HIDEN ANALYTICAL

DEMS System

Differential Electrochemical Mass Spectrometry

Bench-top Mass Spectrometer for Electrochemistry – DEMS System

Differential Electrochemical Mass Spectrometry is a technique that allows unique online analysis of gaseous and volatile products from electrochemical reactions. The Hiden DEMS system combines advanced electrochemical half cells with excellent performance in mass spectrometry to achieve outstanding analytical capabilities.

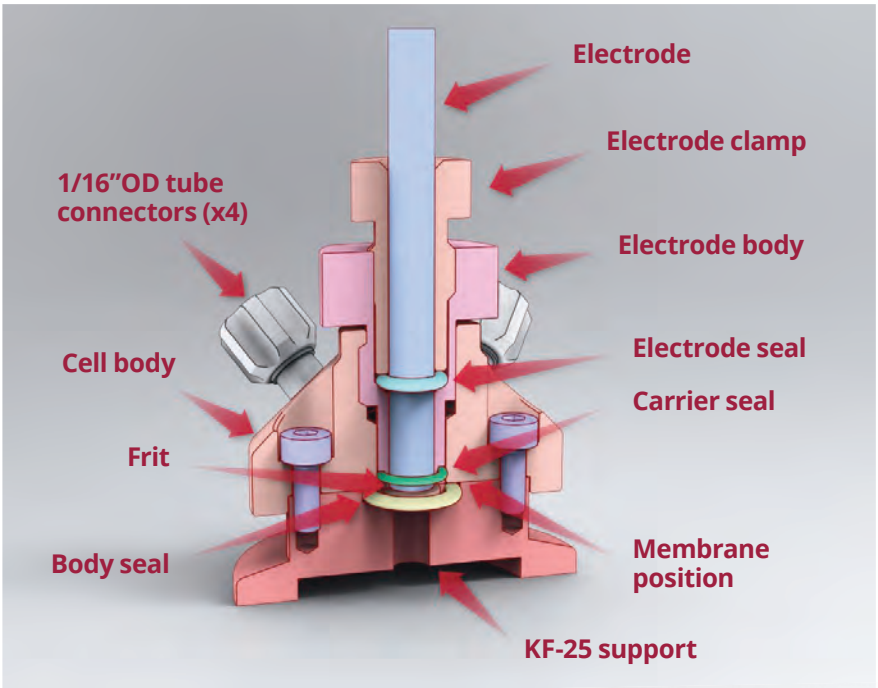
Key Features

- Compact bench-top mass spectrometer system
- Mass scanning, and time/intensity trend monitoring of multiple species
- Modular, user configurable system including DEMS cell
- Fast response (< 1 second), nano-porous electrolyte/MS interface
- DEMS off-gas analysis capillary sampling option with micro flow inlet
- Mass range: 200 amu is standard. 300 amu option

System Configuration & Options

ITEM	DESCRIPTION	PARTCODE
SYSTEM	HPR-40 DEMS bench-top gas analysis system for electrochemistry, including DEMS cells type A and type B and Hiden HAL 201 RC mass spectrometer with Faraday/Electron Multiplier detector. Mass range 200 amu.	305250
OPTIONS & ACCESSORIES	Extended mass range. 300 amu mass range (in place of standard 200 amu mass range).	305021
GAS INLET OPTIONS	QIC inlet - heated capillary inlet for sampling gases and vapours at atmospheric pressure	303560
	Microflow inlet, flow rate from 12 µl/min, unheated	303452
	MIMS inlet. Direct membrane inlet probe - 500 mm	303416
	MIMS inlet. Flow through probe inlet, integrated MIMS probe and thermocople inlet with signal conditioning module.	303420
SPARES KIT	Recommended spares kit	
	▸ Twin filament, oxide coated iridium	201200
	▸ Filament kit	201600
SOFTWARE OPTIONS	QGA - Quantitative Gas Analysis software	800595

DEMS Cells

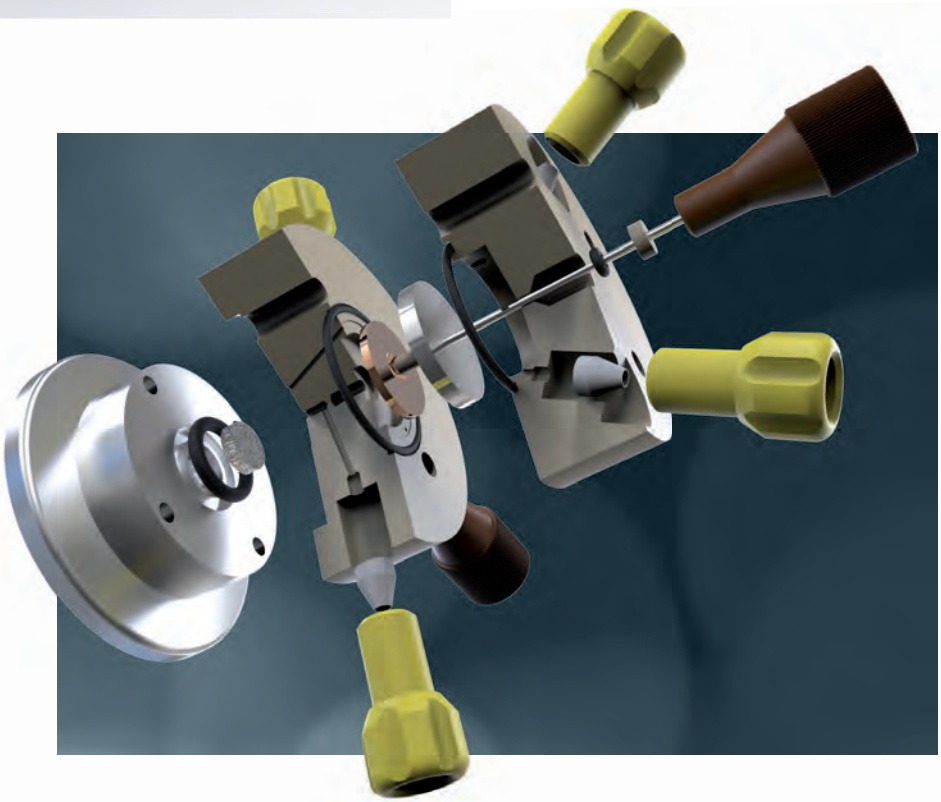


Type A DEMS cell

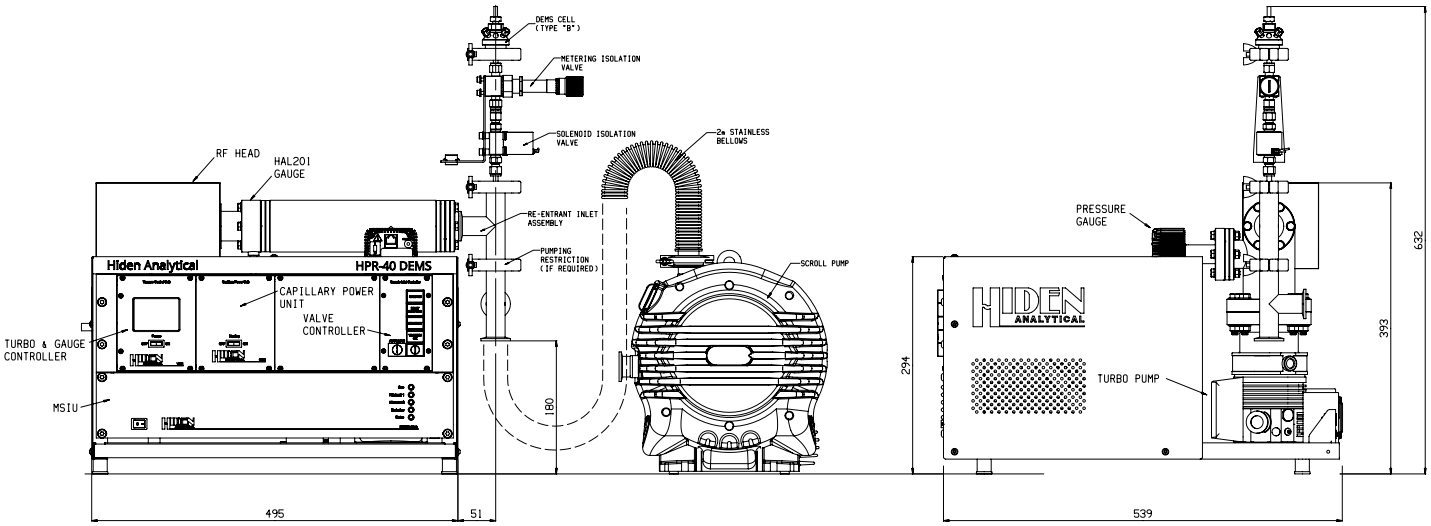
The Type A DEMS cell is optimised for ease of use and flexible experimentation setup. Its four ports allow for electrolyte flow and electrode plus sensor positioning close to the reaction area in between the working electrode and the membrane. Depending on application, the electrocatalyst can be deposited on the bottom side of the electrode or the vitreous carbon can be used as an inert electrode.

Type B DEMS cell

The Type B DEMS cell was designed in collaboration with E. Clark and A. Bell from UC Berkeley. The design optimises electrode configuration, electrolyte flow and membrane position for optimum analyses of electrochemical reactions. The lower chamber houses the membrane inlet to the MS, while the upper chamber contains the working and counter electrode, separated by an ion-conducting membrane. An additional port within the electrolyte inlet allows firm positioning of a reference electrode.

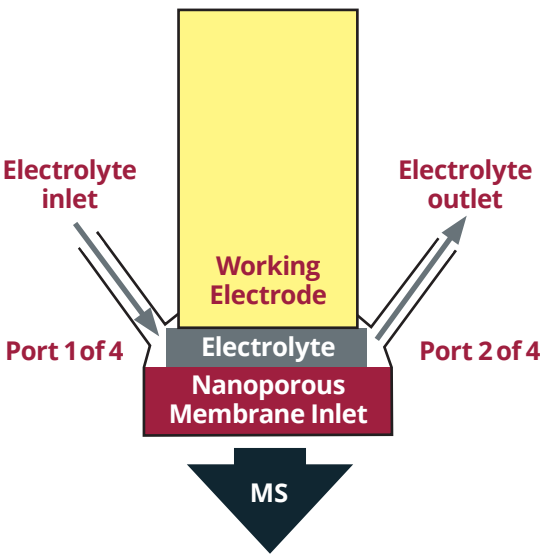


The DEMS system

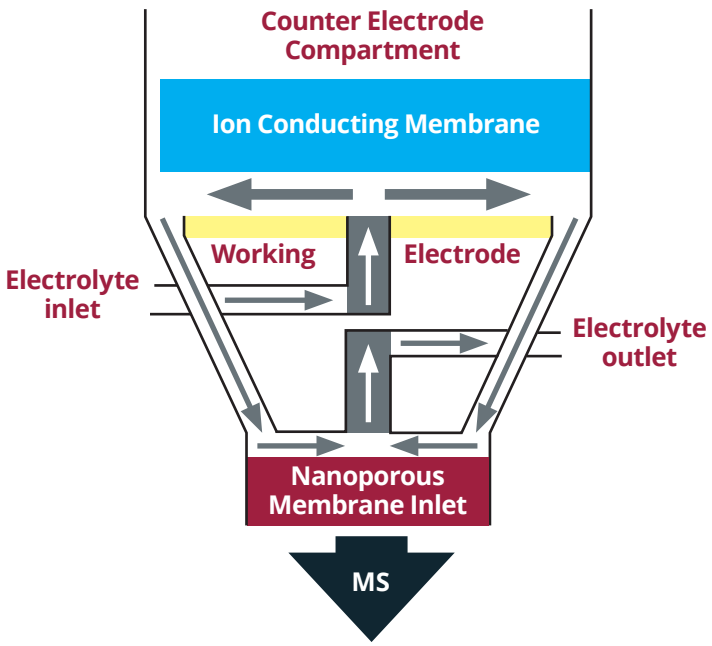


Dimensions in mm

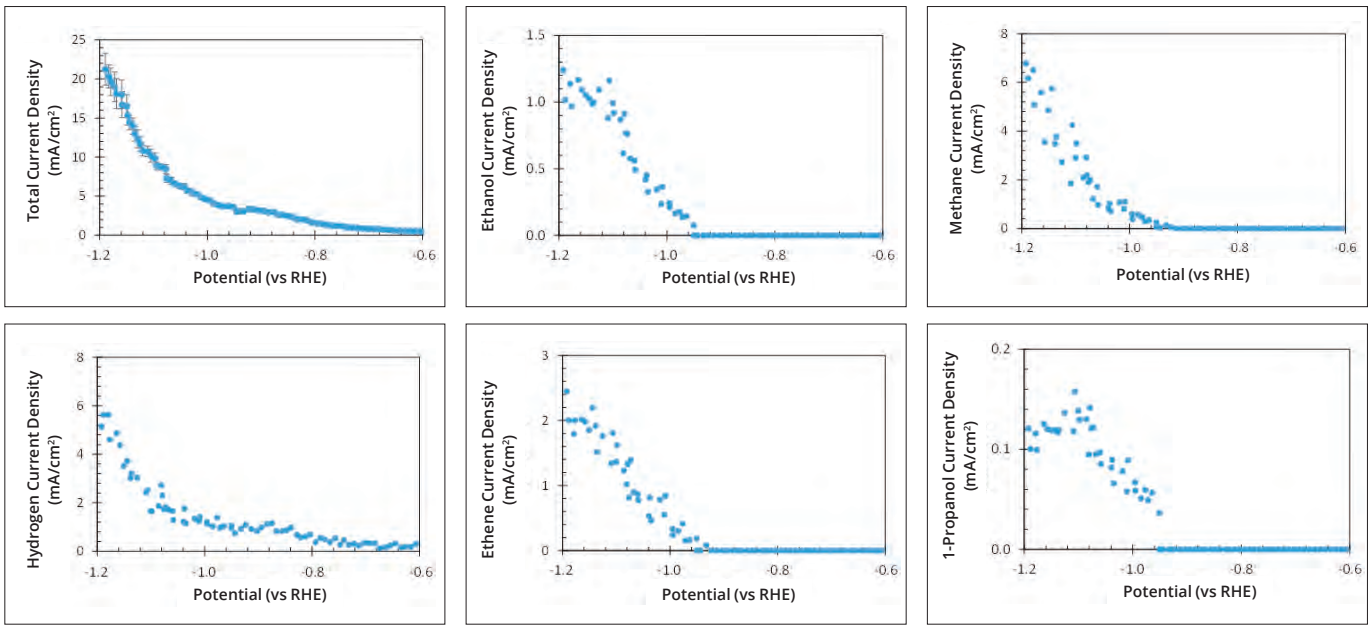
Type A DEMS cell for materials/catalysis studies



Type B DEMS cell for electrochemical reaction studies



Example data



DEMS results obtained for CO_2-sparged 0.05 M K_2CO_3 electrolyte (pH = 6.8) with an electrolyte flow rate of 1 mL/min and a scan rate of 0.2 mV/s. Further details are included in the ACS publication. E. L. Clark, M. R. Singh, Y. Kwon, and A. T. Bell (2015) 'Differential Electrochemical Mass Spectrometer Cell Design for Online Quantification of Products Produced during Electrochemical Reduction of CO_2' Anal. Chem., 87 (15), 8013–8020.

Technical Data

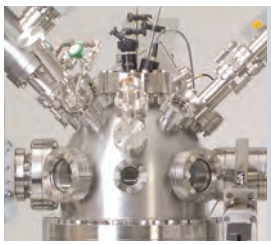
Mass ranges, amu:	1-200 / 1-300 amu
Sensitivity:	100% to 100 ppb subject to spectral interference
Speed:	Up to 650 measurements/second
Response time:	<1 s (dependant on flow rate)
Software:	MASsoft Professional
	Windows 7/8/10 compatible
Interface:	Ethernet/USB/Serial (RS-232) connections
Detector:	Dual Faraday/Channeltron Electron Multiplier
Analogue input:	8x (optional)/16 bit
Analogue output:	8x (optional)/14 bit
Digital input:	8x
Digital output:	8x, 24 V
Dimensions (L x W x H), mm:	495 x 539 x 632 mm
Weight, kg:	Typically 33 kg and external scroll pump 26 kg
Power requirement:	110/220/240 V AC, 50/60 Hz, 1.2 kVA

HidenAPPLICATIONS

Hiden's quadrupole mass spectrometer systems address a broad application range in:

GAS ANALYSIS

- dynamic measurement of reaction gas streams
- catalysis and thermal analysis
- molecular beam studies
- dissolved species probes
- fermentation, environmental and ecological studies



SURFACE ANALYSIS

- UHV TPD
- SIMS
- end point detection in ion beam etch
- elemental imaging – 3D mapping

PLASMA DIAGNOSTICS

- plasma source characterisation
- etch and deposition process reaction kinetic studies
- analysis of neutral and radical species

VACUUM ANALYSIS

- partial pressure measurement and control of process gases
- reactive sputter process control
- vacuum diagnostics
- vacuum coating process monitoring

HIDEN ANALYTICAL

Hiden Analytical Ltd.
420 Europa Boulevard
Warrington WA5 7UN England

T **+44 [0] 1925 445 225**
F **+44 [0] 1925 416 518**
E **info@hiden.co.uk**
W **www.HidenAnalytical.com**

Sales Offices:

We have sales offices situated around the globe. **Visit our website for further information.**