Infrared Temperature Measurement

Temperature measurement has been traditionally carried out by contact with the process being measured. For example a Pt100 or thermocouple temperature probe can be physically inserted in the process being measured.

In some applications this is not possible so, in these cases we can use Infrared temperature sensors (also known as Pyrometers). The main advantage of using an infrared sensor is that it does not need to be in contact with the subject to be measured.

Typical Applications For An Infrared Temperature Sensor?

Sometimes a non-contact sensor is preferred instead of a contact sensor. Situations include:

- **The target is moving.** An IR sensor is ideal for measuring the temperature of a moving target
- **You need a fast response time**. Contact probes take time to heat up, but infrared temperature sensors provide a reading within a fraction of a second.
- **The target has a high voltage.** Non-contact sensors can be positioned a safe distance away from conductors to avoid electrical arcing.
- **The target is vibrating.** The pyrometer can be mounted elsewhere, where there is no vibration.
- **The target cannot be touched for sanitary or manufacturing process reasons.** There is no need to clean an infrared temperature sensor after every measurement, making them ideal for the food and pharmaceutical industries. In the plastics industry for example, IR sensors can be used to check the surface temperature of plastic as it cools to avoid it deforming.

Operation

Everything on the planet emits energy in the form of electromagnetic radiation. The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation. Emissivity is the ratio of the thermal radiation from a surface to the radiation from an ideal black surface at the same temperature. The ratio varies from 0 to 1. The surface of a black object emits thermal radiation at the rate of approximately 448 watts per square meter at room temperature (25°C); objects with emissivities less than 1.0 emit radiation at correspondingly lower rates.

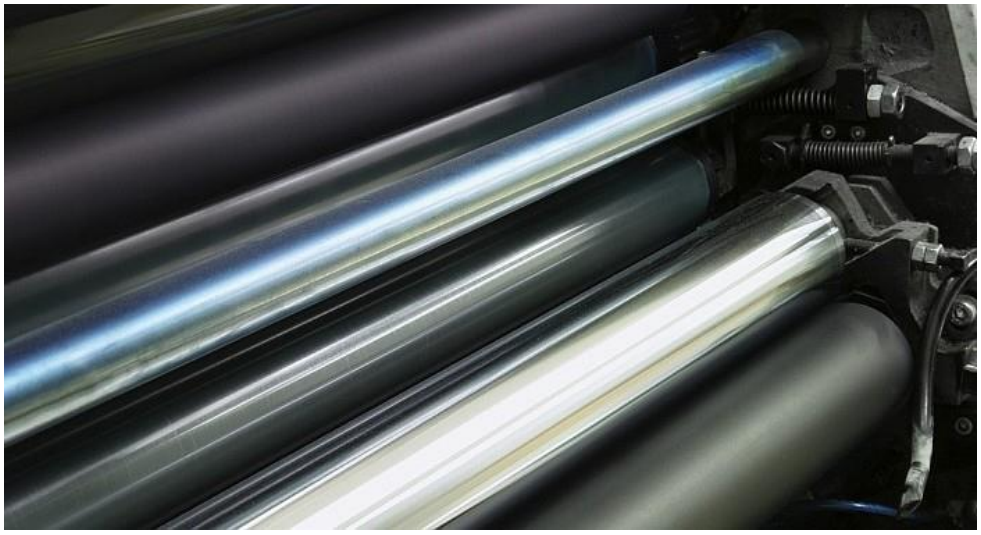
Infrared temperature sensors work by measuring the intensity of that energy and converting it into a meaningful temperature reading. In the case of the IR200 it converts the energy into a 4 to 20 mA signal over the temperature range chosen.

Materials To Be Measured

Target material and condition

Examples of materials with high emissivity. Materials like these are easy to measure with general-purpose IR pyrometers.

As well as emitting infrared radiation, most materials are reflective to some extent. A shiny bare metal surface will reflect more IR energy than a matt painted surface. The sensor needs to know how much of the energy it is “seeing” has been emitted by the object as a result of its own temperature. This is done using the sensor’s emissivity setting.

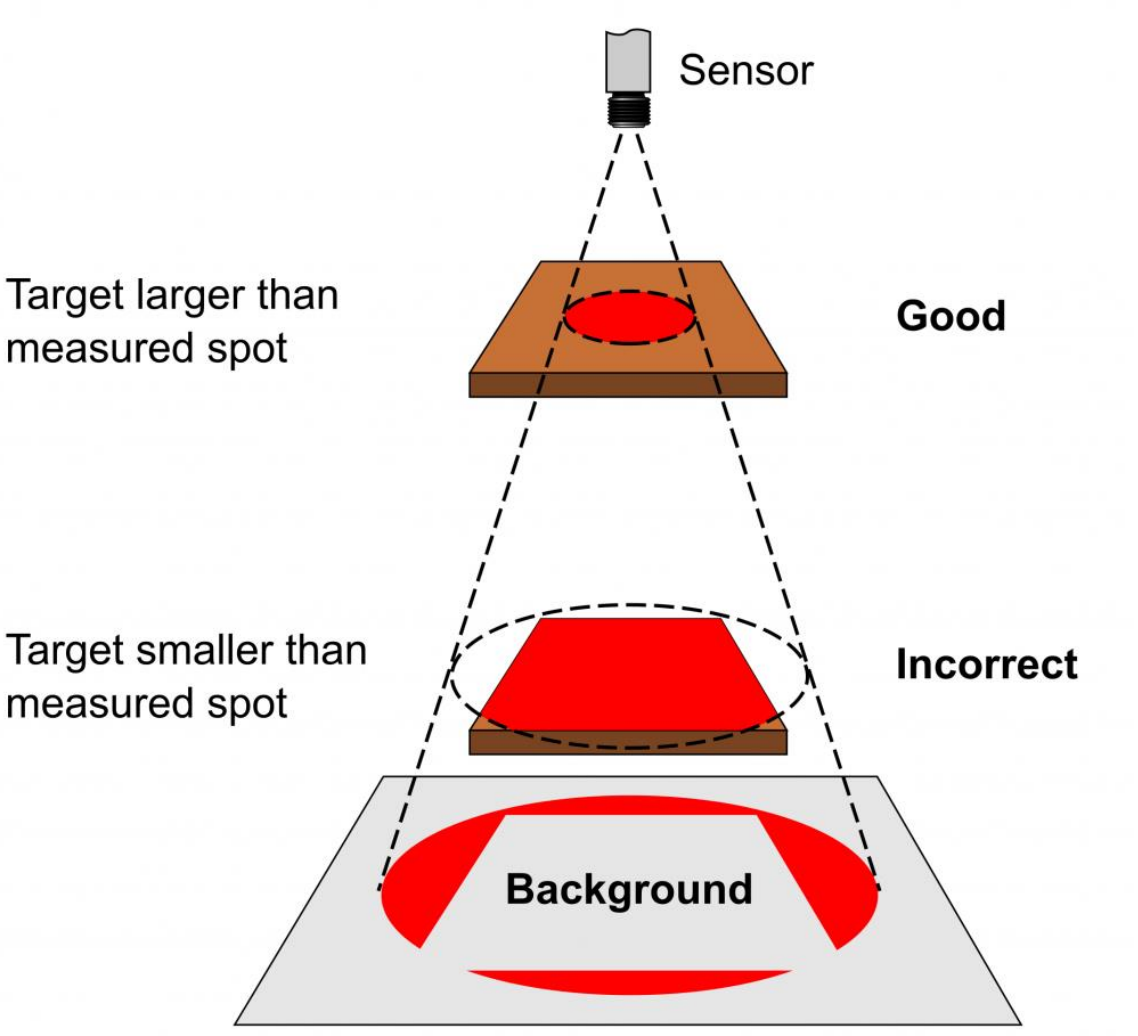


Reflective metal surfaces are more challenging to measure using infrared temperature sensors. If the surface cannot be painted or coated to make it non-reflective, then a short-wavelength sensor should be used.

Emissivity is the opposite of reflectivity: a non-reflective surface will have a high emissivity. Wood, paper, thick plastics, food, water, asphalt, rubber and painted surfaces all have a high emissivity. These materials can be measured easily using simple, general-purpose sensors with a fixed emissivity setting (such as the IR200) whereas reflective materials require a sensor with an adjustable emissivity setting, and sometimes a short measurement wavelength, for accurate results.

For reflective metals, the easiest way to achieve a good measurement is to make the surface non-reflective by painting or coating it with another material, if possible. But if not, contact us for advice.

Size of measurement area



The pyrometer measures the average temperature of an area of the target surface, and the size of that area depends on two things: the optics of the sensor, and the distance between the sensor and the target. Choose the optics and measurement distance so that the measurement spot is smaller than the target.

Ambient temperature

Check the air temperature where the sensor will be placed, and make sure it is within the operating temperature limits of the sensor. Most general-purpose sensors can be used up to 70°C (depending on the model), however for higher ambient temperatures of up to 200°C, contact us for advice.

Line Of Sight

Steam, smoke, dust, flames and machinery in the sensor's field of view can affect the accuracy of the temperature reading. They should be avoided as much as possible. If the air looks clear then you should be able to achieve good results.

Output type

The IR200 has a 4 to 20mA loop powered output. Therefore it can be used with our signal conditioning, panel meters and alarm products and to integrate further into your control system.