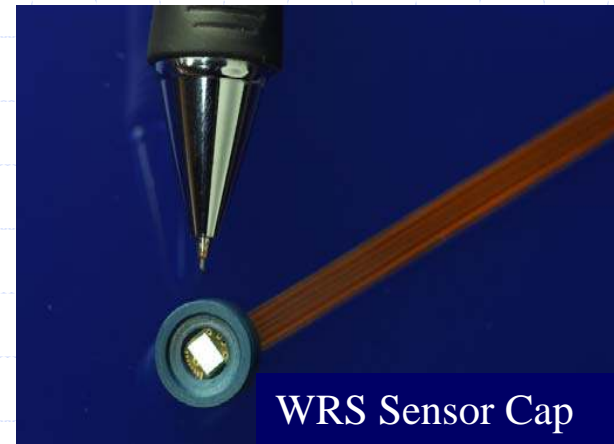


H2scan Market Overview

H2scan Corporation
Valencia, California



Hydrogen Sensor Systems

H2scan is the leading provider of high performance hydrogen specific sensor systems, which provide accurate monitoring and control functions for a wide range of applications.

- Three **hydrogen-specific** product series:

SAFETY

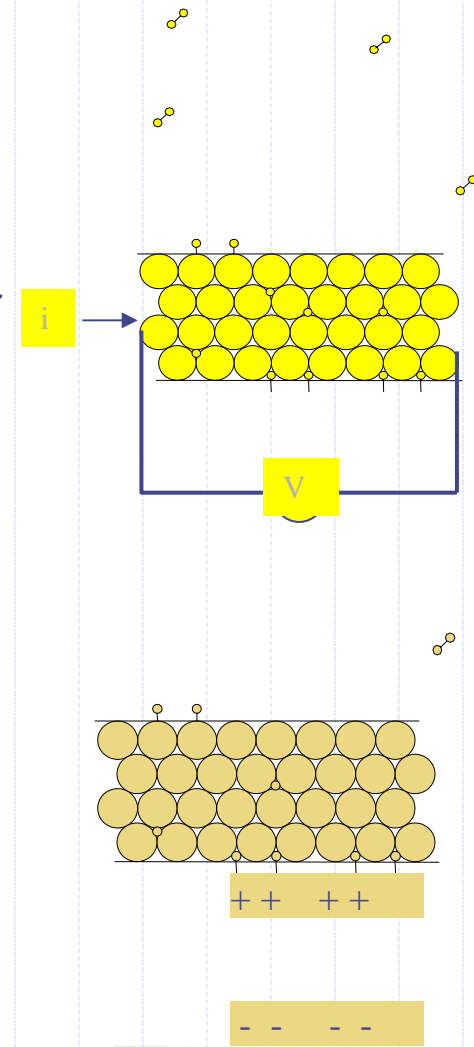
- HY-ALERTA 500: Portable Hand Held Hydrogen Leak Detector
- HY-ALERTA 600: Fixed Area Hydrogen Monitor

PROCESS

- HY-OPTIMA 700: In-line Process Hydrogen Monitor

Technology Background

- ◆ Pd catalyzes H₂ (molecular) into 2H (atomic)
- ◆ Hydrogen absorbed into the Pd alloy lattice creates changes:
 - Bulk Resistivity – The Hydrogen Sensing Resistor (HRES) uses this property to measure hydrogen from 0.4% to 100% hydrogen in multiple atmospheres.
 - Charge Density – The Hydrogen Sensing Capacitor (HCAP) uses this property to measure hydrogen from 15ppm to 0.5% in air.
- ◆ Hydrogen-specific, no cross-sensitivities to combustible gases
- ◆ Operates with or without O₂ present
- ◆ 0% to 100% hydrogen sensitivity range in a single system, no peripherals needed



H2scan Intellectual Property

- ◆ Exclusive license 96-C00333 from Sandia National Labs for patent # 5,279,795 issued in 1993
- ◆ Four H2scan patent applications filed 2005
- ◆ Overseas patent protection filed in 2006
- ◆ Trade secrets relating to firmware, electronic circuit design, manufacturing wafer processing

Focus Markets and Applications

- ◆ Petrochemical Refineries
 - Process Control
 - In-Line Real-Time Measurement for Hydrogen Production
- ◆ Process Gas
 - Process Control
 - Chlorine Manufacturing / Gas Production
 - In-Line Real-Time Measurement for Hydrogen Production
- ◆ Energy / Nuclear
 - Nuclear Power / Nuclear Waste
 - Fossil Fuel Power
- ◆ Industrial Manufacturers
 - Chrome Plating
 - Lead Acid Battery Monitoring
- ◆ Research Laboratories / Universities
- ◆ Semiconductor and Electronics Manufacturers
 - Capital Equipment Manufacturers
 - Industrial and Consumer Electronics Manufacturers
 - Abatement Unit Exhausts
- ◆ Transformer Oil
- ◆ Fuel Cell Technologies / Automotive
 - Hydrogen Refueling Stations
 - Vehicle Exhaust Analyzer
 - Fuel Cell Vehicles

How to Apply H2scan Technology

- ◆ Hand Held Leak Detectors (series 500) and Fixed Area Monitors (series 600) are ideal for hydrogen-safety related applications
 - Plants (Commercial or Pilot scale)
 - ◆ Process leaks (tubing/compressor/vessels)
 - ◆ Analyzer buildings/control rooms
 - ◆ Storage tanks and transfer of H₂
 - Laboratories (Industrial/University)
 - ◆ Hydrogen storage area and transfer lines
 - ◆ Work Area (fume hood/pilot plant)
 - ◆ Process leaks (point-of-use)

How to Apply H2scan Technology

- ◆ Process control (series 700) applications
 - In-line monitor of H2 feed concentrations
 - In-line monitor of process gas H2 concentrations
 - In-line monitor of feed to stack gas, H2 concentrations
 - In-line monitor of recycle gas H2 concentrations
 - In-line monitor of stack gas (vent) H2 concentrations
 - Real-time back-up H2 monitor to Gas Chromatograph – Mass Spectrometer
 - Off-line monitor of H2 in grab samples

HY-ALERTA Series 500 Hand Held Hydrogen Leak Detector



- ◆ 3rd Generation
- ◆ Patented Sensor-on-a-Flex
- ◆ 100% Hydrogen specific
- ◆ 15PPM to 100% hydrogen by volume detection range
- ◆ Unique LED visual detection alert
- ◆ Auto-zero/Reset functions
- ◆ Compact ½ inch head
- ◆ Water resistant
- ◆ On-site calibration

H2scan Series 500 Advantages

- ◆ The Model 500 is a single system that has a detection and measurement range of 15PPM to 100% hydrogen by volume without the need of any peripheral equipment
- ◆ The only sensor capable of detecting hydrogen with no cross-sensitivities to methane and other combustible gases
- ◆ Compact size of sensor wand and controller with a ½ " diameter sensor head to get into small, hard to reach areas
- ◆ The system's built-in-battery has an extended life of over 9 hours operating continuously, charging in just 4 hours.
- ◆ The system has a 10 year product life expectancy with a full warranty for 1 year
- ◆ It has a unique re-zero feature that allows for a complete self diagnostic check at each power cycle, while at the same time, re-setting the sensor readings. This eliminates the need for numerous, costly re-calibrations.
- ◆ Visual detection of a low concentration hydrogen leak is illuminated at the sensor tip by an LED array; above hydrogen concentrations of 5000ppm, concentrations are reported numerically on the controller LCD panel.
- ◆ Series 500 field calibration kits are available with all necessary gases

HY-ALERTA Series 600 Fixed Area Hydrogen Monitor



- ◆ 3rd Generation
- ◆ 100% Hydrogen specific
- ◆ 10% to 125% of LFL
- ◆ 0.4% to 5% H₂ by volume
- ◆ Fast response time
- ◆ Two built-in contacts
- ◆ ASCII, RS422 or RS232 serial connectivity
- ◆ On-site calibration

H2scan Series 600 Advantages

- ◆ Can be mounted on a wall or ceiling and be implemented to alert and alarm for dangerous levels of hydrogen leaks in open air.
- ◆ Hydrogen-specific with no cross-sensitivities to methane and other combustible gases eliminating false alarms.
- ◆ It has two built-in relays that can be set to actuate at selectable concentrations; can also be changed in the field
- ◆ Weatherproof housing
- ◆ Entire unit (2in. X 7.25in. X 3.35in.), compact sensor head
- ◆ Electrical firmware completely updated allowing for field calibrations, making changes in contact points, adjusting the analog output, etc.
- ◆ The system has a 10 year product life expectancy with a full warranty for 1 year
- ◆ Series 600 field calibration kits are available with all necessary gases

HY-OPTIMA Series 700 In-Line Process Hydrogen Monitor



- ◆ 3rd Generation
- ◆ 100% Hydrogen specific
- ◆ In-line, real-time measurements in process gas streams up to 100°C
- ◆ 95% RH environments
- ◆ Unique models for CO, H₂S, wet CL₂ applications
- ◆ Two built-in contacts
- ◆ ASCII, RS422 or RS232 serial connectivity
- ◆ On-site calibration

H2scan Series 700 Advantages

- ◆ Only sensor capable of operation in non-oxygen environment
 - Fuel cell applications
 - Non-combustion
- ◆ Protection from humidity and condensation
 - Operation in saturated water vapor
 - Withstand up to 95% RH environments
 - Repeatable performance in humid air and humid N₂ backgrounds
- ◆ Only sensor capable of detecting Hydrogen in harsh background gases (carbon monoxide, sulfur, chlorine, ammonia, no cross-sensitivities to methane and other combustible gases):
 - Petrochemical production
 - Hydrogen production
 - Chlorine manufacturing
 - Nuclear waste monitoring
- ◆ Only process sensor capable of operation up to 100°C:
 - Less expensive integration
 - Access to more process streams and environments than our competition
 - 2x higher temperature than closest competition for process applications

H2scan On-Site Calibration Kit



- ◆ Customer friendly interface
- ◆ Calibration kit for field maintenance
- ◆ Minimal factory refurbishing
- ◆ Available in customer-specific hydrogen concentrations

H2scan's Competing Technologies

Markets	Catalytic Bead	Thermal Conductivity	H2scan 3rd Generation
Petrochemical		X	X
Process Gas		X	X
Energy / Nuclear		X	X
Industrial Manufacturers	X	X	X
Research Laboratories / Universities	X	X	X
Semiconductor and Electronics Manufacturers		X	X
Transformer Oil			X
Fuel Cell / Automotive	X	X	X

H2scan Advantages by Specification

Specifications	Catalytic Bead	Thermal Conductivity	H2scan 3rd Generation
Availability	Today	Today	Today
H2 Specific	No	No	Yes
Require O2	Yes	No	No
Range	2,000 PPM	~ 1PPM - 100%	15 PPM - 100%
Response Time	10 - 90 Seconds	Seconds	2 - 10 Seconds
Temperature Range	-20 to 50°C	< 50°C	-20 to 100°C
Operates in the presence of CO, H2S, wet CL2	NO	NO	YES

Series 700 Product Selector Guide

Model	Analog Output	Relays	Calibration Background	Hydrogen Sensitivity Range	Process Gas Temperature Range	CO Tolerance	H2S Tolerance	Corrosion Tolerance
700 Standard Process Monitor	4mA to 20mA 0mA to 20mA 0VDC to 5VDC 1VDC to 5VDC 0VDC to 4VDC 0.5VDC to 4.5VDC	yes	Nitrogen	0.5% to 100%	-20°C to 100°C	< 1%	no	no
710 Value Process Monitor	0VDC to 5VDC 1VDC to 5VDC 0VDC to 4VDC 0.5VDC to 4.5VDC	no	Nitrogen	0.5% to 100%	-20°C to 100°C	< 1%	no	no
720 Air Process Monitor	4mA to 20mA 0mA to 20mA 0VDC to 5VDC 1VDC to 5VDC 0VDC to 4VDC 0.5VDC to 4.5VDC	yes	Air	0.4% to 5%	-20°C to 75°C	< 1%	no	no
730 CO Process Monitor	4mA to 20mA 0mA to 20mA 0VDC to 5VDC 1VDC to 5VDC 0VDC to 4VDC 0.5VDC to 4.5VDC	yes	Nitrogen	0.5% to 100%	-20°C to 100°C	< 30%	< 100ppm	no
740 H2S Process Monitor	4mA to 20mA 0mA to 20mA 0VDC to 5VDC 1VDC to 5VDC 0VDC to 4VDC 0.5VDC to 4.5VDC	yes	Nitrogen	0.5% to 100%	-20°C to 100°C	< 30%	< 1000ppm	no
750 Corrosion Process Monitor	4mA to 20mA 0mA to 20mA 0VDC to 5VDC 1VDC to 5VDC 0VDC to 4VDC 0.5VDC to 4.5VDC	yes	Nitrogen	0.5% to 100%	-20°C to 100°C	< 30%	< 1000ppm	yes