The Science behind using Infrared Thermometer for Fever Checks

Measuring Accurate Skin Temperatures is Not as Easy as Most Think

We started our pursuit to provide accurate fever checks on April 1st, 2020 and have embarked on a steep learning curve through months of research and field testing. We initially wanted to figure out a way to connect a standard hand-held thermometer to our control system but we ultimately figured out how to utilize 4-20 ma industrial infrared thermometer to achieve the accurate and precision we originally set out to achieve. We determined simple linear scaling cannot be used to achieve accuracy while measuring skin temperature with an industrial infrared thermometer. These types of sensors are usually fixed to measure all objects at a specific emissivity (the effectiveness of an object's surface to emit energy as thermal radiation). Emissivity varies from object to object. The emissivity of skin needs to be taken into consideration when taking measurements from an industrial infrared sensor that was not calibrated at the factory to measure human skin. To accommodate we provide special scaling in the range of human skin and perform physical verification measurements with blackbody body references that have a constant heat source to ensure accuracy and repeatability. Our scaling is set up to not necessarily be the most accurate over the entire range, but to ensure **anyone who has or is close to a body temperature of 100.4 degrees F will fail a fever check**.

Camera thermal scanning systems are also available on the market for fever checks. They are complicated, difficult to troubleshoot, and a high-resolution camera is necessary to direct the image to the correct areas of measurement. A sophisticated algorithm is required to pinpoint exactly where the measurement should be taken and can be done in error without anyone knowing. These systems measure surface skin temperature in the low 90s and large offsets must be added to get in the range of actual body temperature. Also, unlike Infrared thermometers infrared cameras cannot be used outdoors due to the interference of the sunlight's infrared rays which, will impact the results.

Early on in IntelliSCREEN™ development we had a customer who wanted us to integrate a system using a thermal imaging camera with the rest of our system. We were open minded with this because we knew our health check survey, label printing, traceability

application, and interlock options could be packaged with any type of temperature sensing. We set up the thermal imaging camera in parallel with our infrared thermometer scanner over the course of a day. The measurements were taken in a hall where the doors where wide open, so the environment and ambient temperature varied throughout the day. The initial temperature being read in by the camera was averaging around 93 degrees and we had to manually add an offset of 5 degrees F to emulate a body temperature. We found that the offset had to be adjusted at least once an hour to maintain accuracy as the environment changed. Our temperature scanner did not need to be modified during the same time frame. The camera was supposed to take measurements from the inner eye sockets. We found if you walked into the field of vision incorrectly it would take your temperature from all sorts of different locations. We walked the customer through both temperature sensing options and ran through several fever checks using both. Within minutes our customer decided to go with our infrared thermometer solution and from there on we continued to focus on optimizing this. We feel based on hands on experience and research that our solution is simpler, much more reliable, and is more likely to identify a person with a 100.4-degree F fever.