

Application

Safety and process hydrogen measurement in hydrogen electrolyzers, generators, fuel cells and refueling stations for the alternative fuel cell industry

Background

Hydrogen can be generated on-site for fuelling stations using hydrogen generators which employ a polymer electrolyte membrane fuel cell (PEM) or electrolyser stack technology.

An electrolyser splits water into hydrogen and oxygen by passing an electrical current through it. A fuel cell is a device that produces electricity by combining a fuel, usually hydrogen with oxygen. Hydrogen is either used as source or obtained as a by-product. For safety reasons, the hydrogen content in an electrolyzer needs to be less than 4% hydrogen v/v to ensure a safe operation of stationary electrolyser and refueling stations.

The anodic side of a fuel cell vehicle needs to control the amount of feed hydrogen to ensure process efficiency of a PEM based fuel cell and membrane integrity. Continuous hydrogen measurement is necessary in carbon dioxide, H₂O environments.



Figure 1: Hydrogen generator (top, left), fuel cell vehicle (top, right) and H₂ refueling nozzle (bottom).

Measurement Technique

H2scan sensors employ a solid-state hydrogen specific technology based on a palladium alloy that provides continuous and reliable H₂ measurements. The sensing material is inherently specific to hydrogen and has the capability to operate in a variety of multi-component gas backgrounds including water, carbon dioxide and hydrocarbons. No interference with alkaline or acidic environment is expected.

Advantages

- **Safety:** Conventional catalytic bead or metal oxide sensors though widely used for detecting combustible gases are not inherently hydrogen specific. H2scan sensors are inherently hydrogen specific and can detect hydrogen explosive environments without any false alarms. (Series HY-ALERTA™ 600)



Figure 2: HY-ALERTA™ (safety), HY-OPTIMA™ (process) for alternative fuel industry

flammable levels (Model 720)

Reference Users

United Technologies, Hydrogenics, ITM Power

- **H₂ Generators / Electrolyzers:** For a hydrogen generator, the concentration of hydrogen needs to be detected in an oxygen rich environment at the outlet of the stationary electrolyser. H2scan sensors can measure hydrogen effectively in oxygen rich or oxygen free environments that ensures the hydrogen delivered to the end user is well below the explosive or



APPLICATION NOTE

HYDROGEN SPECIFIC SENSOR FOR ALTERNATIVE FUEL INDUSTRY

- *Fuel Cell Vehicles:* Hydrogen is used as the primary fuel for the operation of PEM fuel cell for hydrogen powered vehicles (automotive, forklifts etc.). Continuous measurement of hydrogen is enabled by series 700 process monitor in the anode inlet of the fuel cell to control fuel cell efficiency and membrane integrity (Model 799, 1700)

HYDROGEN SPECIFIC SENSING SYSTEMS



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