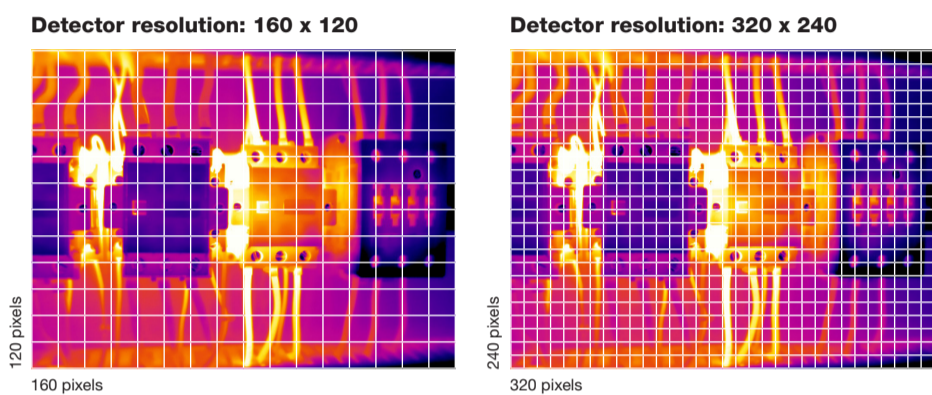


Infrared resolution/ detector resolution

As in a digital camera, the detector in a thermal imager records image points (pixels), which are ordered in the so-called sensor matrix in a thermogram. A sensor matrix of 160 x 120 pixels records a total of 19,200 pixels, reflecting 19,200 individual measurement values. An imager with a 320 x 240 pixel detector (= 76,800 pixels) therefore produces four times more measurement values than an imager with 160 x 120 pixels.

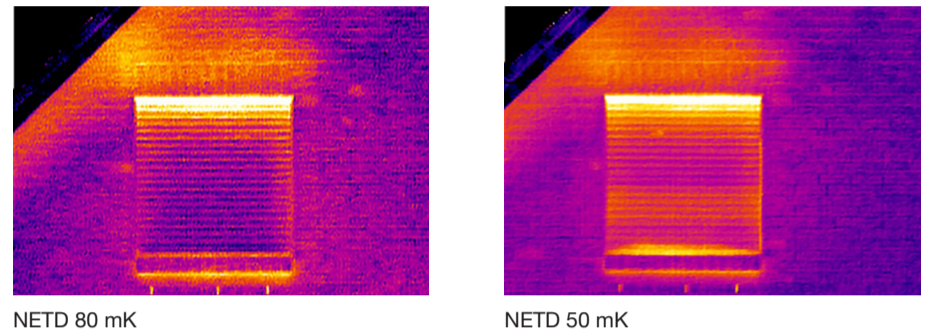
Conclusion: The higher the resolution, the better a thermal imager can measure smaller objects from a greater distance, still providing sharp-focus images.



Thermal sensitivity (NETD)

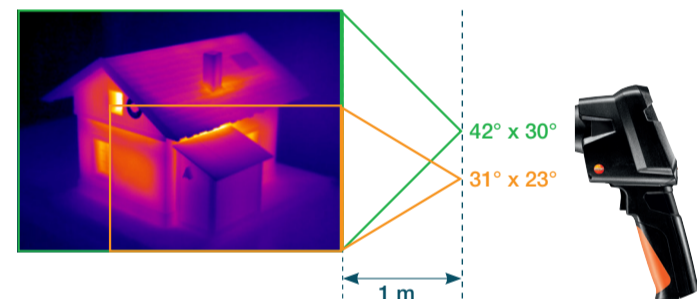
The thermal sensitivity (Noise Equivalent Temperature Difference, NETD) states which smallest possible temperature difference a thermal imager can display. The value is usually given in millikelvin (mK). For example, the value 120 mK means the thermal imager is able to record temperature differences from 120 mK (= 0.12 °C).

Conclusion: The smaller the NETD value, the higher the quality of the measurement.



Field of view (FOV) Spatial resolution (IFOV)

The field of view (FOV) determines the visible image section of a thermal imager. It is given in degrees of angle, and is dependent on the detector resolution and lens of the imager. It can be compared to a person's field of view.



IFOVgeo is given in milliradians (mrad) and describes the smallest object which can still be demonstrated by one pixel in the thermal image and shown in the display, dependent on the measurement distance. What does that mean? At a distance of 1 m, a detector resolution of 160 x 120 pixels and an FOV of 31°, the IFOVgeo is 3.4 mrad. One pixel thus demonstrates a measurement spot with a 3.4 mm edge length, which is shown in the imager's display.

More example calculations:

Distance: 2 m, detector resolution = 160 x 120, field of view = 31°: measurement spot = 6.8 mm (3.4 mrad x 2)

Distance: 5 m, detector resolution = 160 x 120, field of view = 31°: measurement spot = 17 mm (3.4 mrad x 5)

The IFOVgeo is however only a theoretical value. An object to be measured will in reality not fit into the grid prescribed by the imager's resolution. This is why there is the IFOVmeas.

IFOVmeas is the smallest real measurable object.

The rule of thumb is: $IFOV_{meas} = IFOV_{geo} \times 3$

Example: $3.4 \text{ mrad} \times 3 = 10.2 \text{ mm}$.

This means: From 1 m distance, objects up to a size of 10.2 mm can be correctly measured.

Tip: If the object to be thermographically recorded is smaller than the IFOVgeo, the measurement of the object will not be correct. Recommendations: reduce the measurement distance, select a different lens, or use a thermal imager with a better IFOVgeo.

Emissivity, reflectance, transmittance

Emissivity is a measure of the ability of a material to emit infrared radiation. 100 % emission, and therefore an emissivity of 1, would be ideal, however this never occurs in daily life. Concrete is close, with an emissivity of 0.93, i.e. 93 % of the IR radiation is emitted by the concrete itself. Objects with an emissivity of 0.8 and higher are considered to be well suited to thermography. This value can be set in the imager.

Reflectance is a measure of the ability of a material to reflect infrared radiation. In general, smooth, polished surfaces reflect more strongly than rough, matt surfaces made of the same material. Applied to the already mentioned example of concrete, that means that concrete reflects 7 % of the ambient IR radiation. The reflected temperature must be taken into account in the measurement of objects with low emissivity. An offset factor in the camera enables the reflection to be calculated out and the accuracy of the temperature measurement is thus improved. This value can be set in the imager.

Transmission is the ability of a material to allow IR radiation to pass through it. However, most materials do not allow long-wave IR radiation to pass through, so that the transmissivity can as a rule be neglected.

