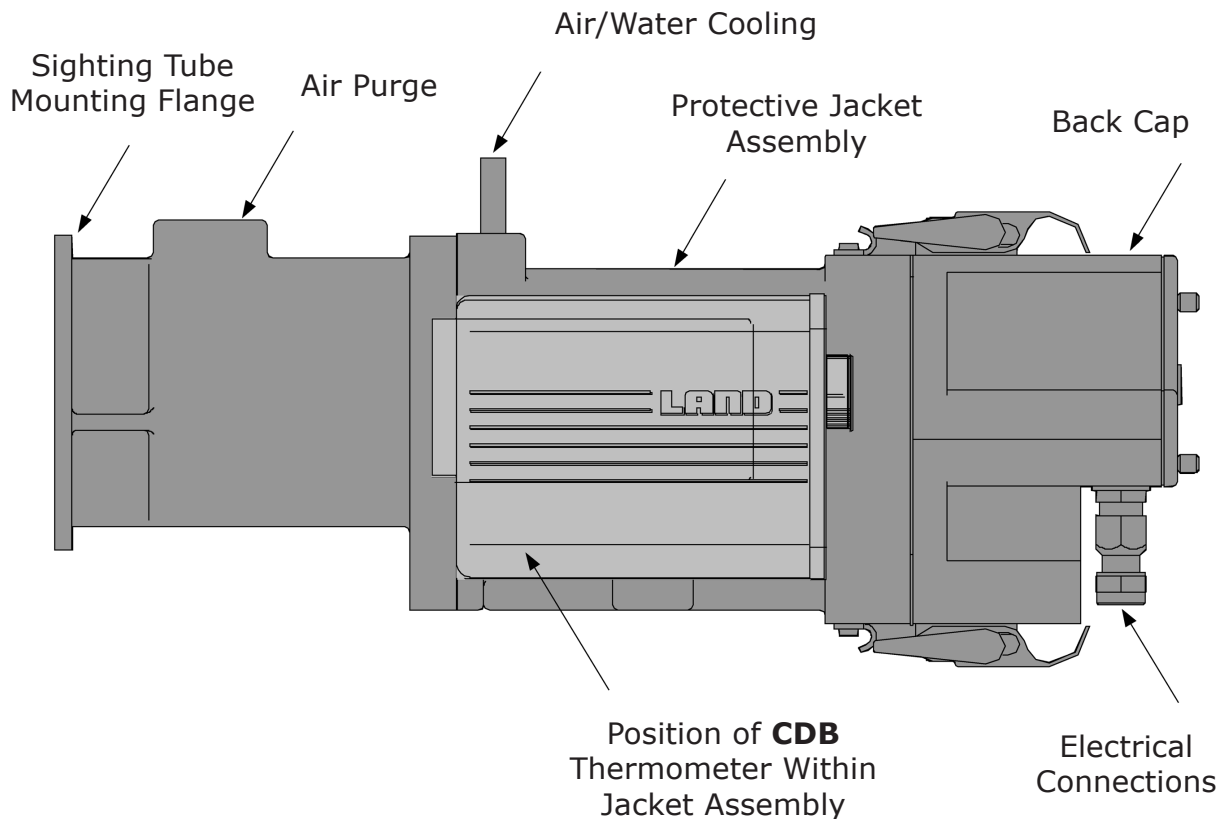


Fig. 2 - **CDB** Thermometer in Protective Jacket Assembly

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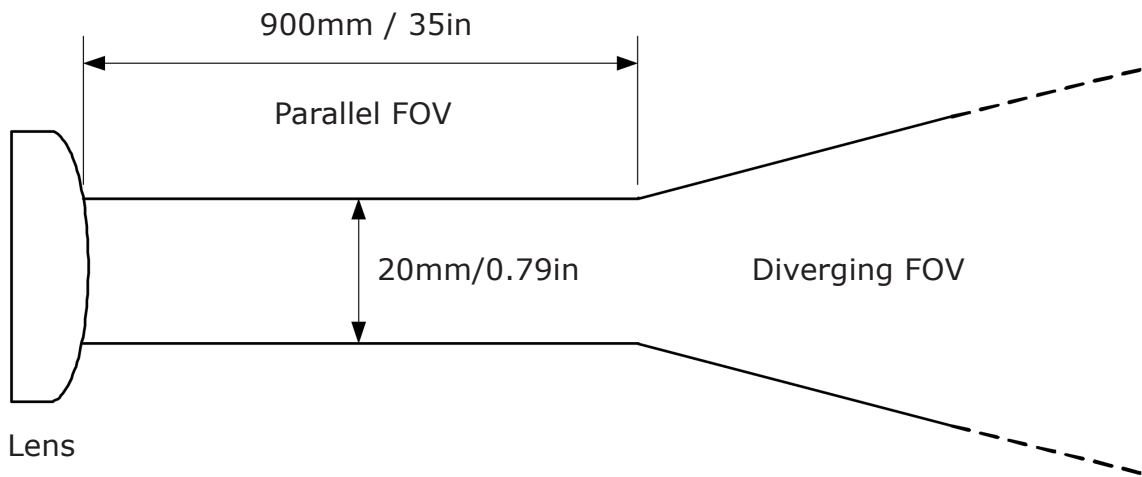
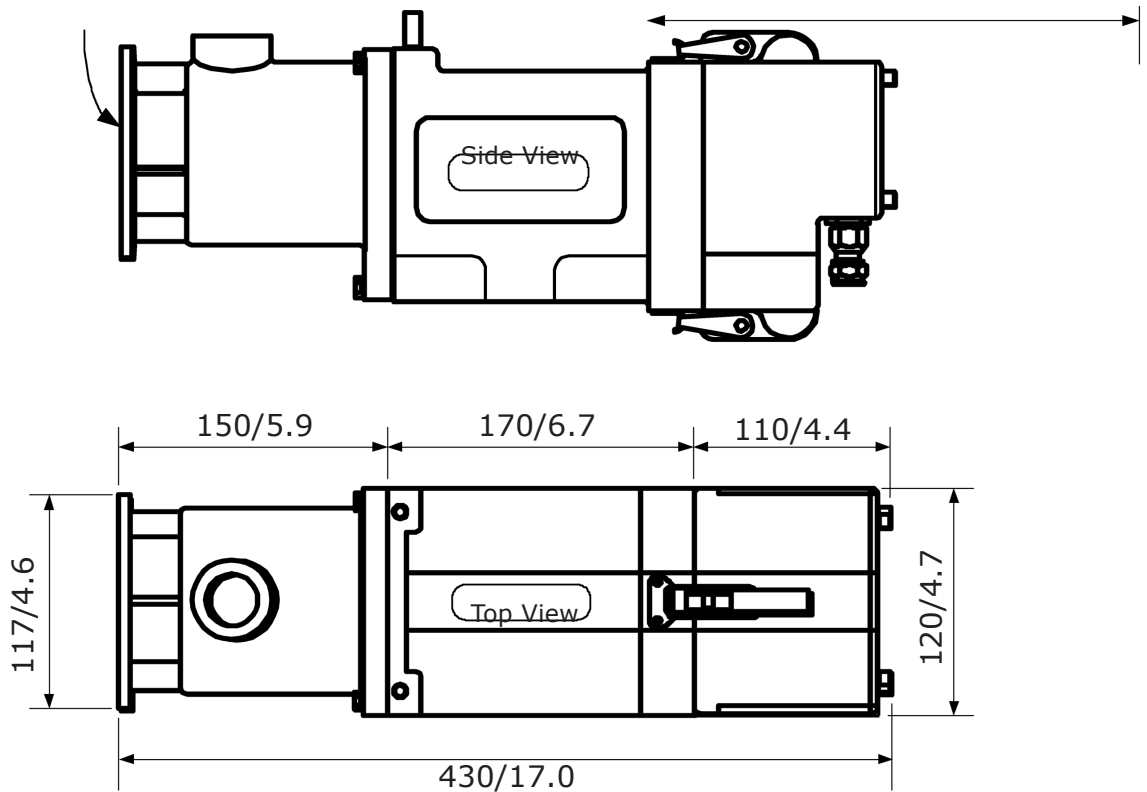


Fig. 3 - Thermometer Sighting diagram

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3x equi-spaced mounting holes 6.5 to 7.0/0.26 to 0.28 clearance for M6 bolts

Thermometer removal clearance Approx. 200/8.0



All dimensions in mm/in

Not to scale

Fig. 4 - Thermometer Protective Jacket Assembly dimensions

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2 Specifications

Temperature Range	400 to 1800 °C/752 to 3272 °F
Output:	4 to 20 mA linear (2-wire loop connection) Must not be isolated to >50 V from earth
Field of View:	20 mm/0.6 in parallel to 900 mm/35 in (nominal)
Alignment:	Permissible misalignment between thermometer optical and mechanical axes = 1°
Emissivity:	0.1 to 1.09 in steps of 0.01
Response Time (3τ):	1 to 10 s (adjustable)
Resolution:	≤0.5 °C/1 °F
Accuracy:	0.5 %K or 5 °C 0.5 %K or 9 °F (Whichever is higher)
Drift with ambient temperature:	≤2° per 10° ambient
Drift with Time:	≤1 °C/2 °F per year
Environmental Specification	
Ambient Temperature Limits:	5 to 50 °C/41 to 122 °F
Humidity:	0 to 99 % non-condensing
Sealing:	To IP65/NEMA4X requirements
CE:	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)
Vibration:	3g - 10 to 300Hz
Power Supply:	11 to 45 V d.c.

3 Installing the Thermometer

3.1 Introduction

The information detailed within this section of the **CDB** User Guide, should be cross-referred with information found in the **CDB** Installation Guide.

If the thermometer is to be used in conjunction with a protection jacket and air purge (recommended), refer to the Installation Guides supplied with the relevant accessory.

3.2 Aiming Consideration

The thermometer senses radiation (only) from within a well defined field-of-view. Fig. 3 shows this. The thermometer will normally be sighted down a tube which penetrates the incinerator wall. This tube must not "clip" the field of view and thus needs to be of sufficient diameter. Fig. 6 shows recommended minimum internal diameter versus tube length - reasonable allowance is included here for misalignments.

The instrument responds to hot CO₂ in the atmosphere. To obtain an accurate reading there must be a sufficient "column depth" of CO₂ - i.e. enough path length at a high enough concentration. The column depth actually required depends on the temperature. As a "rule of thumb" good measurements are possible for temperatures above 600°C where the concentration exceeds 4% in a path length of several metres. A more precise indication is given in Figs. 7 and 8. These errors assume a cold back wall and will be reduced if the back wall temperature is close to the gas temperature. They add to the "black body" errors in the instrument specification above.

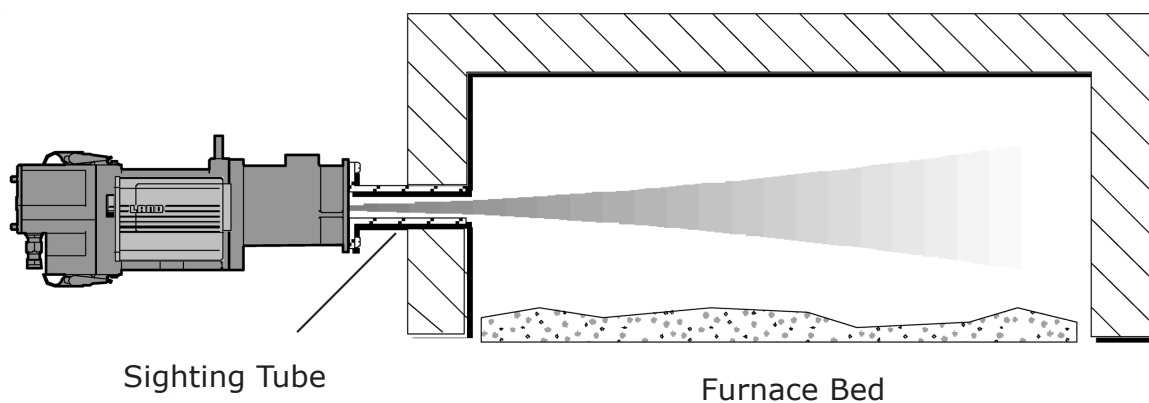


Fig. 5 - Thermometer aimed above furnace bed

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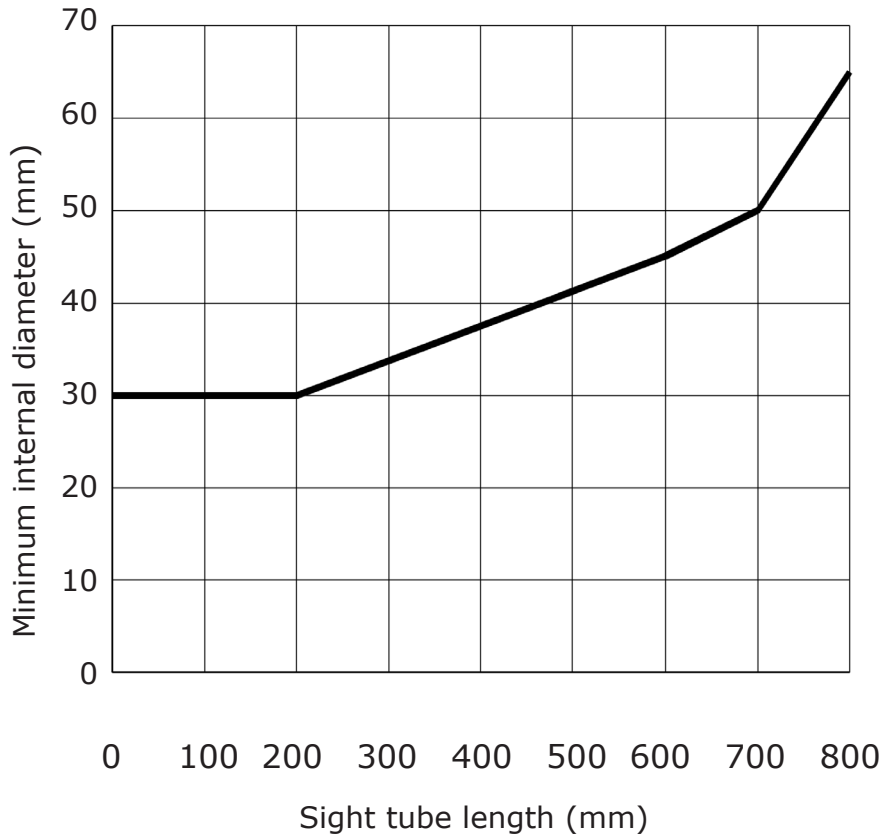


Fig. 6 - Minimum recommended Sight Tube diameters

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Thermometer error versus path length for several CO₂ concentrations. Gas temperature 1500K

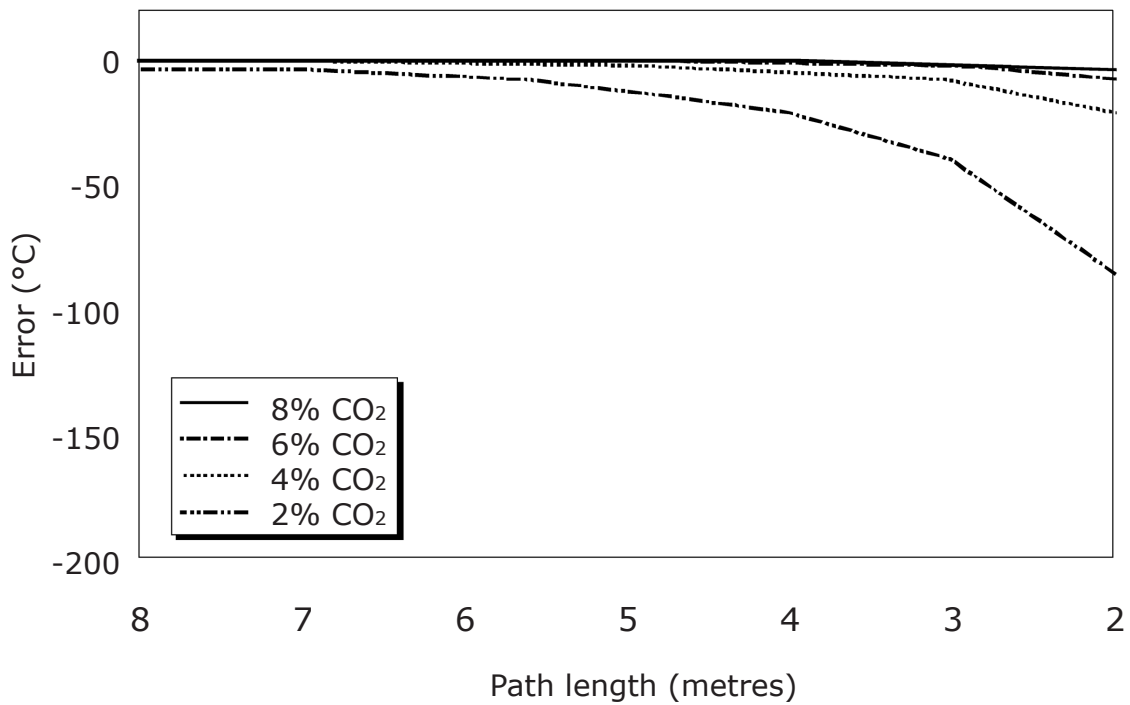


Fig. 7 - Thermometer error at 1500K gas temperature

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Thermometer error versus path length for several CO₂ concentrations. Gas temperature 1200K

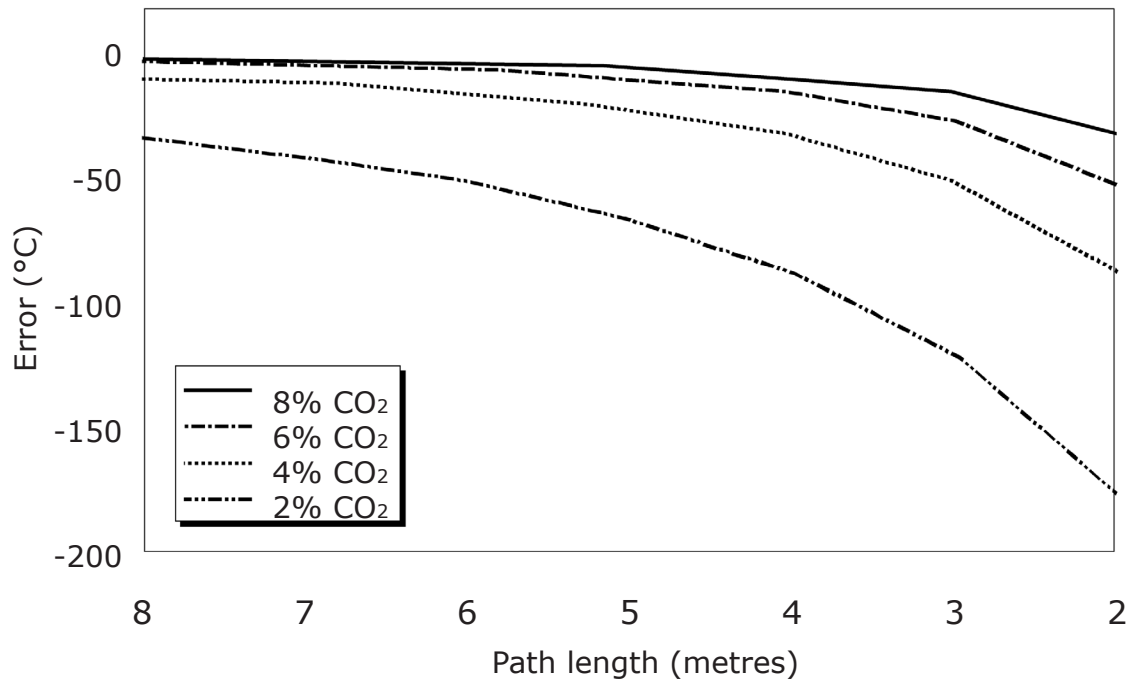


Fig. 8 - Thermometer error at 1200K gas temperature

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4 Using the Thermometer

It is recommended that the 'Emissivity' and 'Response Time' controls are set to match the requirements of the particular 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 used in conjunction with a jacket and back cap.

4.1 Location of Controls

The 'Emissivity' and 'Response Time' control switches are located on the rear face of the thermometer. The controls are protected by a screw-on cap (See Fig. 9).



NOTE

To keep the thermometer electronics sealed against ingress of dust and moisture, always replace the screw-on cap after adjusting the settings.

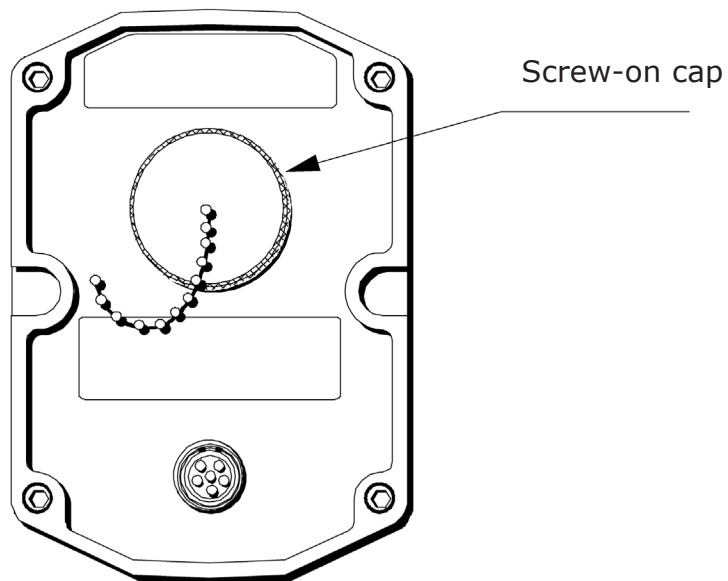


Fig. 9 - Location of the screw-on cap

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4.2 Adjusting the Emissivity value

For accurate temperature measurement, the **Emissivity** setting must be set to correspond with the target being measured.

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

The **CDB** is supplied with the emissivity factory-set to 1.00.

The **Emissivity** value is set using switches **SW1** and **SW2**. See Fig. 10.

When switch **SW1** 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 '0.85', set SW1 to '8' and SW2 to '5'.

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', set SW1 to '0' and SW2 to '0'.



NOTE

For an opaque gas measurement, an emissivity value of 1.00 should be used.

Emissivity
Example = 0.85

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

Response time (3τ)
Fully anti-clockwise = 1 sec
Fully clockwise = 10 sec

Fig. 10 - 'Emissivity' and 'Response Time' controls

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4.3 Adjusting the Averager Response Time

The response time control allows the time constant of the thermometer to be adjusted to suit the application.



NOTE

For longer time constants (e.g. to mimic thermocouples), an averaging meter is advised. Suitable units provide 0 to 999 seconds of response, 4 to 20 mA retransmission output and also power to the **CDB**.

For further information, contact Land Instruments International.

To adjust the Averager Response Time function, use the potentiometer P1 (see Fig. 10). The Response Time value can be set to between 1 and 10 seconds (for 0 to 95% of the final reading).

For a **faster** Response Time:

Turn the potentiometer **P1** anticlockwise. If **P1** is turned fully anticlockwise, the 'Response Time' is at the fastest setting (approx. 1 second).

For a **slower** Response Time:

Turn the potentiometer **P1** clockwise. If **P1** is turned fully clockwise, the 'Response Time' is at the slowest setting (approx. 10 seconds).

4.4 Noting 'Emissivity' and 'Response Time' Settings

It is advisable to make a note of the settings for 'Emissivity' and 'Response Time', once these settings have been determined and verified. Each time a re-adjustment is made to the settings, make a note in the table below, using the spaces provided. This table can then be used as a quick reference guide.

CDB Serial Number	Date	Emissivity	Response Time

5 Electrical Connections

5.1 Thermometer Operation

The LAND Incinerator Thermometer is a rugged, stand alone, non contact thermometer, designed for measuring relatively low temperatures in hostile environments. It has a temperature measurement range of 400 to 1800°C/752 to 3272°F.

The thermometer operates on a simple 4 to 20mA current loop. A block diagram of the key features of the thermometer is shown in Fig. 11.

The thermometer contains an integral lens, which focuses infrared radiation from a predefined target area onto an infrared detector. This detector converts the incoming infrared radiation into a low level electrical voltage which is proportional to the temperature of the target. This electrical voltage is then amplified, corrected for emissivity and linearized to produce an analog 4 to 20mA current output.

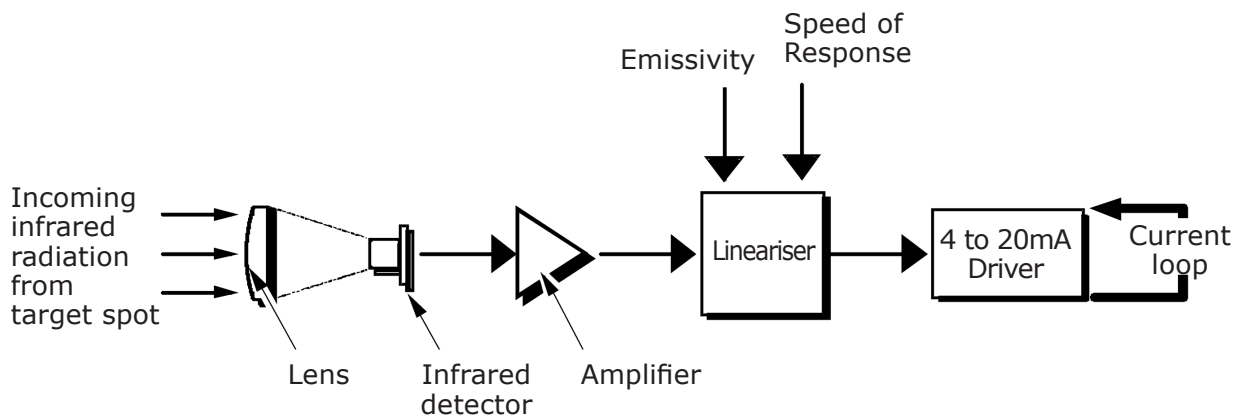


Fig. 11 - Thermometer block diagram

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In normal operation the 4-20mA output is designed to stay within the 'saturation' range as defined by NAMUR NE43.

Fail High -	$\geq 21.0\text{mA}$
Saturation High -	20.5mA
Signal Range -	4-20mA
Saturation Low -	3.8mA
Fail Low -	$\leq 3.6\text{mA}$

5.2 Electrical connections

The electrical connections for the thermometer power supply and temperature outputs are made via the 6-way socket on the rear of the thermometer.

The 6-way cable connections are as follows:

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

Electrical connections to the **CDB** thermometer must be made through the prewired plug supplied with the thermometer or through the plug housed in the protective jacket back cap.

To connect either plug type to the thermometer socket:

- 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 either plug type from the thermometer socket:

- 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.

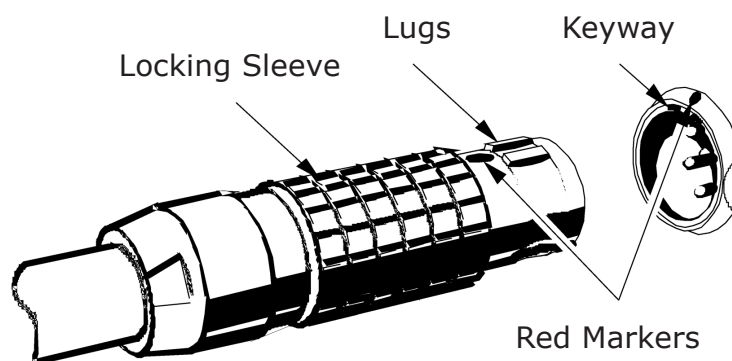


Fig. 12 - Connection of a 6-way plug to the thermometer socket

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5.3 Loop Resistance

The maximum allowable resistance in the thermometer current loop for a given power supply voltage is illustrated in Fig. 13. Information on how to adjust the power supply voltage for a LAND power supply is given in the Power Supply Unit User Guide.

i **NOTE**
The system load resistance includes the cable resistance and the indicator resistance.

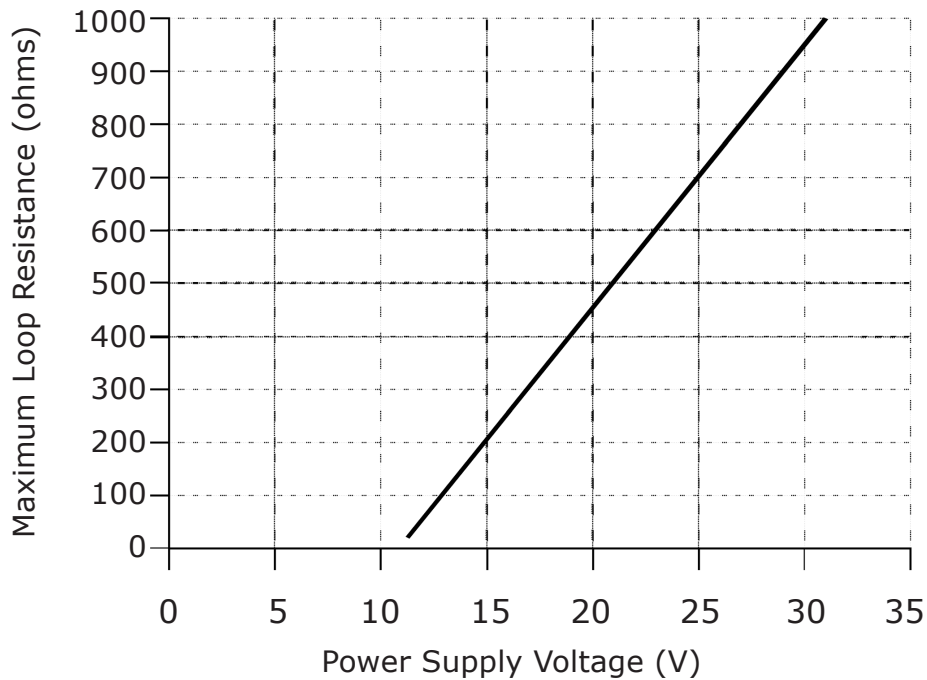


Fig. 13 - Graph showing load resistance versus power supply voltage

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6 Mounting and Accessories

6.1 Recommendations

The **CDB** thermometer is compatible with all Land System 4 thermometer mountings and accessories.

For the majority of incinerator and furnace applications, the following package of accessories is recommended (see Fig. 2):

Air Purge: Land Part No. 091.561

Jacket: Land Part No. 091.560

Back Cap: Land Part No. 091.562

For further information detailing the **CDB** thermometer mountings and accessories, cross-refer to the System 4 Thermometer Mountings and Accessories Installation Guide.

6.2 Sighting Tubes

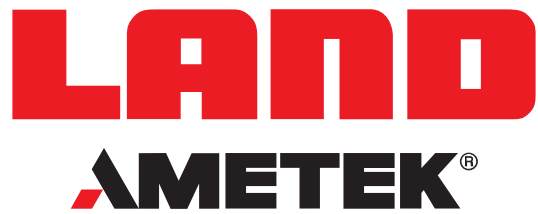
It is normal to use a "sighting tube" to penetrate the incinerator wall. The thermometer jacket is then bolted to a flange at the rear of this tube. Land Instruments supply a short tube (type FS6 - length 150mm, internal diameter 54mm) but it is recommended that a longer tube be fabricated to suit the particular installation.

It is important that the sighting tube is of sufficient internal diameter to avoid "clipping" the sight path of the thermometer. Fig 6 gives recommended minimum diameters. The tube length should be minimised, consistent with standing the thermometer jacket clear of the outer wall of the incinerator.

7 Maintenance

CDB 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.

For further information detailing services supplied to any **CDB** thermometer system mountings and accessories, cross- refer to the System 4 Thermometer Mountings and Accessories Installation Guide.



PRODUCT WARRANTY

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

36 MONTHS WARRANTY



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

- SPOT thermometers, accessories* and mountings* and special instruments based on SPOT.
**Note: SPOT Actuators are provided with an 12 months Warranty.*
- System 4 thermometers, processors, accessories and mountings and special instruments based on System 4.
- UNO thermometers, accessories and mountings and special instruments based on UNO.
- Application-dedicated processors based on LANDMARK® Graphic.
- ABTS/S and ABTS/U
- FTS
- VDT/S and VDT/U
- DTT
- FLT5/B
- 4500 MkIII (Transmissometer and AFU-APS-I/O only)
- LWIR Thermal Imaging Cameras
- NIR-B / MWIR-B Thermal Imaging Cameras

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

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

24 MONTHS WARRANTY

The following Land Instruments International products are provided with a 24 months warranty:

- LSP-HD Linescanners
- NIR
- SDS-640

12 MONTHS WARRANTY

All other AMETEK Land products including NIR-B Camera Retraction and Mounting Systems, VIRALERT Human Body Temperature Screening Systems, Water Cooled Housings & Accessories, SPOT Actuator, and Air PurgeEquipment

PRODUCT WARRANTY

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.

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

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

- improper installation
- misuse
- unauthorised alteration
- inappropriate routing, support, physical shock & strain protection, etc. of the fibre-optic lightguide (where fitted)
- environmental conditions exceeding the IP / NEMA rating of the product
- inappropriate recalibration which results in product calibration being taken outside specification
- improper resealing of thermometer following parameter adjustment (UNO, FLT5/A, etc.)
- damage caused by an unauthorised repair
- consumables including filters, electrochemical cells, batteries and sorbents

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