

# LANDCAL R1500T

## USER GUIDE

ISSUE 9: MARCH 2026  
PUBLICATION Nº 198.033  
LANGUAGE: ENGLISH



 CALIBRATION SOURCE



**LAND**<sup>®</sup>  
**AMETEK**<sup>®</sup>



QUALITY CUSTOMER SOLUTIONS



## SAFETY WARNING

### **Insulation made from High Temperature Insulation Wool Refractory Ceramic Fibre, (better described as Alumino Silicate Wool) (ASW)**

This product contains alumino silicate wool products in its thermal insulation. These materials may be in the form of blanket or felt, formed board or shapes, mineral wool slab or loose fill wool. Whilst there is no evidence of any long term health hazards, we strongly recommend that safety precautions are taken whenever the materials are handled.

**Exposure to fibrous dust may cause respiratory disease.**

**When handling the material always use an approved respiratory protection equipment (RPE-i.e. FFP3), eye protection, gloves and long sleeved clothing.**

**Avoid breaking up waste material. Dispose of waste in sealed containers.**

**After handling, rinse exposed skin with water before washing gently with soap (not detergent). Wash work clothing separately.**

Before commencing any major repairs we recommend reference to the European Association representing the High Temperature Insulation Wool industry ([www.ecjia.eu](http://www.ecjia.eu))

### 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 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.

## Copyright

This manual is provided as an aid to owners of LAND's products and contains information proprietary to LAND. This manual may not, in whole or part, be copied, or reproduced without the expressed written consent of LAND.

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# 1 Introduction

The LANDCAL blackbody type R1500T provides a temperature source for the on-site or in-laboratory calibration of radiation thermometers up to a temperature of 1500°C (2750°F). The source has been designed primarily for the calibration of short wavelength thermometers (silicon cell and Germanium detectors) but it can also be used for thermometers fitted with other types of detectors. However when the calibration of longer wavelength thermometers are checked it is recommended that the calibration by comparison method is adopted.

Calibration is made by comparing the output from the thermometer under test with the target temperature.

The target temperature can be measured in 3 ways:

- 1) If traceability to national standards is not required, a check on the thermometer can be conducted by using the controller indication. From previous work, the indicated temperature has been found to agree with the radiance temperature to within  $\pm 10^{\circ}\text{C}$  at 1000°C when using thermometers operating at short wavelengths.
- 2) The temperature of the target can be measured by using a radiation thermometer of similar detector and optical characteristics, the calibration of which is traceable to national standards. This method of calibration can be described as calibration by comparison with a standard radiation thermometer.
- 3) Prior to supply, the relationship between the indicated controller temperature and the true radiance temperature, as measured by a secondary standard radiation thermometer, will have been determined and reported in a traceable calibration certificate for the source. The temperature of the target is determined using the controller indication and corrected for any errors as reported in the certificate.

A UKAS (United Kingdom Accreditation Service) Certificate of Calibration is available from LAND Instruments International for either the source or the radiation thermometer.

## 1.1 Safety information

Every effort has been made during the design and manufacture of this furnace to ensure that it meets National and International standards of product safety. However great care should be shown by the user at all times when operating and maintaining high power furnaces which are capable of achieving high temperatures.

To reduce the risk of accident, follow the instructions listed below:

Warning



To avoid the possibility of electric shock, never expose the elements, terminals or other electrical components with the source connected to the mains supply. After completion of a repair, replace all safety plates before switching on the source.



To avoid the possibility of burns never attempt to dismantle the source until it has cooled to a safe temperature. This may involve an overnight wait.



This source contains no asbestos. The alumina-silicate (ceramic fibre) materials used release dust when disturbed which may, in some individuals, be an irritant to the skin, nose and throat.

### Safety Note - Refractory Fibrous Insulation

This product contains alumino silicate wool products in its thermal insulation. These materials may be in the form of blanket or felt, formed board or shapes, mineral wool slab or loose fill wool. Whilst there is no evidence of any long term health hazards, we strongly recommend that safety precautions are taken whenever the materials are handled.

**Exposure to fibrous dust may cause respiratory disease.**

**When handling the material always use an approved respiratory protection equipment (RPE-i.e. FFP3), eye protection, gloves and long sleeved clothing.**

**Avoid breaking up waste material. Dispose of waste in sealed containers.**

**After handling, rinse exposed skin with water before washing gently with soap (not detergent). Wash work clothing separately.**

Before commencing any major repairs we recommend reference to the European Association representing the High Temperature Insulation Wool industry ([www.ecjia.eu](http://www.ecjia.eu))

We can provide further information on request. Alternatively, our Service Department can quote for any repairs to be carried out, either at your premises or at Land Instruments International.

## 2 Description

The LANDCAL blackbody source type R1500T is a transportable, self contained unit designed for use on any reasonably flat surface.

The cylindrical target with conical end is manufactured from silicon carbide and is designed to give a high emissivity cavity. The target is heated by radiant energy from six silicon carbide rod heaters. The source is fitted with a three term temperature controller which allows the source to heat up to 1500°C in about 30 minutes and holds it stable at temperatures to within  $\pm 1^\circ\text{C}$  ( $2^\circ\text{F}$ ).

If the source is used as a transfer source (i.e. calibration by comparison method adopted) a set of optional standard radiation thermometers will be required. The selection of standards will depend upon customer requirements, e.g. working temperature range, type of radiation thermometers to be calibrated etc. Ideally the standards should be of a similar type to those being tested as strict comparisons can then be made. The standards listed below are recommended.

### System 4

Type M1	Calibrated Temperature Range:	600 to 1500°C
Type M2	Calibrated Temperature Range:	500 to 1100°C

### Portable

Cyclops 100	Calibrated Temperature Range:	550 to 1500°C
-------------	-------------------------------	---------------

One standard should be returned each year to LAND for re-certification or at any time when a discrepancy is detected.

An optical bench assembly is also offered as an accessory. This is used as a convenient means of mounting and lining up the jacket used to house in turn the standard and test thermometers. It ensures that both items use the same sighting path. Vernier adjustments allow precise positioning.



Fig. 1 Landcal black body calibration source type R1500T

CA970248/a

### 3 Specification

Maximum working temperature:	1500°C/2750°F
Heating rate:	30 mins to 1450°C/2650°F
Recommended temperature range:	500°C/950°F to 1500°C/2750°F
Stability:	Radiance temperature variation $< \pm 1\text{K}$ ( $\pm 2^\circ\text{F}$ ) over a 30 minute period
Uniformity:	The temperature gradients across the middle 40mm of the 45mm cavity are within $\pm 2^\circ\text{C}$ at 500°C, and within $\pm 1^\circ\text{C}$ at 1500°C
Radiation cavity	
Material:	Silicon carbide
Design:	Cylinder with 120° conical end
Inner diameter:	45mm/1.8in
Internal length:	100mm/4.0 in. When the radiation cavity is installed in the source, the distance from front face to cone point is 180mm/7.1in
External aperture:	Approx. 38mm/1.5in.
Emissivity:	Approximately 0.99 at short wavelengths
Resistance heating elements:	220V/240V source. 6 off, SiC type 14/175/315.D.5/7.0 Part N° 135.160  110V/120V source. 6 off, SiC type 14/175/315.D.5/5.5 Part N° 135.162
Controller:	Eurotherm 3216 with RS 232 serial interface
Electrical supply:	220/240V a.c. 50/60 Hz                      Part Number 135.191 110/120V a.c. 50/60 Hz                      Part Number 135.180
Power consumption:	3.0 kW
Overall dimensions	
Height:	540mm/21.3in
Width:	350mm/13.8in (upper case) 380mm/15.0in (lower case)
Depth:	500mm/19.7in
Bench to cavity centre height:	355mm/14.0in
Weight:	
Nett:	26kg/57 lbs
Gross:	32kg/77 lbs
Uncertainty (with UKAS Certificate) 500°C to 1500°C:	$\pm 3$ to $\pm 3.5^\circ\text{C}$ / $\pm 6$ to $\pm 7^\circ\text{F}$

## 4 Electrical Supply

### 4.1 Electrical connections

A suitable single phase a.c. electrical supply with earth (ground) will be necessary. The supply may be live to neutral non reversible, live to neutral reversible or live to live. The furnace must be connected to the electrical supply for which it was ordered. Details of the voltage, current and frequency required are stated on the furnace plate attached to the furnace. The supply point must be within reach of the operator and must incorporate either an isolating switch or a quickly removable plug.

If the furnace is supplied with a mains cable fitted then it may be wired directly to an isolator or fitted with a line plug. Supply rated fuses will be internally fitted.

If the furnace is supplied without a mains cable, the specification for suitable cable for 220/240V operation is:

300/500 volt, PVC insulated 3 core cable. Each core 4mm<sup>2</sup> for 110/120V operation.

300/500 volt, PVC insulated 3 core cable. Each core 2.5mm<sup>2</sup> for 220/240V operation.

The colour code for the cable is:

Brown lead	Live
Blue lead	Neutral
Green Yellow lead	Earth (ground)

As no internal supply rated fuses are fitted, a permanent connection to an appropriately fused and isolated supply must be made to the internal terminals after temporary removal of the furnace panel.

### 4.2 Fuses

Refer to the circuit diagram, Fig. 2.

F1 Internal supply fuses are only fitted if a mains cable is fitted. The supply to the furnace should be fused to the same rating.

110/120V 40 amp fuse

220/240V 25 amp fuse

F2 Instrument circuit fuses 32mm x 5mm glass, 2 amp

F3 Heat light fuses 32mm x 5mm glass, 2 amp  
Not fitted for 220/240V operation  
Fitted for 110/120V operation

### 4.3 Earth leakage



Warning

It is recommended that this furnace is not used in conjunction with an earth leakage trip switch. At elevated temperatures all ceramic materials become slightly conductive. This may mean that at temperatures above 1000°C a leakage current in excess of 30 milliamps is present. This will cause an earth leakage trip switch to activate.



## 5 Commissioning

### 5.1 Inspection on receipt

Physically examine all items for any damage that may have occurred during transit. Check the contents against the packing note.

If any items have been damaged in transit, this should be reported to the carrier and to the supplier immediately, BUT DO NOT RETURN damaged items until the carrier has considered a claim. Save the packing with the damaged article for inspection by the carrier.

### 5.2 Furnace assembly

The following paragraphs describe the step by step procedure to prepare the furnace for switch on. See also Fig. 3.

Place the furnace in a well ventilated room on a surface which is resistant to heat. Ensure that there is free space around the furnace. Do not obstruct any of the vents in the control section, they are needed to keep the controls cool.

To minimise the risk of damage to the furnace during transit, the target cavity together with a ceramic plug, six silicon carbide heating elements and a set of element support brackets/braids are supplied separately. These items should be fitted as follows:

- 1) Remove the stainless steel front panel unscrewing the four equally spaced screws. The ceramic tube in the back of the furnace chamber supports the smaller end of the cavity.
- 2) Insert the cavity into the furnace so that the front edge of the cavity is level with the second layer of insulation.
- 3) Gently push the ceramic plug into the insulation to hold the target in place.
- 4) Replace the stainless steel plate.
- 5) Remove the four screws that hold the painted rear panel to gain access to the element connections.
- 6) Carefully insert the elements into the furnace ensuring that they locate into the recess at the front. Extreme care should be taken not to strain the elements as they are very fragile.
- 7) Position the element support brackets to locate onto the element heads and use the self-tapping screws to attach the brackets to the brickbox. Tighten firmly into position.
- 8) Attach the electrical connections as shown in Fig. 4 (220/240V) or Fig. 5 (110/220V).
- 9) Replace the back panel.
- 10) Connect the furnace to the mains supply as described in 'Section 4.0 - Electrical Supply'.

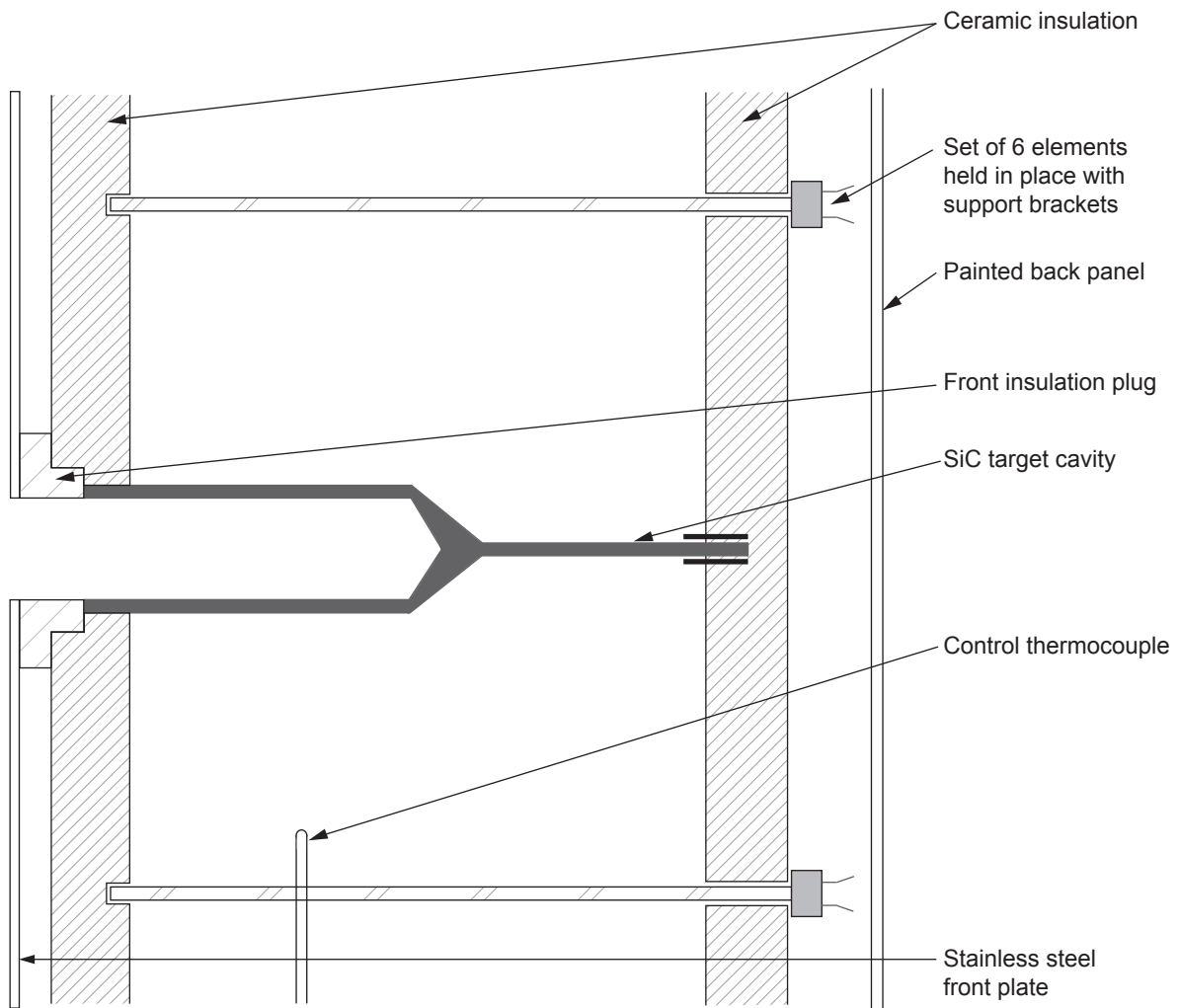


Fig. 3 Assembly diagram for the LANDCAL Blackbody type R1500T

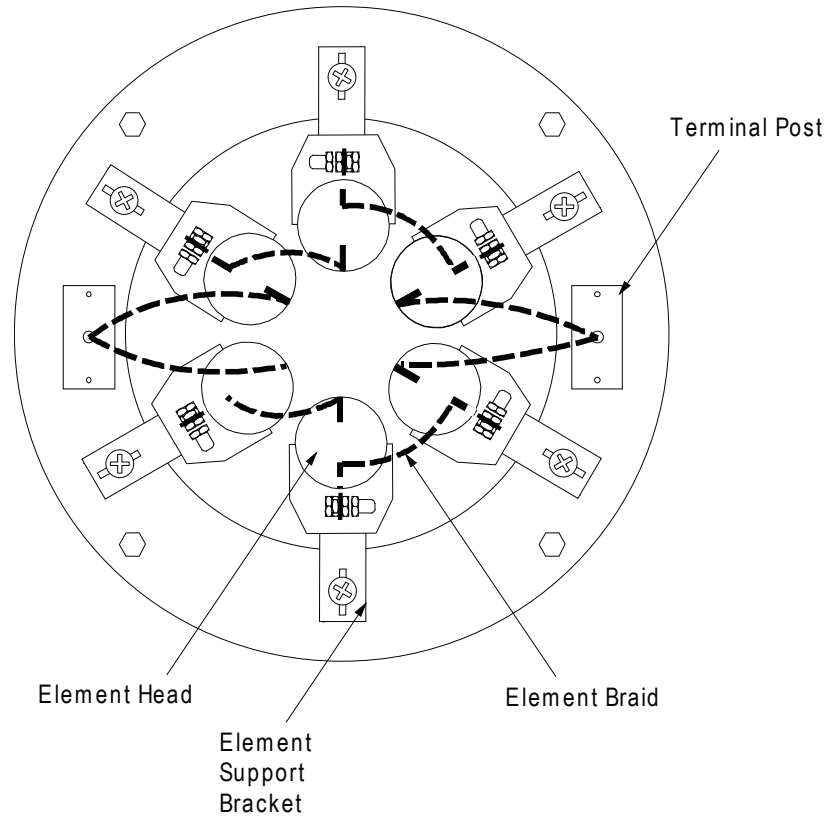


Fig. 4 Elements connections for the LANDCAL Blackbody Type R1500T- 220/240V

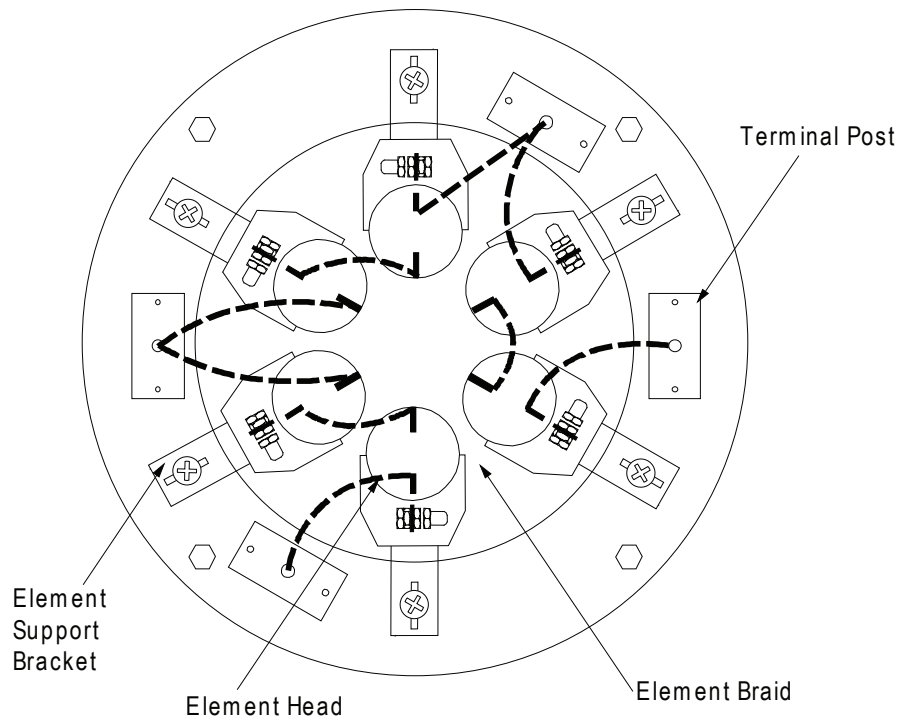


Fig. 5 Element connections for the LANDCAL Blackbody Type R1500T - 110/120V

### 5.3 Heating up the source



**Caution**

When the source is operated at any temperature above ambient, the front face and plate become hot.

The recommended temperature range for the source is 500°C to 1500°C (950°F to 2750°F). Set the controller to the required value as follows:-

- 1) When first switched on the controller goes through a self check procedure.
- 2) When this check is completed two displays will be visible.  
Upper display            Actual source temperature  
Lower display            Set point temperature
- 3) To modify the set point, press the 'Up' or 'Down' button until the required value is obtained.
- 4) The source will be ready for use at 1450°C (2650°F) approximately 30 minutes after switch on.
- 5) The output light 'OP' indicates the state of the controllers output signal to the solid state relay which in turn switches the power to the heating element.

**NOTE**

All other controller parameters are factory set and locked. It should not be necessary to adjust them.

### 5.4 Using the RS232C Serial Interface Port

The source is supplied with a sub-miniature D-socket connected to the controller communication module to give RS232 serial communication. RS232 is suitable for direct connection to a personal computer (PC), using a cable configuration as shown below. The linked pins at the computer end are recommended, but may not be necessary.

The required cable is a 9-pin to connect to the furnace, and either a 9-pin or 25-pin to connect to the computer.

#### RS232 Cable: Furnace to PC connections

Furnace end of cable - female		Computer end of cable - male		
<b>9-pin</b>		<b>9-pin</b>	(25-pin)	
<b>Rx</b>	<b>3</b> _____	<b>3</b>	(2)	<b>Tx</b>
<b>Tx</b>	<b>2</b> _____	<b>2</b>	(3)	<b>Rx</b>
<b>Com5</b>	_____	<b>5</b>	(7)	<b>Com</b>
		<b>7,8</b>	(4,5)	<b>Link together</b>
		<b>1,4,6</b>	(6,8,20)	<b>Link together</b>

The source is shipped with the RS232C communications protocol set to MODBUS, with the baud rate set to 9600 and no delay. The communication address is set to 1.

The source must only be connected and used with a PC by a person who understands how the serial communications function operates. If further information is required, either contact your local Eurotherm agent and request a copy of the Series 3000 Communication handbook, or consult the Eurotherm website.

## 6 Using the Furnace

### 6.1 Introduction

The furnace has been designed to create a target of uniform temperature with a high emissivity at short wavelengths for calibrating radiation thermometers. The target is a conical cavity at one end of a hollow cylinder, and the thermometer views the target along the axis of the cylinder.

The cone plays an important part in establishing uniformity of radiation emitted by the target and when calibrating radiation thermometers the target size requirements must be met by the cone. If the thermometer target size is so big that the walls of the cylindrical block are viewed, a less accurate calibration will result.

### 6.2 Measuring thermocouple/indicating controller

A thermocouple situated between the heating elements and the conical target is used to measure and control the temperature. The controller's digital indicator on the side of the furnace displays the temperature measured.

Agreement between the thermocouple measurement and a reference standard radiation thermometer is better than  $\pm 20^{\circ}\text{C}$  at  $1500^{\circ}\text{C}$ ,  $\pm 10^{\circ}\text{C}$  at  $1000^{\circ}\text{C}$ .

The errors are repeatable, and a correction curve can be obtained with a Certificate of Calibration for the source. A UKAS (United Kingdom Accreditation Service) Certificate of Calibration is available from LAND Instruments International.

### 6.3 On-site use

The source is transportable, so it can be used either in the laboratory where the radiation thermometers are brought to the source for checking or taken to site where the source is used close to the thermometer installations.

Before taking to site it is recommended that the elements are removed from the source and carried separately in the foam lined boxes provided. After use it is recommended that if possible the source is left to cool to an internal temperature of below  $200^{\circ}\text{C}$  and the elements again removed before shipment. These precautions will extend the life of the heating elements.

## **7 Calibration of Radiation Thermometers**

### **7.1 Preparation**

The furnace control setting will usually be the normal working temperature of the thermometer to be tested. The target temperature is either that indicated by the measuring thermocouple displayed on the controller indicator, or that indicated by a standard radiation thermometer.

### **7.2 Thermometer calibration**

When the source is stable at the chosen control temperature, place the thermometer under test in the holder and measure the thermometer output. Note the target temperature immediately.

### **7.3 Calibration procedures**

When calibrating radiation thermometers it is important to follow documented step-by-step procedures to ensure that specified calibration conditions are met, irrespective of operator. If difficulty is experienced in writing procedures, LAND Instruments International will be pleased to offer guidance.

## 8 Maintenance

### 8.1 Routine servicing

The source is fully tested and evaluated before supply and should give years of trouble free operation. No regular servicing or maintenance is required. The outer surfaces may be cleaned with a damp cloth. Do not allow water to enter the case. Do not clean with organic solvents.

In the unlikely event of a failure we would recommend the source is returned to a LAND company direct or to one of the LAND distributors for repair.

Sections 8.2 to 8.4 provide information for the customer replacement of consumable items.

### 8.2 The heating elements

Silicon carbide elements oxidise slowly during use, resulting in increasing resistance. The effect is offset by re-adjustment of the power regulator.

A time will come when the resistance becomes so high that correct adjustment is unobtainable. At this point the elements must be changed.

In the event of an element failure, replace it in the manner described in Section 5.2. It is advisable to replace all elements if only one or two fail, because new elements have a lower resistance than used ones which have aged. The elements are series connected and the lower voltage drop across a new element will tend to cause premature failure of the remaining older elements. The good older units can be saved to make up a set of part worn elements.

### 8.3 The control thermocouple (Pt 13% Rh/Pt)

Replacement of the control thermocouple is carried out as follows:

- 1) Make sure that the furnace is not connected to the mains supply.
- 2) Remove the lower side panel not containing the controller.
- 3) Disconnect the thermocouple assembly from the insulation cylinder.
- 4) Disconnect the thermocouple from the connector block.
- 5) Remove the thermocouple from its sheath.
- 6) Fit the new thermocouple, connecting the positive leg (Pt 13% Rh) to the positive side of the compensating lead (coloured red) and the Pt leg to the green lead.
- 7) Re-connect the thermocouple assembly.
- 8) Replace the cover.

## 8.4 Replacing solid state relays

- 1) Disconnect the furnace from the electrical supply.
- 2) Remove the lower side panel (not containing controller) from the furnace. Locate the solid state relay(s), removing any other panels necessary to give reasonable access.
- 3) Disconnect the five wires, noting their numbers and positions.
- 4) Remove the faulty relay and replace it with a new one, noting which way round to fit it.

Original relays are fitted with a thin layer of 'off-white' paste to give good heat transfer to the aluminium sheet. New relays are supplied with a heatsink 'pad'. All remnants of the old heatsink paste must be removed. The thin white heatsink pad must be fitted between the solid state relay and the plate to which it is mounted.

- 5) Tighten the two fixing screws.
- 6) Refit the wires as noted in step (iii). If the replacement solid state relay is supplied with a metal oxide varistor (MOV) it must be connected between the load terminals as shown in Fig. 6. It is not polarity dependent. The MOV protects the SSR from short periods of excess voltage. If the replacement SSR is supplied without an MOV this is because later versions have the MOV built in.
- 7) Replace the panel(s).
- 8) Reconnect the furnace to the electrical supply.

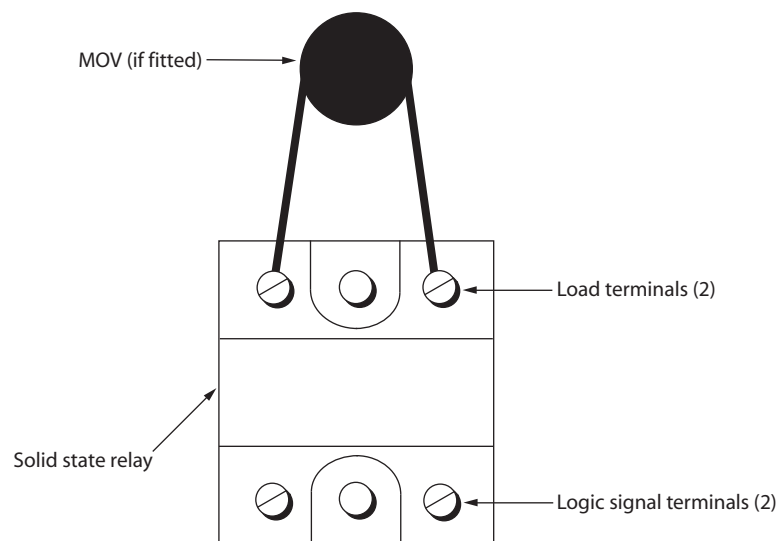


Fig. 6 Connections to solid state relays

CA970252

## 9 Fault Finding

### 9.1 Furnace does not heat up

- |                                     |   |  |
|-------------------------------------|---|--|
| The <b>HEAT</b> light is <b>ON</b>  | → The heating element has failed  | → Check also that the SSR is working correctly   |
| The <b>HEAT</b> light is <b>OFF</b> | → The controller shows a <b>very high temperature</b> or a code such as <b>S.Br</b> | → The thermocouple is broken or has a wiring fault   |
|                                     | The controller shows a <b>low temperature</b>                                       | → The door switch(es) (if fitted) may be faulty  |
|                                     |   | → The contactor (if fitted) may be faulty  |
|                                     |   | → The SSR could be failing to switch on due to internal failure, faulty logic wiring from the controller, or faulty controller |
|                                     | There are no lights glowing on the controller                                       | → The <b>SUPPLY</b> light is <b>ON</b>   |
|                                     |   | The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault                                |
|                                     |   | → The <b>SUPPLY</b> light is <b>OFF</b>  |
|                                     |   | Check the supply fuses and any fuses in the furnace control compartment  |

### 9.2 Furnace Overheats

- |   |   |  |
|---|---|--|
| The <b>HEAT</b> light goes <b>OFF</b> with the instrument switch        | → The controller shows a <b>very high temperature</b> | → The controller is faulty   |
|   | → The controller shows a <b>low temperature</b>       | → The thermocouple may have been shorted out or may have been moved out of the heating chamber |
|   |   | → The thermocouple may have been mounted the wrong way round                                   |
|   |   | → The controller may be faulty   |
| The <b>HEAT</b> light <b>does not go OFF</b> with the instrument switch | → The SSR has failed <b>ON</b>                        | → Check for an accidental wiring fault which could have overloaded the SSR                     |

## 10 Eurotherm Temperature Controller Type 3216CC

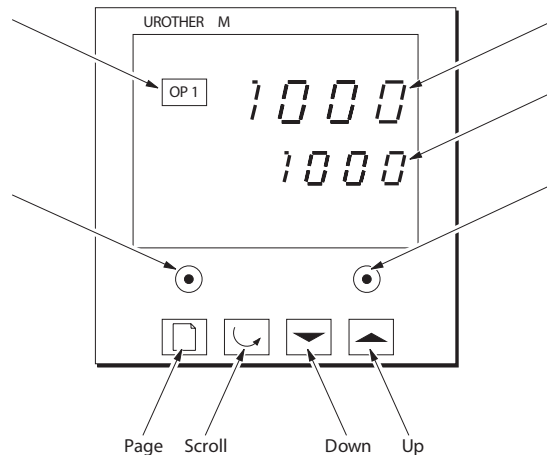


Fig. 5 'Eurotherm' Controller - front panel controls

### 10.1 Introduction

When switched on, the controller lights up, goes through a short test routine, and then displays the measured temperature and starts to control. The output light glows or flashes as heating occurs.

In **Level 1** operation, both the setpoint temperature and the actual measured temperature are displayed.

The **Page** key allows access to the **Level 2** mode of operation. When in **Level 2**, the parameter lists within the controller can be displayed.

The **Scroll** key allows access to the adjustable parameters within the controller. Most lists and parameters are hidden and cannot be accessed by the operator even when in **Level 2** mode of operation. These hidden features contain factory-set parameters which should not be changed.

The **Up** and **Down** keys are used to alter the setpoint temperature in **Level 1** operation and parameter values when in **Level 2** operation.

To enter the **Level 2** mode of operation:

- 1) Press and hold the **Page** key for 3 seconds.
- 2) The display will show **Leu 1 Goto**. Release the **Page** key.
- 3) Press the **Up** or **Down** button to choose **Leu 2** (Level 2).
- 4) Press the **Up** or **Down** button to enter the Level 2 access code, which is **9**.  
The Home page is displayed.

The parameters within Level 2 are:

- 1) Press the scroll button. **WRK.OP** (working output) is displayed.
- 2) Press the scroll button. **SP.RAT** (setpoint rate limit) is displayed. This is set to **OFF**, but is adjustable.
- 3) Press the scroll button. **OP.HI** (maximum power output setting) is displayed. This is factory-set, but is adjustable downwards.
- 4) Press the scroll button. **ADDR** (communications address) is displayed. This is set to **1** and is adjustable.

- 5) Press the scroll button. **UNITS** (display units) is displayed. This is used to select °C or °F operation.

To return to the Level 1 mode of operation:

- 1) Press and hold the **Page** key.
- 2) Press the down key to select **Leu 1**.

## 10.2 Altering the Setpoint

- 1) Press either the **Down** or **Up** key once to display the setpoint.
- 2) Use the **Down** or **Up** key to adjust the setpoint value.  
The display returns to the measured temperature when no key is pressed for 0.5 seconds.

## 10.3 Altering the Ramp Rate

- 1) Press the **Scroll** key until **SP.RAT** (SetPoint ramp rate) is displayed.
- 2) Use the **Down** or **Up** key to adjust the ramp rate value.  
The ramp rate sets the maximum rate of heating or cooling in degrees per minute. A value of **OFF** cancels the ramp rate, allowing heating and cooling at the maximum rate. **OFF** is the default setting.

## 10.4 Altering the Power Limit (when applicable)

- 1) Press the **Scroll** key until **OP.Hi** (Output High) is displayed.
- 2) Press the **Down** key once to display the value of **OP.Hi ...and write down the value.**

Warning

Do not increase the value without correct calculation: the furnace elements or wiring could burn out.

- 3) To alter the value, use the **Down** or **Up** key. Do not set the value to zero: this will prevent the furnace from heating.

## 10.5 °C to °F Conversion

To change the controller from °C to °F operation:

- 1) Press the **Scroll** key until **UNITS** is displayed.
- 2) Use the **Down** or **Up** key to select the required units of measurement.

## 10.6 Altering the Communication Address

- 1) Press the scroll key until **Addr** (address) is displayed.
- 2) To alter the value press the **Down** or **Up** key.

The display returns to the measured temperature when no key is pressed for 45 seconds.

**Warning**

Do not alter any other parameters.

## 11 Spares

The following spare parts are available for use with the Landcal Type R1500T:

<b>Description</b>	<b>Land Part N°</b>
Silicon carbide target	135.161
Set of 6 heating elements - 220/240 Volts	135.160
Set of 6 heating elements - 110/120 Volts	135.162
Front insulation plug	135.165

## 12 Accessories

The accessories listed below are available for use with the Landcal Type R1500T:

Description	Land Part N°
UKAS Certification of Landcal R1500T (range 500 to 1500°C)	089.005

Optical Bench Calibration Accessory 135.204

**Note 1:** The Optical Bench Calibration Accessory enables simple line up of Land fixed installation radiation thermometers. When the source is stood on the optional carrying case, the bench to mid-target dimension equals that of the optical bench assembly.

**Note 2:** Mounted onto the 36in / 915mm long optical bench are vertical and horizontal adjustment positioners, which allow precise alignment of Land radiation thermometers. The accessory is supplied with the following items:

- A thermometer jacket holder suitable for mounting Land System 3 thermometers.
- This holder can also be used for mounting Land Solo and Land Micrathem thermometers.
- A separate holder for mounting Land System 4 thermometers.
- This holder can also be used for mounting Land Fibroptic type thermometers.
- The holders are fitted with quick-release connectors.



## PRODUCT WARRANTY

This LAND manufacturer's 'back-to-base' warranty covers LAND products ("Product") to be free from defects in material and workmanship. The warranty period commences on the date the Product is delivered from LAND. LAND shall at its option repair or replace the defective part of the Product.



### 36 Months Warranty

- 4400 and 4500 MkIII (Transmissometer and AFU-APS-I/O only)
- Application-dedicated processors based on LANDMARK<sup>®</sup> Graphic
- DTT
- FLT5/B
- FTS
- LWIR Thermal Imager
- NIR-b and MWIR-b borescope thermal Imagers
- SPOT+ thermometers, accessories and mountings and special instruments based on SPOT+
- 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
- VDT/S and VDT/U



### 24 Months Warranty

- LSP-HD Linescanners
- Model FG
- MWIR, NIR Thermal Imagers
- SDS-640



### 12 Months Warranty

All other LAND Product including NIR-b Camera Retraction and Mounting Systems, Water Cooled Housings & Accessories, SPOT+ Actuator, and Air Purge Equipment.

## EXCLUSIONS FROM WARRANTY

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

The foregoing warranty shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer
- Customer-supplied hardware, software or interfacing
- Improper installation
- Misuse of the Product
- Unauthorised alteration
- Inappropriate routing, support, physical shock & strain protection, etc. of the fibre-optic lightguide (where fitted)
- Operation outside of the temperature specifications of the Product
- 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

### RETURNS PROCEDURE

All items returned to LAND under warranty must have a Return Merchandise Authorisation (RMA). Please contact LAND Customer Service for the necessary authorisation.

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