Infrared Sensors for Industrial Automation

Raytek – The Worldwide Leader in Noncontact Temperature Measurement

Raytek®
A Fluke Company

Raytek – The Company

The Raytek success story began in 1963 with the founding of a small company in California's Silicon Valley and the development of the Raytek Raynger, the first handheld microprocessor-driven infrared thermometer. In the following years, the company established its current headquarters in Santa Cruz, California, and introduced a variety of innovative infrared sensors, which made Raytek a well-known brand name in North America and beyond.

Raytek European Headquarters in Berlin, Germany

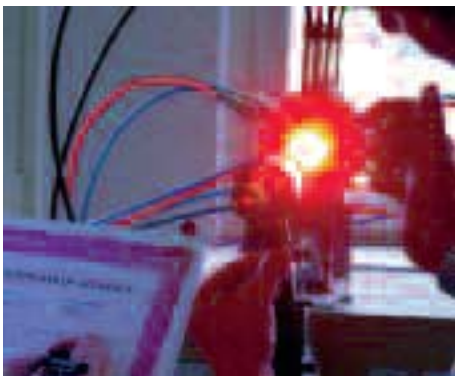
In 1991, Raytek began its worldwide expansion with the acquisition of *Sensytec GmbH*, a manufacturer of infrared thermometers in Berlin, Germany, which then became the company's current European headquarters.

As a result of targeted concentration on this specialised technology, and by focusing its marketing and sales activities on the world market, Raytek has quickly developed to become a leading worldwide provider of non-contact temperature measurement solutions.

Since 2002, Raytek is part of **Fluke Corporation**, a leading manufacturer of electronic measurement devices, owned by U.S.-based **Danaher Corporation**.

Know-How and Competence

Raytek has nearly 100 employees throughout Europe reporting to its European headquarters in Berlin. Here, in its modern production facility, the ISO 9001-certified company develops and manufactures a broad palette of innovative and reliable infrared temperature sensors and systems. It is also the Sales, Marketing and Service Centre for all of Europe, Africa and the Middle East.



The high accuracy and long-life durability of Raytek infrared temperature sensors have contributed greatly to the company's success in the infrared temperature measurement market. Not only the infrared thermometers themselves, but also calibration devices, are continuously being developed by Raytek to maintain its dedication to innovation and reliability.

Raytek infrared sensors measure temperature quickly, safely and accurately within a range of -40 to 3000°C without contacting the surface of the measurement target. Their excellent price-performance ratio makes it possible for customers throughout the world to continuously find new applications for the products. Raytek infrared temperature sensors are used worldwide in a broad range of applications where temperature plays an important role to ensure quality – whether in service trades, or in metal, glass and cement plants.

Raytek has over 40 years of experience in infrared temperature measurement. Through our global network of qualified distributors, we guarantee you flexibility, dedicated local customer support, fast service, and individual application assistance.

Raytek at a Glance

Profile:
Mid-sized company with manufacturing and development centres in the United States, Germany, and China; worldwide sales and service network.

Product/Activity:
Development, manufacturing, sales and service of non-contact temperature measurement devices:

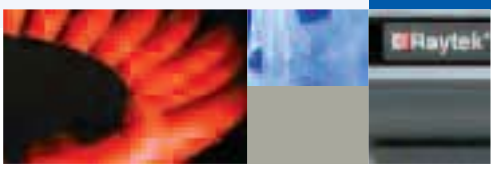
- Fixed industrial pyrometers
- Thermal imaging systems
- Handheld infrared thermometers

Raytek Customer Service:
On-site installation, service, training, calibration, and additional customer-specific services

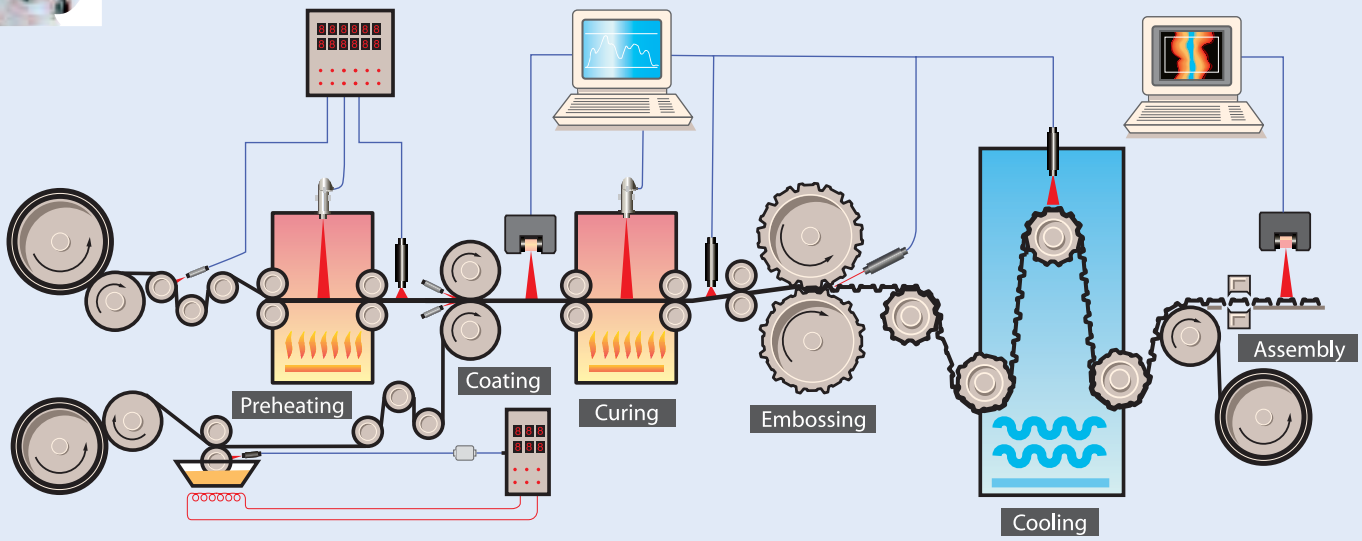
About the Beginnings of Temperature Measurement

Fire and ice, hot and cold – elemental extremes have always fascinated and challenged people. Various techniques and devices have been used throughout time in an effort to accurately measure and compare temperature conditions. For example in the early days of ceramics manufacture, meltable materials were used, which indicated through deformation that certain higher temperatures were reached. A baker on the other hand, used a piece of paper – the quicker it became brown in the oven, the hotter the oven was. The disadvantage of both of these techniques was that they were not reversible – cooling could not be determined. Also, the accuracy of the results was very dependent on the user and his or her experience. It was not until the discovery of thermometers, a little over 400 years ago, that actual temperature conditions could be measured exactly.

The discovery of infrared radiation by the physicist Wilhelm Herschel at the beginning of the 19th Century opened up new possibilities for measuring temperature – without contact and thus without affecting the object being measured and the measurement device itself. Compared to early infrared temperature measurement devices, which were heavy, awkward, and complicated to operate, the image of such devices today has completely changed. Modern infrared thermometers are small, ergonomic, easy to operate, and can even be installed into machinery. From versatile handheld devices to special sensors for integration into existing process systems, the spectrum of product offerings is vast. A variety of accessories and software for the collection and analysis of measurement data are provided with the majority of infrared temperature sensors.



Raytek sensors measure the temperature of hot, moving, or inaccessible materials safely, accurately, and with the repeatability you can count on. As part of a process control loop, a Raytek sensor can help you improve and maintain product quality and it provides you the data needed to optimise throughput and minimize downtime.



The MP150 process imager profiles a thermoformed plastic sheet to ensure proper and uniform temperature distribution.

Accurate temperature measurement of slabs, billets, or blooms on a hot rolling mill ensures product uniformity.

Monitoring edge temperature and drying uniformity results in higher yields and reduced downtime during paper production.

During coating processes, the MP150 thermal imaging linescanner produces a temperature profile of the fusion areas of the extruder, and detects deviations in material flow caused by insufficient viscosity and impurities.

Monitoring temperature of molten metal prior to and during pouring ensures correct metallurgical properties.

The advanced signal processing capabilities of smart infrared sensors ensure accurate temperature measurement for glass bottles and other discrete processes.

Sample Applications for IR-Measurement

Steel Processing and Manufacturing

Raytek provides temperature measurement solutions for every step in the steel making process, from coke ovens and blast furnaces to annealing mills and coating mills, and also has temperature measurement solutions for forging mills and heat treating facilities.

- Continuous Casting
- Reheating
- Rolling Mills
- Rod/Wire Mills
- Forging Mills
- Induction Heatings

Primary and Secondary Glass Manufacturing

Raytek noncontact infrared sensors for glass applications are designed for realtime monitoring and control of nearly every aspect of glass processing.

- Melt Furnace
- Flat Glass
- Bottles, Containers, Special Glass
- Molds & Plungers
- Lamps, Bulbs & Tubes
- Glass Fibre
- Automobile Windows
- Safety Glass
- Coated Glass

Plastic Processing

Raytek has temperature measurement solutions for every aspect of the plastic manufacturing process - from the melt to the packaging, from raw material to the finished goods.

- Blown Film Extrusion
- Cast Film Extrusion
- Biaxially-oriented Film Extrusion
- Sheet Extrusion
- Extrusion Coating
- Laminating and Embossing
- Thermoforming

Additional Application Areas

- Non-ferrous Metals
- Printing, Paper & Converting
- Petrochemical
- Asphalt, Cement, & Construction Materials
- Semiconductors
- Utilities & Electrical Inspection
- Automotive
- Textiles
- Food Processing

3i Series	Linescanner	Marathon Series			
Production of Metals, Glass, Thin Film Plastics; Heat Treatment; Energy Inspection; Power Distribution	Production Lines, Moving Objects, Discrete Processes, Kilns (see section *Process Imager Systems*)	Metals Production – Casting, Forging & Extrusion, Rod/Wire Mills, Induction Heating, Heat Treating, Welding, Molten Glass, Thermoforming, Paper Production, Food Manufacture, Lightbulb & Halogen Lamp Production, Semiconductor Surfaces			
					
3i	**MP150**	**MR**	**MM**	**FR**	**FA**
Portable pyrometers for specialty applications Sighting: Single, Dual, or Crossed Laser, Scope, Scope with Single Laser	Continuous temperature measurement and imaging of rotating, indexing or web-based processes; integrated laser sighting; System software with OPC interface; Remote Monitoring	Ratio measurement can be used for targets obscured by dust or steam; System software; Dirty-lens alarm	High-performance pyrometer with video sighting; variable focus; broad temperature range; high optical resolution; System software	Robust fibre-optic two-colour pyrometer for harshest environments; System software; Field calibration software	Single-colour fibre-optic sensing head provides a low-cost solution to the toughest applications; System software; Field calibration software
Spectral Response	Spectral Response	Spectral Response			
1.0 µm 1.6 µm 5.0 µm 7.9 µm 8 - 14 µm	1.0 µm 3.9 µm 1.6 µm 5.0 µm 3.43 µm 3-5 µm	1 µm nominal	1 µm 1,6 µm 2,3 µm 3,9 µm 5 µm 8 - 14 µm	1 µm nominal	1.0 µm 1.6 µm
Temperature Range	Temperature Range	Temperature Range			
-30 - 3000°C	20 - 1200°C	600 - 3000°C	-40 - 3000°C	500 - 2500°C	250 - 3000°C
Optical Resolution	Optical Resolution	Optical Resolution			
25:1 up to 180:1	up to 150:1 up to 1024 data points per line 45° / 90° FOV	Focusable optics, up to 130:1 (95% Energy)	up to 300:1	up to 65:1 (95 % Energy)	up to 100:1 (95 % Energy)
Accuracy	Accuracy	Accuracy			
±1%	±2% or ±2°C	±0.75% full scale	±0.3% or ± 1°C	±0.3% ± 1°C	±0.3% ± 1°C
Repeatability	Repeatability	Repeatability			
±1°C	±1% or ±1°C	±0.3% full scale	±0.1% or ± 1°C	±1°C	±1°C
Response Time	Scan Rate	Response Time (95%)			
550 or 700 mSec Varies by Model	As fast as 150 Hz	10 mSec	1 mSec**	10 mSec	10 mSec
Data Logging	Outputs	Outputs			
100 data points	0/4 - 20 mA RS-485 Mechanical Relay; Built-in Ethernet TCP/IP Communication	0/4 - 20 mA RS-485 Mechanical Relay	0/4 - 20 mA RS-485 Mechanical Relay	0/4 - 20 mA RS-485 Mechanical Relay	0/4 - 20 mA RS-485 Mechanical Relay
Outputs					
1 mV/°C RS232					

* Unless otherwise noted, optical resolution specified at nominal 90% energy.

** Exposure time according to VDI/VDE 3511

All specifications subject to change without notice. Please contact your local Raytek Representative for the most current information.

XR Series

Heating, Forming, Thermoforming, Calendering, Embossing, Sealing, Converting, Bonding, Plastic Extrusion

XR

Sensor with aluminium or stainless steel housing; Optional with laser sighting; Field calibration software

Spectral Response

3.9 µm
5.0 µm
7.9 µm
8 - 14 µm

Temperature Range

-40 - 1650°C

Optical Resolution

up to 50:1

Accuracy

±1% or ±1°C

Repeatability

±0.5% or ±0.5°C

Response Time (95%)

150 mSec

Outputs

Thermoelement Typ J/K
0/4-20mA, 0-5 V
RS-485
Mechanical Relay

TX Series

Heating, Thermoforming, Calendering, Embossing, Converting, Molding, Bonding

TX

2-wire sensor with digital communication; ATEX-certified; System software

Spectral Response

2.2 µm
8 - 14 µm

Temperature Range

-18 - 2000°C

Optical Resolution

up to 60:1

Accuracy

±1% or ±1.4°C

Repeatability

±0.5% or ±0.7°C

Response Time (95%)

165 mSec

Outputs

2-wire 4-20 mA
HART Field Bus,
Optional RS-232
Relay

Compact Series

Ovens, Drying, Laminating, Coating, Paint Drying, Curing, Machinery Monitoring, Street Paving

CM	MI	GP
Compact stainless steel sensors; Thermocouple replacement	Miniature sensor for automated processes (also as OEM module); Ambient temperature up to 180°C (without cooling)	1/8th DIN panel meter provides multiple outputs and digital display; Optional sensor with laser sighting
Spectral Response		
8 - 14 µm	8 - 14 µm	8 - 14 µm
Temperature Range		
-20 - 500°C	-40 - 600°C	-18 - 538°C
Optical Resolution		
13:1	2:1 10:1 22:1	50:1
Accuracy		
±1.5% or ±2°C	±1% or ±1°C	±1% or ±1°C
Repeatability		
±0.5% or ±2°C	±0.5% or ±0.5°C	±0.5% or ±1°C
Response Time (95%)		
150 mSec	150 mSec	300 mSec
Outputs		
Thermoelement Typ J/K 0-5 V RS-232	Thermoelement Typ J/K 0-5 V, 0/4-20 mA Optional RS-232 or RS-485	Thermoelement Typ J/K/E/N/R/S/T 0-5 V 4-20 mA Mechanical Relay

System Software

Set up, Data Monitoring and Recording

DTMD

Easy configuration and monitoring for MI, TX, XR and Marathon Series

DataTemp Multidrop software provides you with the tools you need to configure multiple sensors in a network - then monitor temperatures on a real-time graphical display.

The bar graph feature shows temperature profiles across a web or at various spots along a process.

Use the program to record and archive temperature data or format data for import into popular spreadsheet or database programs.

ThermoJacket

Protective Housing

TJ

Sensor head protection (MM, MR, TX, XR) for extreme industrial conditions

Cooling

Air/water cooling and air purge

Ambient Temperature

up to 315°C

Blackbody

Instrument Verification and Calibration

Fluke 4180/4181

Calibration Sources

Temperature Range

-15 - 120°C
35 - 500°C

Target Diameter

152,4 mm

Nominal Target Emissivity

0.95

Stabilisation Time

10 Minutes

Computer Interface

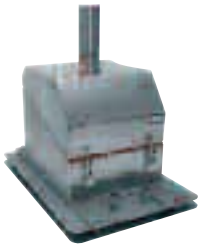
RS-232

* Unless otherwise noted, optical resolution specified at nominal 90% energy.
All specifications subject to change without notice. Please contact your local Raytek Representative for the most current information.

Process Imaging Systems

Linescanner MP150

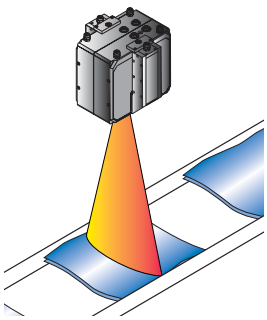
The **MP150** Linescanner Series is a family of advanced infrared linescanners providing accurate, real-time, thermal imaging for a wide variety of industrial applications.
The MP150 is surprisingly easy to install and manage. Pre-wired cables allow for fast, easy installation and connection to a standard PC. Versatile **DataTemp** DP Software allows custom configuration of MP150 operating parameters and display of thermal images and temperature profiles. The MP150 is designed for reliability and continuous operation in harsh industrial environments.

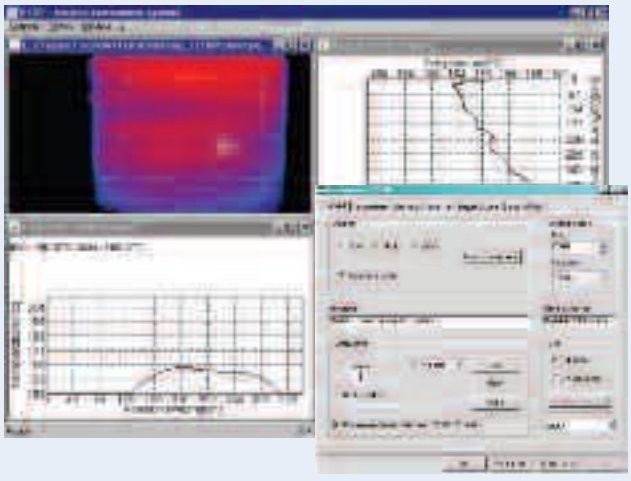


The rugged high temperature enclosure protects the MP150 Linescanner while simplifying installation and maintenance.

Edge-to-edge Temperature Measurement

Unlike point sensors that measure a single point, the MP150 measures multiple temperature points across a scan line. The MP150's motorized mirror scans at rates up to 150 lines per second. The faster scan rate allows rapid detection of temperature non-uniformities and hot spots. Rotating optics collect infrared radiation at 1024 points within a 90° field of view. A two-dimensional image is formed as the material moves across the MP150's field-of-view.





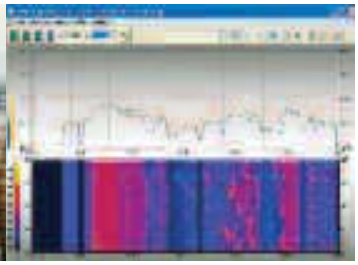
The easy-to-use Windows® system software display can be customized to meet your specialised process control requirements.

Application-Specific Systems

Raytek offers customized process imaging systems to meet specific application requirements for kiln shell monitoring, gypsum wallboard production, thermoforming machine control, extrusion coating, and glass processing:

CS200E Rotating Kilns:
Comprehensive temperature measurement system for monitoring, control, and analysis of rotating kiln shells used in cement and lime production, but also in other industries.

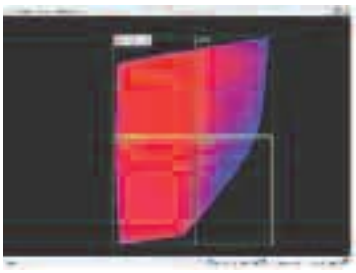
CS200E System Installation



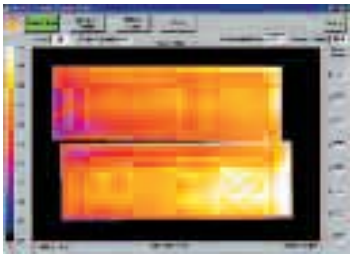
Thermogram with temperature profiles

The system combines an environmentally-protected infrared linescanner and a powerful, industrial software program. The system allows you to accurately detect and monitor hot spots in refractory bricks in order to prevent costly kiln damage and extend production runs.

GS150/GS150LE
Glass Processing:
Thermal imaging and analysis for defect detection and quality improvement in glass annealing/tempering and glass bending processes.



TIP450E Wallboard:
Detailed dryer balance analysis and thermal mapping improves board quality, production, fuel savings, defect detection, and scrap reduction.



TF150 Thermoforming: Thermal imaging and analysis to reduce scrap, improve product quality and operating economy of thermoforming processes.

EC150 Plastic Extrusion: Thermal imaging and analysis for real-time defect detection and quality improvement of plastic extrusion, coating, and lamination processes.

More Than Specifications:

Selecting The Right Infrared Temperature Sensor For Your Application

What is the temperature range of your process? How big is the measurement spot? How far away is that spot from the sensor? These are the first questions to ask to identify the right Raytek temperature sensor for your application. Environmental and operating conditions will determine other sensor specifications (e.g., ambient temperature, display and output, and protective accessories). Raytek offers a variety of products with specific temperature measurement features.

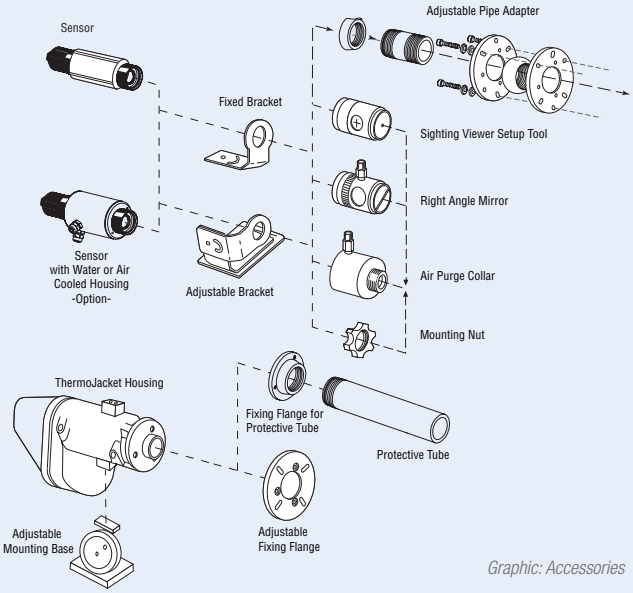
Single wavelength infrared temperature sensors need a clear line of sight between the instrument and the target. Sighting optics allow the user to aim the sensor on the target. Some instruments have a built-in laser that pinpoints the target, which is especially helpful with small targets or in dark or inaccessible areas.
A two-colour or ratio pyrometer is most effective when the target is very small, or is moving in and out of the field of view. A fibre optic unit, where the cable can snake around obstructions, is best if a direct line of sight between the instrument and the target is otherwise impossible.

Target Size and Material

For single wavelength sensors, the measurement target should be 50% larger than the field of view. If the target is smaller than the field of view, background objects (for example, a furnace wall) will influence the temperature reading. The target material's temperature range, emissivity, and surface characteristics determine the response or wavelength needed in a sensor. Highly reflective metals with different alloy compositions may have low or changing emissivities. The optimum wavelength for measuring high-temperature metal is around 1 to 1.6 µm. Since some materials are transparent at certain wavelengths, select a wavelength at which the material is opaque. A good choice for surface measurement of glass is 5 µm. Plastic films have transmission coefficients that vary according to the wavelength of the sensor and the thickness of the materials. Choosing 3.43 µm for polyethylene or polypropylene allows measurement of thin films. The recommended spectral response for low temperature applications is 8 to 14 µm.

Environmental Considerations

Raytek sensors are specified for performance within certain ambient temperature ranges. Dust, gases, or vapors can cause inaccuracies in measurement or can damage sensor lenses. Electrical noise, electromagnetic fields, or vibration are other conditions to consider before installation begins.



Graphic: Accessories

A protective housing, air purging, and air or water cooling systems can protect the sensor and ensure accurate measurements.

Noncontact Temperature Measurement:

Impressive benefits...

Infrared (IR) thermometry measures the energy that is naturally emitted from all objects, without actually touching them. This allows quick, safe measurement of the temperature of objects that are moving, extremely hot, or difficult to reach. Where a contact instrument could alter the temperature, damage, or contaminate the product, a noncontact thermometer allows accurate product temperature measurement.

These sensors are also used in applications where the high temperature of the target could damage or destroy a contact temperature sensor.

...measurable results...

Raytek Automation sensors are integrated into industrial processes to provide continuous temperature monitoring. Our smart, digital systems allow process engineers to configure sensors and monitor temperatures remotely. From miniature, single-point sensors to sophisticated imaging systems with custom user interfaces, Raytek process sensors provide accurate, reliable temperature monitoring for demanding industrial processes.

...and equal tangible return on investment.

Raytek industrial sensors deliver dependable, cost-effective, easy to use solutions for temperature monitoring. Our loyalty and commitment to worldwide service and support provides a solid foundation on which we build lifetime partnerships with our customers. By decreasing down-time and waste and improving process efficiency and output, our products ensure immediate and substantial savings in time and money.

Model Overview

CM		Temperature Range (°C)	Spectral Response (µm)
	CM	-20 to 500	8-14
Compact MI			
	LT	-40 to 600	8-14
Compact GP			
	GP	-18 to 538	8-14
XR			
	LT	-40 to 600	8-14
	MT	250 to 1200	3.9
	G5	250 to 1650	5.0
	P7	10 to 350	7.9
Thermalert TX			
	LT	-18 to 500	8-14
	HT	500 to 2000	2.2
Marathon			
	MR	600 to 3000	1.0
	FA	250 to 3000	1-1.6
	FR	500 to 2500	1.0
Marathon MM			
	LT	-40 to 800	8-14
	MT	250 to 1100	3.9
	G5L	250 to 1650	5.0
	G5H	450 to 2250	5.0
	3M	100 to 600	1.6
	2ML	300 to 1100	1.6
	2MH	450 to 2250	1.6
	1ML	450 to 1740	1.0
	1MH	650 to 3000	1.0
Linescanner MP150			
	LT	20 to 350	3-5
	MT	100 to 800	3.9
	G5	100 to 950	5.0
	P30	30 to 250	3.43
	P31	100 to 350	3.43
	1M	600 to 1200	1.0
	2M	400 to 950	1.6
3i			
	LT/LR	-30 to 1200	8-14
	G5	150 to 1800	5.0
	P7	10 to 800	7.9
	1M	600 to 3000	1.0
	2M	200 to 1800	1.6

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