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Technology Specifications

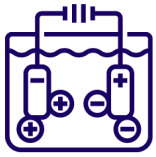
Project 961108

Spec Sheet VOCID® H2Confirm

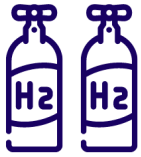
NanoScent's VOCID® H2Confirm, is a sensor-based monitoring system designed to be applied to various points of the hydrogen supply chain, from production to storage and refueling stations, for the continuous monitoring of hydrogen purity in realtime and in-line. VOCID® H2Confirm measures gases, volatile organic compounds (VOCs) and moisture levels in hydrogen onsite while providing real time alerts in the event of contamination or when hydrogen purity levels fall below a pre-programmed threshold. As a result, hydrogen supply and operations are efficiently monitored. Target customers and use cases of VOCID® H2Confirm include:

Hydrogen Production

H2-based Transport and Fuel Cells



Electrolyzer Producers



Logistics: Storage & Distribution

Hydrogen Refuelling Stations

VOCID® H2Confirm offers companies an innovative service for monitoring their manufacturing processes, including the purity or cleanliness of their production machines, while providing results in minutes-time, indicating whether the supply is clean with pass / fail results. At present time, VOCID® H2Confirm is capable of quantifying moisture levels in hydrogen in real time in lab or operational settings. In a few months, customers will be able to add another module to the device, if they choose, to also monitor oxygen traces in the hydrogen supply. The combined ability to monitor both moisture and oxygen levels in real-time makes VOCID® H2Confirm a great choice for monitoring hydrogen supply derived from electrolysis as those are the two main contaminants from that production method.

VOCID® H2Confirm System Description

Customer Interfaces	
Modular System	Modular system designed for detecting moisture trace quantification in hydrogen gas
Operational Run Time	24/7
Electricity	220V
Connectivity	LAN for software updates and over-the-air data uploading
Sample Gas	Hydrogen 5.0 free of oil mist, dry gas
Gas Temperature	-10 to 30°C
Gas Humidity	Dry gas, <50ppm
Gas Pressure and Flow	< 3 bar (minimum 1 bar) @ 1L/min
Integration	Push to connect connector suitable for 1/4 inch teflon tube
System Outlet	Integrated to the customer's vent system (1/4 inch)
Dimensions	20 x 20 x 30cm; 12L
Weight	4 Kg
Validation	Validated under hydrogen at 1 to 10 ppm moisture
Note:	Since the measurement is relative, a reference gas (Hydrogen 5.0 with moisture level <2ppm) is needed.

Measurement/ Sensor Specifications	
LOD	2 ppm
Resolution	2 ppm
Measurement Frequency	4/ hour
Time to Result	10 minutes

VOCID® H2Confirm System Description (continued)

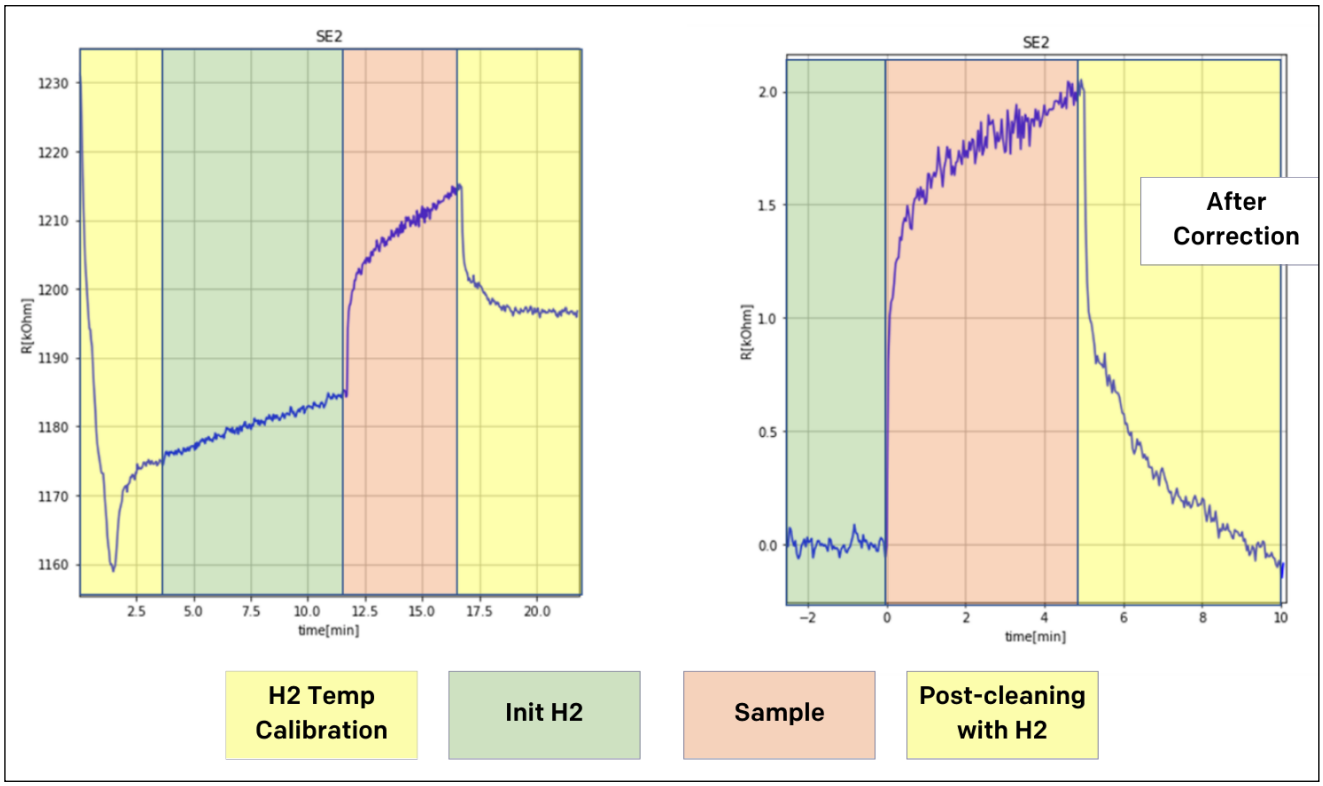
Environmental Conditions	
Temperature	-10 to 30°C

Reporting	
Measurement Output	Moisture concentration (ppm)
Report	Over-the-air data download available

Maintenance and Handling	
Sensor Handling	Yearly
Warm-up procedure (after shut-down)	1 hour under reference H2 @ flow rate of 1 Litre per minute
Ready-to-use procedure (after downtime)	1 hour under reference H2 @ flow rate of 1 Litre per minute

Sensor Response

In the graph below, a sample representation of a sensor response is shown. As can be seen, a sensor response is made up of four phases: temperature calibration (under reference hydrogen), Init (under reference hydrogen), Sampling (exposure of the sample from the supply), and post cleaning (under reference hydrogen).



1. **Temperature Calibration with H2**: Used to measure a calibration curve the sensor measuring the response to different temperatures.
2. **Init with H2**: Creates a baseline based on the sensors' reading of reference H2.
3. **Sample Exposure**: Delivery of the sample to the sensor.
4. **Post Cleaning with H2**: Used to wash any residues of sample gas from the sensors.

The 'After Correction' signal demonstrates the response of the sensor after you calibrate the response based on the calibration curve and the Init phase.

Methods of Measuring with VOCID® H2Confirm

There are two main ways of measuring hydrogen quality with VOCID® H2Confirm:

1. **Spot measurements**: To perform spot measurements, a sample is collected from an electrolyzer or from a refueling station into a cylinder and placed near a reference gas cylinder and provides a measurement.

2. **In-line measurements**: In-line measurements require for the VOCID® H2Confirm device to be integrated directly into the gas line.

Modular Approach for Sensing and Monitoring

To fit the many market's needs across the value chain for monitoring various types of contaminations, NanoScent is taking a modular approach. Within this approach NanoScent is developing its VOCID H2Confirm analyzer in modules, steadily adding new contaminants that it can detect. The first module is dedicated for quantifying moisture levels in hydrogen. This module is currently available and is ideal for use by electrolyzer manufacturers and electrolyzers users for multiple applications to monitor moisture levels in their production in real-time. The next module which will be released will focus on quantifying traces of Oxygen in the supply (at the ppm level). The combined ability to monitor oxygen and humidity will fulfill the need of monitoring the quality of the hydrogen supply derived from electrolyzers where the only expected contaminants are H2O and O2.

NanoScent can measure dozens of other gases and volatile organic compounds in different gas environments, including nitrogen, for a complete list of detectable analytes - please refer to the *Technology White Paper*.

Core Competencies

NanoScent's core competencies are in 4 main areas which collectively distinguish NanoScent's R&D process and strengths as a startup:

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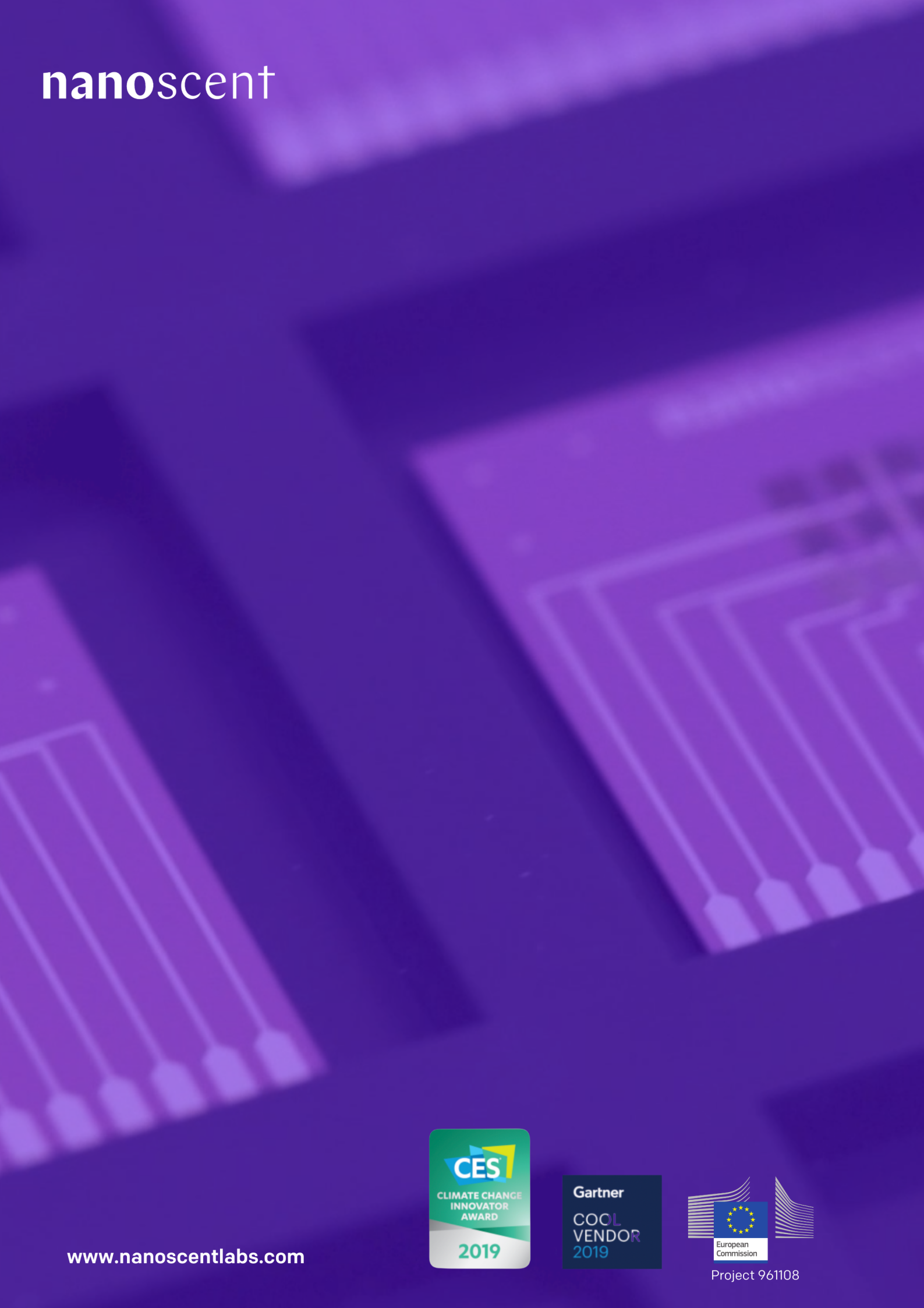

CES CLIMATE CHANGE INNOVATOR AWARD 2019

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