

# Steel Industry

## Processing and Manufacturing



## Noncontact Temperature Measurement Solutions

### Major Applications

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

Raytek noncontact infrared thermometers are designed for use in steel manufacturing processes where monitoring and controlling temperature is critical to productivity and product quality.

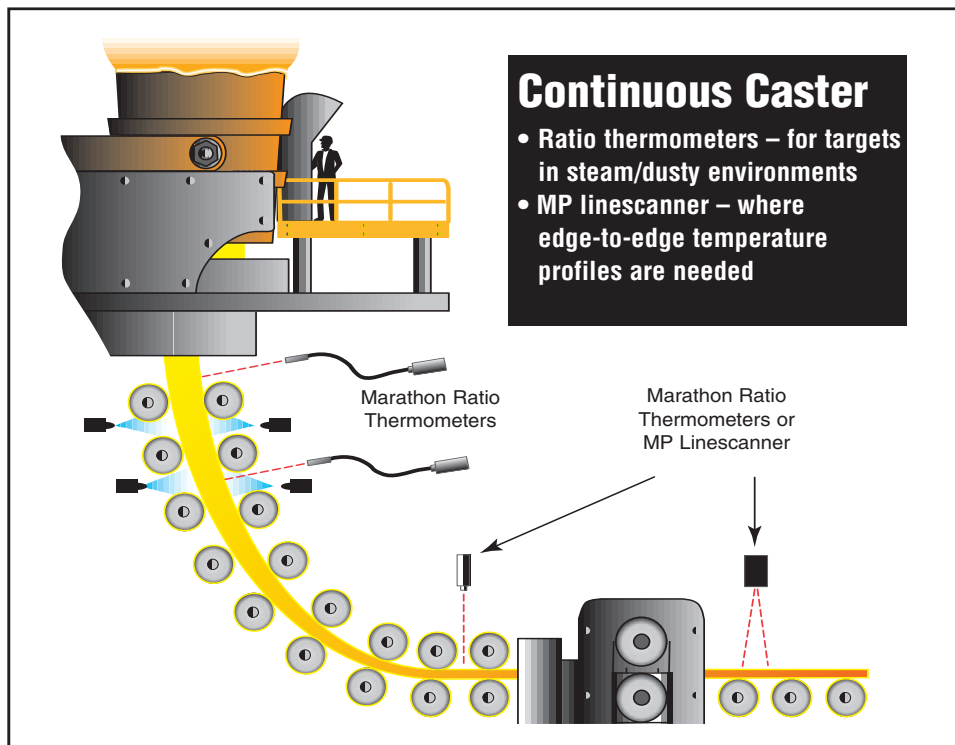
Temperature readings show whether processes are operating within their proper ranges, whether a reheater is too cold or too hot, whether a stand needs adjusting, or how much cooling should be applied. Each stage can be accurately monitored so the steel retains correct metallurgical properties as it travels through the milling process.

Every section of the steel manufacturing process can benefit from Raytek infrared thermometers. They help to achieve:

- Higher quality products
- Increased productivity
- Reduced energy costs
- Enhanced worker safety
- Reduced downtime
- Easy data recording

Raytek infrared sensors take temperature measurement one step further. Simultaneous analog and digital output allows temperature data to be integrated into a closed loop control system and simultaneously output for remote temperature monitoring and analysis. Raytek smart sensors, with digital electronics and 2-way communications, can be configured remotely from the safety of the control room - especially important for metals with changing emissivities. The result: increased functionality and greater control.

A wide range of optics, including a remote-controlled, motorized variable focus, covers an enormous variety of applications. This is supported by integrated through-the-lens sighting, plus either laser or video sighting for correct target location.



Accurate ongoing temperature measurements are crucial throughout the steelmaking process to produce quality products and enhance process efficiency.

## Continuous Casters

At the continuous caster (similar to the above illustration) where molten steel begins its transformation into slabs, billets, or blooms, productivity problems can slow or shut down an entire plant.

Accurate real-time temperature monitoring coupled with the ability to adjust water nozzles and water flow rates allow for proper cooling, which helps maintain metallurgical properties. The results are better quality products, higher levels of productivity, and longer equipment life.

The type and model of sensor is governed by the type of process and the sensor's location. Marathon infrared ratio thermometers, such as FR fiber optic sensors and MR integrated sensors, are the perfect choice for installation in harsh, dirty environments where the line of sight is obscured by dust, water spray, or steam. Use MP linescanners where edge-to-edge temperature profiles are needed.

## Reheating Process

Reheating steel to a uniform temperature is critical so that deformation does not occur. Uneven heating strains milling equipment and increases maintenance downtime. Measuring inside of a reheater with a series of temperature measurement devices (see lower right illustration) gives an operator the

ability to check the reheater's overall temperature and burner efficiency. Being able to correct the reheating process results in a more efficient use of fuel, which in turn produces a better quality product with less environmental waste.

Once the slab or billet exits the reheat furnace (bottom left illustration), Marathon ratio thermometers or MP line-scanners (for wide slabs) transmit temperature data immediately to an operator or controller allowing milling operations to be adjusted to their correct settings.

## Hot Rolling Mills

The diversity in the types of hot rolling mills and the number of types of stands in a process vary according to the type of product being manufactured. (Refer to the hot rolling mill illustration on the top of next page.)

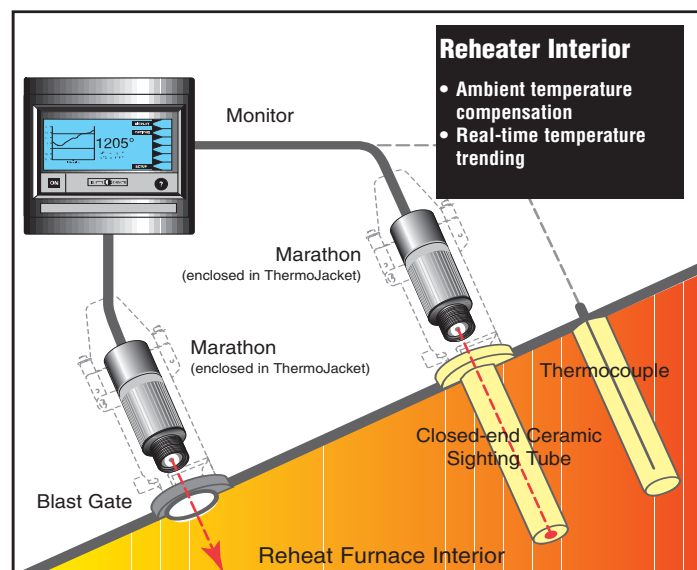
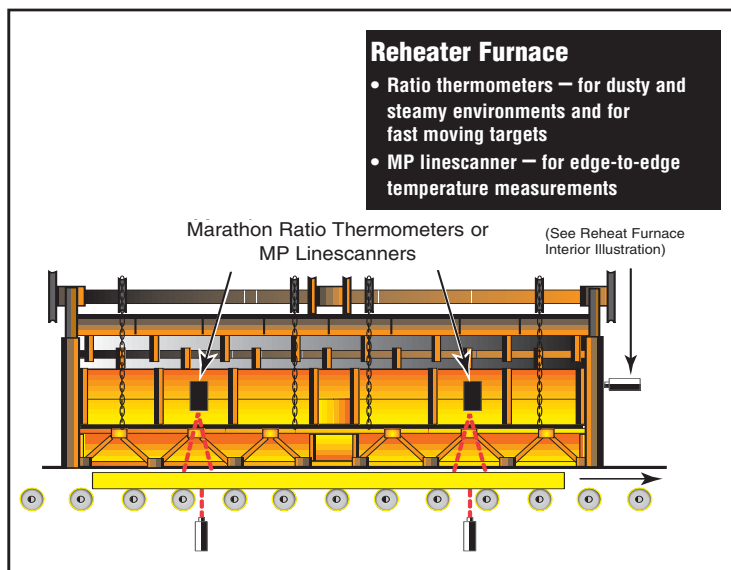
## Scale Breaker

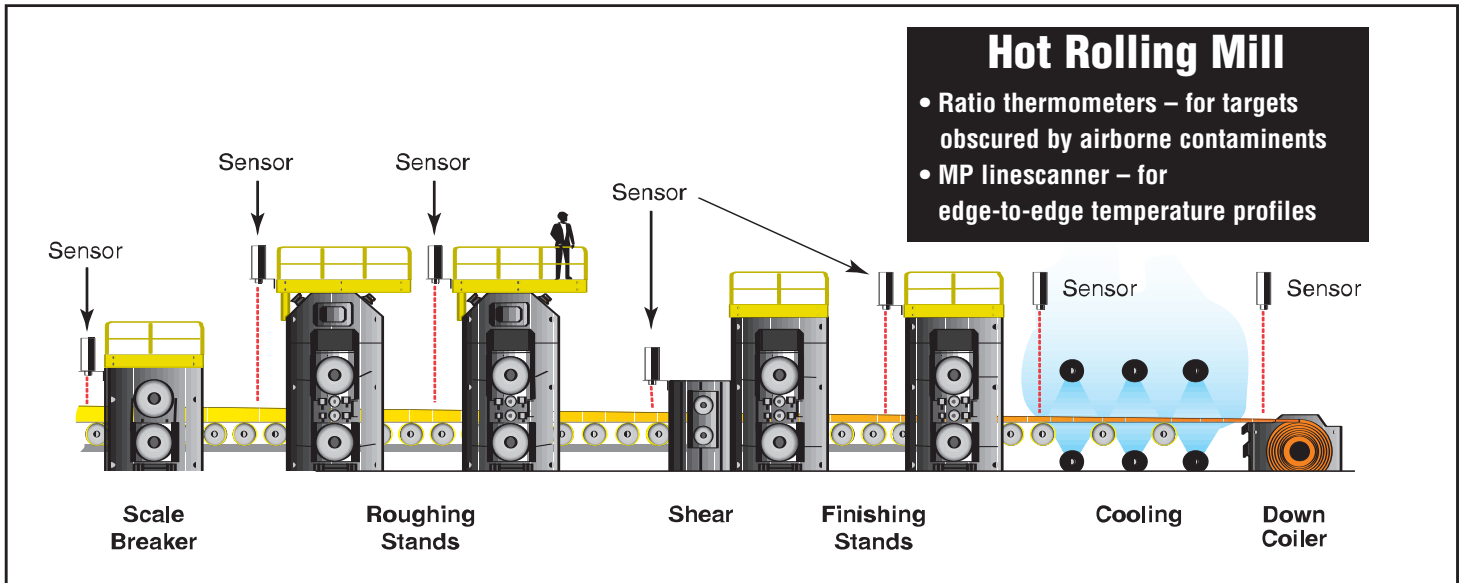
In all aspects of steel manufacturing process, ongoing temperature measurements and stand adjustments ensure that quality and process line uptime is the norm and not the exception.

Marathon high performance ratio thermometers or a 1-micron MP linescanner (for wide slabs) placed before the scale breaker and before the roughing stands allows the operator to check that product temperatures are within rolling limits and to set the roughing mills accordingly.

## Rolling Stands

Cooling continues as the steel makes its way to the rolling stands. If a process line stops for any length of time, the steel may cool more than usual before starting up again.





Either way, the stands' rolls must be set to compensate for the temperature change. Rolls can be set manually by the operator, or Raytek infrared sensors mounted before each stand can automatically set the milling equipment. This makes sure the stands are configured properly for the steel's temperature. For controlling cooling areas, where steam and dust can block temperature readings, a Marathon ratio thermometer takes accurate measurements with up to 95% of the target obscured.

### Down Coiler

At a hot rolling mill (similar to top illustration) cooled steel is often rolled up at the down coiler for transport to a cold mill or another facility.

Accurate temperature measurements at the down coiler are needed to maintain proper cooling at the laminar-flow cooling section. Temperatures at this point are critical so the steel can be cooled properly before coiling. Incorrect cooling can change metallurgical properties, and the coil would have to be scraped.

### Coil Box

Because the cooler steel at this point may be traveling 20 to 30 m/s, a low-temperature infrared sensor with fast response time, such as the Marathon Sensor, is needed. Another type of coiling is done at some mills where hot steel is coiled after the roughing stands for transport to another plant location. The rolls are then uncoiled and run through the finishing stands, cooled, then recoiled at the down coiler.

Where the hot roll is uncoiled, accurate temperature measurement and monitoring are

important so the operator can correctly configure the finishing stands' rollers.

### Cold Mills

Coiling is also often done at the end of the finishing stands after cooling, and the coiled steel is transported to cold mills in another area in the plant or shipped to other facilities. Cold rolling makes a product thinner and smoother and is done while the steel is around 100°C or at room temperature. Sensors mounted between each finishing stand allow the operator to detect temperature changes that require any adjustments.

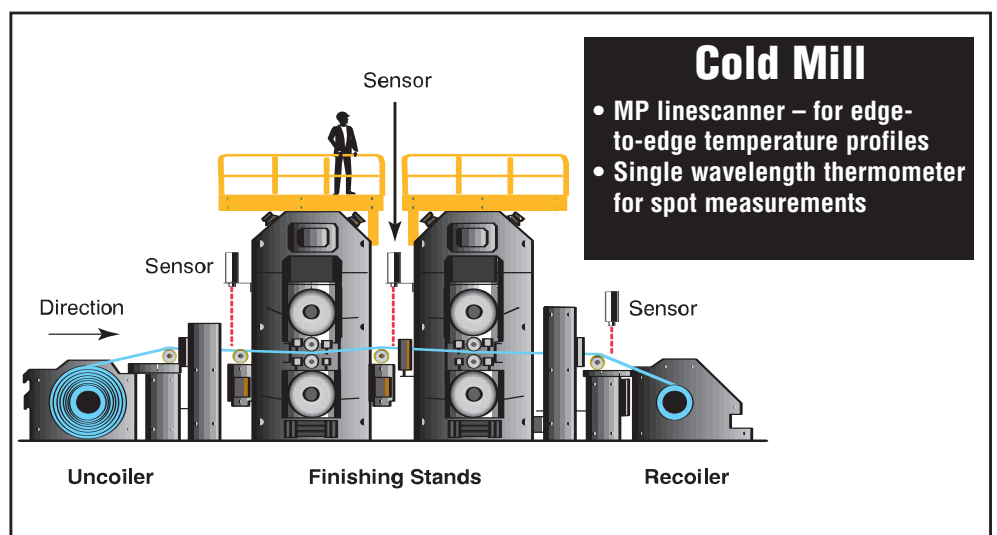
### Rod/Wire Mills

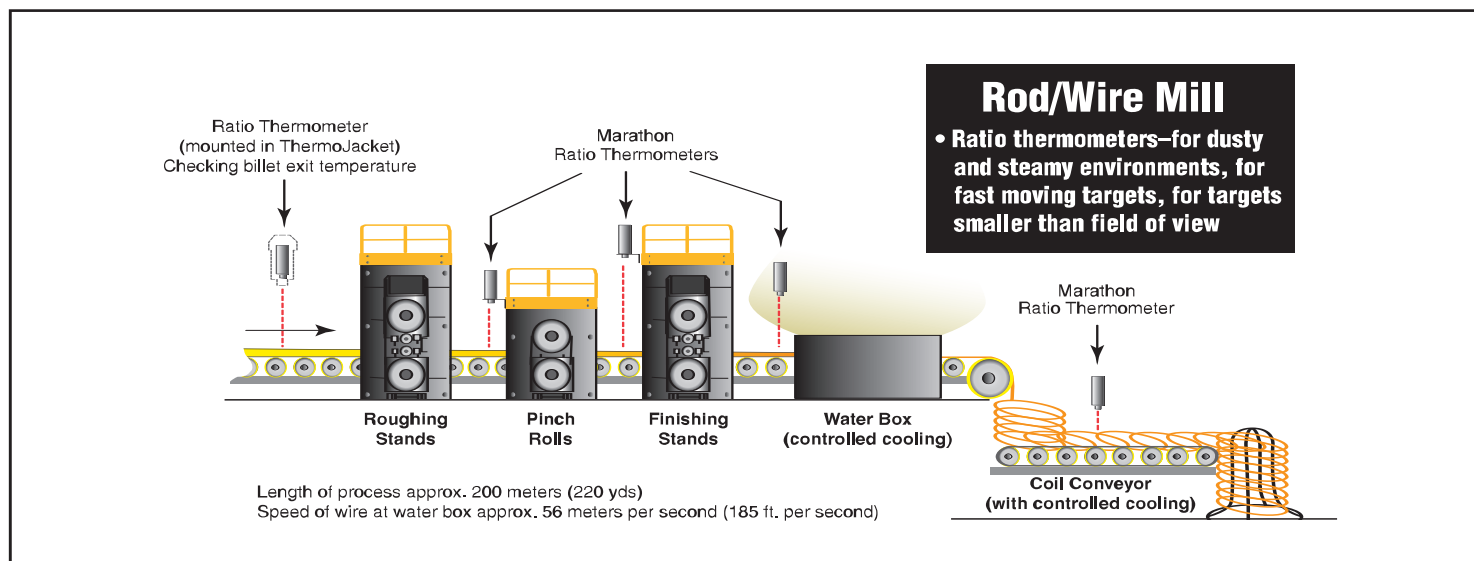
Other high-speed processes include rod and wire mills. In a typical rod and/or wire mill, billets are reheated and sent to a rolling mill to be reshaped as rods. (Refer to the Rod/Wire Mill illustration on the following page.) From here the rods go through a

series of intermediate stands that reduce the rods to different sizes. Finishing stands reduce and smooth the rods into a product that can be further processed into hundreds of different products.

Reheating a billet to a uniform temperature is critical to the entire process. Uneven heating strains milling equipment and increases maintenance downtime. (See the Reheating section on page 2 for more information.) Knowing the temperature of the product at each stand allows the operator to adjust the rollers accordingly. When the product heads for the cooling area, cooling is rapid but carefully monitored to make sure the metallurgical properties are correct. If cooling is improperly controlled, the product would not meet specifications and could be downgraded or scrapped.

In some processes, the high speeds and vibrations of narrow rod or wire products make temperature measurement difficult.





Marathon high-performance infrared ratio thermometers solve this problem. Even when the target drifts in and out of the field-of-view or is partially obscured (dust, steam, obstacles), the Marathon sensor will still take accurate temperature measurements.

## Other Processes

Raytek has temperature measurement solutions for every step in the steel making process, from coke ovens and blast furnaces to annealing mills and coating mills. Raytek also has temperature measurement solutions for forging mills and heat treating facilities. Wherever temperature is a factor in production, from the raw material to the finished goods, Raytek is there to help.

## Raytek Solutions for Steel Industries

**Marathon Series** - combining superior performance with state-of-the-art digital technology, the Marathon Series is a family of unique infrared instruments designed for harsh operating environments. These integrated units offer advanced electro-optics, smart digital electronics, and a built-in user

interface in a rugged, compact housing.

Included in the series are the following:

- One- and two-color infrared thermometers
- Short wavelength/low temp thermometers
- Fiber optic infrared thermometers
- Wide range of optics, including a remote-controlled, motorized variable focus
- Through-the-lens sighting, plus either laser or video sighting
- ThermoJacket and accessories
- Configuration and monitoring software
- Field calibration and utilities software

## DataTemp Multidrop Software:

Windows software for all Marathon thermometers, features trend plotting, data logging, sensor setup, process alarming, and statistical process control.

## XR Series:

Designed to optimize continuous temperature monitoring. The XR is a rugged, IP65 sealed single-piece system with the flexibility to handle nearly any application. The Sensor provides multiple extended temperature ranges, precision temperature resolution and a wide feature set.

## MP Linescanner:

The cost-effective way to measure edge-to-edge temperatures for control of product uniformity. Provides data for up to 256 points per scan, 48 scans per second, in a 90° field-of-view.

## DataTemp DP Software:

Windows software for the MP linescanner. Remote temperature monitoring, control, and analysis. View real-time and saved thermal images, and correct process irregularities before they become problems.

## Raytek Know-how and Service

With over 40 years experience, Raytek knows infrared temperature measurement. Our application specialists are located around the world to help answer your technical questions. In addition, maintenance, training, calibration and other customized services are available to ensure that you receive the maximum benefits from your Raytek infrared, noncontact thermometer. For more information on Raytek infrared temperature measurement solutions, contact us today.

## CONTACT US FOR MORE INFORMATION

Hugo Tillquist AB  
info@tillquist.com  
+ 46 8 594 632 00