AVL H2D™ / AVL H2D™ +

Hydrogen Mass Spectrometer for H_2 ICE or Fuel Cell Applications

THE CHALLENGE

Global environmental protection initiatives require drastic reduction of greenhouse gas emissions in the coming years. The transport and automobile industry is working on different zero-emission concepts to meet future decarbonization targets. Green hydrogen for fuel cells or as fuel for internal combustion engines is considered CO_2 neutral and is consequently seen as one of the most promising energy carriers of the future.

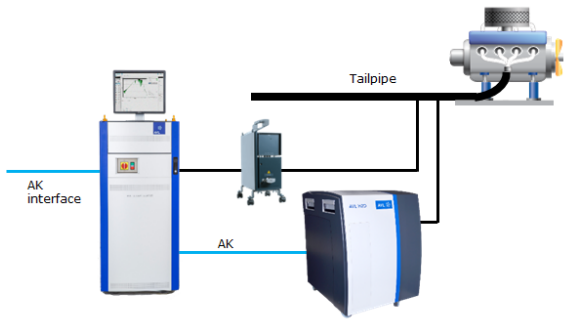
The measurement of hydrogen emissions is essential for both fuel cell and ICE applications. The latest drafts of the GTR-13 and EPA 40 CFR part 1065 regulation for example address zero carbon fuels and demand the measurement of components like hydrogen (H_2) and water (H_2O) to calculate the chemical balance.

THE AVL SOLUTION

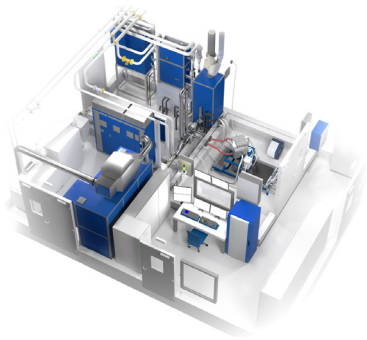
The AVL H2D is a versatile high-end hydrogen mass spectrometer to support the development of fuel cells and H_2 internal combustion engines (ICE). It measures H_2 and optionally N_2, O_2, H_2O and CO_2.

THE ADDED VALUE

- Fast response to dynamically track the behavior of the unit under test (UUT)
- Separate non-intrusive anode measurements using a high pressure, low consumption inlet
- Monitoring of operating states of the fuel cell by detection of critical components (N_2, O_2, H_2O and CO_2)
- Device control either directly (stand-alone) or as a sub-device to an AVL emission measurement system e.g. for engine development



SESAM i60 FT and H2D on H2-ICE testbed



H2D on fuel cell testbed

TECHNICAL DETAILS

	H2D for ICE	H2D H2 ICE	H2D + for ICE	H2D for fuel cell	H2D + for fuel cell
Dimensions W x D x H	534 x 639 x 743 mm				
Weight	65 kg		75 kg	65 kg	75 kg
Power Supply	200 – 230 V ±10% / 50 Hz or 100 – 120 V ±10 % / 60 Hz or 50 Hz				
Interface	AK-communication via or TCP/IP or RS232 (D-Sub, 9-pole) / analog interface as an option				
Ambient Temperature	20 – 35 °C				
Ambient Conditions	800 – 1050 hPa, 10 – 80 %, non-condensing				
Sample Inlet Pressure	1 - 2 bar(a)			1 - 2 bar(a) / 0.75 - 6 bar(a) for anode inlet	
Measurement Principle	Mass spectrometer with electron impact ionization				
Mass Filter	Magnetic sectorfield		Quadrupole	Magnetic sectorfield	Quadrupole
Mass Range	2-4 amu		1-100 amu	2-4 amu	1-100 amu
Sample Inlets	1			2	
Sample Flow	<3 l/min			<3 l/min / <100 ml/min for anode inlet	
Sample Frequency	1 – 10 Hz		1 – 5 Hz	1 – 10 Hz	1 – 5 Hz
Measurement Ranges	H_2: 0 – 50,000 ppm 0 – 100 Vol%		H_2: 0-100Vol% N_2: 0-100Vol% O_2: 0-100Vol% CO_2: 0-100Vol% H_2O: 0-40Vol%	H_2: 0 – 50,000 ppm 0 – 100 Vol%	H_2: 0-100Vol% N_2: 0-100Vol% O_2: 0-100Vol% CO_2: 0-100Vol% H_2O: 0-40Vol%
Limit of Detection	H_2 ≤ 1 ppm (Range 1) ≤ 0.01 Vol% (Range 2)		H_2 ≤ 500 ppm N_2 ≤ 1000 ppm O_2≤ 500 ppm H_2O ≤ 500 ppm CO_2 ≤ 250 ppm	H_2 ≤ 1 ppm (Range 1) ≤ 0.01 Vol% (Range 2)	H_2 ≤ 500 ppm N_2 ≤ 1000 ppm O_2≤ 500 ppm H_2O ≤ 500 ppm CO_2 ≤ 250 ppm
Chiller	Yes	No		No	
Response Time (t_{90})	≤ 4 s	≤ 200 ms		≤ 200 ms or ≤ 2 s for anode inlet	
Noise	≤ 1 % range full scale				
End Point Drift	≤ 5 % range full scale over 24 h at max. ± 2 °C temperature deviation				
Zero Drift	≤ 1 % range full scale over 24 h at max. ± 2 °C temperature deviation				
Repeatibility	≤ 3 % range full scale			≤ 1 % range full scale	
Accuracy	≤ 1 % range full scale				
Linearity	≤ 1 % range full scale			≤ 3 % measurement point in the range 10-100 % of range whichever is smaller	

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