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A comparison of Testo thermal imagers

		testo 860i	testo 865(s)	testo 868(s)	testo 871(s)	testo 872(s)	testo 883
		NEW					
Main functions							
Infrared resolution	Number of pixels: The more the better	256 x 192 pixels (49,152 pixels)	160 x 120 pixels (19,200 pixels)	160 x 120 pixels (19,200 pixels)	240 x 180 pixels (43,200 pixels)	320 x 240 pixels (76,800 pixels)	320 x 240 pixels (76,800 pixels)
testo SuperResolution	Fourfold number of pixels	–	320 x 240 pixels (76,800 pixels)	320 x 240 pixels (76,800 pixels)	480 x 360 pixels (172,800 pixels)	640 x 480 pixels (307,200 pixels)	640 x 480 pixels (307,200 pixels)
Thermal sensitivity (NETD)	Smallest possible detectable temperature difference: The smaller the better	<0.05 °C (50 mK)	<0.10 °C (100 mK)	<0.08 °C (80 mK)	<0.08 °C (80 mK)	<0.05 °C (50 mK)	<0.04 °C (40 mK)
Measuring range		-20 to +150 °C 0 to +350 °C (automatic or manual measuring range switching)	-20 to +280 °C	-30 to +100 °C 0 to +650 °C (automatic or manual measuring range switching)	-30 to +100 °C 0 to +650 °C (automatic or manual measuring range switching)	-30 to +100 °C 0 to +650 °C (automatic or manual measuring range switching)	-30 to +100 °C 0 to +650 °C (automatic or manual measuring range switching)
Focus	Image focussing	Fixed focus	Fixed focus	Fixed focus	Fixed focus	Fixed focus	Manual
Integration of external measuring instruments	Connection to other Testo measuring instruments	Thermohygrometer testo 605i/testo 625, clamp meter testo 770-3 and all testo Smart App-compatible measuring instruments	–	–	Thermohygrometer testo 605i, clamp meter testo 770-3	Thermohygrometer testo 605i, clamp meter testo 770-3	Thermohygrometer testo 605i, clamp meter testo 770-3
Connection to free testo App	Fast and easy image analysis, creation and dispatch of short reports, remote control of the imager	testo Smart App	–	testo Thermography App	testo Thermography App	testo Thermography App	testo Thermography App
PC software testo IRSoft	Free, licence-free software for comprehensive analysis and reporting	✓	✓	✓	✓	✓	✓
Additional functions							
DeltaHeat I DeltaCool	Determine spread of flow/return temperature at heating system & optimization suggestions | Assistant for determining temperature differences	✓	–	–	–	–	–
Humidity mode	Evaluate mould risk with traffic-light scale	✓	–	–	✓	✓	✓
testo ScaleAssist	Automatic contrast adjustment for optimum evaluation of building shell	–	✓	✓	✓	✓	✓
Panoramic image assistant	Stitch up to 3 x 3 images together to one overall image	–	–	–	–	–	–
testo SiteRecognition	Automatic measurement location recognition and image management	–	–	–	–	–	✓
Process analysis package	Record thermal processes as a time progression as a video or timelapse	–	–	–	–	–	–
Technical data							
Lens/field of view (FOV)	The larger the value, the larger the visible image section	48° x 36°	31° x 23°	31° x 23°	35° x 26°	42° x 30°	Standard: 30° x 23° Wide-angle: 42° x 32° Telephoto: 12° x 9°
Spatial resolution (IFOV)	Smallest possible object size which can be recognized from 1 m distance	3.3 mrad	3.4 mrad	3.4 mrad	2.6 mrad	2.3 mrad	Standard: 1.7 mrad Wide-angle: 2.3 mrad Telephoto: 0.7 mrad
Minimum focusing distance		0.3 m	0.5 m	0.5 m	0.5 m	0.5 m	Standard: < 0.1 m Wide angle: 0.1 m Telephoto: 0.5 m
Accuracy		±3 °C or ±3 % of m.v. (at ambient temp. -10 to 40 °C and scene temp. 0 to +150 °C or +100 to +350 °C)	±2 °C, ±2% of reading (higher value applies)	±2 °C, ±2 % of reading (higher value applies)	±2 °C, ±2 % of reading (higher value applies)	±2 °C, ±2 % of reading (higher value applies)	±2 °C, ±2 % of measured value (higher value applies)
Image refresh frequency within EU	Number of images per second	9 Hz	9 Hz	9 Hz	9 Hz	9 Hz	27 Hz (9 Hz)
Features							
Integrated digital camera	Real image is stored with thermal image	✓	–	✓	✓	✓	✓
Rotating handle and display		–	–	–	–	–	–
Laser marker	Shows exact position of the laser and the corresponding temperature measurement value in the imager display	–	–	–	–	✓	✓
LED (additional light)	For better lighting of the the real image	–	–	–	–	–	–
Order number		0560 0860 0563 0860 (kit)	0560 8650 (0560 8651)	0560 8681 (0560 8684)	0560 8712 (0560 8716)	0560 8721 (0560 8725)	0560 8830 (30°) 0560 8836 (42°)
Price		xxx.xx €	xxx.xx €	xxx.xx €	xxx.xx €	xxx.xx €	xxx.xx €

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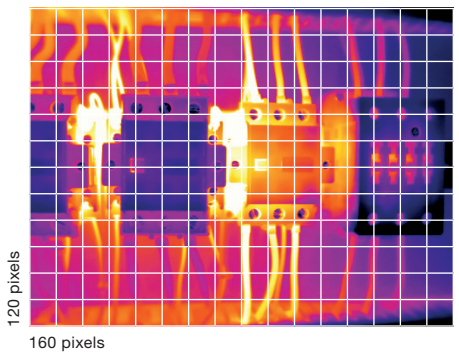
Infrared resolution/detector resolution

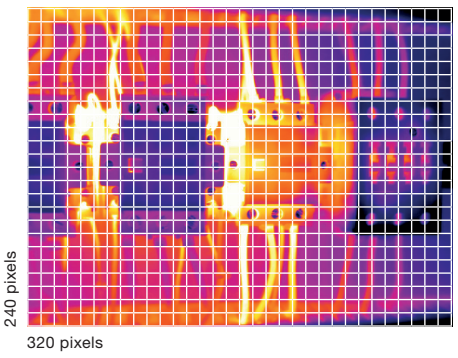
As in a digital camera, the detector in a thermal imager records image points (pixels), which are ordered in the so-called sensor matrix in a thermogram. A sensor matrix of 160 x 120 pixels records a total of 19,200 pixels, reflecting 19,200 individual measurement values. An imager with a 320 x 240 pixel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

Detector resolution: 160 x 120



Detector resolution: 320 x 240

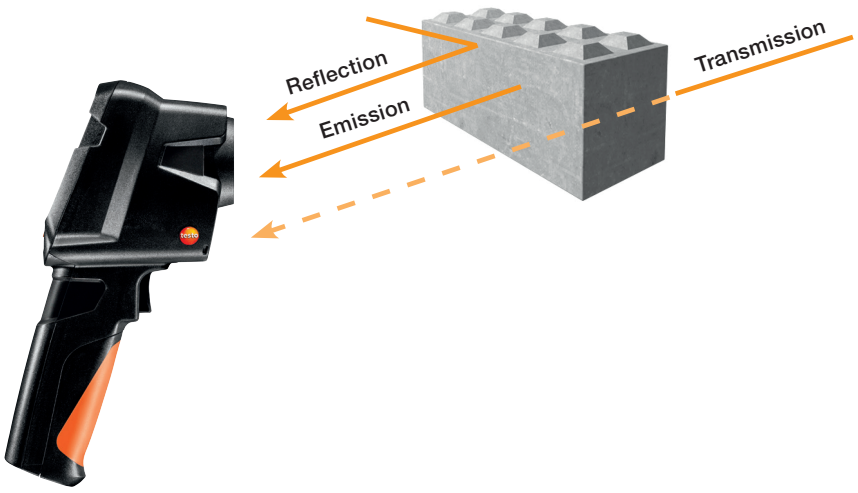


Emissivity, reflectivity and transmissivity

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.

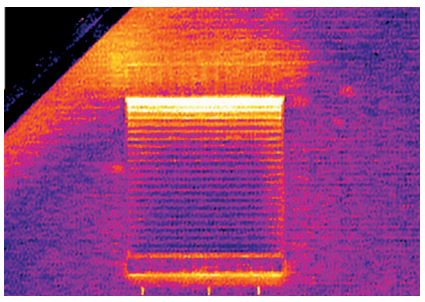
Transmission is the ability of a material to allow IR radiation to pass through it. However, most materials do not allow long-wave IR radiation to pass through, so that the transmissivity can as a rule be neglected.



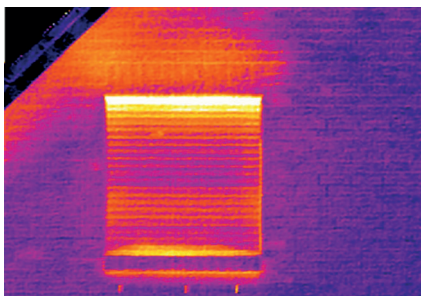
Thermal sensitivity (NETD)

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 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.



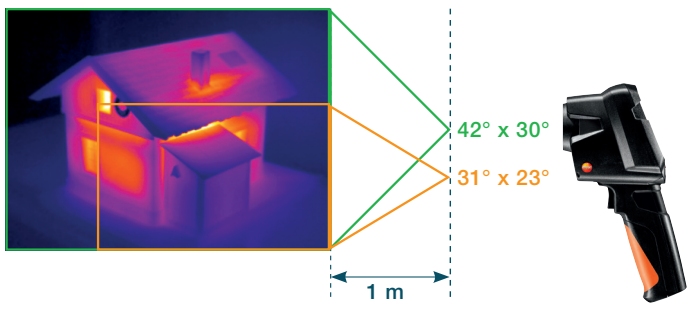
NETD 80 mK



NETD 50 mK

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 milliradiants (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.

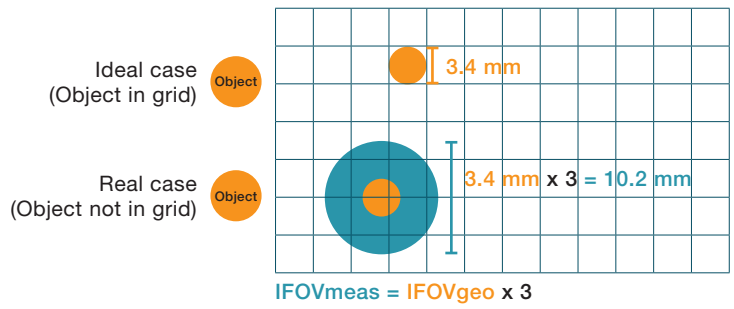
More example calculations:
Distance: 2 m, detector resolution = 160 x 120, field of view = 31°:
Measurement spot = 6.8 mm (3.4 mrad x 2)

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 thoeretical 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 IFO-Vmeas.

IFOVmeas is the smallest real measurable object.
The rule of thumb is: IFOVmeas = IFOVgeo x 3
For example: 3.4 mrad x 3 = 10.2 mm.
This means that: 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: educe the measurement distance, select a different lens, or use a thermal imager with a better IFOVgeo.



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