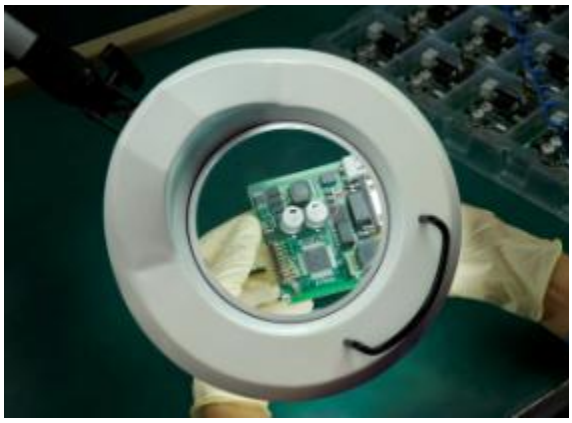
Controlling relative humidity and temperature in electronics manufacturing plants

The two main automated processes used in electronics manufacturing plants for soldering components to an assembled PCB are reflow soldering and wave soldering. Managing temperature and relative humidity levels in the manufacturing environment is the key to maintaining high levels of quality and reducing overall defects in finished products.



Reflow soldering

Primarily used for the soldering of surface mount components, reflow soldering involves the use of solder paste to temporarily affix electronic components to their solder pads on a PCB. Once the solder paste has been applied using a stencil, the entire PCB assembly is then passed through a reflow oven, heating the surfaces to be joined and melting the solder, while avoiding overheating the electronic components.

During the stenciling stage, low humidities cause the solvent in the solder paste to evaporate too quickly, drying out the paste. This leads to poor release of stencils before reflow and can reduce overall stencil lifetime. Dry solder paste also causes problems during the reflow stage, including insufficient wetting of components and inadequate spread of the solder to PCB solder pads. In extreme cases reflow may not occur at all. Low temperatures reduce the viscosity of solder paste, leading to poor results when printing.

In conditions of high humidity, solder paste absorbs water from the ambient environment, resulting in poor coalescence, slumping of the paste, and the formation of solder balls during reflow. High temperatures reduce the viscosity of solder paste, increasing incidences of smearing and slumping, bridged joints and solder balls.

Wave Soldering

This process is primarily used for through-hole components. The assembled PCB is pre-heated, before a flux coating is applied to the side to be soldered. The fluxed PCB is then passed over a wave or waterfall of molten solder, coating with solder any areas of the board that have not had solder-mask applied. An optional cleaning stage finalizes the process, depending on the type of flux used.

Considerations for both processes

At high humidities the entire assembly, including the PCB and electronics will also adsorb and absorb moisture. The moisture out-gasses during reflow processes, leading to defects in the soldering of BGA components. In wave soldering processes this can lead to formation of solder balls, and pinholes. High temperatures combined with high humidities increases the oxidation rate of solder, component pads or leads, and PCB solder pads leading to problems with solder wetting and spread on both reflow and wave soldering processes.

Low humidities in the manufacturing area reduce surface conductivity, promoting the build-up of static electricity, ultimately leading to more defects caused by electrostatic discharge.

Solution

In order to avoid the aforementioned problems, a suggested relative humidity of 40-60% should be maintained in the manufacturing environment, alongside a temperature range of 20-25°C.

Michell Instruments provides a number of different solutions for monitoring ambient relative humidity and temperature, providing digital, or analogue outputs and alarm relays for use with an environmental control system.

Suggested Products

I7000

The I7000 (Hygrosmart) Series is interchangeable without the need for recalibration. The small size allows its integration in any equipment while the plug-and-play system allows fast replacement even by non-skilled staff. The low-power module provides a voltage output for relative humidity. The temperature output is in the form of a 3-wire 1/3 DIN PT100 that can be measured directly.

WM33

The WM Series are wall-mounted humidity that provide a voltage or current output signal of % RH, dew point or absolute humidity and temperature. The WM Series offers excellent measurement accuracy and stability wherever a wall-mounted sensor is required. An optional display can be fitted for local monitoring of measured parameters.

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Michell Instruments
48 Lancaster Way Business Park
Ely Cambridgeshire
CB6 3NW

Q06284

Tel: +44 1353 658000
Fax: +44 1353 658199
Email: uk.info@michell.com
Web: www.michell.com