

# LAND

## AMETEK®

PROCESS & ANALYTICAL INSTRUMENTS



# SYSTEM 4

STANDARD AND FIBROPTIC THERMOMETERS

# SYSTEM 4

## INFRARED APPLICATIONS

Non contact temperature measuring systems are designed for continuous quality and process monitoring and control in a wide range of industries including Iron & Steel, Glass, Plastics, Rubber, Minerals, Paper... and many more.

With measurement capabilities from 0 to 2600°C/50 to 4700°F, infrared thermometers measure both the product being processed and the plant and machinery used in the production. Here are just a few of the processes where SYSTEM 4 can solve your measurement problems.

### Metal Production

Smelting, refining, pouring, continuous casting, slabbing, reheating, rolling, drawing, coiling, extruding, coating, annealing, stamping, pressing, forging, sintering, galvanizing, heat treatment...

### Glass Production

Melting, refining, firing, gob formation, furnaces, floating, molding, tempering, laminating, fiber drawing, vapor deposition, preforming...

### Mineral Processing

Firing, mixing, drying, storing, conveying, laying...

### Paper

Rolling, drying, calendering, coating, printing, photographic, curing..

### Rubber

Mixing, calendering, extruding, thermoforming, molding, shrinking, laminating, blown film...

### Chemical

Catalyst beds, powder drying, mixing, furnaces, thermal reactors...

### Food & Pharmaceuticals

Freezing, molding, extrusion, sterilizing, tablet drying, labelling, sealing...

### Electronics

Wave soldering, glass coating, circuit board testing, doping...

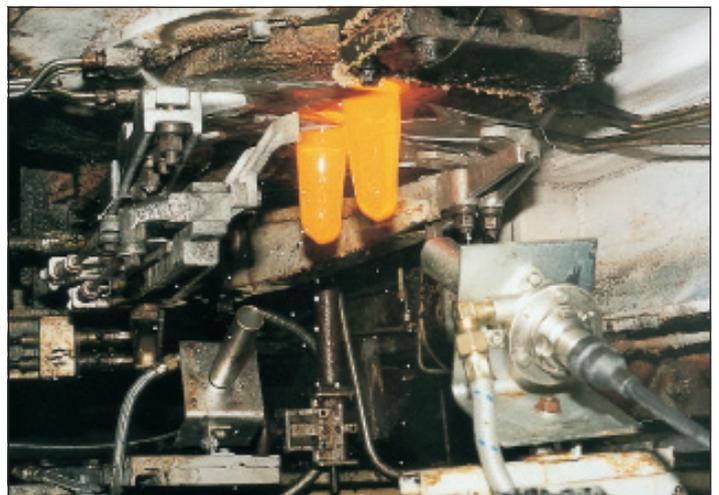
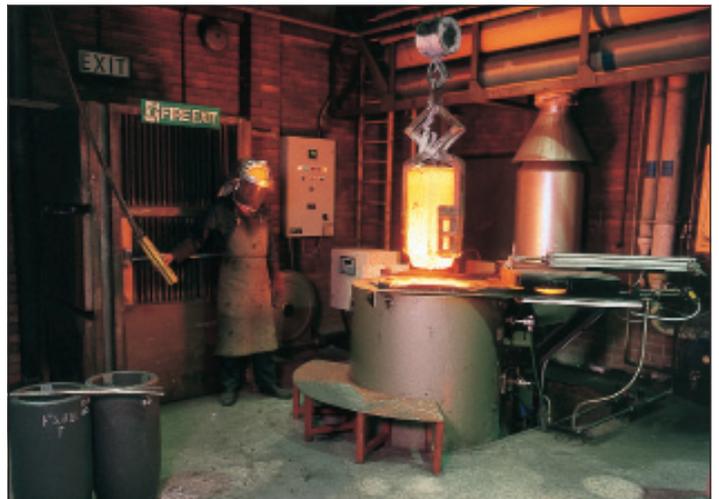
There is a choice of thermometer type to match your temperature requirements and process.

Single wavelength thermometers are intended for both general purpose use as well as solving problems in specific applications.

Ratio thermometers are used in difficult environments containing steam, smoke, or dust, or where the target does not completely fill the field of view.

Fiberoptic thermometers are used to measure the temperature of materials where the target is difficult to access.

The use of fiber optics is most effective in high temperature, high magnetic fields etc. which would prevent location of other sensors.



## SYSTEM 4 THERMOMETERS



Typical System



Standard Bodied Thermometer

Fiberoptic Thermometer



SYSTEM 4 comprises an advanced range of high precision radiation thermometers, LANDMARK® processors and a range of mounting accessories which combine to form a complete temperature measurement system.

SYSTEM 4 thermometers offer exceptional flexibility with a choice of single wavelength, ratio, fibroptic and fibroptic ratio models.

Thermometer type, temperature range, spectral response and optical characteristics are chosen to suit any application from 0 to 2600°C/50 to 4700°F

- Focusable optics - standard and short focus versions with through-the-lens sighting providing clear and guaranteed definition of target

- Optional close-up lenses - giving measurement of targets as small as 0.45mm/0.02in

- Accurate, reliable, drift-free measurement

- Rugged design with a range of mounting options

- Flexible fiber optics light guide versions - with optional laser targeting system to define target spot

- High level linear output

### RADIATION THERMOMETERS

Proven, reliable electronics and a high quality optical system combine to deliver accurate, dependable temperature measurement. A rugged die-cast aluminium body, with a high quality electrical connector, ensures reliable performance.

Standard bodied thermometers all feature through-the-lens sighting with a 6° field of view. Adjustable focus with a circular graticule gives precise alignment on to the smallest targets.

Two optical variants are available: Standard focus - adjustable between 500mm/19.7in and infinity, and Short-focus - viewing from 350mm to 1m/13.8 to 39.4in. Close-up lenses are also available which can measure targets as small as 0.45mm/0.02in from as close as 90mm/3.5in.

### FIBROPTIC THERMOMETERS

The use of flexible fiber optics allows the detector and electronics enclosure to be located in a less hostile environment, and enables access to difficult targets.

The fibroptic thermometers are available with an optional integral laser targeting system which defines the target spot for accurate alignment.

The use of fiber optics permits viewing of normally inaccessible targets, where there are high magnetic fields or in high ambient temperatures up to 200°C/400°F without cooling of the optic head. There is a choice of three optic heads and three light guide lengths.

# SYSTEM 4

Thermometer Description	Model N°	Wavelength (µm)	Range	Minimum Target Dia* (mm/in)
<b>M1 Thermometers</b> M1 thermometers are for general purpose use in high temperature applications. They utilize a silicon cell detector and operate at short wavelengths around 1.0µm where emissivity errors are minimized. They have a fast response time of 5ms.	M1 450/1000C M1 600/1600C M1 800/2600C M1 850/1850F M1 1100/2900F M1 1500/4700F	1.0 1.0 1.0 1.0 1.0 1.0	450 to 1000°C 600 to 1600°C 800 to 2600°C 850 to 1850°F 1100 to 2900°F 1500 to 4700°F	3.0/0.12 0.9/0.04 0.45/0.02 3.2/0.13 0.9/0.04 0.45/0.02
<b>M2 Thermometers</b> M2 thermometers use the latest generation of germanium detectors and operate at a wavelength of 1.6µm. They extend the measurement range of short wavelength thermometers down to 300°C/600°F and have a fast response time of 5ms.	M2 300/1100C M2 600/2000F	1.6 1.6	300 to 1100°C 600 to 2000°F	0.9/0.04 0.9/0.04
<b>M4 Thermometers</b> M4 short wavelength thermometers are used on low temperature, low or uncertain emissivity surfaces such as bright or unoxidized metals. They use lead sulphide detectors in a unique null balance mode to guarantee stability. They have a response time of 100ms.	M4 50/250C M4 150/550C M4 150/500F M4 300/1000F	2.4 2.4 2.4 2.4	50 to 250°C 150 to 550°C 150 to 500°F 300 to 1000°F	3.2/0.13 1.0/0.04 3.2/0.13 1.0/0.04
<b>M5 Thermometers</b> M5 thermometers are specifically designed for glass surface temperature measurement. Fast speed of response, coupled with small target size and accurate sighting facility make it ideal for all flat glass, glass toughening and optical fiber preform applications.	M5 400/1300C M5 1000/2500C M5 750/2400F M5 1800/4500F	4.8 to 5.2 4.8 to 5.2 4.8 to 5.2 4.8 to 5.2	400 to 1300°C 1000 to 2500°C 750 to 2400°F 1800 to 4500°F	1.0/0.04 1.0/0.04 1.0/0.04 1.0/0.04
<b>M6 Thermometers</b> M6 thermometers are designed specifically for lower temperature applications. Unique short wavelength operation minimizes errors where emissivity is low or variable.	M6 0/300C M6 100/700C M6 50/600F M6 200/1300F	3.0 to 5.0 3.0 to 5.0 3.0 to 5.0 3.0 to 5.0	0 to 300°C 100 to 700°C 50 to 600°F 200 to 1300°F	3.2/0.13 1.0/0.04 3.2/0.13 1.0/0.04
<b>M7 Thermometers</b> M7 thermometers operate at waveband selected especially for measurement on plastic films as thin as 20 micrometers (1 mil).	M7 25/375C M7 75/700F	3.43 3.43	25 to 375°C 75 to 700°F	3.2/0.13 3.2/0.13
<b>M8 Thermometers</b> M8 thermometers are designed for low temperature applications such as food, textiles, paper and plastics. They operate at a waveband which avoids the effects of atmospheric absorption.	M8 0/1000C M8 30/1830F	8.0 to 14.0 3.43	0 to 1000°C 30 to 1830°F	5.0/0.20 5.0/0.20
<b>R1 Ratio Thermometers</b> R1 ratio thermometers use dual silicon cell detectors operating at 0.85 to 1.1µm. They are used for difficult, high temperature applications where the field of view is not fully filled or where the sight path is obscured. They can accurately measure temperature of targets with up to 95% obscuration.	R1 600/1600C R1 1000/2600C R1 1100/2900F R1 1800/4700F	0.85 to 1.1 0.85 to 1.1 0.85 to 1.1 0.85 to 1.1	600 to 1600°C 1000 to 2600°C 1100 to 2900°F 1000 to 4700°F	1.8/0.07 0.45/0.02 1.8/0.07 0.45/0.02
<b>Fiberoptic M1 Thermometers</b> Fiberoptic M1 thermometers combine the flexibility of fiber optics with short wavelength operation. They can be used in high temperature applications such as metals, glass, coke ovens and induction heating.	M1 600/1600CYL M1 800/2600CYL M1 1100/2900FYL M1 1500/4700FYL	1.0 1.0 1.0 1.0	600 to 1600°C 800 to 2600°C 1100 to 2900°F 1500 to 4700°F	4.0/0.15 1.3/0.05 4.0/0.15 1.3/0.05
<b>Fiberoptic M2 Thermometers</b> Fiberoptic M2 thermometers are used in applications such as glass mold temperatures where access to the target is restricted, or limited to a few milliseconds.	M2 300/1100CYL M2 600/2000FYL	1.6 1.6	300 to 1100°C 600 to 2000°F	4.0/0.15 4.0/0.15
<b>Fiberoptic M3 Thermometers</b> Fiberoptic M3 thermometers are designed for low temperature applications, with low or uncertain emissivity, such as secondary metals.	M3 50/250CQ M3 150/500FQ	2.1 2.1	50 to 250°C 150 to 500°F	5.0/0.20 5.0/0.20
<b>Fiberoptic R1 Ratio Thermometers</b> Fiberoptic R1 ratio thermometers provide accurate high temperature measurement of small intermittent targets, such as rod and wire, and tube welding. Other typical applications include kilns and vacuum furnaces.	R1 600/1600CYL R1 1100/2900FYL R1 1000/2600CYL R1 1800/4700FYL	0.85 to 1.1 0.85 to 1.1 0.85 to 1.1 0.85 to 1.1	600 to 1600°C 1100 to 2900°F 1000 to 2600°C 1800 to 4700°F	4.0/0.15 4.0/0.15 1.3/0.05 1.3/0.05

\* When fitted with Close-up lens

Y denotes Laser Targeting Version

# THERMOMETER SPECIFICATIONS

	Model	Range	Wavelength µm	Field of View	Ambient Temperature	Response Time <sup>(1)</sup>	Interchangeability	Repeatability	Accuracy <sup>(2)</sup>	Stability
STANDARD THERMOMETERS	M1 450/1000C	450 to 1000°C	1	30:1	0 to 70°C	5ms	<1K	1K	0.4%K	<0.2K/K
	M1 850/1850F	850 to 1850°F	1	30:1	32 to 158°F					
	M1 600/1600C	600 to 1600°C	1	100:1	0 to 70°C	5ms	<1K	<1K	0.4%K	<0.2K/K
	M1 1100/2900F	1100 to 2900°F	1	100:1	32 to 158°F					
	M1 800/2600C	800 to 2600°C	1	200:1	0 to 70°C	5ms	<1K	2K	0.7%K	<0.3K/K
	M1 1500/4700F	1500 to 4700°F	1	200:1	32 to 158°F					
	M2 300/1100C	300 to 1100°C	1.6	100:1	0 to 50°C	5ms	<1K	<1K	0.25% + 1K	<0.2K/K
	M2 600/2000F	600 to 2000°F	1.6	100:1	32 to 122°F					
	M4 50/250C <sup>(3)</sup>	50 to 250°C	2.4	30:1	5 to 45°C	100ms	<1K	1K	3K	<0.1K/K
	M4 150/500F <sup>(3)</sup>	150 to 500°F	2.4	30:1	41 to 113°F					
	M4 150/550C	150 to 550°C	2.4	100:1	5 to 45°C	100ms	<1K	1K	4K	<0.1K/K
	M4 300/1000F	300 to 1000°F	2.4	100:1	41 to 113°F					
	M5 400/1300C	400 to 1300°C	4.8 to 5.2	100:1	0 to 70°C	100ms	<2K	<1K	0.6%K <sup>(4)</sup>	<0.02%K/K
	M5 750/2400F	750 to 2400°F	4.8 to 5.2	100:1	32 to 158°F					
	M5 1000/2500C	1000 to 2500°C	4.8 to 5.2	100:1	0 to 70°C	100ms	<2.5K	1K	0.5%K	<0.02%K/K
	M5 1800/4500F	1800 to 4500°F	4.8 to 5.2	100:1	32 to 158°F					
	M6 0/300C	0 to 300°C	3 to 5	30:1	5 to 45°C	100ms	<1K	<1K	0.3% + 2.5K	<0.15K/K
	M6 50/600F	50 to 600°F	3 to 5	30:1	41 to 113°F					
	M6 100/700C	100 to 700°C	3 to 5	100:1	5 to 45°C	100ms	<1K	1K	0.3% + 2K	<0.2K/K
	M6 200/1300F	200 to 1300°F	3 to 5	100:1	41 to 113°F					
M7 25/375C <sup>(3)</sup>	25 to 375°C	3.43	30:1	5 to 45°C	100ms	<1K	1.5K	3K	<0.1K/K	
M7 75/700F <sup>(3)</sup>	75 to 700°F	3.43	30:1	41 to 113°F						
M8 0/1000C	0 to 1000°C	8 to 14	100:1	0 to 70°C	100ms	2K	<1K	1%K + 1K	<0.3K/K	
M8 30/1830F	30 to 1830°F	8 to 14	100:1	32 to 158°F						
R1 600/1600C	600 to 1600°C	0.85 to 1.1	50:1	0 to 50°C	15ms	0.25%K	1K	0.65% K	<0.05%K/K	
R1 1100/2900F	1100 to 2900°F	0.85 to 1.1	50:1	32 to 122°F						
R1 1000/2600C	1000 to 2600°C	0.85 to 1.1	200:1	0 to 50°C	15ms	0.45%K	2K	1.1% K	<0.1%K/K	
R1 1800/4700F	1800 to 4700°F	0.85 to 1.1	200:1	32 to 122°F						
FIBROPTIC THERMOMETERS	M1 600/1600CYL	600 to 1600°C	1	25:1	0 to 70°C	5ms	<1K	<1K	0.4%K	<0.2K/K
	M1 1100/2900FYL	1100 to 2900°F	1	25:1	32 to 158°F					
	M1 800/2600CYL	800 to 2600°C	1	75:1	0 to 70°C	5ms	<1K	2K	0.7%K	<0.3K/K
	M1 1500/4700FYL	1500 to 4700°F	1	75:1	32 to 158°F					
	M2 300/1100CYL	300 to 1100°C	1.6	25:1	0 to 50°C	5ms	<1K	<1K	0.25% + 1K	<0.2K/K
	M2 600/2000FYL	600 to 2000°F	1.6	25:1	32 to 122°F					
	M3 50/250CQ <sup>(3)</sup>	50 to 250°C	2.1	20:1	0 to 50°C	<100ms	1K	1K	3K	<0.1K/K
	M3 150/500FQ <sup>(3)</sup>	150 to 500°F	2.1	20:1	32 to 122°F					
	R1 600/1600CYL	600 to 1600°C	0.85 to 1.1	25:1	0 to 50°C	15ms	0.25%K	1K	0.65% K	<0.05%K/K
	R1 1100/2900FYL	1100 to 2900°F	0.85 to 1.1	25:1	32 to 122°F					
R1 1000/2600CYL	1000 to 2600°C	0.85 to 1.1	75:1	0 to 50°C	15ms	0.45%K	2K	1.1% K	<0.1%K/K	
R1 1800/4700FYL	1800 to 4700°F	0.85 to 1.1	200:1	32 to 122°F						

<sup>(1)</sup> Time quoted to 95% of step change

<sup>(2)</sup> Accuracy quoted to ITS90

<sup>(3)</sup> Above 75°C/170°F

<sup>(4)</sup> Optimized for glass toughening = 3K at 630°C/1170°F

## STANDARD OPTICAL SPECIFICATIONS

Focus range	0.5m/19.7in to infinity (V version) 0.35 to 1.0m/13.8 to 39.4in (S version)
Sighting	6° graticule-defined field of view 1.8x magnification 30mm/1.2in eye relief (with or without spectacles/ safety glasses) At least 98% of energy detected is guaranteed to be within area defined by graticule

## ENVIRONMENTAL SPECIFICATIONS

Vibration	3g - 60 to 300Hz, 0.5mm - 10 to 60Hz
Humidity	0 to 99% non condensing
CE	EN 50-082-2 (immunity) EN 50-081-1 (emission)
Sealing	To IP54 requirements
Fiberoptic: Optic Head	200°C/392°F Maximum ambient temperature
Lightguide	200°C/392°F Maximum ambient temperature

## FIBROPTIC OPTICAL SPECIFICATIONS

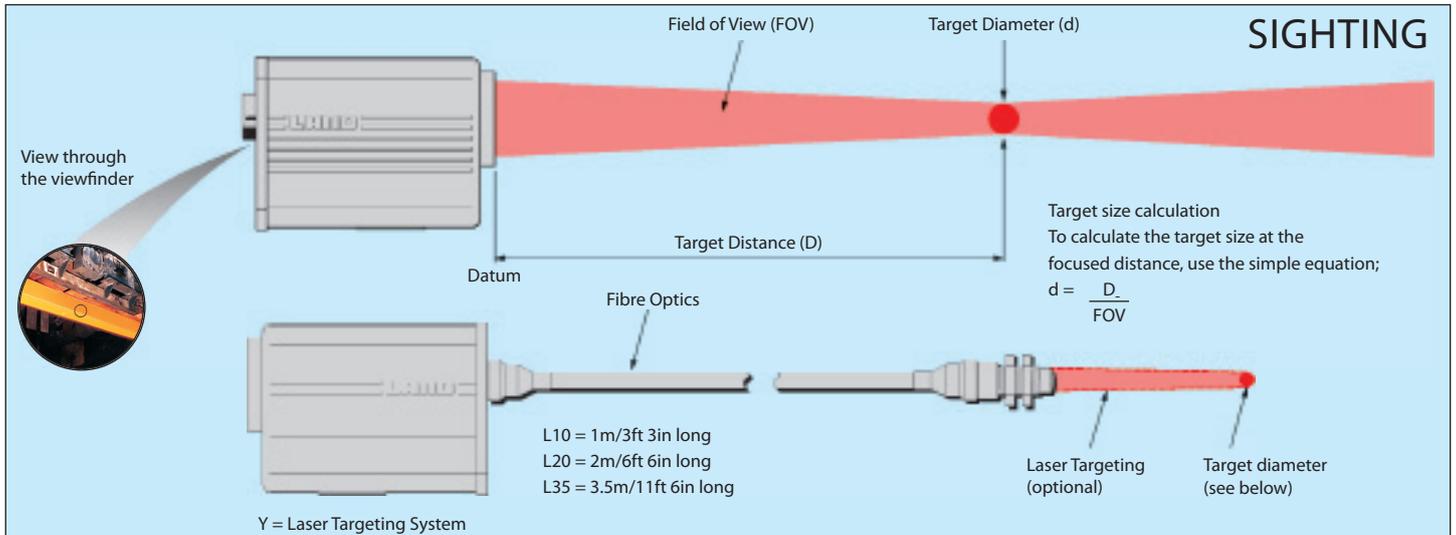
Focus range	Determined by Spacer fitted
None	500mm/19.69in
Blue	250mm/9.84in
Red	100mm/3.94in
Lightguide length	1.0m/3ft 3in, 2.0m/6ft 6in and 3.5m/11ft 6in

## OPTIONAL EXTRAS

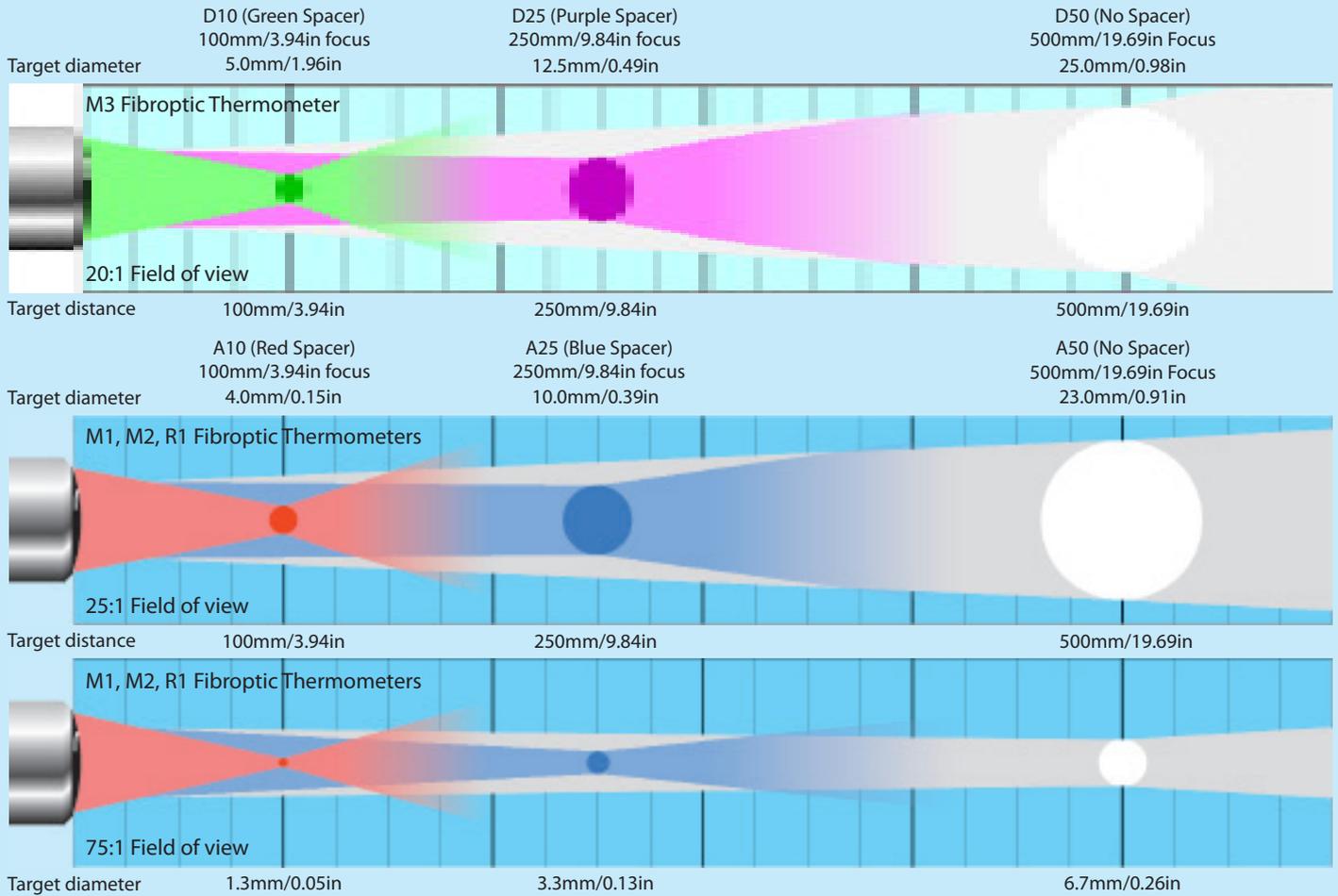
Standard Body	Close-up lenses
Fiberoptic	Laser targeting

Note: 'D' focal variants relate to M3 only

# SYSTEM 4



## FIBROPTIC THERMOMETER TARGET SIZES



### THERMOMETER MOUNTINGS AND ACCESSORIES

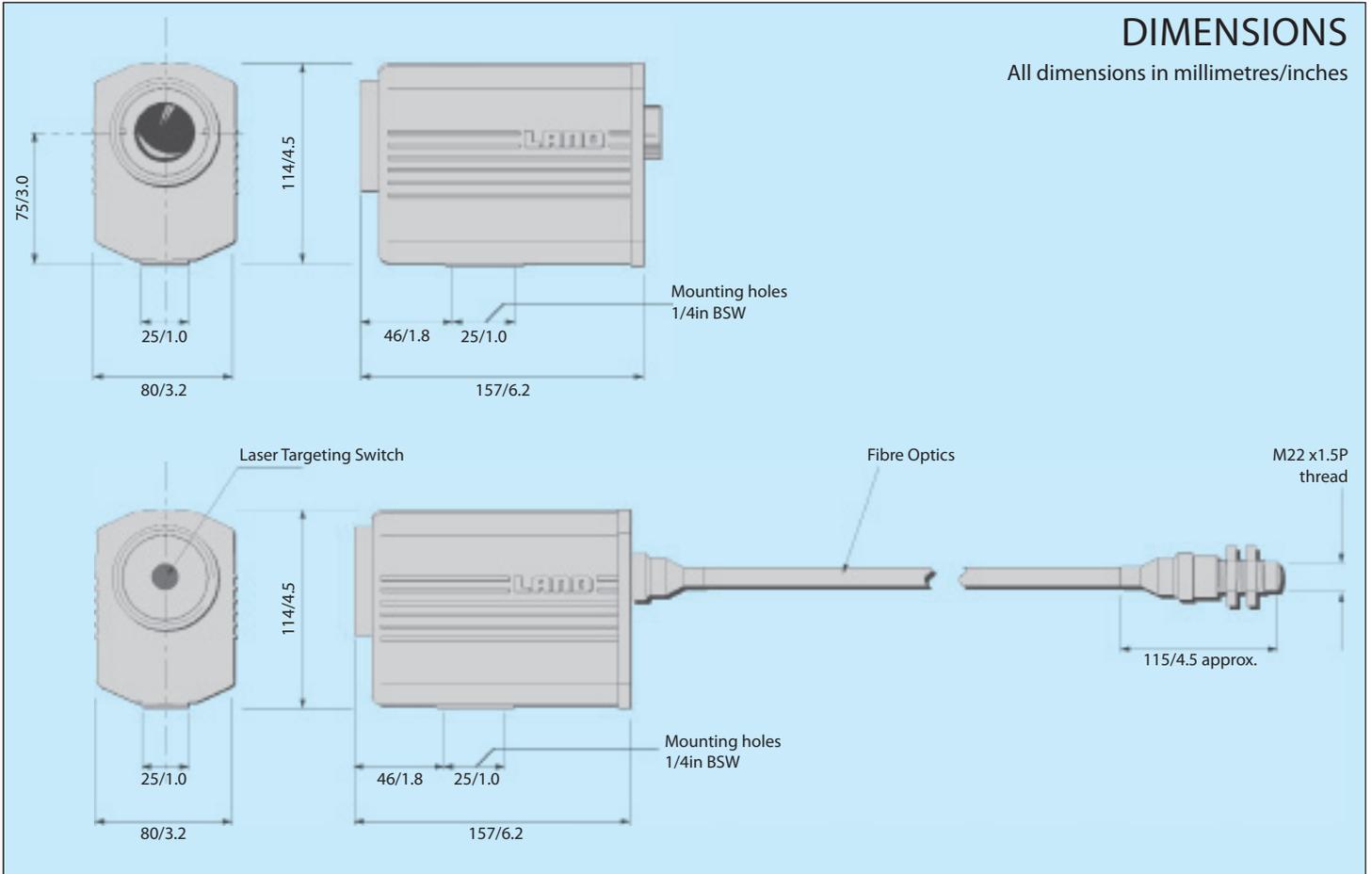
A complete range of thermometer protection and mounting accessories is available, which provides full mechanical and thermal protection for the thermometer and electrical connections, and ensures continued service with minimal maintenance, in even the most severe operating conditions.

For more information, refer to the Mountings and Accessories Brochure - ref S4M100



## DIMENSIONS

All dimensions in millimetres/inches



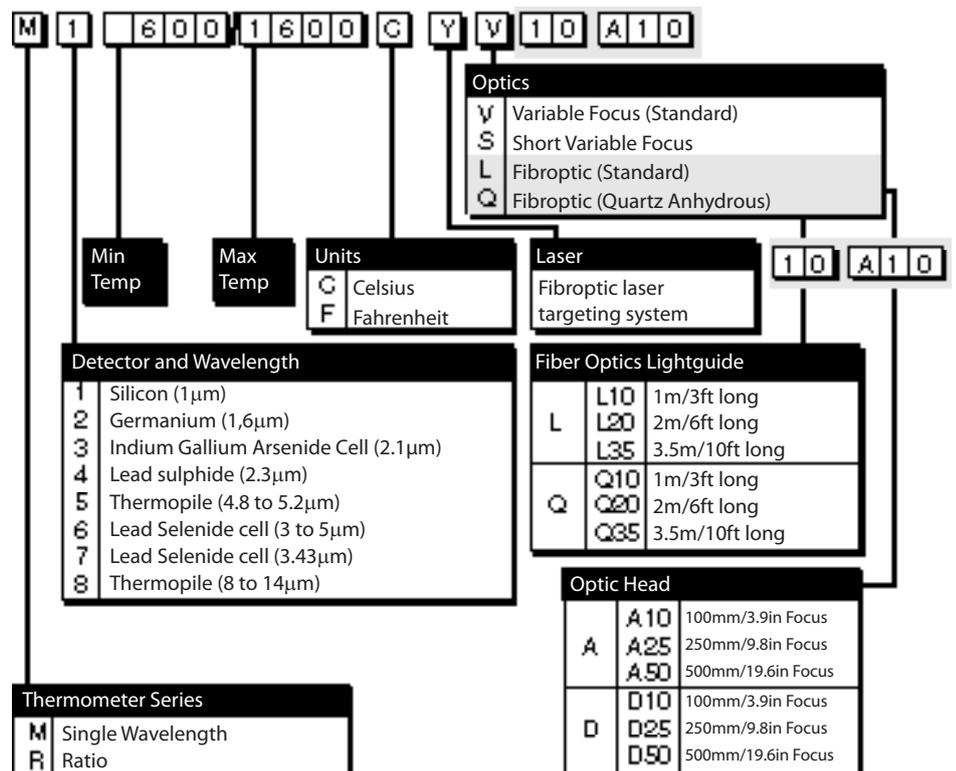
## ORDERING INFORMATION

SYSTEM 4 thermometers have a unique part number to suit the particular combination of features which make up the model.

The model number, consisting of the various options available, describes the exact SYSTEM 4 thermometer type required.

This model number can be used for selection and ordering purposes.

For example: M1 600/1600 C - V describes a single wavelength thermometer, operating at 1.0 $\mu$ m, with a measurement span of 600 to 1600 $^{\circ}$ , celsius version, with standard variable focus optics.



For more than 60 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.

**WORLDWIDE SUPPORT**

**Expert advice and support is never far away**

**WORLD LEADERS**

**LAND** is the world leader 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.

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

Land operates extensive calibration services - and all calibrations made are traceable to National Standards. In the U.S.A. Land is an ISO 9001:2000 company. Additionally calibration certificates are issued in compliance with ISO 17025:1999

**CALIBRATION**

**LAND** operates an extensive calibration service. All calibrations made are traceable to National Standards. In the USA a traceable calibration certificate can be issued complying with the National and International Standards. In the UK, **LAND** can issue a UKAS calibration certificate.

**LAND** also supplies a full range of temperature reference sources which are used to verify or re-establish the accuracy of calibration in the field or in the laboratory.

A consultancy service is also available for those companies who wish to establish their own in-house calibration facility.

**LAND**

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