



SYSTEM 4
R4 Low Temperature Thermometer

User Guide

Issue 3
28 April 2015
Publication N° 807382
Language: English

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.

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 Instruments International 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 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.

Contact Us

UK - Dronfield

Land Instruments International

Tel: +44 (0) 1246 417691

Email: land.enquiry@ametek.co.uk

Web: www.landinst.com

USA - Pittsburgh

AMETEK Land, Inc.

Tel: +1 412 826 4444

Email: irsales@ametek.com

combsales@ametek.com

Web: www.ametek-land.com

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



0034

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



This instrument complies with current European directives relating to Electromagnetic Compatibility 89/336/EEC, Low Voltage Directive 73/23/EEC, and ATEX Directive 94/9/EC.



The Quality Management System of Ametek Motors (Shanghai) Co. Limited is approved to ISO9001:2008 for the Design and Manufacturing of Motors and the Manufacturing of Gas Analysers.

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 or pneumatic parts 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 Instruments International's products and contains information proprietary to Land Instruments International. This manual may not, in whole or part, be copied, or reproduced without the expressed written consent of Land Instruments International Ltd.

Copyright © 2014 Land Instruments International.

Contents

1	Introduction	1
1.1	About the Thermometer	1
1.2	Unpacking the Thermometer	1
1.3	Nomenclature	1
2	Specifications	2
3	Installing the Thermometer	3
3.1	Positioning the Thermometer	3
3.2	Target Size	4
4	Thermometer Operation	5
4.1	Alignment Laser	5
4.2	Aiming the Thermometer at the Target	6
4.3	Electrical Connections	6
4.4	Connections to the LMG Signal Processor	7
5	Maintenance	8
6	Accessories	9
6.1	Protective Jacket Assembly	9
7	Ratio Thermometry	10



Fig. 1 Land R4 thermometer

S4970222

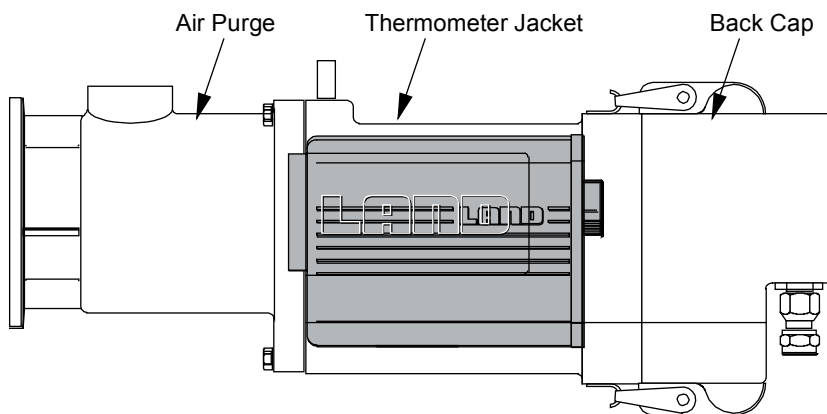


Fig. 2 System 4 Thermometer with Air Purge, Protection Jacket and Back Cap

S4970223

1 Introduction

This User Guide gives the necessary information required to operate a LAND R4 Thermometer.

1.1 About the Thermometer

The LAND R4 Thermometer is an accurate, non-contact thermometer designed for use in conjunction with a LAND LMG signal processor containing an R4 I/O card (card type = 6) from which it derives the nominal +/-20V d.c. power supply required for its operation.

The optical system focuses infrared energy from the target surface onto a detector. The thermometer outputs two individual d.c. signals which are analogues of the surface temperature. The actual target surface temperature is then calculated by the LMG signal processor, from the ratio of these two signals.

Ratio thermometers are principally used for applications where radiation reaching the detection system is reduced by atmospheric obscuration in the line of sight, or where the field of view is only partially filled by the target surface.

1.2 Unpacking the Thermometer

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

The packaging should contain the following items:

- R4 Thermometer User Guide.
- A binder for documentation.
- R4 Thermometer fitted with protective lens cap.

It is recommended that the protective lens cap is kept attached until thermometer installation is fully complete.

1.3 Nomenclature

The thermometer detail label is on the rear face of the thermometer above the eyepiece.

Make a note of your thermometers instrument type and Serial Number in the space provided below. This information is required to configure a Landmark processor to work with your thermometer.

Instrument type:

Serial Number:

<input type="text"/>	<input type="text"/>	/	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	/	<input type="text"/>	<input type="text"/>	/	<input type="text"/>	<input type="text"/>

2 Specifications

Thermometer type:	R42x
Temperature range:	300 to 600°C
Uncertainty:	±5°C
Repeatability:	
Detector:	InGaAs, Silicon
Response time:	1s to 98%
Output:	≈10V d.c at 600°C
Optics:	Two element, reflective
Nominal field of view:	30:1
Focus distance:	R423 = 600mm R429 = infinity
Ambient temperature range:	5 to 45°C
Vibration:	3G any axis 10 to 300Hz
Sealing:	To IP65/NEMA 4x requirements
CE:	EN 50-082-2 (immunity) EN 50-081-1 (emission) IEC 1010 (safety)

3 Installing the Thermometer

If the thermometer is to be used in conjunction with a protection jacket and air purge (recommended), cross-refer to the Installation Guides provided with those accessories.

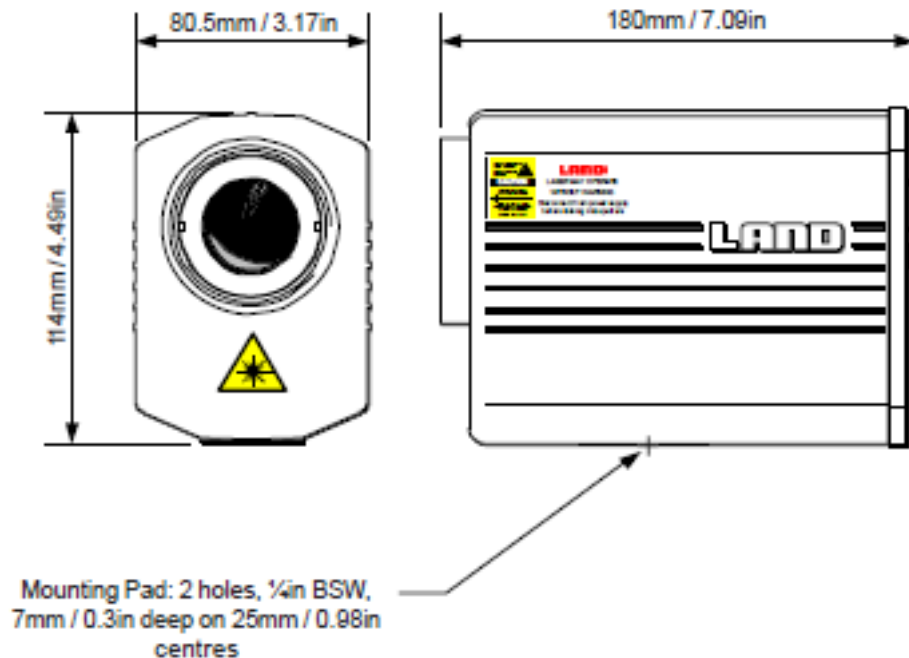


Fig. 3 R4 Thermometer Installation Dimensions

3.1 Positioning the Thermometer

A position should be chosen for the thermometer that is accessible for servicing and where it is not exposed to heat, fumes and water spray etc. The path between the thermometer and hot surface should be as free as possible from smoke or water spray and from the intrusion of machinery.

The axis of the thermometer should be approximately at right angles to the hot surface. However, an angle of up to 45° from the normal is usually acceptable.

3.2 Target Size

The R423 Thermometer is nominally focused at 600mm.

The R429 Thermometer is focused at infinity.

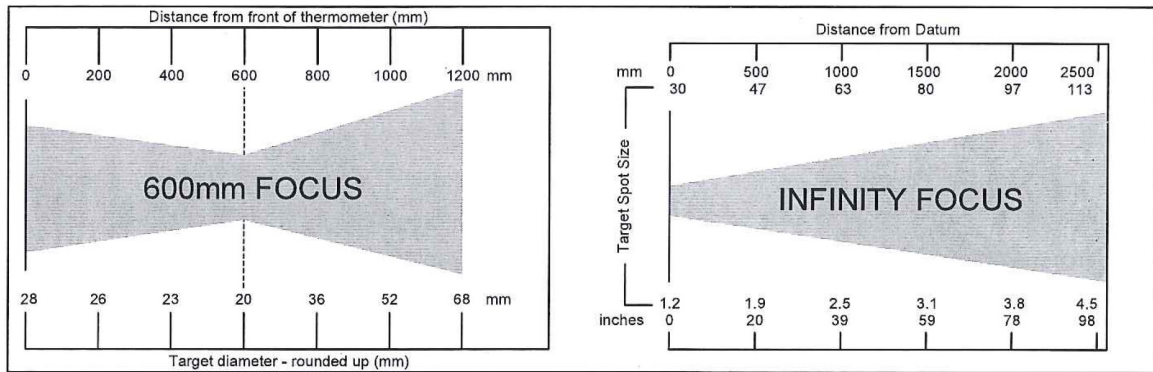


Fig. 4 R4 Thermometer Target Size tables

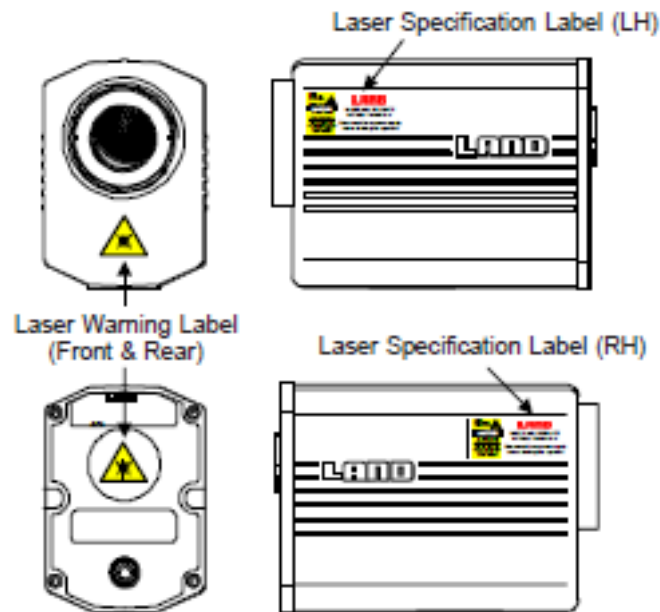


Fig. 5 R4 Thermometer laser warning labels

4 Thermometer Operation

4.1 Alignment Laser



Warning

CLASS 2 Laser Product.

DO NOT stare into laser beam. (1.0mW maximum output at 635nm)

DO NOT look directly towards the thermometer window, or into the laser beam during operation.

If the laser is projected onto a highly reflective surface, DO NOT look at the laser spot from a position where a direct ('mirror-like') reflection may enter the eye.



Warning

CLASS 2 Laser Product.

DO NOT attempt to disassemble the laser unit or any of its mounting components.

Embedded laser has a maximum output of 5mW with a beam divergence of <math><5\text{mrad}</math>.



Caution

Caution - use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

4.1.1 Alignment Laser Specifications

Operating Wavelength: 635nm

Output Power: <math><1\text{mW}</math>

Laser Safety Classification: Class II / Class 2

4.2 Aiming the Thermometer at the Target

When the thermometer has been correctly installed in the desired location, it must then be aimed at the target area using the in-built Laser Alignment facility.

The laser is triggered into operation by the use of a push button switch which applies a transient signal (changing from a positive voltage to 0V) to the signal 4 terminal. Once activated, the laser remains on, irrespective of the switch position, for a period of between 50 and 60 seconds after which time it switches off automatically. The laser beam has been aligned during manufacture to be coincident with the optical centre of the thermometer's infrared viewing axis.

Remember that the measurement target is much larger than the laser spot, the size being defined as in Section 3.2.

There are two different possibilities for positioning the trigger switch:

- Operation from LMG signal processor rear panel.
- Operation from an auxiliary push button switch mounted near to the thermometer jacket when the signal processor is distant from the thermometer location.

Further information detailing the connections required, for both methods of positioning the trigger switch, can be found in the Thermometer Installation Guide.

4.3 Electrical Connections

The electrical connections for the thermometer power supply and temperature outputs are made via the 8-way socket on the rear of the thermometer.

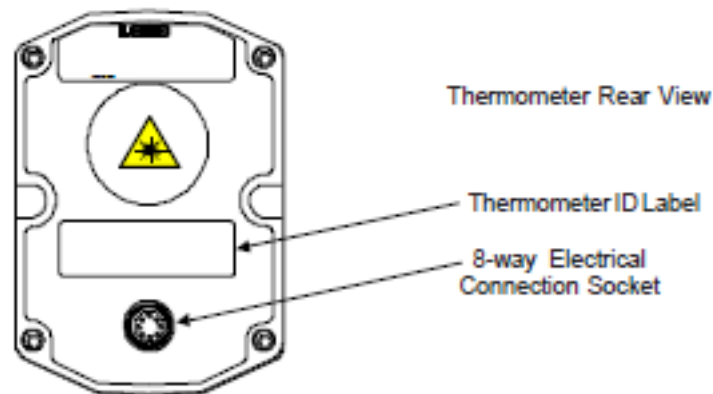


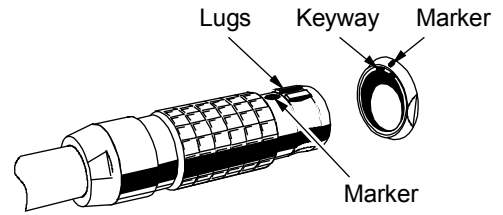
Fig. 6 Location of 8-way electrical connection socket

NOTE

Cable lengths - The maximum overall resistance of the cable used to connect the thermometer to the processor is 20 ohms. The commonly used cable is 7 x 0.2mm core, which is rated at 92 ohms per km thus allowing a maximum cable length of 217 metres (i.e. $20/92 \times 1000$ m). This is the maximum total cable length. Therefore we recommend a maximum cable length of 200 metres, including any junction boxes:

e.g. Thermometer > 150m cable > Junction box > 50m cable > Processor

Electrical connections to the thermometer must be made through the pre-wired plug supplied with the thermometer or through the plug housed in the protective jacket back cap.



To connect either plug type to the thermometer socket:

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

To disconnect either plug type from the thermometer socket:

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

4.4 Connections to the LMG Signal Processor

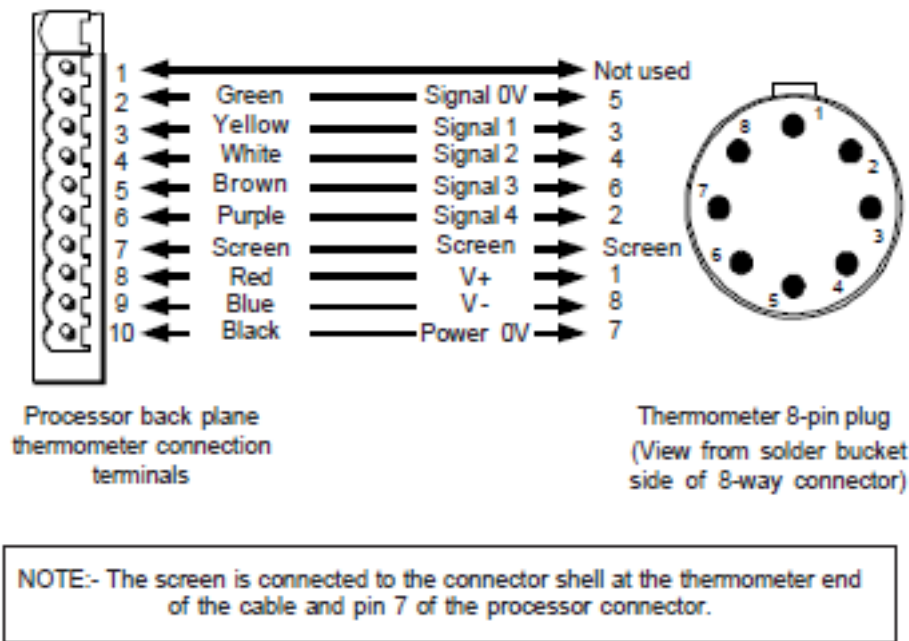


Fig. 6 Connection Schedule for 8-way Plug and Socket

Depending upon the Landmark Graphic (LMG) signal processor operating software version, the thermometer type selection should be set to either:

RP42 C

or **R4 300/600C**

5 Maintenance

Thermometer maintenance consists mainly of ensuring that the front lens remains clean and free from contamination.

If the lens becomes dirty, it is recommended that a soft, lint-free cloth and a suitable lens cleaning fluid is used to clean any contamination from the lens surface.

Should it be found that the lens becomes repeatedly dirty, it may be necessary to utilise an air purge accessory which can be supplied by Land Instruments. Contact Land Instruments International for more information regarding available accessories.

If the thermometer is used in conjunction with a protective cooling jacket, ensure that there is an adequate supply of coolant. The recommended flow rate for coolant is 1 litre per minute (1l/min or 0.035cuft/min).

If the thermometer is to be used in conjunction with an air purge accessory, ensure that there is an adequate supply of clean, dry air. The recommended flow rate for purge air is 1 litre per second (1l/sec or 2cuft/min).

Warning

Never 'over-cool' the thermometer as this may result in condensation either on or inside the thermometer.

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

6 Accessories

The following section gives information about the range of mountings and accessories available for use with this thermometer system.

If the thermometer is to be used in an environment where the ambient temperature is higher than that specified, or where the atmosphere contains a high proportion of dust/smoke/steam etc, then the thermometer **must** be housed in a Protective Jacket Assembly.

All system mountings and accessories are available from Land Instruments International.

6.1 Protective Jacket Assembly

This assembly fully protects the thermometer and thermometer connections from the effects encountered when installed within an hostile environment.

6.1.1 S4J Protective Jacket (Part No: 091.560)

The S4J Protective Jacket provides an effective air or water cooling facility for the thermometer. It ensures that the thermometer is protected from the excessive environmental conditions that may be encountered during the operation of the process.

6.1.2 S4P Air Purge Assembly (Part No: 091.561)

The S4P Air Purge Assembly provides a stream of clean, dry air to the lens of the thermometer, ensuring that the lens is kept free from condensation, dirt and any other contaminants which may otherwise settle onto and soil the lens surface.

6.1.3 S4CA End Cap Assembly for AET/AQT (Part No: 092.699)

The S4CA End Cap Assembly ensures environmental protection for the electrical connections to the thermometer. Connections are made to the terminal strip inside the End Cap cover. Camlock fasteners ensure that the End Cap is securely fastened to the protective jacket.

7 Ratio Thermometry

A ratio (or two colour) thermometer measures the radiation from a target surface at two separate wavelengths. The two signals are then electronically divided to produce the ratio signal; this signal is taken as a measure of the target surface temperature:

$$\text{Ratio Signal} = \frac{\text{Voltage signal at short wavelength}}{\text{Voltage signal at long wavelength}}$$

The individual outputs are obviously dependant on surface emissivity but if this is equal at both wavelengths, then the ratio is unaffected and the temperature estimation will be exactly the same as for the black body calibration. Such a surface is said to be "grey" at these wavelengths.

For most surfaces, however, the emissivity changes with wavelength and thus the measured signal ratio is changed by the non-greyness factor:

$$\frac{\text{Emissivity at short wavelength}}{\text{Emissivity at long wavelength}}$$

For a body whose emissivity is larger at the shorter wavelength the non-greyness factor is >1 and the ratio is also high by this factor. This produces an artificially high temperature indication which may be corrected by dividing the measured ratio by the non-greyness factor during the processor stage.

The setting of non-greyness control and the range of values which may be used are dealt with in the Landmark Signal Processor User Guide.

LAND

AMETEK[®]
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



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

- SPOT thermometers, accessories and mountings and special instruments based on SPOT.
- 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
- NIR

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 (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.

Land Instruments International Ltd • Dronfield S18 1DJ • England • Tel: +44 (0) 1246 417691 • Fax: +44 (0) 1246 410585
Email: land.enquiry@ametek.co.uk • www.landinst.com

AMETEK Land, Inc. • 150 Freeport Rd. • Pittsburgh, PA 15238 • U.S.A. • Tel: +1 (412) 826 4444
Email: irsales@ametek.com • www.ametek-land.com

For a complete list of our international offices, please visit www.landinst.com

Issue 3: 15 January 2015