Precise temperature measurement and profiling enhances quality and manufacturing efficiency

Temperature measurement and monitoring are critical to ensuring that automotive components meet demanding safety and quality requirements. Fluke Process Instruments offers a versatile range of industry-specific pyrometer, thermal imager, and data logger products that also help manufacturers optimize productivity and resource efficiency.

Illustration 1: The Datapaq TP3 gathers detailed data and provides CQI-9 certification

Fluke Process Instruments manufactures class-leading infrared sensors, thermal imagers, temperature profiling instruments, and software functions for various stages throughout automotive parts production. The company’s Raytek, Ircon, and Datapaq product lines reflect the combined experience of over 125 years in manufacturing the world’s finest temperature measurement technology. Application experts are readily available to provide technical support to customers, helping them choose and set up the correct system for specific conditions that vary greatly from steelworks and automotive press shops to electronics manufacturing and paint shops.
Temperature measurement at a safe distance

Fluke Process Instruments specializes in managing high-temperature processes and otherwise demanding or tricky applications. Where the use of thermocouples and resistance thermometers is impractical, Raytek and Ircon infrared thermometers are a viable alternative with crucial advantages for users. The noncontact systems cannot cause the measured object to be contaminated or spoiled in any way. They can be used to monitor stationary objects as well as moving processes. The sensors can be installed at a safe distance, allowing for long-term continuous use in harsh environments and in high-temperature applications. They can even be fitted with suitable cooling equipment, which is also available from Fluke Process Instruments. Measuring points are typically set up for automatic operation and minimal maintenance.

Illustration 2: Set up and forget it: even miniature infrared sensors like this one provide high-quality data for automated process control

The infrared sensor solutions cover a range of very different requirements: spot instruments measure the temperature of a specific part of the target's surface; thermal imagers monitor the target surface in its entirety; and linescanners compile thermal images of moving parts and extra-wide objects such as reheated steel blanks.
Profiling systems that enter the furnace

Sometimes, observation from afar is insufficient and a look into the oven is in order. Paint cure processes and reflow soldering of PCBs, for instance, require specific heating and cooling ramps. Consequently, the oven zone temperatures must be carefully adjusted during setup. Other, lengthy thermal treatment processes or high-value production steps with very narrow specifications may require immediate action when critical thresholds are breached. Since infrared sensors need a clear view of the measured object, they are of limited help. Conventional oven-integrated thermocouples measure the air temperature but do not provide conclusive data about the product itself. After long-time use, these may deliver faulty readings, if not recalibrated regularly, or they may fail entirely.

Oven operators do have the choice of using trailing thermocouples – attached to the product at crucial positions. However, even these prove problematic in certain applications such as long tunnel furnaces or walking beam furnaces, since the trailing thermocouple lines may be severed. In response to all these challenges, Fluke Process Instruments continues to develop complete, hardware and software, in-process temperature profiling solutions that take the data logger through the oven or furnace and provide accurate product temperature profiles. The Datapaq line comprises the most comprehensive range of thermal barriers to suit virtually any thermal treatment, including combined heat and quench processes. Their insulating power is such that it can protect the electronics for hours in ambient temperatures up to +1,370 °C. The data can be downloaded to a PC after the measurement run is finished, or the
logger can be fitted with a radio module in order to make the data available to the operator for real-time monitoring.

**Application cases:**

**Hot working of structural parts**

In the manufacture of light-weight pillars that meet today’s high safety standards, infrared linescanning systems ensure correct thermal treatment and 100% quality control and documentation of all processed pillars. When red-hot blanks leave the furnace, they are immediately picked up by a robot and placed in the press. The linescanner has only a 100 mm wide window for scanning the entire surface to ensure uniform heating. The system scans 150 lines per second, which the software compiles into thermal images and archives for all pillars. After hot working and quenching, when the formed pillar is removed from the tooling, two linescanners generate thermal images. Looking at the pillar from different perspectives, they can view all sections and again ensure proper temperature distribution that is necessary to achieve the desired high-tensile strength.

**Die casting**

Automated die cast cells are monitored by means of a Raytek ThermoView Pi20 thermal imager combined with Raytek DataTemp Pi software. The camera solution designed for fixed installation and standalone operation ensures repeatable measurements. Thanks to onboard Ethernet capabilities for fast data transmission, thermal images are available for monitoring via a PC in real-time. The software offering up to 64 free-form programmable areas of interest can manage various areas and surfaces simultaneously. Alarms can be configured for up to 192 measurement conditions (max, min, time at temperature) and linked to automatic shutdown procedures in order to reduce rejects and increase productivity.

**Furnace surveying**

Designed for versatile use in automotive heat treatment applications, the Datapaq TP3 data logger performs temperature uniformity surveys (TUS) and system accuracy tests (SAT) compliant with CQI-9. Its uses are, for instance, in the manufacture of motor blocks, cylinder heads, frames, and chassis components. An onboard digital calibration certificate and automatic
measurement correction functions eliminate risk of human error and save time on reporting. Featuring up to 20 channels and a large memory for 3.6 million data points, the data logger records detailed temperature profiles with an accuracy of ±0.3 °C. It provides full connectivity options, including Bluetooth and USB download as well as real-time data transfer via radio. Users can perform ten consecutive profiling runs before downloading to a computer via USB or Bluetooth. Datapaq’s proven process optimization tool automatically and accurately predicts the effect of altered parameters such as process temperature and line speed. This speeds up process setup and line changes and helps improve overall line performance and energy utilization.

**Instant feedback on paint cure success**

Fluke Process Instruments also offers a temperature profiling system especially engineered for automotive paint shops. The Datapaq Oven Tracker XL2 enables time-saving measurements of a whole series of processes, for instance e-coat, primer, base coat, and clear-coat curing. Up to 16 thermocouples are attached to the car body, particularly in areas that are at risk of over-curing such as the roof and hood or under-curing such as pillars and sills. Traffic light signals on the logger housing indicate the success or failure of the thermal treatment upon leaving the oven. This enables users to correct any problem very early before they even download the data. The logger can store up to ten profiles, thereby saving time and effort while maintaining full transparency for quality assurance and documentation. The software provides comprehensive process optimization and evaluation functions and enables reporting compliant with Qualicoat, QS9000, ISO9000, ISO9001, and CQI-12.

**Illustration 4:** The Datapaq Insight software includes comprehensive probe location reporting for repeatable measurement setups
Conclusion

Temperature measurement with the right choice of sensor and advanced industry-specific software functions can achieve significant cost savings by way of higher quality, faster setup, greater throughput, efficient energy use, and less scrap. Industry-standard reporting provides an added value.