



# CONTAINER GLASS

Infrared temperature measurement  
Application Information





## SPECIALISTS IN NON CONTACT TEMPERATURE MEASUREMENT

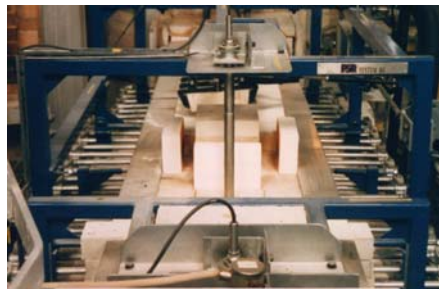
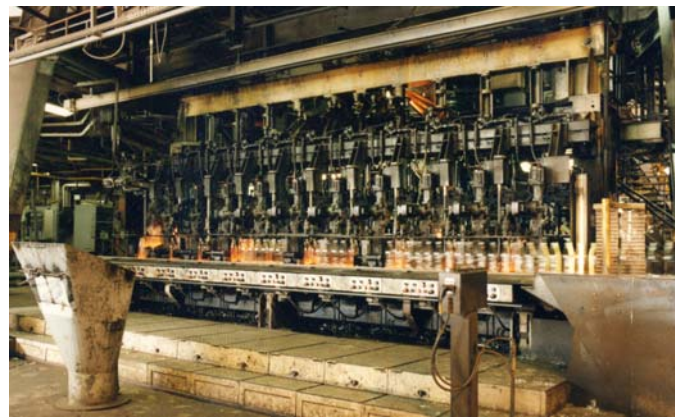
**LAND, acknowledged leaders in the field of temperature measurement, have supplied the glass container and hollowware industry throughout the world with temperature measuring equipment for over 55 years. Today, LAND manufacture a whole range of measurement instruments specifically designed for the glass industry. All are designed to the highest standards of quality and reliability to ensure accurate measurements under plant operating conditions.**

Land's reputation for quality products and service is attributable to good product design; to the combination of technical expertise and especially to application know-how. This know-how has been gained by providing effective solutions to the varied problems of temperature measurement in the glass industry.

The measurement of temperature at critical locations in the production process is essential for the full understanding

and efficient control of glass manufacture and processing. The illustrations shown in this brochure represent some of the locations for these measurements and the tables offer the best choice of instrument.

There may be further areas where non contact infrared thermometers may be the solution to your temperature measurement problem. Call LAND to discuss your particular needs.



### WHY USE LAND NON CONTACT RADIATION THERMOMETERS?

- Radiation thermometers need no contact with the measured object, which means, no contamination, no interference with processes, no seeding or bubbling.
  - Accurate, reliable and stable measurement increases confidence in long-term product quality.
  - Virtually maintenance free, which means 'set and forget' once correctly installed.
  - Flexibility in the choice of fixed, fibre optics or portable systems to give comprehensive cover for nearly all temperature measurement needs.
  - All Land Instruments International products are backed by BS EN ISO9001:2000 Quality Management System Approval backed by BS EN ISO/IEC 17025.
  - Traceability of calibration is to National Standards. Calibration certificates are available from our UKAS accredited calibration laboratory No.0034 in the U.K. and NIST (National Institute of Standards and Technology) in the U.S.A.
- Plus with the short wavelength (0.7 - 1.1  $\mu\text{m}$ ) thermometers:
- Fast response and high sensitivity offers tighter temperature control
  - "Sees through" products of combustion (water vapour and  $\text{CO}_2$ ), so there is no need to worry about such gases in the thermometer's field of view.
- And:
- LAND know-how, expertise, and support - world wide

## SELECTING THE THERMOMETER TO MATCH THE APPLICATION

MEASUREMENT Nº. LOCATION	TYPE OF INSTRUMENT										
	ON-LINE THERMOMETERS & PROCESS IMAGERS							PORTABLE THERMOMETERS & THERMAL CAMERAS			
	STANDARD & FIBROPTIC THERMOMETERS					PROCESS IMAGERS					
	M1/ U1	M1L/ U1L	M2L/ U2L	R1/ V1	FG	LSP	FTI	C53/ 153(A)	C241/ GMT	300AF/ PT3	PPM+ ER
<b>REGENERATOR</b>											
1 CROWN					*						
1 PACKING					*						
<b>TANK</b>											
2 BRIDGE WALL	*							*			
3 PORT ARCH	*							*			
4 TANK ROOF					*			*			
5 OUTER SURFACE							*			*	*
6 BULK GLASS					*			*			
<b>REFINING/FOREHEARTH</b>											
7 WORKING END					*			*			
8 BULK GLASS					*						
9 FOREHEARTH					*			*			
<b>FORMING SECTION</b>											
10 GOB	*	*		*				*			
11 MOULD			*	*					*		
<b>FINISHED PRODUCT</b>											
12 LEHR						*	*			*	*

The above table gives options for continuous on-line systems or portable spot instruments to meet your individual needs, and within both of these categories are flexible packages which can be field-tuned to your application.

### TYPICAL ELEMENTS OF AN ON-LINE INFRARED THERMOMETER SYSTEM

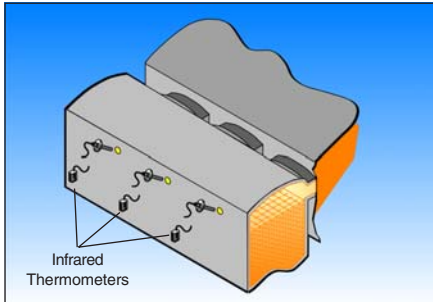
- 1 A radiation thermometer which detects infrared energy emitted from a target surface and converts it into an electrical signal for transmission to a signal processor.
- 2 A signal processor which takes the electrical signal and produces an output suitable for use with any indicating, recording or control equipment.
- 3 Protection against the measurement environment. In the on-line systems this may involve the use of a protection jacket and end cap. The Fiberoptics are exempt from this requirement by their very nature. Cooling and air purge may also be required.





### REGENERATOR ①

Accurate and reliable temperature measurement of the crown and packing is essential for this important and vulnerable area of the tank. Thermocouples, despite their lower initial cost, can rapidly deteriorate. Infrared thermometers provide a long-term, cost effective and more reliable measurement.



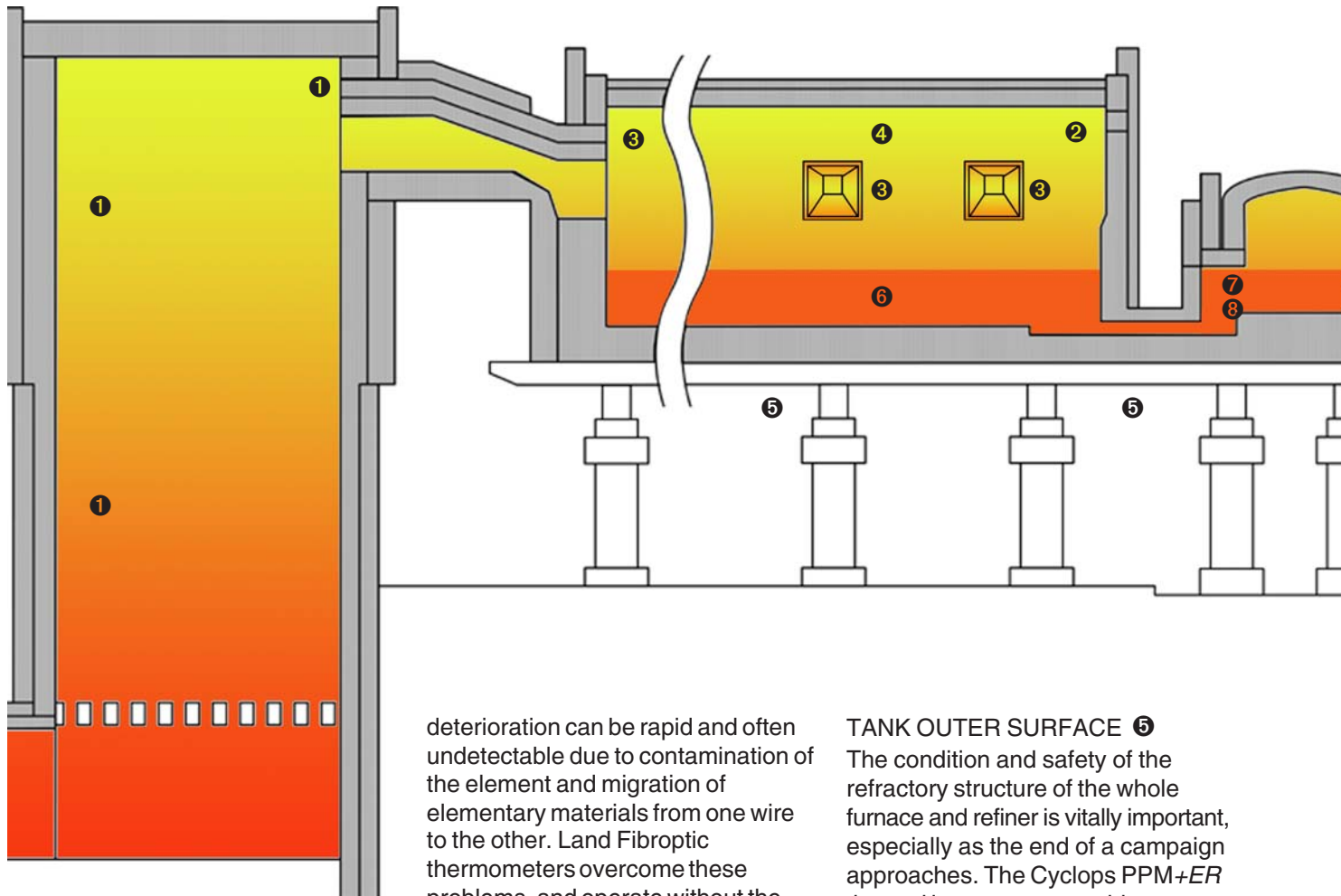
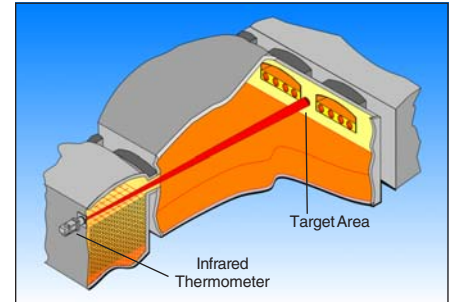
### BRIDGE WALL ②

This measurement is often taken using outdated Disappearing Filament Pyrometers, which although widely used in the glass industry, are prone to operator variations and hence poor reproducibility of results. Both portable and on-line radiation thermometers improve measurement quality.



### PORT ARCH ③

Measurement of the port arches, especially in cross-fired furnaces, can provide important information on basic firing conditions, giving early indication of an incorrect or unbalanced firing situation.



### TANK ROOF ④

Thermocouples have been used for many years for this critical measurement. However, at the high temperatures at which they operate,

deterioration can be rapid and often undetectable due to contamination of the element and migration of elementary materials from one wire to the other. Land Fibroptic thermometers overcome these problems, and operate without the need for water cooling.

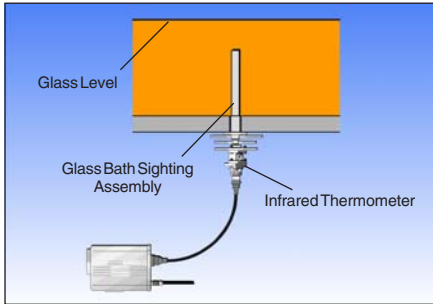
This location can also be used for bulk glass temperature as an alternative to mounting thermometers underneath the tank in the Glass Bath Sighting System.

### TANK OUTER SURFACE ⑤

The condition and safety of the refractory structure of the whole furnace and refiner is vitally important, especially as the end of a campaign approaches. The Cyclops PPM+ER thermal imager or a portable thermometer such as C300AF from the Cyclops range can be used to make routine checks on key areas of the tank to minimise the possibility of glass break-out or refractory failure.

## BULK GLASS ⑥ ⑧ \* ④

Where electric boosting is used, thermocouple measurement of the glass itself can be dramatically upset by electrical interference. Fibroptic thermometers used with the well proven Glass Bath Sighting System supplied by tank manufacturers, provide stable and reliable measurement. \* See also Tank Roof.



## WORKING END/REFINER ⑦

The temperature of glass emerging from the Refiner or Distributor can be critical. As in many other areas of the process, thermocouples can be easily damaged and have a limited useful life. They can also introduce "seeding". Radiation thermometers are non-intrusive and can give many years of trouble free operation.



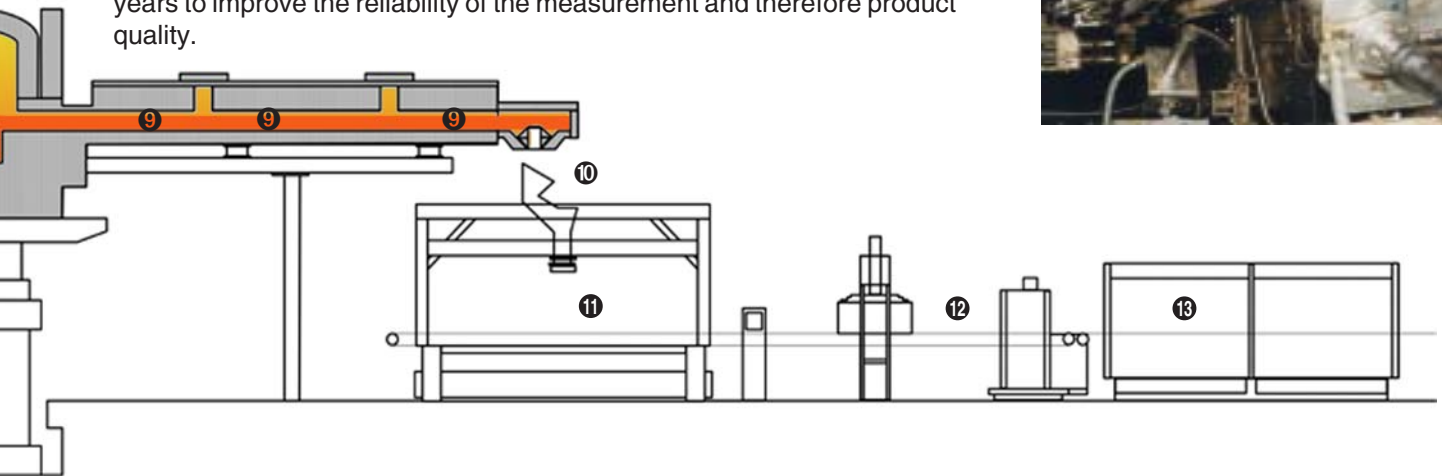
## MOULD ⑪

Land pioneered the use of the fibre optics thermometer to measure mould temperatures, and the new GMT thermometer is the best tool to aid rapid setting of cooling levels after a job change. Other fully portable thermometers such as the Cyclops 241 may also be suitable for mould temperature measurement.



## GOB ⑩

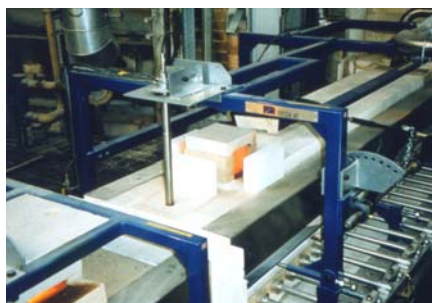
It is vital to obtain an accurate measurement of gob temperature to maintain the relationship between glass viscosity and gob weight. Both portable thermometers such as Cyclops 153 and 53 and on-line thermometers such as System 4 M1 Fibroptic are available, and have been proven over many years to improve the reliability of the measurement and therefore product quality.



## FOREHEARTH ⑨

Delivering the glass, in an homogenous condition and at a precise temperature makes accurate and consistent temperature control in the forehearth vital. The silicon cell detector used in so many radiation thermometers in the glass industry is at the heart of the Fibroptic Model FG thermometer, custom designed for this application. Water cooling is not required and installation is simple.

Model FG has become the industry standard forehearth thermometer with over 6000 units shipped worldwide.



## LEHR ⑫ ⑬

A low temperature thermometer at the loading point views the conveyor chains to ensure that they are heated sufficiently to prevent cracking or build up of stress in the glass.

Defects in finished product may only become evident when it leaves the annealing lehr. Land provide two high speed process imagers capable of thermally mapping the surface of the hot product - LSP linescanning and FTI 6 thermal imaging systems.

## BRIEF OUTLINE SPECIFICATIONS

TYPE	MODEL	TEMPERATURE RANGE	SPECTRAL RESPONSE	RESPONSE SPEED	ACCURACY (UNCERTAINTY)
STANDARD AND FIBROPTIC THERMOMETERS	M1/M1L/U1/U1L	600 to 1600°C/ 1100 to 2900°F	1.0µm	5ms (to 95%)	0.4%K
	M2L/U2/U2L	300 to 1100°C/ 600 to 2000°F	1.6µm	5ms (to 98%)	≤0.25%+1K
	R1L/V1L	600 to 1600°C/ 1100 to 2900°F	0.85 to 1.1µm	15ms (to 98%)	0.65%K
	MODEL FG	980 to 1650°C or 1800 to 3000°F	0.7 to 1.0µm	0.5s (to 98%)	±5°C (Absolute)
PROCESS IMAGERS	FTI 6	-20 to 2000°C/ -5 to 3600°F	'L' range 3.2 to 4.2µm 'M/H' range 3.9µm	20Hz (Frame frequency)	-
	LSP 5 Series	150 to 1100°C/ 302 to 2012°F	5µm	10 to 100Hz	<±4°C/7.2°F
PORTABLE THERMOMETERS AND IMAGING CAMERAS	POCKETHERM	-50 to 500°C/ -50 to 950°F	8 to 14µm	1.5s	±1% ±1 digit
	CYCLOPS 300AF	-50 to 1000°C/ -50 to 1800°F	8 to 13µm	0.5s (to 90%)	>200°C/390°F ±1% ±1 digit <200°C/390°F ±2°C/4°F ±1 digit
	CYCLOPS 53/153(A)	600 to 3000°C/ 1100 to 5500°F	0.8 to 1.1µm	0.45s (98% response)	±0.5% ±1 digit
	CYCLOPS 241	250 to 800°C 500 to 1470°F	1.1 to 1.7µm	0.3 to 0.6s	>300°C/570°F ±1% <300°C/570°F ±4%
	GMT	350 to 650°C/ 662 to 1202°F	0.8 to 1.0µm	10ms	±4°C (Absolute)
	CYCLOPS PPM+ER	-20 to 500°C -4 to 932°F	7 to 14µm	25Hz (PAL), 30Hz (NTSC)	-

### FIBROPTIC THERMOMETERS

M1 and M2 are Fibroptic models from the System 4 range. Each incorporates three separate parts, the optic head, the light guide and the amplifier which is linked to either a LANDMARK Graphic, Classic, Technic or Basic signal processor/power supply as used in the System 4 range.

The Fibroptic Model FG has been designed specifically for use within the glass industry - particularly on the forehearth and working end. Its output can be linked directly to readout or control equipment. ▼

The use of fibre optics provides the ideal solution to two measurement problems. Firstly, the detector and electronics can be located remotely where the ambient temperature is much lower than the measuring point. This, combined with the fact that the optic head and fibre optics can withstand high (200°C) ambient temperatures, eliminates the need for water cooling of the thermometer at the measurement point. Fibre optics thermometers rated to 350°C are also available to special order. Secondly, fibre optics allow access to the target surface which might otherwise be inaccessible.



### LANDSCAN PRO LSP5 SERIES

A series of infrared linescanning systems designed specifically for use in the glass industry. The system comprises an LSP5 head and Landscan Control signal processor. These systems are available with dedicated ruggedized protection and mounting accessories. ▲

### STANDARD SYSTEM 4 THERMOMETERS

M1 is an on-line infrared thermometers with a focusable lens system from the System 4 range. System 4 operates as a three part system incorporating a high precision thermometer, a LANDMARK signal processing unit and a full range of protection jackets, mountings and purges. There are three models in the M1 series with different temperature ranges and focusing distances providing a choice of measurement spot sizes and working distances.



	REPEATABILITY	SIGHTING	FIELD OF VIEW/ SIGHTING ANGLE	MINIMUM TARGET SIZE	LITERATURE CODE
	<1K	Thru-the-lens or optional laser targeting	100:1 (standard); 25 or 75:1 (Fibroptic)	3.5mm/0.13in(standard); 4.0mm/0.15in (Fibroptic)	S4T/UNO100
	<1K	Optional laser targeting	25:1	4.0mm/0.15in	S4T/UNO100
	1K	Optional laser targeting	25:1	4.0mm/0.15in	S4T/UNO100
	±2°C/4°F	-	-	20mm/0.8in at 1.0m/39.4in	MFG
	-	-	From 16° x 16° to 60° x 60°	-	TIFB
	<1°C/1.8°F	-	100:1, 80° scan angle	-	LSP5
	±1°C/2°F	Laser targeting	Defined by laser	70mm/2.76in at 1.0m/39.37in	PDS PT
	±1°C/2°F	Auto focus, thru-the-lens	8° FOV; 1° measuring	9mm/0.35in at 500mm/19.6in	C103
	±0.15% (C153) ±0.1% (C53)	Thru-the-lens	8° (153) FOV; 1/3° measuring 9° (53) FOV; 1/3° measuring	4.8mm/0.18in at 1.0m/39.0in (153) 5.0mm/0.19in at 1.0m/39.0in (53)	PDS003
	±2°C/4°F	Thru-the-lens	9° FOV; 1° measuring	15mm at 1m/0.6in at 39.3in	C103
	±1°C/2°F	-	-	-	GMT
	-	Colour PDA or mono viewfinder	25° x 18.5°	-	PPM+ER100

**Land Cyclops** portable thermometers provide high precision spot temperature measurement. Features include either a laser targeting system, or thru the lens optics with a temperature display in the viewfinder. A digital output is also provided. An optional data processor, data logger and digital printer are also available. The DP-C2 data processor greatly expands the measurement and data analysis capabilities of Cyclops. **PockeTherm** thermometers offer a lower cost alternative to the high precision Cyclops portable thermometers.



**LAND GMT** - The Glass Mould Thermometer was developed specifically for the glass industry, for measuring accurately the surface temperatures inside metal moulds on glass container machines.



**Cyclops PPM+ER** thermal imaging camera combines high performance thermal imaging with accurate temperature measurement and outstanding ergonomic design.

Used with LIPS PPM+ analysis and report generation software, it answers the maintenance engineer's thermographic needs at an affordable price.

The Cyclops PPM+ER creates a high definition thermal image which is displayed on an LCD screen designed to be visible even in the brightest ambient light, including sunlight.



**The FTI 6** thermal imager is ruggedly constructed to cope with demanding industrial environments as either a permanently mounted plant sensor or as a transportable process imaging system.

An integral visual video camera enables scenes to be viewed as thermal, visual or in combination.



For more than fifty five years **LAND** has supplied temperature measuring systems and instruments to many different industries all over the world. Now the world leader in non contact thermometry, our expert advice and support is never far away.



## WORLD LEADERS

**LAND** is one of the world leaders in the manufacture of non contact temperature measurement systems, thermal imagers and linescanners.

## WORLDWIDE SUPPORT

In addition to the companies established in the USA, Europe, Mexico and Japan, **LAND** is represented by distributors in most of the major industrial countries throughout the world.

Our customers benefit, on a global basis, from practical and expert advice from fully trained technicians who are aware of specific requirements for their country and industry.

## APPLICATIONS

**LAND** has solved many different temperature measurement problems in a wide variety of industries from food to atomic energy, some of which are listed below:

- |                  |                     |                      |
|------------------|---------------------|----------------------|
| • Iron & Steel   | • Maintenance       | • Plastics           |
| • Petrochemical  | • Power & Utilities | • Paper              |
| • Heat Treatment | • Aerospace         | • Rubber             |
| • Minerals       | • Electronics       | • Textiles           |
| • Glass          | • Pharmaceuticals   | • Non-ferrous Metals |

For further information or free advice on specific temperature measurement problems within these or any other industry, contact your nearest Land office.

## PRODUCT ASSURANCE

When you specify **LAND** products you are assured of receiving a completely pretested, calibrated working product. Each instrument is carefully checked to ensure complete compliance with specification and is fully guaranteed. **LAND** was the first manufacturer of infrared instruments to successfully obtain ISO 9001 Quality Management System Approval for both design and manufacture of non contact infrared temperature measuring equipment.



These products comply with current European directives relating to electromagnetic compatibility and safety (EMC directive 89/336/EEC; Low voltage directive 73/23/EEC).

The Quality Management System of Land Instruments International Ltd. is approved to BS EN ISO9001:2000 for the design and manufacture, stockholding, in-house repair and site servicing of non contact temperature measuring instrumentation. Associated software designed and developed in accordance with TickIT. Calibration certificates are available from our UKAS accredited Calibration Laboratory No. 0034. The Land calibration laboratory complies with the requirements of the international standard BS EN/IEC17025.



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# LAND

instruments international

Infrared Temperature Measurement

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