March 2011

Trace Oxygen measuring systems for Reflow and Wave solder machines

Most manufacturers and users of inerted reflow and wave soldering ovens use trace O_2 analysers to either measure the oxygen impurity or even with a feedback loop control the O_2 impurity.

There are many manufacturers of these instruments but only a small number that operate on a worldwide basis, with corporate service centres and knowledgeable representatives.

There are two major technologies used in these types of applications, namely Zirconia, ceramic, solid state and Fuel Cell. There are advantages and disadvantages with both of these types.

Many manufacturers only produce one of these types.

Systech Illinois (formerly Systech Instruments Ltd and Illinois Instruments Inc.) manufacture both types and with over 22 years of experience have sold more than seven hundred solutions. Ever since the pioneers of Soldering ovens began introducing Nitrogen into the controlled atmosphere to improve the production quality of circuit boards.

Here at Systech Illinois, we believe that we have the best solutions available in both Cell types and technologies. We are the best in the market today because we have an additional solution that no one else has…the RACE™ Cell.

- We are the only company that has the option of RACE™ technology.
- This technology employs a second fuel cell which protects the first cell from being exposed to high concentrations of O_2.
- The guarded cell never sees high O_2levels and therefore responds very quickly, just as quickly as a Zirconia based system at the normal O_2 levels seen by soldering ovens.
- Systech Illinois have Patents on this technology and therefore it is not available from any other manufacturer.
- Systech Illinois have the fastest solution available in the marketplace. With our RACE™ technology there is no need to use a special filter canister to absorb the volatiles/hydrocarbons. This gives far better response times and much lower running costs. Filters do not have to be replaced therefore operators do not have to remember this task, providing continuous accurate measurement.

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Zirconia Based instruments

How does it work?

The instrument utilises a Zirconia cell to detect oxygen concentrations. The Zirconia cell is an electrochemical galvanic cell employing a high temperature ceramic sensor containing stabilised zirconium oxide.

The instrument is a self contained unit with the Zirconia cell mounted in a high temperature controlled furnace. The necessary electronics process the signal from the detection cell and display it directly via a digital display as oxygen concentration over the range 0.01vpm to 100%.

Advantages:

- The response time is very fast, and much faster than the Fuel Cell approach. There is usually no problem with the speed of measurement.
- The sensor is non- depleting; in other words it will last the lifetime of the instrument.

Disadvantages:

- In the presence of hydrocarbons the oxygen that the instrument is trying to measure is catalytically converted to CO_2 or other elements and therefore measures oxygen concentrations much lower than expected.
- In order to overcome this manufacturers use a special filter canister to absorb these volatiles/hydrocarbons. This increases the time response and running costs and inevitably because the filter has to be replaced often, operators do not carry out these tasks, with breakdown of the measurement.
- Some manufacturers have what claim to be non-catalytic sensors, which do not work effectively in such high hydrocarbon conditions that exist.

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Fuel Cell based instruments

How does it work?

The cell performs essentially as a battery and consists of two electrodes in contact with a liquid or semi-solid electrolyte. The electrodes are connected through an external electronic metering circuit. Oxygen comes in contact with the negatively charged cathode (usually silver) where the first of two reactions take place. Oxygen is reduced (electron consumption) to the negatively charged hydroxyl species anode (usually lead) where the second reaction takes place. The hydroxyl ions react with the lead which is subsequently oxidised (release of electrons) to lead oxide. The use (reduction) and release (oxidation) of electrons results in a flow of electrons proportional to the oxygen concentration and is measured by the generation of an electric current.

Advantages:

- Inexpensive to replace, without interference from other gases (except CO_2, which is not encountered in soldering oven applications).

Disadvantages:

- Slow to respond to low ppm O_2 when exposed to high % O_2 levels. Consequently the O_2 level in the oven can be actually lower than the reading of the analyser, therefore can sometimes show the operator non ideal conditions.
- Systech Illinois solve this problem by employing their RACE™ technology. This employs a second fuel cell which protects the first cell from being exposed to high concentrations of O_2.
- The guarded cell never sees high O_2 levels and therefore responds very quickly, just as quickly as a Zirconia based system at the normal O_2 levels seen by soldering ovens.
- Systech Illinois have patents on this technology and therefore it is not available from any other manufacturer.

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Which is best -Zirconia or Fuel Cell?

Systech Illinois is completely independent on this issue! We make both types and we have no preference.

Some manufacturers have to use Zirconia because the Fuel Cell is too slow. However Zirconia needs the use of expensive filters that normally do not get replaced, rendering the installation useless.

We find that most of our customers use our RACE™ Fuel cell based system, but not all. We have no preference and can advise the prospective customer of the best solution for their application site.

9500/8500 Oxygen Control System

The Zirconia or Fuel cell technology instruments are available as fully controlled Oxygen measuring and feedback control instruments.

The instrument not only measures and displays the Oxygen concentration, by employing a fuzzy logic control algorithm and control valve on the incoming Nitrogen feed to the oven but it can also control the O2 impurity.

We are finding more and more of our sales to these applications are control systems.

- Save on N2 usage and rework costs
- Automatically detects a halt in production and reduces N2 flow for even greater savings
- Small footprint, one box solution allows OEM manufacturers to install in their machine
- Nitrosave Viewer PC software makes set up quick and easy