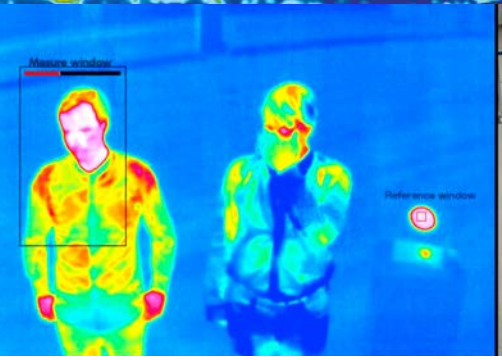
COMPACT
GUIDE

MOBOTIX Thermal Solutions

Technical features and areas of application



SYSTEL®

MOBOTIX

1. Thermal Imaging Technology - Versatile application areas of modern video surveillance systems

With its unique advantages, thermal imaging is an indispensable part of many civil security and surveillance applications. An increasing number of industrial companies, public institutions, authorities and agencies use thermal imaging technology to protect their assets and personnel. Additionally, Thermal technology can also be used to **improve efficiency of production and processing**, resulting in a greater return of invests.

Power stations, industrial plants, warehouses, ports and airports - facilities like these can be perfectly protected with thermal imaging cameras. MOBOTIX thermal solutions are the key to **protecting assets and avoiding dangerous situations**.

With thermal images, threats can be **detected early on**. Even in darkness or unfavorable weather conditions, e.g. dust, fog or smoke. Suspicious persons hiding behind bushes or in the shade are detected by a thermal imaging system due to their thermal characteristics.

M16 – Multifunctional All-Round Solution

M16 Thermal

The intelligent video system with an integrated high-performance thermal image sensor takes full advantage of the M16 camera design. Thanks to the two directly adjacent lenses, there is also a thermal overlay function with image overlay (thermal and optical) to pinpoint the exact location of hotspots like fires in a visible image.

M16 Thermal TR

“TR” stands for thermal radiometry. This means that, in addition to carrying out the existing MOBOTIX thermal camera functions, these cameras feature a calibrated thermal image sensor that enables them to measure thermal radiation across the entire image area, even down to individual pixels. The power consumption of a MOBOTIX Thermal TR is less than 8 watts.

S16 – Ultra-Flexible Installation Solution

S16 Thermal

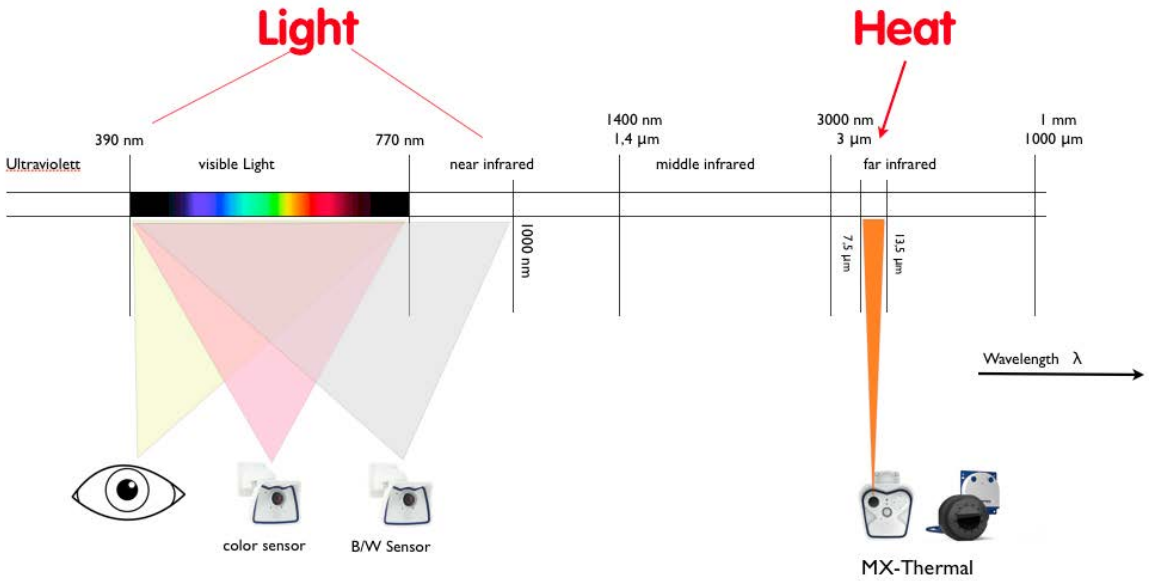
MOBOTIX present the most flexible dual thermal camera in the world. It is possible to connect either one or two weatherproof thermal sensor modules to the easily concealable camera module with up to three-meter-long sensor cables. The design concept of the S16 means that even thermal cameras can have particularly discreet installations and customer-specific special installations.

S16 Thermal TR

Temperature values measured by the TR technology can automatically trigger an event from the camera (alarm, call, activation of a signal output etc.) if the temperature increases above or decreases below an individually set trigger level. All settings can be adjusted via the camera firmware using a web browser.

2. How thermal imaging works

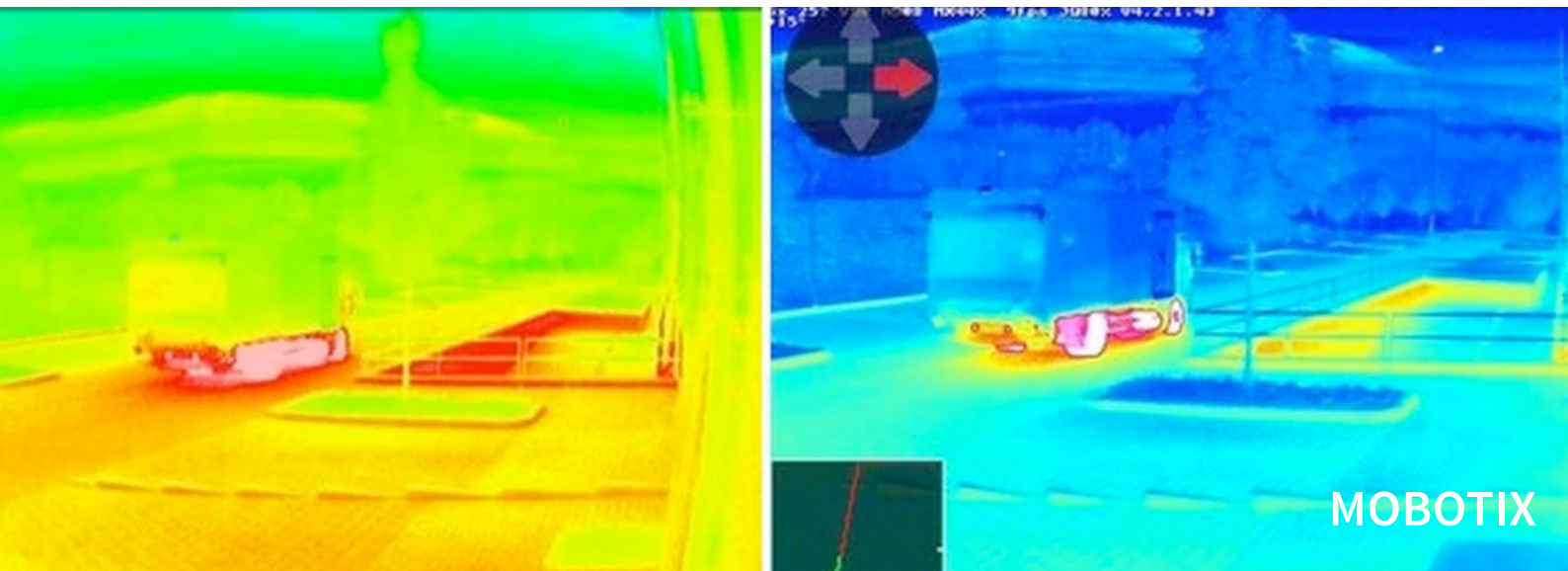
Thermal imaging is a **non-contact technology** that makes the thermal radiation (mid-infrared) of an object or body, invisible to the human eye, visible. In thermal imaging, temperature distributions on surfaces and objects are recorded and displayed. The bolometer matrix (image resolution) is considerably lower in terms of the number of pixels than in cameras for the visible spectral range.

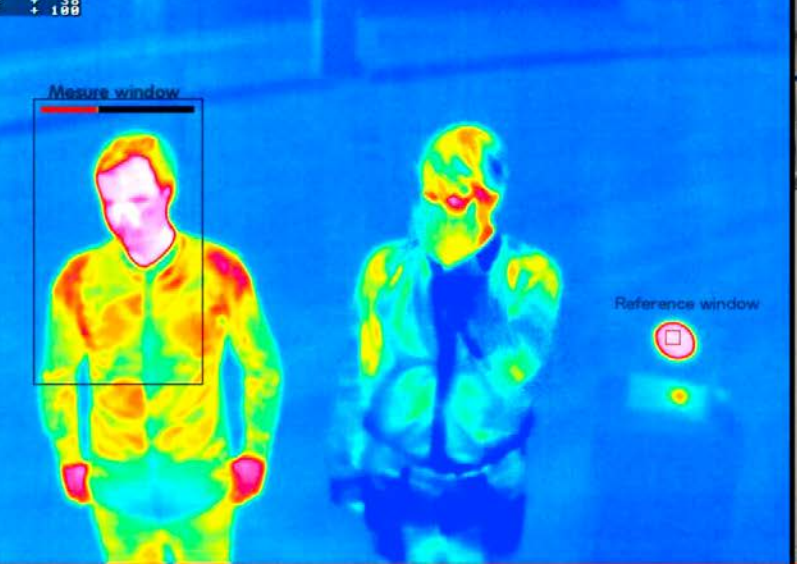


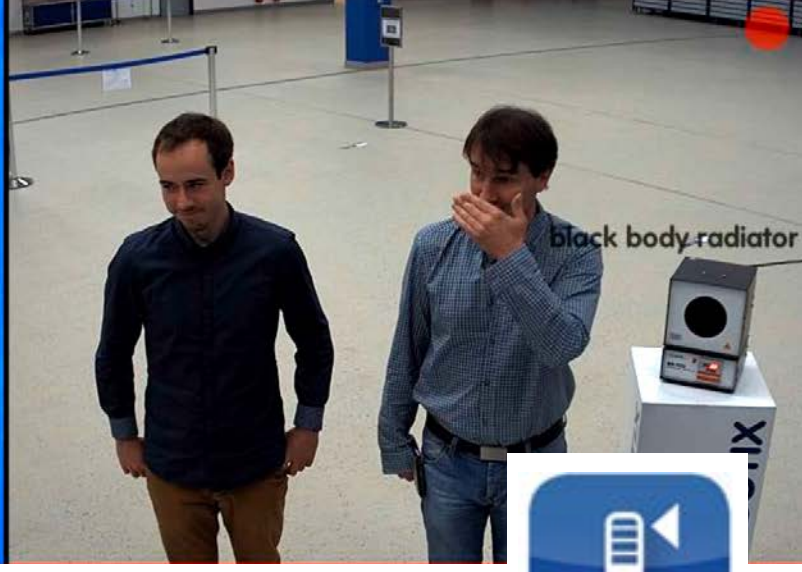
In contrast to cameras with optical image sensors, a thermal camera can detect extremely small temperature differences and visually display them with colors. MOBOTIX thermal cameras can monitor **temperature differences as low as 0.1 °C**, which is within the peak range currently available for general use.

MOBOTIX's range of thermal cameras not only provide meaningful thermal images, but can also automatically trigger temperature notifications and events within a **temperature range of -40 °C to +550 °C**. These state-of-the-art systems then also serve to automatically alarm temperature limits or ranges, which is crucial for the timely detection of sources of fire, heat or malfunction.

The MOBOTIX thermal image (with additionally activated MxActivitySensor) shows significantly more details than the lower-performance thermal imaging cameras.







Thermal Radiometry by MOBOTIX

3. Thermal Radiometry (TR)

Optionally , MOBOTIX can also provide thermal cameras and sensor modules with **integrated TR technology** and **calibrated high-end thermal image sensor** with a NETD sensitivity of 50 mK. Thermal Radiometry indicates that in addition to the existing MOBOTIX thermal camera functions, these cameras can measure thermal radiation in the entire image area and assign a temperature value per pixel.

Measurement accuracy and calibration of TR technology

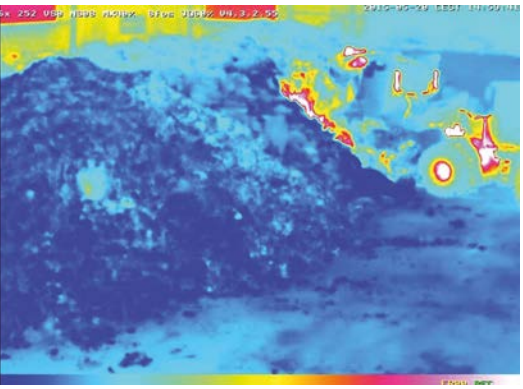
These measured values can be used to trigger an event (camera alarm, network message, activation of a switching output, etc.) when a predetermined value is exceeded or not reached, depending on the logic programmed.

The ideal measuring object is a black body with emissivity 1, bare metals are at values of 0.1 and lower (bodies with reflecting surfaces have generally a lower emissivity), human skin has an emissivity of typ. 0.98. On the other hand, the camera measures not only the radiation coming from the object itself, but also that reflected back from other objects, for example from a table or window. For more information on emissivities, please refer to section 7 of this brochure.

To increase the measuring accuracy, a **black body radiator** is often used in practice. This is installed directly next to the measuring object and enables an exact reference value adjustment. Furthermore, the closer an object is to the camera and and the more stable environmental conditions are, the more accurate the measurement can be. For example, if it is foggy or the air is dusty, this can be taken into account by measuring the transmission and entering the value in the camera software.

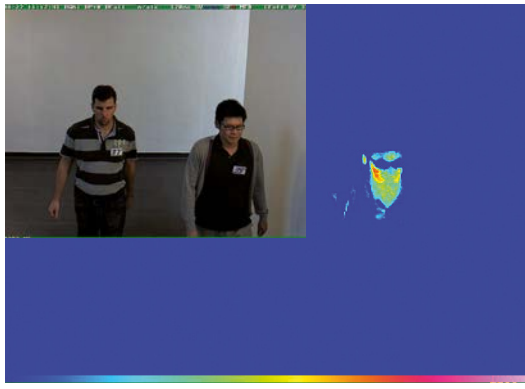
4. Typical applications for MOBOTIX thermal imaging cameras

- **Perimeter protection**
- **Indoor and Outdoor Fire protection**
- **Plant protection and safety in Industrial & Manufacturing facilities**
- **Machine and equipment monitoring**
- **Food industry and logistics**
- **Production, storage and transport of dangerous goods**
- **Borders and other controlled areas**
- **Public transportation**

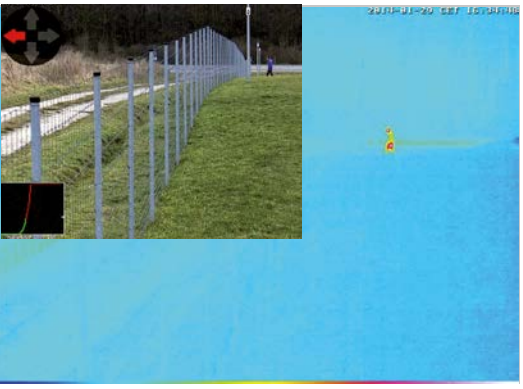


Early Fire Detection

Thermal Image Overlay



Entry Control



Perimeter Protection

Privacy

No Smoking

Perimeter protection - even in absolute darkness

Just one MOBOTIX thermal camera can secure a very large outdoor area **without additional lighting**, even in total darkness. Detection can also be carried out from distances of up to several hundred meters, including over large areas as well as areas that are difficult to access.

Privacy protection

The temperature profile generated by thermal cameras **does not show any details for personal identification** and thus guarantees privacy.

As soon as an object moves into a relevant surveillance area, MOBOTIX dual camera systems **can automatically switch from the thermal sensor to the optical sensor**, recording high-resolution video while maintaining privacy.

Temperature measurement and early fire detection

The M16 and S16 **Thermal Radiometry (TR) models automatically alarm** when the temperature exceeds or falls below defined limits. This is crucial for the detection of fire or heat sources. **Up to 20 different temperature events** can be configured simultaneously in defined TR windows or over the complete sensor image over a **temperature range of -40 to 550 °C**. This creates preventative measures where critical situations can be analyzed in advance and the next steps can be initiated immediately, before any harm is done. Critical systems such as emergency power generators, wind turbines or radio stations can also be maintained and tested remotely at low cost. With Thermal Overlay, „hotspots“ in the visible image can be precisely identified and major damage avoided.

The TR technology is not designed to to determine the exact temperature of surfaces, but rather to proactively detect potential dangers from suddenly occurring and enable users to react automatically without delay. Such dangers can be, for example, smoldering fires or escaping hot gases that are invisible to the eye. Another important advantage of MOBOTIX thermal imaging technology is that **detection and measurement** can also be performed from distances of **up to several hundred meters** and thus over large areas as well as areas that are difficult to access.

5. Dual camera: Thermal image sensor plus optical sensor in one camera

MOBOTIX dual camera systems can **automatically switch from the thermal sensor to the optical sensor** and generate high-resolution video for optimal viewing when an object is moving in the surveillance area. This unique MOBOTIX concept combines two otherwise irreconcilable aspects, namely the protection of privacy during video surveillance and simultaneous access to high-resolution video material in case of relevant or critical events. MOBOTIX thermal cameras, such as the M16-Thermal, also offer a **special thermal image overlay function** to fade in thermal radiation information from the thermal sensor into the optical sensor image (color or black and white).

Thermal Overlay: Placement of the thermal image on the optical sensor image. For example, it is possible to determine at a glance which vehicles were most likely last used or recently parked based on the visible heat radiation of their engines.

The Thermal Overlay thermal image overlay

A thermal camera cannot usually display important details visible to the naked eye based on temperature. Information such as numbers, words, labels, signs and other important features are lost in the „thermal image“. Therefore a separate „optical image“ is required. This way the position and type of thermal detected event can be clearly located. The image of a thermal camera only shows traces of heat as a representation of colours.

Details can not been seen under this overlay. To overcome this disadvantage, you can combine thermal imaging cameras with optical modules to create a kind of enhanced thermal image. By overlaying the images, high-contrast images can be created. Important aspects from the visible range of the light spectrum can then be detected via the thermal image. At the same time, however, the thermal information can still be clearly recognized.

Thermal image combined with high-contrast visual details

By superimposing the thermal image and the real image, the high-contrast details are brought out. The visual content is superimposed on the thermal images, so to speak. This procedure allows the display to show sharp images with clear details that are otherwise not visible on thermal images.

When using a MOBOTIX thermal camera with an optical sensor module (with or without TR), **the current thermal image can be displayed with adjustable transparency** and minimum thermal radiation (e.g. only display of all heat sources that are shown in red in the thermal image) **directly above the current optical sensor image**. This creates visible „hotspots“ and dangerous sources of heat or fire to be identified immediately. This technology can be used very efficiently in fire protection for the timely detection and combating of sources of danger (smouldering fires, overheated equipment).

6. Durability

Durability for high investment security

MOBOTIX cameras are known and appreciated around the world as extremely robust and durable systems, and are Made in Germany. The **MTBF (Mean Time Between Failures)** of the thermal sensor is also in the absolute premium range with **80,000 operating hours (over 9 years!)**. In contrast to other manufacturers, MOBOTIX thermal imaging cameras do not have a shortened warranty period.

Extremely low energy consumption

Equipped without extra cooling, heating or PTZ motors, the weatherproof MOBOTIX thermal imaging cameras require **only <10 watts** of power and can therefore be connected and powered cost-effectively via PoE with just one cable at **outside temperatures of -30 to 60 °C**.

7. Emissivities of measurement objects

The accuracy of the temperature measurement depends on whether the emissivity of the measured object, which is determined by its material and surface, has been taken into account accordingly and entered correctly in the camera software. A table available online **(http://www.infrared-thermography.com/material-1.htm)** shows a selection of objects that have different emissivities due to their physical properties.

At an emissivity of 0.97 (e.g. asphalt road surface), the corresponding percentage value „97“ is then entered in the camera software. For objects with a low to very low emissivity of less than 0.5 or 50 %, only the approximate value 50 % can be entered in the camera software, which may affect the accuracy of the temperature measurement (the temperature determined by the camera is always below the real temperature value and never above it).

However, the margin of **error for measuring objects** with emissivities below 50 % **can be reduced**,

- by adjusting the set triggering threshold for temperature-related events accordingly (e.g. only 90 instead of 100 degrees Celsius)
- or, if possible, the surface condition of the material is changed (only) at the measuring point/measuring window: For example, by sticking a coloured matt PVC film (or electrical insulating tape), which in turn has a very good emissivity of 0.96 (96%), which can then be adjusted in the camera software for optimised temperature measurement results.