



The use of Thermal Imaging in Electronic Equipment Applications

Thermal Imaging has become well established as an invaluable tool for diagnostic and preventive maintenance in manufacturing and process industries worldwide; the technology enables the appropriate maintenance to be carried out before complete breakdown occurs and consequently reduces equipment downtime and minimizes the associated impact on profits. Just as with these (normally electrical and mechanical) applications, the simple use and low cost of the current generation of thermal imagers make them the ideal tool for a host of other applications, and in particular for the Electronic Equipment Industry. Infrared thermal imaging cameras have been used for many years in this sector and have proved to be invaluable in the diagnostic (R&D) and Quality Assurance (production) fields. Thermal imaging is often able to pinpoint problems or identify incorrect or unsuitable components when classical diagnostic approaches are unable to do so. The cost of the equipment however, has meant that the technology has only been available to a limited number of specialists. Thermal imaging is now available at an affordable price, which means that handheld cameras can now be available to more in the engineering field.

Thermography

Infrared thermography is one of the most important sensing technologies to be applied to the detection and monitoring of manufacturing and production equipment. Until recently this sophisticated technology was prohibitively expensive, being driven primarily by military applications; over the last few years, however, the technology has improved and it has been introduced to high volume commercial and professional applications by innovative companies such as Wahl. This has brought the price down to a level, which is opening up a host of new applications.

Thermal imagers measure the infrared energy emitted by surfaces remotely and are extremely simple to operate because no physical contact is necessary. Many facilities have employed thermographers to carry out inspections every 6 or 12 months; the cost of the equipment and its ease of use mean that these inspections can now be carried out as and when required by the organizations own maintenance staff. Appropriate thermal imagers no longer need to cost \$45,000 or more; for example the comprehensive range of imagers from Wahl starts from less than \$2,500 – less than the cost of a single survey from a thermographer.

Electronic Applications

The thermal imaging camera enables the engineer or technician to view small circuits and identify individual objects, which may have contained a variety of regular or irregular shapes. Many design and manufacturing problems cause thermal anomalies. Consequently problems can often be solved by the design team by replacing, redesigning or relaying out an over (or under) heating component or circuit; similarly the quality assurance group can often identify electrical discrepancies in a circuit or product which, although not causing any immediate problem, may result in a functional or reliability problem in the future. The imaging approach can be applied to all types of electronic equipment.

Examples are:

Bare Printed Circuit Boards

Thermal imaging cameras are often used to monitor and control printed circuit board temperatures during the curing process; this is because the temperatures involved are extremely critical and as there are several such cycles involved in the complete process, there are many opportunities for errors to creep in and for scrap material to be generated.

Assembled printed circuit boards

In the design phase, the engineer can monitor the thermal characteristics of the various components and use this information to optimize his design. In the production place the thermal imager can locate poor soldering, track discontinuities, incorrect component values and power ratings as well as incorrect polarities. These discrepancies can often be located at a glance by comparing a faulty board with a "known good" reference board.

Integrated circuits

Thermal mapping of a semiconductor integrated circuit can be very beneficial to the design engineer in optimizing his design as above; it can also be an invaluable aid to the semiconductor process engineer who is charged with maintaining control of the implementation and diffusion processes. It can subsequently be used by the quality engineer to inspect both the diffused structures in the bare semiconductor and the bonded structures in the packaged device.

Hybrid Micro?

Thermal imaging technology can be used to monitor the controlled heating and cooling profiles applied to the wire bonding process, which is used to connect the integrated circuit and other components to the circuitry. This can benefit the engineers in terms of increased throughput and reduced scrap generation.

Whatever the circuitry, whether destined for mobile phones, personal computers or satellites, the thermal imaging camera can help to reduce time to market, improve manufacturing efficiency and reduce recalls and warranty claims.