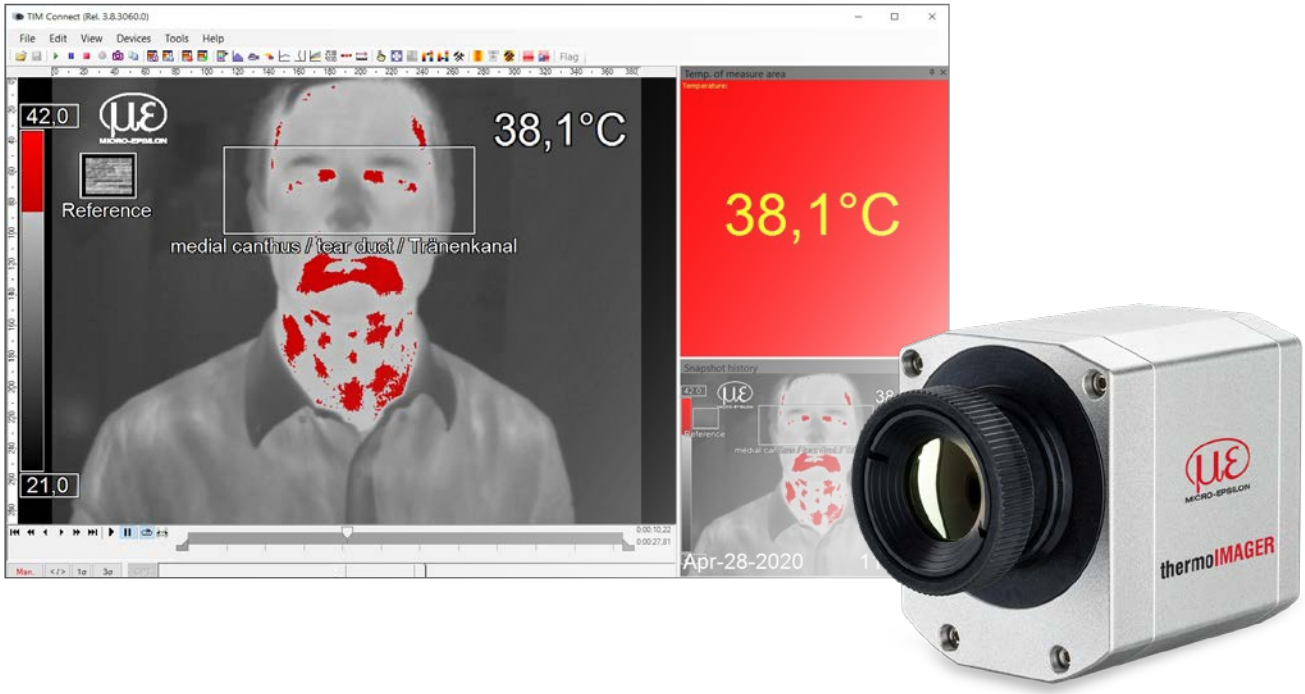
TechNote

T033 // thermoIMAGER TIM | Non-contact early recognition of fever

Introduction

Now that staff and employees are allowed to return to work after the shut down, it is vital for companies to ensure that the health of returning workers is not put at risk by workers who may have become infected with a virus outside the company. Many people infected with the coronavirus (COVID-19) show signs of fever within five days after the outbreak of infection.

Virus epidemics such as the swine flu in 2009/2010 and the Ebola virus disease in 2014 led to a worldwide demand for suitable screening techniques that enable fast, non-contact detection of employees and visitors with potential fever. To ensure error-free and best possible application of non-contact infrared temperature measurement using the QVGA-HD-T100 cameras, this TechNote summarizes all important notes.



1. Benefits of the system solution using the QVGA-HD-T100 camera

- The system works discretely. The software displays people whose skin temperature exceeds a predefined value.
- The visual alarm immediately identifies people whose skin temperature is above the average.
- The camera provides the current body temperature values.
  This enables discrete inspection and follow-up testing of people affected.
- Thermal images can be stored when the temperature exceeds the predefined threshold.
- Easy and fast installation of complete system.
- Quick and easy camera repositioning.
- Password-protected system.
- Resolution up to ± 0.5 °C combined with the TM-BR20AR ambient reference radiator

2. Fields of application for the QVGA-HD-T100 camera

The camera system is ideally suited to applications in **entrance halls & foyers** of companies and institutions in order to detect the body temperature of visitors, employees, etc. The individual temperature measurement is particularly suitable for **gates in airports or train stations** as it enables the inspection of many people in a very short time. Furthermore, the system can also be applied in **hospitals, supermarkets, shopping malls, schools and universities**.

3. Functioning principle of the QVGA-HD-T100 camera / What does it measure?

In order to achieve a reliable measurement result, it is of vital importance to measure an area in the face that approximately corresponds to the core temperature of the human body. The tear duct of the human eye, also called "medial canthus", is located in both eyes in the corner next to the nose. This is where the upper and lower eyelids meet. It's the "hot spot" which is ideally suited as a measurement point. This measuring range has a diameter of approx. 3 mm.

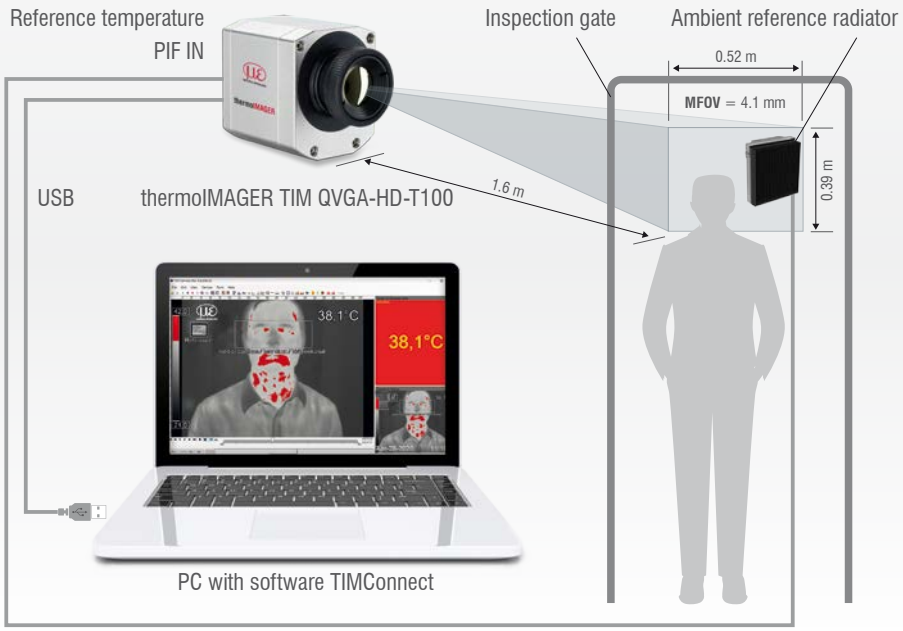
Note: The temperatures measured on the "medial canthus" and the body surface do not correspond 100 percent with the core temperature of the human body. Only a conventional medical thermometer can precisely measure the core temperature!

4. System design

- The measuring system consists of the **TIM QVGA-HD-T100** and the **TIM NetPCQ** or a PC. Alternatively, the TIM 640 VGA can be used. The IR camera is either connected to a PC with the TIMConnect software or to the **TIM NetPCQ** as a standalone solution.

- In addition, the **QVGA-HD-T100** can be combined with the **TM-BR20AR ambient reference radiator**. It has a digital temperature sensor with an accuracy of ± 0.1 °C. The reference must be positioned in the measuring field of the IR camera in such a way that the head of the person to be measured is the same distance from the radiator. The possibility of referencing is integrated into the **TIMConnect software with Software Developer Kit** and ensures an accuracy of ± 0.5 °C in this "closed-loop operation".

Installation of TIM QVGA-HD-T100 and TM-BR20AR-TIM at an inspection gate for individual fever screening



5. Optimal application of / measurement using QVGA-HD-T100 camera

To ensure the optimal measurement performance of an IR thermal imaging camera, please consider the following points:

- Only one person at a time should be in the measuring field of the camera to ensure a reliable measurement.
- Observe optimal distance of 1 m to 1.6 m from the camera (depending on lens).
- Camera must be vertically aligned to visual field.
- Temperature is to be measured on the tear duct ("medial canthus") as this area provides the strongest correlation to the body temperature.
- From a thermographic point of view, you require approx. 3 x 3 px to cover the train duct for a precise measurement. As guideline for a camera with an optical resolution of 382 x 288 pixels, the face of an individual must fill out > 50 – 75 % of the image width in order to ensure sufficient pixel density for accurate measurements.
- When using an ambient reference radiator, it should be the same distance from the camera as the face to be measured so that both the face/the eyes and the ambient reference radiator are focused.
- Hats, glasses, sun glasses etc. must be taken off so that the eyes are visible.
- Factors such as sweating, make-up and movements may completely invalidate the skin temperature measurement.

Possible factors influencing the skin temperature:

- Alcohol consumption increases the skin temperature due to vascular dilation.
- Unreliable measurement results with strong transpiration.
- Pregnancy and physical complaints such as high blood pressure can also increase the body temperature.
- Medications such as Aspirin, Paracetamol and other antipyretics can reduce the body temperature and make reliable fever detection impossible.
- Other influences such as extremely hot and cold ambient temperatures negatively impact the accuracy.

6. Accuracy of absolute temperature measurement using the QVGA-HD-T100 camera

The IR camera detects temperature differences with temperature measurements between -20 °C and 100 °C. The system accuracy of the QVGA-HD-T100 is ± 2 °C of the measured temperature value. As there are many influencing factors that may impact the accuracy of the IR camera, it is essential to know the following: focus, distance, emissivity of the target, ambient temperature and the speed with which the temperature is detected. In order to increase the accuracy, it makes sense to use the ambient reference radiator. Based on this reference, an accuracy of ± 0.5 °C and better can be achieved. The reference must be permanently installed in the measuring field of the IR camera and present high emissivity. The high precision **TM-BR20AR-TIM ambient reference radiator** from Micro-Epsilon combined with the **TIM QVGA-HD-T100** enables camera uncertainties to be reduced. Device settings, ambient temperature drift and short-term stability achieve a system accuracy of ± 0.5 ° C with a confidence interval of 95%.

7. What the QVGA-HD-T100 IR camera is unsuitable for

The system is designed for individual temperature measurement and can also be used for crowd/group screening. Differentiated identification is only possible when measuring an individual person. The infrared camera can be used as an effective instrument in public institutions such as airports and hospitals, at service providers, manufacturers and in public transportation to measure the temperature of the skin surface. In case of suspicion, people with increased skin temperature can subsequently be examined by doctors (thermometer measurement).
This camera is not suitable for reliable fever diagnosis. In addition, it does not guarantee reliable detection of an infection or illness.

8. Summary

The camera's technology is intended for temperature detection in the face. The system was designed for versatile fields of application and can be effectively used in EBT (Elevated Body Temperature) screening applications. However, it is vital to know the technology's limitations. Thermal imaging cameras may generate a distorted image of safety as an unremarkable temperature measurement suggests a person is not infected with the virus. However, the TIM QVGA-HD-T100 presents a reliable early warning systems for fever in order to interrupt infection chains in advance.
None of the IR cameras available on the market are able to reliably detect and recognize the coronavirus. TIM QVGA-HD-T100 is ideally suited to measuring the temperature differences on the skin surface and in the "medial canthus". It provides a reliable indication of elevated body temperature and a possible illness. Subsequently, only a registered doctor can determine whether a person with elevated body temperature is ill or infected. Therefore, this technology is a great support tool during this crisis in order to be able to interrupt infection chains in advance.