

# LANDCAL P550P

## USER GUIDE

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 CALIBRATION SOURCE



**LAND**  
**AMETEK®**



QUALITY CUSTOMER SOLUTIONS

### 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 the loss of data.

### Equipment Operation

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

### 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 Instruments International.

### 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 Instruments International.

### Storage

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

### 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 done as stated in local regulations.

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**For further details on all LAND/Ametek offices, distributors and representatives, please visit our websites.**

## 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. They will be able to advise you on the correct returns procedure.

Any item returned to Land Instruments International 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.



Approvals apply in the USA

**CE** This instrument complies with current European directives relating to Electromagnetic Compatibility 89/336/EEC and Low Voltage Directive 73/23/EEC.

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 both CE and IP classifications to this product may be invalidated if alterations or additions are made to the structural, electrical, mechanical or pneumatic parts of this system. Such changes may also invalidate the standard terms of warranty.

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## 1.0 LANDCAL BLACKBODY SOURCE TYPE P550P

### 1.1 Introduction

The LANDCAL blackbody source type P550P is a variable temperature, portable black body radiation source designed for use at temperatures up to 550°C (1020°F).

The source is a primary standard black body for the high precision calibration of radiation thermometers over the range 50°C to 550°C (120 to 1020°F). When the set point temperature is reached, the output from the thermometer under test is compared with the temperature of the source as measured by an optional Platinum resistance thermometer whose calibration is traceable to National Standards.

When used in conjunction with the Platinum resistance thermometer, which is supplied complete with a UKAS (United Kingdom Accreditation Service) calibration certificate, high precision is obtained. Alternatively the source can be used in three other ways.

- 1) If traceability to National Standards is required to a larger value of uncertainty, a UKAS certificate of calibration for the source can be supplied. The relationship between the indicated temperature on the controller and the radiance temperature, as measured by a secondary standard radiation thermometer, is reported.
- 2) The temperature of the source can be measured by using a radiation thermometer of traceable calibration. This method of calibration can be described as calibration by comparison with a standard radiation thermometer. This method of calibration usually results in the most accurate as errors due to temperature gradients and non-black body conditions are eliminated.
- 3) If traceability to National Standards is not required, the source can be used without any certification. From previous work, the temperature, as shown on the controller indication, has been found to agree with the radiance temperature to within  $\pm 8\text{K}$  ( $\pm 15^\circ\text{F}$ ).

The source provides a wide angle target which makes it ideal for use with both fixed installation and portable, hand-held thermometers.

To make the lining up of LAND fixed installation radiation thermometers simpler, an optical bench assembly is offered as an optional extra. When the source is stood on the optional carrying case, the bench to mid target dimension equals that of the optical bench assembly.

### 1.2 Safety

Every effort has been made during the design and manufacture of this source to ensure that it meets National and International standards of product safety. However, great care must be taken by the user at all times when operating and maintaining sources that are capable of achieving high temperatures.

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#### Warning



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



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



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

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## 2.0 DESCRIPTION

The LANDCAL blackbody source type P550P comprises a cylindrical closed end tube (cavity) approximately 160mm (6.3in) long with an internal diameter of 65mm (2.6in). The cavity is manufactured from Aluminium which is blackened and the closed end is angled at 120° to increase the emissivity value.

The cavity is heated using mineral insulated rod heaters. The temperature is controlled by a thermocouple connected to a 3-term digital controller having a  $\pm 0.1^{\circ}\text{C}$  or  $\pm 0.1^{\circ}\text{F}$  resolution.

An optional standard platinum resistance thermometer possessing a traceable UKAS (United Kingdom Accreditation Service) Certificate can be inserted into the cavity from the front of the source and used to determine the true (radiance) temperature.



Fig. 1 Landcal Blackbody source Type P550P

CA970258

**3.0 SPECIFICATION**

Maximum temperature range:	50 to 550°C (120.0 to 999.9°F)*
Recommended temperature range:	50 to 500°C (210 to 930°F) - continuous operation. <b>Note:</b> continuous operation at temperatures above 500°C will reduce the life of the elements and the cooling fan.
Heating rate:	Approx. 60 minutes to 500°C (930°F)
Stability:	Radiance temperature variation $<\pm 0.5\text{K}$ ( $\pm 1^\circ\text{F}$ ) over a 30 minute period
Uniformity:	The temperature gradients across the middle 50mm of the 65mm cavity are within $\pm 0.2^\circ\text{C}$ at 150°C and $\pm 0.5^\circ\text{C}$ at 500°C.
Radiation cavity -	Material: Aluminium with black, high temperature refractory coating
	Design: 120° cone
	Inner diameter: 65mm (2.6in)
	Internal length: 160mm (6.3in)
Emissivity:	$>0.995$
Controller input:	Type N thermocouple
Controller:	Eurotherm 3216 with RS232 serial interface
Electrical Supply:	220/240V, 50 to 60 Hz. Part No. 135.182 110/120V, 50 to 60 Hz. Part No. 135.198
Power consumption:	0.8 to 1.0kVA (220/240V operation)
Measuring sensor - (if supplied)	Type: Platinum Resistance Thermometer (UKAS certified)
	Length: 450mm (17.7in) plus 2m (78.7in) cable
	Diameter: 6mm outer diameter, inconel sheath
	Uncertainty: $\pm 0.2\text{K}$ or better
	Part N°: 135.142
Overall dimensions -	Height: 185mm (7.3in)
	Width: 260mm (10.2in)
	Depth: 315mm (12.4in)
Bench to tube centre height:	100mm (2.5in)
Weight -	Nett: 11kg (24.2lb)
	Gross: 13kg (28.6lb)

**NOTE\***

The controller fitted to the furnace is configured for °C operation. If °F operation is required, details of how to re-configure the controller can be found in the Controller Operating Instructions.

If °F mode of operation is selected the maximum temperature of the source will be 999.9°F which is equivalent to 537°C. Do not attempt to remove the decimal point as this will corrupt control parameters.



## 5.0 COMMISSIONING

### 5.1 Inspection on Receipt

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

If any items have been damaged in transit, report this to the carrier and to the supplier immediately, BUT DO NOT RETURN damaged items until the carrier has considered a claim. Retain the packaging with the damaged article for inspection by the carrier.

### 5.2 Connections to the electrical supply

Connect the brown lead to live, blue to neutral and green/yellow to earth. When connected to the electrical supply and switched on, the instruments will light. At no time should any panels be removed when connected to the supply.

### 5.3 Heating up the source



#### Note

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

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The source can be operated at any temperature in the range 50 to 550°C (120 to 1020°F).

To set the controller to the required value:

- 1) When the power is connected, the fluorescent indicator panel displays the measured value (upper display) and the set point value (lower display).
- 2) To raise or lower the set point value, depress the respective up/down button. After a short delay, the setpoint will change in the required direction. Release the up/down button when the required temperature value is reached.
- 3) If the source is used in conjunction with a residual current circuit breaker, it is possible that on initial heat up the breaker will trip. This is due to the fact that the heater insulation material is hygroscopic and may have absorbed moisture from the atmosphere. This causes the insulation resistance to fall and in a few instances the circuit breaker will trip. Under such conditions the solution is to operate the source for a short time on an unprotected supply until the heat removes the moisture and the insulation resistance returns to a very high value.



#### Note

All other control parameters are factory set and locked. For correct operation, it is not necessary to adjust any other parameters.

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#### 5.4 Cooling down the source



#### Warning

If this cooling down procedure is not followed, the controller and control circuit may overheat and damage could occur.

A fan is fitted to the source to keep the controller cool and also to increase the cooling rate. If the source has been operated at a temperature in excess of 200°C it is important to allow the source to reduce in temperature before it is disconnected from the mains supply.

After work on the source is completed, a set point temperature of 50°C must be selected. When the source temperature has fallen to a safe value, the source may be switched off.

#### 5.5 Failure of the cooling fan

On rare occasions, the cooling fan may fail. This means that the recommended cooling down procedure cannot be followed. Failures are more common when the source is used extensively at temperatures of 500°C / 870°F and above. To ensure satisfactory operation of the source, the fan should be replaced as soon as possible. See section 8.2 for more information.

The controllers need to be protected from overheating so an over-temperature protection circuit is built into the source. The source can be operated with a fan that has failed. However, if the temperature of the controllers exceed maximum permissible limits a bimetallic over-temperature switch will trip, which cuts power to the heaters. This switch will remain open until the controller temperature falls to a safe level. This may take several minutes. The switch will then close and the temperature of the source will start to rise again.

The effect of switching off and switching on of power to the heaters will give very unstable temperature readings.

#### 5.6 Using the RS 232 serial interface port

Connect the source to the personal computer (PC) as shown in Table 1.

Source. 9 pin 'D' connector	Controller terminal	Function	PC connector	
			25 pin	9 pin
Terminal 2	HE	Rx (receive)	Terminal 2	Terminal 3
Terminal 3	HF	Tx (transmit)	Terminal 3	Terminal 2
Terminal 5	HD	Comm	Terminal 7	Terminal 5

Table 1 P550P to PC serial communications (RS 232) connection schedule

## 6.0 USING THE SOURCE

### 6.1 Introduction

The P550P has been designed to create an enclosure of uniform temperature, ideal for the calibration of radiation thermometers. The cone point of the cavity is placed in the area of minimum gradients within the source. When calibrating radiation thermometers, the target size requirements of the thermometer should, whenever possible, be fulfilled by the cone. If the thermometer views the walls of the cavity, results of greater uncertainty will be achieved.

### 6.2 Measuring sensor (Platinum resistance thermometer) - if supplied

Provision has been made to measure the temperature of the target block using a Platinum resistance thermometer, which can be inserted from the front of the source into the cavity. When placed in the measuring position, the temperature of the source, as measured by the sensor, agrees with the cone point radiance temperature to within  $\pm 1\text{K}$  ( $\pm 2^\circ\text{F}$ ) over the range 50 to 350°C (122 to 660°F) and to within  $\pm 2\text{K}$  ( $\pm 4^\circ\text{F}$ ) over the range 350 to 500°C (660 to 930°F). Above 500°C (930°F), agreement to within  $\pm 3^\circ\text{C}$  ( $\pm 6^\circ\text{F}$ ) will be achieved.

The output from the sensor must be measured on an indicator or digital voltmeter having a resolution of 0.1°C.

This is the recommended way to obtain the true temperature of the target cavity. The temperature indication on the controller must not be used as an accurate measurement of target cavity temperature.

### 6.3 Continuous operation of the Landcal P550P

The Landcal P550P is a compact calibration source that is designed to check the calibration of radiation thermometers.

To ensure that the controllers within the source remain cool during operation, a cooling fan is fitted. It is important that this fan is running whenever the source is operating. This is particularly important if the source is operation above 300°C (570°F). Premature failure of the controllers will occur if the source is operated repeatedly at temperatures in excess of 300°C (570°F) without the fan running. See section 5.3 to 5.5 for more details.

The source is designed for use over the range 50 to 550°C (120 to 1020°F). Continuous operation at the top of this range will reduce the life of the cooling fan and heating elements.

## 7.0 CALIBRATION OF RADIATION THERMOMETERS

### 7.1 Preparation

The control setting will usually be the normal working temperature of the thermometer to be tested.

For calibration checks that are traceable to National Standards, the target temperature is that indicated by the standard platinum resistance thermometer. If traceability is not required, the source can be used without the resistance thermometer. From previous work, the temperature as shown on the control indication has been found to agree with the radiance temperature to within  $\pm 5\text{K}$ .

To make the lining up of LAND fixed installation radiation thermometers simpler, an optical bench assembly is offered as an optional extra. When the source is stood on the optional transportation case, the bench to mid target dimension equals that of the optical bench assembly. Portable radiation thermometers are usually hand held.

Position the holder on the optical bench to obtain the desired distance between target and thermometer. Adjust the vertical and transverse vernier screws to sight the holder correctly on the target.

### 7.2 Thermometer calibration

When soaked conditions have been obtained, place the thermometer in the holder and measure the thermometer output on the measuring apparatus. Immediately after measure the output from the standard platinum resistance thermometer.

Convert both outputs into temperature by reference to the relevant calibration tables and compare.

### 7.3 Accuracy of calibration

The source has been designed for the accurate calibration of LAND radiation thermometers. The accuracy that can be achieved by using the source is dependent on:

- 1) The uncertainty of calibration and resolution of the measuring resistance thermometer.
- 2) The emissivity of the source.
- 3) The resolution of the radiation thermometer under test.
- 4) The temperature gradients present in the source.

The uncertainty of the resistance thermometer, specified on the calibration certificate issued by the calibration laboratory, will be a function of:

- 1) The calibration laboratories capabilities.
- 2) The type of resistance thermometer under test.
- 3) The temperature range covered.

A value of  $\pm 0.2\text{K}$  at  $500^\circ\text{C}$  is typical for the uncertainty. A value of  $\pm 0.1$  to  $\pm 1.0\text{K}$  ( $\pm 0.4$  to  $\pm 2.0^\circ\text{F}$ ) should be specified for the resolution, depending on the type of measuring equipment used.

As the emissivity of the source is less than 1.00, the radiance temperature will be dependent on the wavelength of the thermometer under test. For example, a source operating at a temperature of  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ), with emissivity of 1.00 will show a temperature of  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ) for a thermometer having a pyroelectric (wavelength = 8 to  $14\mu\text{m}$ ) detector. However, a source operating with emissivity of 0.995 at  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ) for the same thermometer will show a radiance temperature of  $49.8^\circ\text{C}$  ( $121.6^\circ\text{F}$ ) for the same thermometer. At a temperature of  $500^\circ\text{C}$  ( $932^\circ\text{F}$ ) for the same thermometer, the measured radiance temperature will be  $498.3^\circ\text{C}$  ( $928.9^\circ\text{F}$ ).

Most hand held thermometers and fixed installation thermometers used in conjunction with an indicator have a resolution of  $\pm 1\text{K}$  ( $\pm 2^\circ\text{F}$ ). Fixed installation thermometers, whose output is measured on a digital voltmeter, will have a resolution of  $\pm 0.1$  to  $\pm 0.5\text{K}$  ( $\pm 0.2$  to  $\pm 1.0^\circ\text{F}$ ).

Any temperature gradients within the source will cause a difference between the temperature as measured by the resistance thermometer and the true radiance temperature of the source. Values of  $\pm 0.5\text{K}$  ( $\pm 1^\circ\text{F}$ ) at  $50^\circ\text{C}$  rising to  $\pm 2\text{K}$  ( $\pm 4^\circ\text{F}$ ) are typical.

To determine the best measurement capability, the uncertainty of each individual measurement component should be added together. Typical values are as follows:

at  $50^\circ\text{C}$  uncertainty is  $\pm 1\text{K}$  ( $\pm 2^\circ\text{F}$ )

at  $500^\circ\text{C}$  uncertainty is  $\pm 5\text{K}$  ( $\pm 10^\circ\text{F}$ )

#### 7.4 Calibration procedures

When calibrating radiation thermometers, it is important to follow documented step-by-step procedures to ensure that specified calibration conditions, such as calibration distance, furnace temperature and aperture size are always met.

If you experience any difficulty in writing your own procedures, LAND would be pleased to offer guidance as to which calibration conditions must be adopted for LAND products.

## 8.0 MAINTENANCE

### 8.1 *Incorrect operation/failure*

The source is fully tested and evaluated before supply and should give years of trouble free operation. No regular servicing or maintenance is required. In the unlikely event of a failure, we recommend the source is returned either directly to a LAND company, or to one of the LAND distributors for repair.

### 8.2 *Replacing the cooling fan*

- 1) Disconnect the source from the mains supply.
- 2) Remove the eight screws that secure the top half of the case, and lift it off the case. The fan is now visible.
- 3) Remove the four screws that hold the fan in place.
- 4) Disconnect the push-fit power connections on the fan and lift out the fan unit.
- 5) Insert the new fan unit and secure it with the four screws. Remember to re-connect the earth lead.
- 6) Reconnect the push-fit power connections to the fan.
- 7) Refit the lid and attach it with the eight screws.

The fan is now replaced and the source can be reconnected to the mains power supply.

### 8.3 *Certification*

To continue to carry out calibration checks which are traceable to National Standards, it will be necessary to obtain a Certificate of Calibration. Depending on useage, and the method of calibration employed, the Platinum resistance thermometer and/or the P550P source and/or the standard radiation thermometer should be returned to LAND every 1 to 3 years for recertification. Certificates of Calibration are available from Land Instruments International, UK and Ametek Land, USA which meet the requirements of ISO 17025.

### 8.4 *Storage and transportation case*

A custom built aluminium storage and carrying case is available as an optional extra. Use of this case is recommended.

## 9.0 EURO THERM TEMPERATURE CONTROLLER TYPE 3216CC

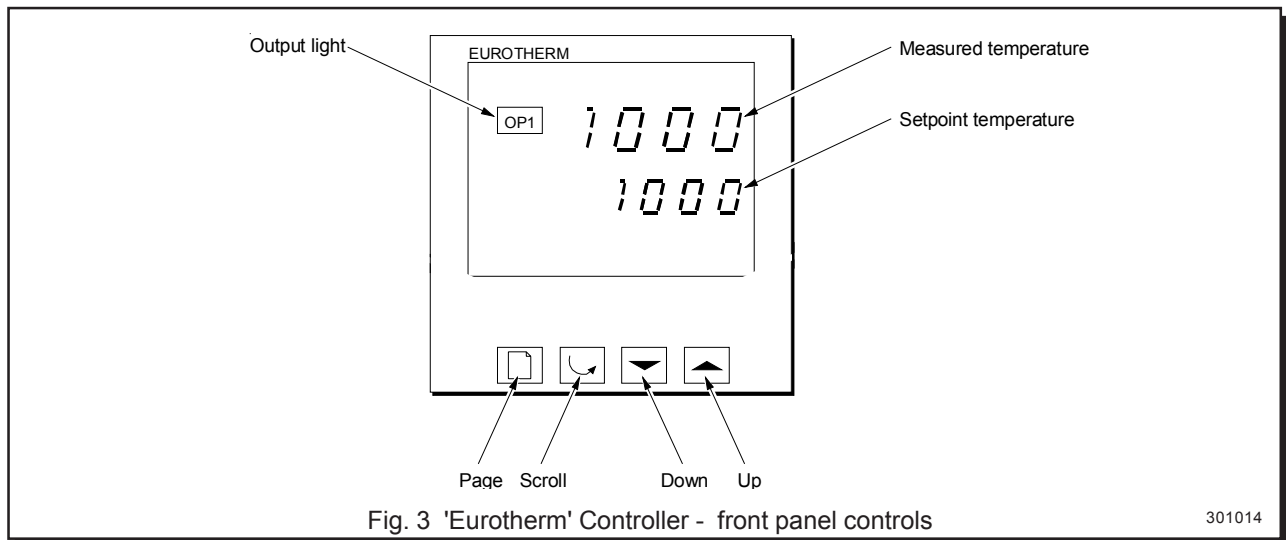


Fig. 3 'Eurotherm' Controller - front panel controls

301014

### 9.1 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. **SP.RAT** (setpoint rate limit) is displayed. This is set to **OFF**, but is adjustable.
- 2) Press the scroll button. **OP.HI** (maximum power output setting) is displayed. This is set to **100.0**, but is adjustable downwards.
- 3) Press the scroll button. **ADDR** (communications address) is displayed. This is set to **1** and is adjustable.
- 4) 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**.

## 9.2 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.

## 9.3 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.

## 9.4 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.

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- 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.

## 9.5 °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.

## 9.6 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.

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### Warning

Do not alter any other parameters.

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## 10.0 SPARES

No spare parts are available for this instrument.  
Contact LAND if you have a specific requirement.

## 11.0 ACCESSORIES

The accessories listed below are available for use with the Landcal Blackbody Source Type P550P.

Description	Land Part N°
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Carrying Case	135.130
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UKAS Certification of Landcal P550P (range 50 to 550°C)	089.005
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Platinum Resistance Thermometer (PRT) complete with UKAS certificate	135.142
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**Note:** The cost of re-certification of the PRT is comparable with to the purchase of a new unit. Therefore, it is recommended that a replacement is purchased when re-certification is required.

Optical Bench Calibration Accessory	135.204
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**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 Micratherm 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.

# LAND

**AMETEK**<sup>®</sup>  
PROCESS & ANALYTICAL INSTRUMENTS

## 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

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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:-

- 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<sup>®</sup> Graphic.
- ABTS/S and ABTS/U.
- FTS.
- VDT/S and VDT/U.
- DTT.
- FLT5/A.

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

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

- ARC.
- FTI-E.

### 12 MONTHS WARRANTY

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All Land Instruments International products not provided with either a 36 month or 24 month warranty (see lists above), are provided with a 12 months warranty.

# PRODUCT WARRANTY

## EXCLUSIONS FROM WARRANTY

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It should be noted that costs associated with calibration checks which may be requested during the warranty period are not covered within the warranty.

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:-

- incorrect electrical wiring.
- connection to electrical power sources outside the rating of the product.
- physical shock (being dropped, etc.) and impact damage.
- inappropriate routing, support, physical shock & strain protection, etc. of the lightguide (Fiberoptic thermometers only).
- environmental conditions exceeding the IP / NEMA rating of the product.
- environmental conditions outside the Ambient Temperature, Humidity and Vibration rating of the product.
- environmental contamination (solvent vapours, deposition of airborne contamination, cooling liquids of non-neutral pH, etc.).
- overheating as a result of interruption of water/air flow through cooling jackets or of incorrect installation.
- inappropriate modification of product (drilling holes in thermometer bodies, etc.).
- inappropriate recalibration which results in product calibration being taken outside specification.
- improper resealing of thermometer following parameter adjustment (UNO, FLT5/A, etc.).
- attempted repair by a non-Land-authorized repair centre.

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