Landcal P80P

Calibration Source

User Guide

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An AMETEK® Company

IMPORTANT INFORMATION - PLEASE READ

Important Health and Safety Information

Equipment Operation
Use of this instrument in a manner not specified by Land Instruments International may be hazardous.

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.

Face and Eye Protection
Suitable face and eye protection must be worn when working on hot vessels and ducts! Special safety measures must be taken when working on a high-pressure duct.

Protective Clothing
Protective clothing must always be worn when working in the vicinity of hot vessels or ducts.

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.

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.

Return of Goods for Repair Form is available for download from our websites.

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.

Design and Manufacturing Standards

UKAS CALIBRATION 0034

LLOYD'S REGISTER QUALITY ASSURANCE · ISO9001 · UKAS MANAGEMENT SYSTEMS 001

The Quality Management System of Land Instruments International is approved to BS EN ISO 9001 for the design, manufacture and on-site servicing of combustion, environmental monitoring and non-contact temperature measuring instrumentation.

REGISTERED ISO 9001 MANAGEMENT SYSTEM

Approvals apply in the USA

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.

Dimensions
Unless otherwise stated, all measurements are given in millimetres and inches.

Copyright

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.


This item or material can be recycled.


This item or material must be disposed of in accordance with the Waste Electrical and Electronic Equipment directive as applied by local regulations.


Protective Conductor Terminal.


Observe precautions for handling electrostatic discharge sensitive devices.

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1 Landcal Blackbody Source Type P80P

1.1 Introduction

The LANDCAL blackbody source type P80P is a variable temperature, portable black body radiation source designed for use at temperatures up to 80°C (175°F).

The source is a primary standard black body for the high precision calibration of radiation thermometers over the range -10 to 80°C (15 to 175°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 ±4K (±8°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 transportation 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.

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.

2 Description

The LANDCAL blackbody source type P80P comprises a cylindrical closed end tube (cavity) approximately 160mm/6.3in long with an internal diameter of 50mm (2.0in). 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 or cooled using Peltier elements. The temperature is controlled by a platinum resistance thermometer connected to a 3-term digital controller having a ±0.1°C or ±0.1°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 P80P CA970256

3 Specification

Maximum working temperature:		80°C (175°F)
Recommended temperature range:		-10 to 80 °C (15 to 175°F)
Heating rate:		(Ambient to 75°C) 60 minutes
Cooling rate:		(20°C to -10°C) 90 to 120 minutes (dependent on ambient). During the cooling cycle, the cooling time can be reduced by inserting an insulated plug into the front of the cavity.
Stability:		With the source controlling at temperature the radiance temperature will vary by less than ±0.5K (±1°F) over a 30 minute period.
Uniformity:		The temperature gradients across the middle 40mm of the 50mm cavity are within ±0.2°C.
Radiation cavity:	Material:	Aluminium with black, high temperature refractory coating
	Design:	120° cone
	Inner diameter:	50mm (2.0in)
	Internal length:	155mm (6.1in)
Emissivity:		>0.995
Controller input:		Resistance thermometer
Controller type:		Eurotherm 3216 with RS 232 serial interface
Electrical supply:		220/240V a.c. 50 to 60 Hz. Part No. 135.181
		110/120V a.c. 50 to 60 HZ. Part No. 135.199
Power consumption:		0.2KVA (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:	<±0.1°C at 50°C
	Part Nº:	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 (24lb)
	Gross:	13kg (29lb)

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.

4 Electrical Supply

The P80P is supplied with a removable electrical supply cable. The cable has an IEC style connector on one end that mates to an integrated power entry module.

The colour code for the cable is:

Brown lead	Live
Blue lead	Neutral
Green/Yellow lead	Earth

The source may be connected directly to a 5 amp fused plug and socket.

The wiring diagram of the P80P is given in Fig. 2.

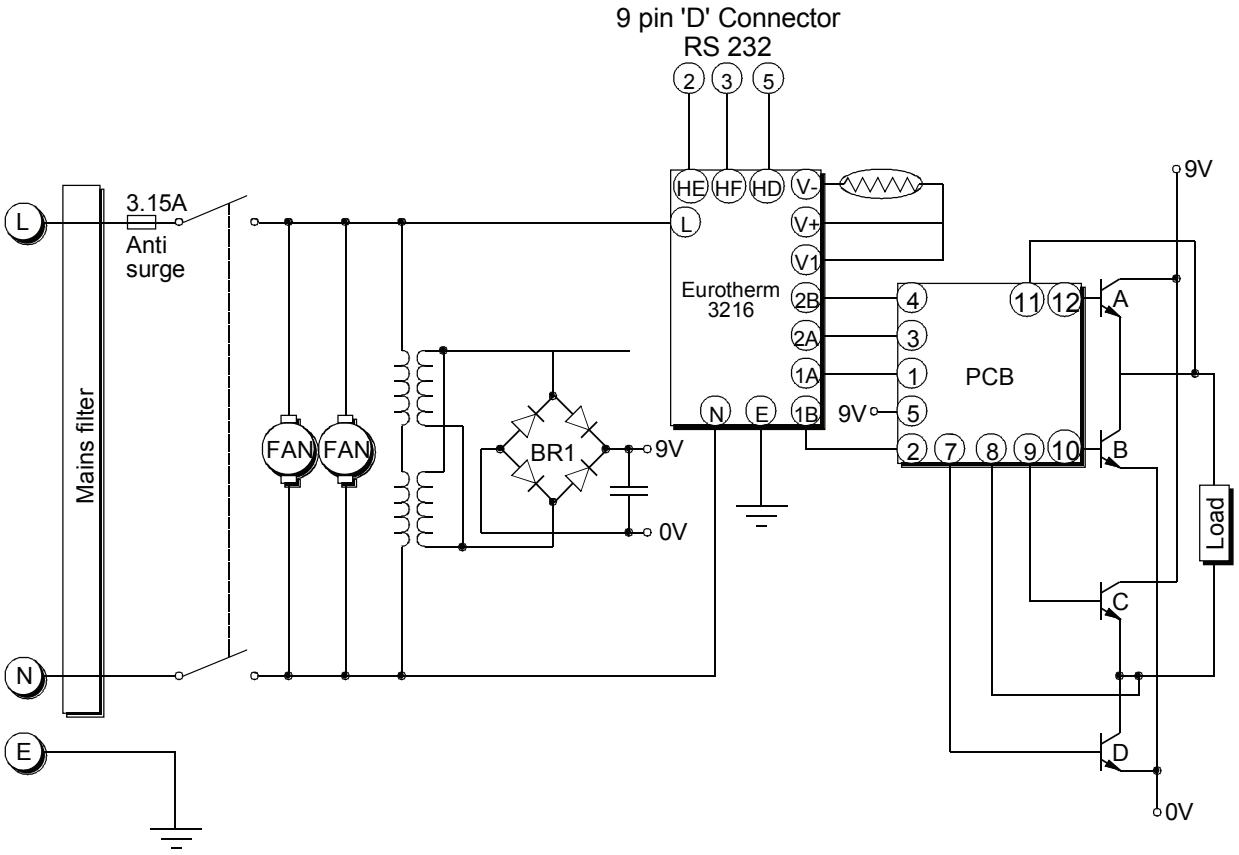

Fig. 2 Wiring diagram for the Landcal Blackbody Source Type P80P

CA970219

5 Commissioning

5.1 Inspection on receipt

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

If any item has been damaged in transit this should be reported to the carrier and to the supplier immediately. Do not return damaged instruments to the sender as the carrier will not then consider a claim. Save the packing with the damaged article for inspection by the carrier.

5.2 Connections to mains Supply

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

5.3 Heating up/cooling down of the source

The source can be operated at any temperature in the range -10°C/15°F to 80°C/175°F. Set the controller to the required value as follows:-

1) When the source is switched on, the fluorescent indicator panel displays the measured value (upper display) and the set point value (lower display).
2) To raise or lower the setpoint 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.

NOTE

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

5.4 Using the RS232 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 P80P to PC serial communications (RS232) connection schedule

6 Using the Source

6.1 Introduction

The P80P 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 junction lies in the same plane as the cone point, but is approximately 40mm/1.5in below. The temperature of the source as measured by the sensor agrees with the cone point radiance temperature to within ±0.5K (1°F).

The output from the sensor should 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 should not be used as an accurate measurement of target cavity temperature.

6.3 Operation of the source at below ambient temperature

The LANDCAL Blackbody Source type P80P uses Peltier modules to cool the source to temperatures as low as -10°C/15°F. However the modules are rated as only achieving a 30°C (55°F) below ambient cooling effect. This means that the final cooling temperature achieved and the length of time it takes to achieve this temperature will be dependent on the ambient temperature. For example if the source is operated in an area with ambient temperature of 30°C the minimum achievable temperature will be approximately 0°C.

The length of time taken to reach a required temperature below ambient can be reduced by inserting an insulated plug into the front of the cavity. This plug should be removed at least 15 minutes before any readings are taken, to allow the source temperature to stabilise.

Condensation may occur inside the cavity when the source is used at temperatures below ambient and above 0°C. This will in no way affect the operation or performance of the source. At temperatures below 0°C this condensation will freeze and form a thin layer of ice. This ice formation will not affect the performance of the source. If prolonged operation (say longer than 8 hours continuous) at temperatures below ambient are anticipated, it is recommended that the cavity is purged with a dry inert gas such as Nitrogen to prevent entry of water vapour into the cavity.

7 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 ±2K.

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. By adjusting the vertical and transverse vernier screws confirm that the holder is sighted correctly.

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 upon:

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.

Values of between ±0.01K (±0.02°F) and ±0.1K (±0.2°F) are typical for the uncertainty. A value of ±0.05K (±0.1°F)and ±0.2K (±0.4°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°C (122°F) with emissivity of 1.00 will show a temperature of 50°C (122°F) for a thermometer having a pyroelectric (wavelength = 8 to 14µm) detector. However, a source operating with emissivity of 0.995 at 50°C (122°F) for the same thermometer, will show a radiance temperature of 49.6°C (121.3°F) for the same thermometer.

Most hand held thermometers and fixed installation thermometers used in conjunction with an indicator have a resolution of ±1K (±2°F). Fixed installation thermometers, whose output is measured on a digital voltmeter, will have a resolution of between ±0.1K (±0.2°F) and ±0.5K (±1.0°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. A value of ±0.3K (±0.6°F) is typical.

To determine the best measurement capability, the uncertainty of each individual measurement component should be added together. Typical values would be between ±0.5K (±1°F) and ±3K (±6°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 difficulty is experienced in writing procedures, LAND would be pleased to offer guidance as to what calibration conditions should be adopted for LAND products.

8 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 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 P80P 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.

9 Eurotherm Temperature Controller Type 3216CC

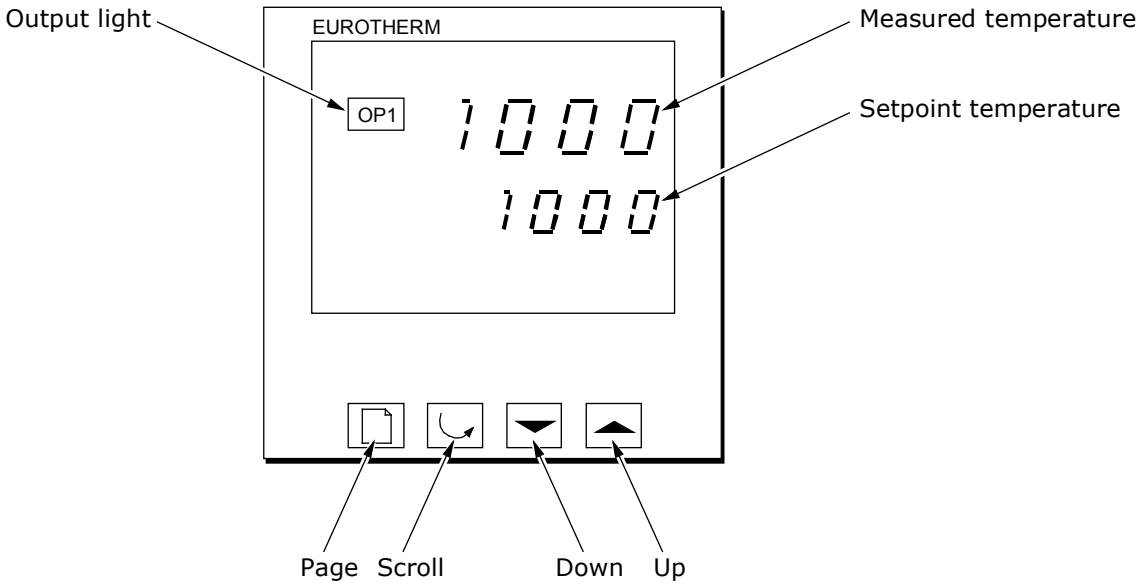

Fig. 3 'Eurotherm' Controller - front panel controls

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.

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.

> **Warning**
>
> Do not alter any other parameters.

10 Spares

No spare parts are available for this instrument.

Contact LAND if you have a specific requirement.

11 Accessories

The accessories listed below are available for use with the Landcal Blackbody Source Type P80P.

Description	Land Part Nº
Carrying Case	135.130
UKAS Certification of Landcal P80P (range -10 to 80°C)	089.005
Platinum Resistance Thermometer (PRT) complete with UKAS certificate **Note:** The cost of re-certification of the PRT is comparable with the purchase of a new unit. Therefore, it is recommended that a replacement is purchased when re-certification is required.	135.142
Optical Bench Calibration Accessory **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.	135.204

LAND

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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:-

- 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/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

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

- ARC.
- FTI-E.

12 MONTHS WARRANTY

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

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 (Fibroptic 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-authorised repair centre.

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