BOSCH

INTRODUCTION TO THERMAL IMAGING

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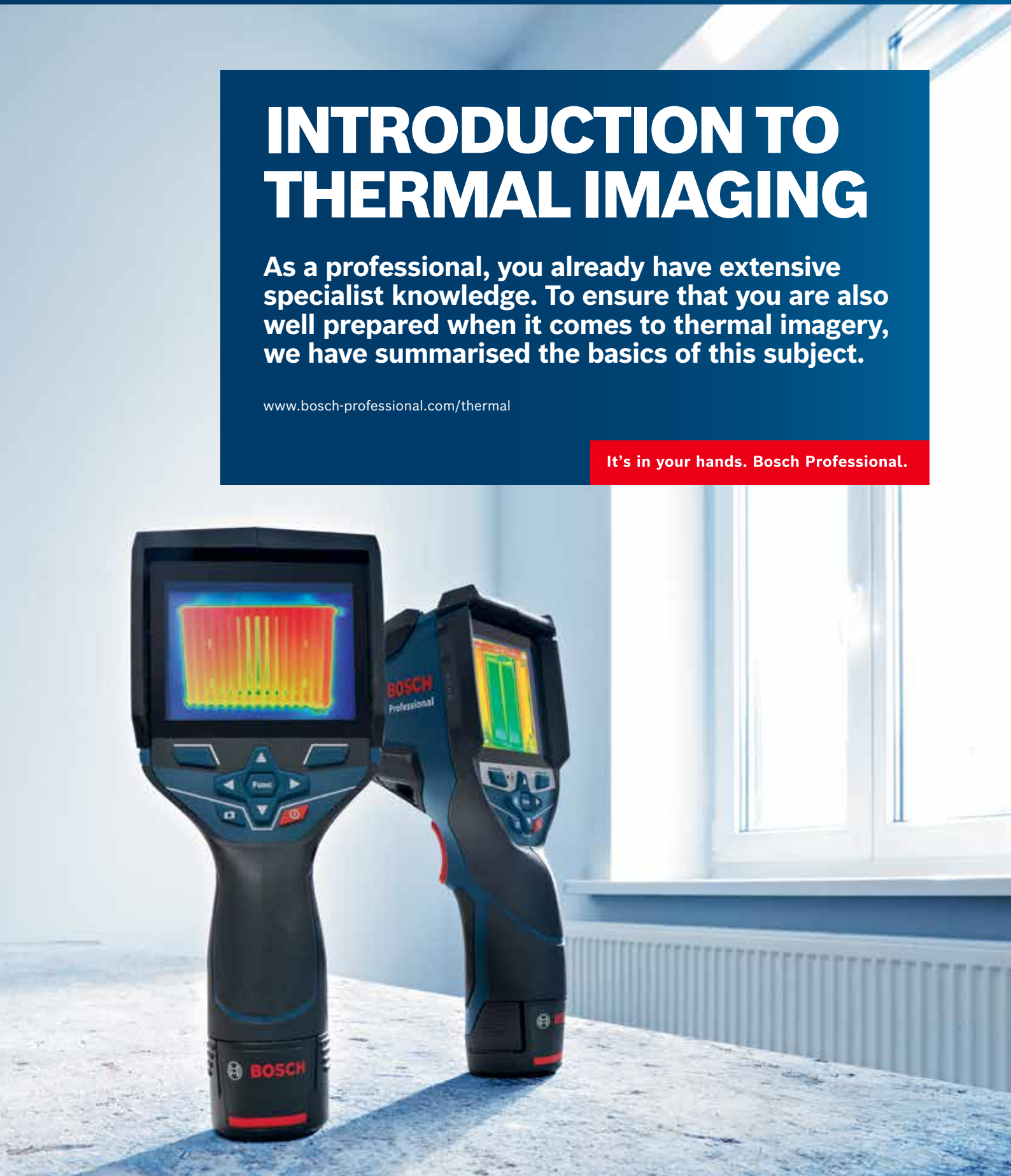


BACKGROUND KNOWLEDGE ON THE TOPIC OF THERMAL IMAGING

The temperature measuring tools from Bosch make work a whole lot better and easier for countless tradespeople every day. As a professional, you already have extensive specialist knowledge. To ensure that you are also well prepared when it comes to thermal imagery, we have summarised the basics of this subject.

Basics of infrared radiation

The wavelength of infrared radiation (IR radiation) is in the increasing wave range of between 780 nanometres and 1 millimetre and is just outside of the spectrum that is visible to humans. Infrared radiation is also referred to as thermal radiation. This has to do with the relationship between radiation and heat. Every object with a temperature above absolute zero (-273 °C or 0 Kelvin) has thermal energy which the object partly emits in the form of radiation. Most of this radiation is in the invisible, infrared range and is therefore referred to as infrared radiation. The hotter the body is, the more IR radiation it will emit.

Infrared radiation and Bosch temperature measuring tools

The Bosch temperature measuring tools visually display the radiation in the form of temperatures and their distribution. While the GIS 1000 C measures the thermal radiation at a specific point, the thermal imaging cameras use colours to show how temperature is distributed across the entire area measured. This is made possible by the fact that the atmosphere in the range of 8 to 14 nanometres is easily permeable for infrared radiation. The Bosch temperature measuring tools measure in this range and register the radiation as electrical voltage. This, in turn, provides the basis of the object temperatures which are later shown on the display. Nevertheless, the main natural source of infrared radiation is the sun, with 50% of all its emitted radiation in the infrared range. However, the sun emits its maximum radiation in the visible range, which is why it can be so dangerous for our eyes. Infrared thermometers should therefore never be directed straight at the sun as its temperature of over 5500 °C would damage the measuring tool's sensitive infrared sensor.

Influences on thermal radiation

As has already been established, a body only emits a certain amount of the thermal energy it contains, which is why it is not possible to measure its temperature 1:1. But that's not at all, because other influencing variables, such as the reflected temperature, have a considerable impact. The measured temperature is therefore a combination of the body's emissivity and the reflected temperature. The ambient humidity also influences these values. However, this influence is so minimal that only taking the reflected temperature and emissivity into account will suffice when taking measurements with a thermal imaging camera. It is only possible to obtain precise temperatures if these parameters for external influences are set in the measuring tool.

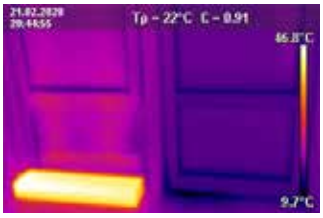
Emissivity and reflected temperature

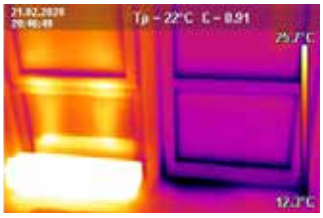
"Emissivity" is therefore an important term when it comes to temperature measurement. This tells you how much thermal radiation is emitted by an object. The higher the emissivity is, the more thermal energy an object emits and, accordingly, the more accurately its temperature can be measured. In contrast, objects with a lower emissivity emit radiation less intensively, which is why the infrared sensor also measures the reflected temperature on the object surface in this case. The surface finish of a material often directly indicates its emissivity. Shiny materials reflect more strongly and therefore have lower emissivity, whereas the emissivity of matt surfaces is higher. The implication is that the more reflective an object is, the less accurate the measurement will be. However, this effect can be corrected by adjusting the emissivity of the measured material and the corresponding reflected temperature in the measuring tool. "Ambient temperature" is a particularly important term when measuring very highly reflective surfaces. However, ambient temperature should not be confused with "air temperature" as the latter describes the temperature of surrounding objects which emit thermal radiation on the object to be measured and then also registered by the infrared measuring tool.

SIX TIPS FOR CARRYING OUT AN INSPECTION

Tip 1: Optimising the image display using colour palettes
Before you begin taking the measurement, there are a few things that should be noted. The GTC models include features such as a variety of different options for the colour scale, depending on your preference. These options include intuitive flame-like colours, the rainbow colour scale, a psychological colour scheme or plain greyscale. For smaller temperature differences, it is recommended to use a high-contrast colour palette (e.g. the rainbow scale), whilst larger variations in temperature make a low-contrast scale (e.g. flame colours) the more intuitive option.

Tip 2: Optimising the image display via the temperature scale
In order to configure the thermal image so that it is rich in contrast and consequently provides conclusive information, the scale needs to be adapted under certain circumstances. To this end, our thermal imaging cameras offer a practical lock function that allows you to optimise this scale quickly and easily. For instance, if you wish to carry out a thermographic analysis of a window under which a radiator is located, the presence of this radiator will alter your entire thermal image, in the sense that the temperatures around the window will be less clearly differentiated. One possible way to avoid this is to approach the window with the thermal imaging camera to the point where the heating system is no longer visible in the thermal image field. Then lock the colour scale by pressing the top right button – and you can now obtain a detailed image even from far away. Alternatively, this can be implemented in manual mode.





Tip 3: Take the time and conditions of the measurement into consideration
Wherever possible, you should measure objects only when they are dry, since rain and other forms of precipitation can influence the surface temperature. Similarly, measurement of objects that have been significantly exposed to sunlight should also be avoided, since the surface can be considerably warmed as a result of this.
If you plan to take thermal images outside, we also recommend that you do this in the early hours of the morning. High humidity and wind can also have a negative impact on the accuracy of the measured values and should therefore be avoided. We also advise against taking measurements in the direct proximity of heat sources (e.g. ovens). It may be possible, however, to shield these off from the rest of the measurement and thus reduce their influence. In most cases where thermal imaging of buildings is required, autumn and winter tend to be the ideal seasons for taking measurements. At these times of year, the temperature difference between the interior and the exterior is great enough for problem areas to be located effectively (recommended minimum temperature difference: 10 °C).

Tip 4: Taking the emissivity and reflected temperature into consideration
If you intend to determine a precise value in degrees Celsius (°C), you should account for the emissivity and the reflected temperature in every case. This way, you can prevent measured values from being rendered incorrectly as a result of strong reflections. You can determine the emissivity from the preset materials in the tool or estimate it on the basis of the surface quality. In order to determine the reflected temperature, you should first check whether the reflection in question is direct or indirect. Direct reflections frequently occur on smooth surfaces and can be recognised as a reflection in the thermal image (e.g. on a glass pane). In such cases, the temperature value of the object being reflected can be used as the reflected temperature. In contrast, indirect reflections mainly occur on rough surfaces (e.g. plaster). In this case, determine the average temperature in front of the object to be measured and set this as the reflected temperature.

SIX TIPS FOR CARRYING OUT AN INSPECTION

Tip 5: Corrective actions for highly reflective surfaces
For excessively reflective surfaces, such as bare metal, we recommend the use of matt black adhesive strips or special sprays. If you apply these to the reflective object, you can take its temperature after a short waiting period and reliably determine this on the basis of a high emissivity. The influence of the reflection of one's own body heat can also be minimised by measuring at a slightly slanted angle.

Tip 6: The correct distance to the object to be measured
In order to guarantee thermal images of high quality, you should keep to a minimum distance of 30 cm when taking a measurement. A two-step procedure has proven to be effective in this regard. For instance, if you are examining a wall for insulation problems, a preliminary inspection from a further distance will provide a good initial overview. A second image capture – this time at a closer range – will then provide more detailed information and be significantly more reliable, since any distance-related errors can then be ruled out at this stage. Because the measuring distance has such great influence on the quality of the measurement, this should generally be taken within the closest possible range to the object.