Raytek® Industrial Automation Products

The Worldwide Leader in Noncontact Temperature Measurement
Noncontact Temperature Measurement:

Impressive benefits...

Infrared (IR) thermometry measures 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 safely 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.

...and measurable results...

Raytek 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.

...equal tangible return on investment.

Raytek industrial sensors deliver dependable, cost-effective, easy-to-use solutions for temperature monitoring. Our 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 throughput, our products ensure immediate and substantial savings in time and money.

Applications for IR Measurement

Maintenance
Raytek has temperature measurement solutions for monitoring critical equipment so repairs can be made when needed and not when estimated.
- Electrical cabinets: bus bar connections, circuit breakers, motor starters
- Electrical motors: housing, bearings & gearboxes
- Pumps: drive motors, bearings
- Furnace Controls
- Heating elements

Solar Solutions
Raytek has temperature measurement solutions for monitoring and controlling temperature critical to productivity and product quality.
- Polysilicon production
- Wafer Polishing
- Single Crystal Silicon Production
- Thin Film Deposition/Lamination
- PV Module Quality Control

Plastic Processing
Raytek has temperature measurement solutions for every aspect of the plastic manufacturing process – from the melt to packaging, from raw material to finished goods.
- Blown film Extrusion
- Cast Film Extrusion
- Sheet Extrusion
- Extrusion Coating
- Thermoforming
- Vacuum Forming
- Laminating and Embossing
- Biaxially-oriented Film Extrusion

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 and coating mills, and also has temperature measurement solutions for forging mills and reheat facilities.
- Continuous Casting
- Reheating
- Rolling Mills
- Rod/Wire Mills
- Stove Dome
- Blast Furnace
- Coke Ovens

Primary and Secondary Glass Manufacturing
Raytek noncontact infrared sensors for glass applications are designed for real time monitoring and control of nearly every aspect of glass processing.
- Melt Furnace
- Glass Fiber
- Automobile & Safety Glass
- Molds & Plungers
- Lamps, Bulbs & Tubes
- Flat Glass
- Bottles, Containers, Special Glass

Additional Application Areas
- Non-ferrous Metals
- Petrochemical
- Utilities
- Textiles
- Semiconductor Processing
- Printing, Paper & Converting
- Asphalt, Cement & Construction Materials
- Food Manufacturing and Processing
**Equipment Monitoring System**

The Raytek® Equipment Monitoring System is an early warning device that provides live temperature data to operators, allowing them to make educated decisions regarding the functionality of their equipment. A temperature rise or spike on the surface of equipment can be a leading indicator that there may be an equipment problem. Being aware of that temperature change means system diagnostics can be done and service planned with no interruption to production - saving money in time and resources.

The Raytek® Equipment Monitoring System is a noncontact infrared monitor that provides a 24/7 temperature measurement of actively powered components or operating machinery. Temperature is displayed on its LCD control module and/or remotely through PC-based Raytek DataTemp® Multidrop software.

**Thermal Imaging System**

**ThermoView™ Pi20 Fixed Thermal Imager**

The ThermoView Pi20 camera, combined with our easy-to-use, fully featured DataTemp DTPi software, allows us to target applications in furnace refractory monitoring, semiconductor and solar, glass, plastics, automotive, building, food & beverage, and petrochemical manufacturing. In addition, we have developed customized solutions for the following applications:

- Engine Testing
- Steel Coating
- Metal Forming
- Materials Testing
- Solar Module Testing
- Automotive Fabrication Applications

**Process Imaging Systems**

**Application Specific Systems**

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

**Cement/Lime Kilns—CS210**

CS210 is a comprehensive temperature measurement system for monitoring, control and analysis of rotating kiln shells used in cement and lime production. 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 resulting from missing or damaged refractory bricks in order to prevent costly kiln damage and to extend production runs.

**Glass Processing—GS150/GS150LE**

Thermal imaging and analysis for defect detection and quality improvement in glass annealing/tempering and glass bending processes.

**Wallboard—TIP450E**

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

**Thermoforming—TF150**

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

**Plastic Extrusion—EC150/ES150**

Thermal imaging and analysis for real-time deflection and quality improvement of plastic extrusion, coating and lamination processes.
Things to consider when selecting a sensor

- What is the temperature range of the target?
- What is the size of the target?
- How close to the target can the instrument be installed?
- Does the target fill the field of view?
- What is the target material?
- How fast is the target or process moving?
- Will you be measuring discrete objects or a continuous process?
- What is the ambient operating temperature?
- Are the ambient conditions contaminated (dust, smoke, steam)?
- Do you want to connect to existing control equipment?
- Do you need to keep records for audit or quality programs?

How Infrared Temperature Sensors Work

Infrared radiation is just one part of the electromagnetic spectrum that also includes radio waves, microwaves, visible light, and ultraviolet light, as well as gamma rays and X-rays. The infrared range of the electromagnetic spectrum falls between the visible portion of the spectrum and radio waves. Infrared wavelengths are usually expressed in microns (10^{-6} m or \(\mu m\)), with the infrared spectrum extending from 0.7 microns to 1000 microns. Only the 0.7 to 18 micron band is used for infrared temperature measurement.

As shown in the figure to the left, an object reflects, transmits, and emits energy. The intensity of an object’s emitted infrared energy increases or decreases in proportion to its temperature. Emissivity is a term used to quantify the energy-emitting characteristics of different materials and surfaces.

Most Raytek infrared sensors have adjustable emissivity settings, usually from 0.1 to 1.0, which allow accurate temperature measurements of various surface types.

An infrared sensor detects the energy emitted from an object and focuses that energy onto one or more detectors. The detector converts the infrared energy to an electrical signal, which is in turn converted into a temperature value based on the sensor’s calibration equation and the emissivity setting. This temperature value can be displayed on the sensor, output as an analog signal, or — in the case of a smart sensor — converted to a digital output and displayed on a computer terminal.

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-color or double wavelength instrument is most effective when the target is very small, partially obstructed or is moving in and out of the field of view. A fiber-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 larger than the field of view by 50%. 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

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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 0.8 to 1.0 micron. 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 microns. Plastic films have transmission coefficients that vary according to the wavelength of the sensor and the thickness of the materials. Choosing 3.43 microns for polyethylene or polypropylene or 7.9 microns for polyester allows measurement of thin films. The recommended spectral response for low temperature applications is 8 to 14 microns.

Fast Response Time
Raytek infrared temperature sensors reach 95% of the final temperature reading — a common definition of response time — much faster than contact temperature sensors (such as thermocouples). This is particularly important when measuring quickly heated or moving objects. Newer Raytek infrared technology feature sensor response times down to one millisecond.

Signal Processing
Discrete processes, such as parts manufacturing, require instruments with signal processing (e.g., peak or valley hold and averaging). For example, using peak hold when measuring the temperature of discrete items on a conveyor prevents the temperature/sensor from reading the background temperature.

Ease of Use
Raytek infrared temperature sensors are easy and intuitive for plant operators to use. Depending on the model, a sensor’s output temperature can be seen directly on the unit, on a separate panel display, or on a PC monitor.

Digital Output
Digital output eases sophisticated temperature variation analysis. DataTemp MultiDrop software allows remote sensor configuration and temperature data acquisition. This data can be exported to other software applications. Temperature information can easily be archived, graphed, or printed to fulfill documentation needs with minimum expense.

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, and vibration are other conditions to consider before installation begins. A protective housing, air purging, or air or water cooling systems can protect the sensor and ensure accurate measurements. When steam, dust, or other particles degrade the measurement signal, choose a Raytek two-color instrument. Fiber-optic sensors, where the optical head is separated from the sensor electronics with a fiber-optic cable, also provide a solution around electromagnetic fields or other harsh environments.

Raytek sensors measure the temperature of hot, moving, or inaccessible materials safely, accurately, and with repeatability you can count on. As part of a process control loop, a Raytek sensor can help you improve and maintain product quality and provide the data needed to optimize throughput and minimize downtime.
<table>
<thead>
<tr>
<th>ThermoView</th>
<th>Process Imaging Series</th>
<th>Marathon Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Thermal Imaging</td>
<td>Production Lines, Moving Objects, Discrete Processes, Kilns</td>
<td>Application Specific Systems</td>
</tr>
<tr>
<td>our process imaging systems have been specifically designed for detailed, accurate and reliable monitoring, alarming and control of industrial processes.</td>
<td>Induction Heating, Heat Treating, Welding, Forging, Casting, Molten Glass, Metal Extrusion, Furnaces, Ovens, Curing Equipment, Plastics Processing</td>
<td></td>
</tr>
<tr>
<td><strong>ThermoView Pi20</strong></td>
<td><strong>MP150</strong></td>
<td></td>
</tr>
<tr>
<td>ThermoView Pi20 is a rugged thermal imaging camera designed for industrial process control applications</td>
<td>Linescanner provides continuous temperature measurement and imaging of rotating, indexing or web-based processes; System software with OP C interface; Remote Monitoring</td>
<td></td>
</tr>
<tr>
<td>Spectral Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-14µm</td>
<td>1.0µm, 1.6µm, 3.43µm, 3.9µm</td>
<td>MR, MM, FR, FA</td>
</tr>
<tr>
<td>1µm Ratio</td>
<td>8-14µm, 3.9µm, 5µm, 2.4µm, 1.6µm, 1µm</td>
<td>1µm Ratio</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>600°C to 3000°C (1112°F to 5430°F)</td>
<td>40°C to 3000°C (-40°F to 5430°F)</td>
</tr>
<tr>
<td>Optical Resolution*</td>
<td>320 x 240</td>
<td>1.024 points across a 90° or 45° field of view</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2% or ±2°C</td>
<td>±2% or ±2°C</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±1% or ±1°C</td>
<td>±1% or ±1°C</td>
</tr>
<tr>
<td>Scan Rate</td>
<td>Up to 150 Hz</td>
<td>Up to 150 Hz</td>
</tr>
<tr>
<td>Outputs</td>
<td>NTSC/PAL, RS-485, Mechanical Relay, Ethernet</td>
<td>4-20mA, RS-485, Mechanical Relay, includes Windows® software</td>
</tr>
<tr>
<td><strong>Application Specific Systems</strong></td>
<td><strong>Ratio measurement can be used for targets obscured by dust or steam</strong></td>
<td><strong>High-performance infrared thermometer with video sighting, broad temperature range; high optical resolution; System software</strong></td>
</tr>
<tr>
<td><strong>Induction Heating, Heat Treating, Welding, Forging, Casting, Molten Glass, Metal Extrusion, Furnaces, Ovens, Curing Equipment, Plastics Processing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Linescanner provides continuous temperature measurement and imaging of rotating, indexing or web-based processes; System software with OPC interface; Remote Monitoring</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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.
<table>
<thead>
<tr>
<th><strong>Industrial</strong></th>
<th><strong>Thermalert Series</strong></th>
<th><strong>Compact Series</strong></th>
<th><strong>3i Series</strong></th>
</tr>
</thead>
</table>

### XR | TX | Equipment Monitoring System | CM | MI3 | GP | 3i |
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single piece sensor with various temperature ranges for specialized applications</td>
<td>Single piece sensor with various temperature ranges for specialized applications</td>
<td>Early warning device for 24/7 monitoring of actively powered components or operating machinery</td>
<td>Intergrated powerful sensor, perfect for OEMs</td>
<td>Powerful two-piece system with miniature sensing head and separate communications electronics with network interface options</td>
<td>1/8th DIN panel meter provides multiple outputs and digital display</td>
<td>Hand held thermometer for specialty applications. Sighting: Single, Dual or Crossed Laser, Scope, Scope with Single Laser</td>
</tr>
</tbody>
</table>

**Spectral Response**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 -14µm 3.9µm 5.0µm 7.9µm</td>
<td>8 -14µm 2.2µm</td>
<td>8-14µm</td>
<td>8-14µm</td>
<td>5µm 8-14µm</td>
<td>8-14µm</td>
<td>1.0µm 1.8µm 5µm 7.9µm 8-14µm</td>
</tr>
</tbody>
</table>

**Temperature Range**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40°C to 1650°C (40°F to 3002°F)</td>
<td>-18°C to 2000°C (0°F to 3600°F)</td>
<td>-40°C to 600°C (-40°F to 1112°F)</td>
<td>-20°C to 500°C (-4°F to 932°F)</td>
<td>-40°C to 1650°C (-40°F to 3002°F)</td>
<td>-18°C to 538°C (0°F to 1000°F)</td>
<td>-30°C to 3000°C (-22°F to 5432°F)</td>
</tr>
</tbody>
</table>

**Optical Resolution**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 50:1</td>
<td>up to 60:1</td>
<td>10:1</td>
<td>13:1</td>
<td>up to 22:1</td>
<td>up to 50:1</td>
<td>25:1 to 180:1</td>
</tr>
</tbody>
</table>

**Accuracy**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>±1% or ±1°C</td>
<td>±1% or ±1.4°C</td>
<td>±1% or ±1°C</td>
<td>±1.5% or ±2°C</td>
<td>±1% or ±1°C</td>
<td>±1% or ±1°C</td>
<td>±1%</td>
</tr>
</tbody>
</table>

**Repeatability**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>±0.5% or ±0.5°C</td>
<td>±0.5% or ±0.7°C</td>
<td>±0.5% or ±0.5°C</td>
<td>±0.5% or ±2°C</td>
<td>±0.5% or ±0.5°C</td>
<td>±0.5% or ±1°C</td>
<td>±1°C</td>
</tr>
</tbody>
</table>

**Response Time (95%)**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>As fast as 150 mSec</td>
<td>As fast as 100 mSec</td>
<td>130 mSec</td>
<td>150 mSec</td>
<td>As fast as 20 mSec</td>
<td>As fast as 500 mSec</td>
<td>550 or 700 mSec Varies by model</td>
</tr>
</tbody>
</table>

**Outputs**

<table>
<thead>
<tr>
<th>XR</th>
<th>TX</th>
<th>Equipment Monitoring System</th>
<th>CM</th>
<th>MI3</th>
<th>GP</th>
<th>3i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type J/K</td>
<td>Type J/K</td>
<td>2-wire 4-20mA</td>
<td>USB, RS485, ASCII includes Windows® software</td>
<td>Type J/K</td>
<td>Type J/K</td>
<td>100 data points</td>
</tr>
<tr>
<td>thermocouple</td>
<td>thermocouple</td>
<td>optional RS-232</td>
<td></td>
<td>thermocouple</td>
<td>thermocouple</td>
<td>Outputs</td>
</tr>
<tr>
<td>0/4-20mA</td>
<td>0-5V</td>
<td>RS485</td>
<td>1mV/ºC</td>
<td>0-5V</td>
<td>4-20mA</td>
<td>RS232</td>
</tr>
</tbody>
</table>

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At Raytek, our commitment to the customer begins long before there is a sale. It starts with the way we do business.

Our mission is to provide superior infrared temperature measurement solutions — for industrial process applications — for industrial and commercial users around the world. This means offering a variety of innovative, rugged products that meet the diverse needs of a wide range of customers.

To reach our goals, we do more than provide high-quality products. We design cost savings into each of our products so that they are value-priced and fit virtually any budget.

We introduce the benefits of infrared technology to new users by continually identifying new markets and applications for our products. By expanding our geographic reach with worldwide subsidiaries and qualified distributors, we ensure that support for our products is local, where our customers need it.

Our vision is global: to bring the benefits of infrared thermometry to every corner of the world. Every day, we discover new industries and applications for our products.