Emissivity

What it is and why it matters

What is emissivity?

All surfaces emit infrared radiation. The amount of energy they emit depends on their temperature and emissivity.

To accurately measure the temperature of a surface, the infrared sensor needs to know how much of the energy it is "seeing" has been emitted from the surface as a result of the object's temperature, and not reflected from the surface, or transmitted through it.

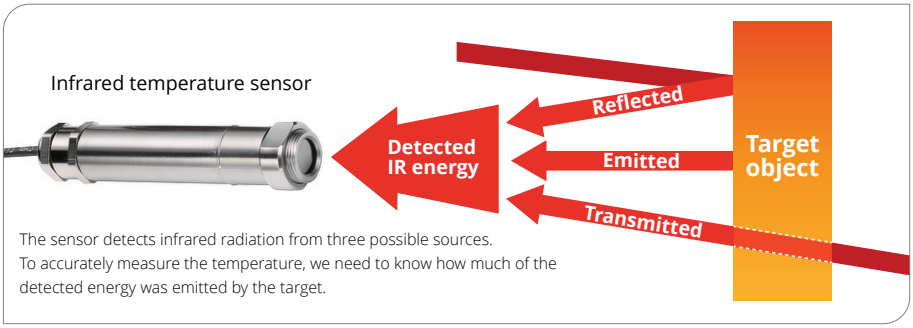
The emissivity of a surface is a measure of how effectively a surface emits infrared radiation.

The sensor's emissivity setting should match the emissivity of the target surface for maximum accuracy.

Transmissive materials

Most materials do not transmit any infrared radiation, so we can assume all the energy the sensor detects has been either emitted or reflected.

Transmissive materials are a special case. See below for more information.



The sensor detects infrared radiation from three possible sources.
To accurately measure the temperature, we need to know how much of the detected energy was emitted by the target.

How to adjust the emissivity setting

If necessary, the emissivity setting can be adjusted in a different way for each type of sensor:

PyroMini	Via the touch screen if fitted, via Modbus if present, or via two rotary switches in the electronics module
PyroEpsilon	Via the 4-20 mA input
PyroUSB	Via USB using the included cable and free software
PyroMiniBus	Via the PM180 or other RS485 Modbus Master
PyroSigma	Via push-buttons on the sensor
ExTemp	Via the optional LCT configuration tools (USB or RS485)
PyroNFC	Via the Android app with an NFC smartphone
PyroCube	Via the PM030 configuration unit, or RS232 Modbus
PyroCouple	The emissivity setting is fixed at 0.95 and cannot be adjusted

High emissivity materials

e.g. painted or very dirty surfaces, food, rubber, thick plastics, paper, glue, asphalt

The emissivity of these materials is often close to 0.95. This is the default emissivity setting of all Calex sensors.

A surface with a high emissivity is easy to measure with a low-cost, general-purpose sensor. In this case, reflections are minimal.

Up to 1000°C: Low-cost 8 to 14 µm sensors such as the PyroCouple, PyroSigma and PyroMini give good results.

It is also possible to use a short-wavelength sensor, such as the PyroUSB PUA2, on high-emissivity materials at high temperatures.

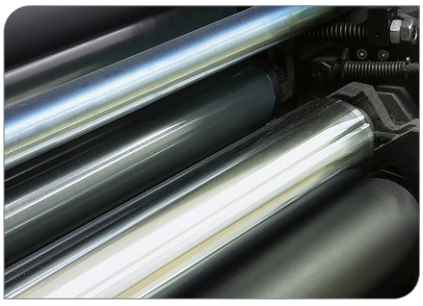
Note: The colour of a surface does not usually affect the emissivity much.

Low emissivity materials

e.g. clean, bare, reflective metal surfaces including iron and steel

Reflective surfaces have a low emissivity and are more difficult to measure accurately.

If the emissivity is known, it is possible to achieve a good reading from a bare metal surface using a short-wavelength sensor.



If it is possible to paint the surface, you can use a low-cost 8 to 14 µm sensor such as the PyroCouple, PyroSigma or PyroMini.

Otherwise, we suggest trying a short-wavelength sensor such as the PyroUSB PUA2 or PyroMini 2.2.

Some metals, most commonly aluminium and copper, are very difficult to measure. Contact Calex for advice.

Transmissive materials

e.g. thin plastic film, silicon

A small number of materials, such as thin film plastics and silicon, transmit most wavelengths of infrared energy. If the plastic film is thinner than about 1-2 mm, there is a possibility that general- purpose IR sensors could "see" through it.

Transmissive materials are difficult to measure. A specialised sensor such as the PyroCube P may be required to achieve a good reading.

Contact Calex for advice.

For more advice on emissivity, including how to measure the emissivity of a surface, see the Guide to Infrared Thermometry on our website, or contact us for help and guidance on a specific application.

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Issue B - Aug 2020

CALEX ELECTRONICS LIMITED