QCM-I Mini

Quartz Crystal Microbalance with Impedance Measurement

The QCM-I Mini is a highly sensitive instrument that detects mass changes down to the nanogram level, and provides real-time insights into the viscoelastic and structural properties of thin films and molecular layers. The QCM-I Mini features one thermally controlled sensor chamber and one external sensor connector. It has a compact footprint, which makes it suitable for both benchtop experiments as well as integrating with other experimental equipment such as microscopes or environmental chambers.

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The QCM-I Mini is a highly **sensitive** and exceptionally **versatile** surface analysis instrument. The **compact modular design** - combined with a **wide range of sensor holder options** - allows for an unparalleled variety of QCM-I and electrochemical eQCM-I measurements. The range of external sensor holders combined with digital in/out and API capabilities also allows the QCM-I Mini to communicate and integrate with an **almost unlimited range** of external **measurement chambers**, **instruments** and **experiments**.

Technology background

The core of the QCM instrument is a highly sensitive quartz crystal sensor with electrodes on both sides.

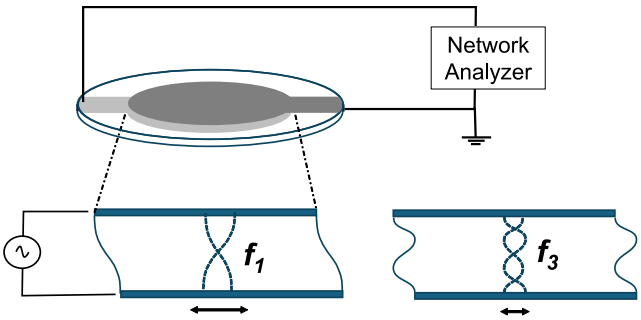
It operates based on **impedance analysis** of the oscillating sensor, tracking **changes in resonant frequency** and the **bandwidth** of the resonance curve to **monitor real-time surface interactions**.

Features

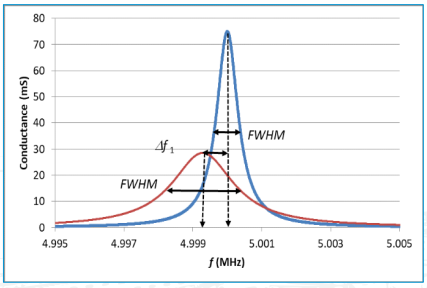
The instrument´s **compact modular design** accommodates a wide range of sensor holders which are compatible with industry-standard quartz crystals. Sensors are available with a **variety of coatings** such as gold (Au), silicon dioxide (SiO_2) or indium tin oxide (ITO). ITO-coated sensors are transparent, ideal for applications that require both optical and electrochemical measurements.

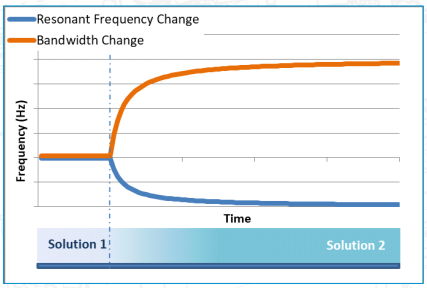
Applications

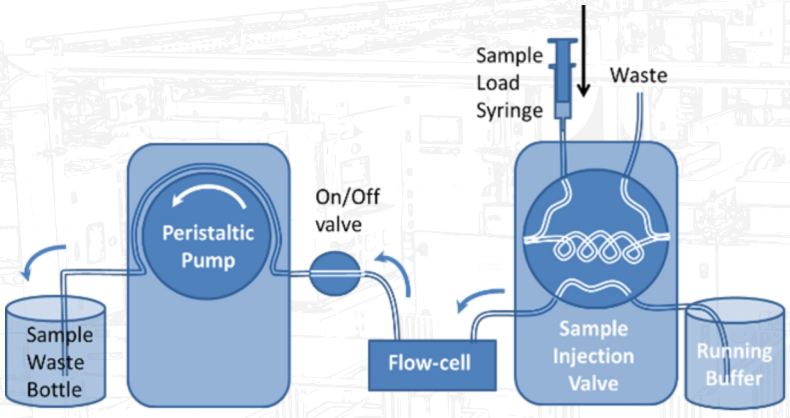
- Molecular self-assembly and nano-science
- Polymer, surfactant and protein adsorption at surfaces
- Thin film coatings
- Lipid bilayer, protein and DNA interactions
- Ligand/receptor binding, immunosensing
- Bioelectronics
- Electrochemistry and battery research
- Humidity and gas monitoring
- Vacuum deposition, CVD
- Bacterial and cellular attachment
- Applications requiring special environmental conditions



Schematic diagram of a quartz crystal sensor resonating at the fundamental and 3rd overtone frequency







Schematic overview of a QCM-I fluidic setup and resulting data

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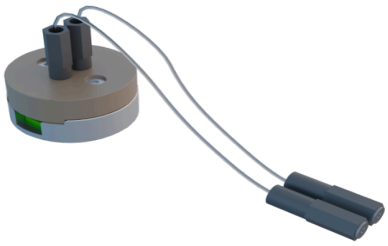
Benefits

- Frequency and dissipation measurement up to the 13th overtone (5 MHz crystal)
- Temperature control between 15-65 °C
- Compact versatile instrument for stand-alone temperature-controlled measurements or integration with other external equipment
- The two channels can be used separately or simultaneously
- Custom fluidic systems can be connected by the user without restrictions
- Modular accessories and options for integration with other instruments
- Measurement of other crystal frequencies possible
- BioSense API allows 3rd party devices to communicate and sync with QCM measurement
- QCM-I Net controls synchronized multichannel experiments with nearly unlimited measuring units

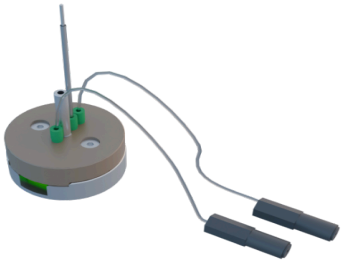
Options

- Range of sensor holders and flow cell modules
- Semi-automatic sample injection with 6-port injection valve and peristaltic pump, controlled by BioSense software
- External sensor holders designed for seamless integration into environmental chambers, demanding conditions, or complementary scientific instruments
- QSH-ext external sensor holder chamber, which accepts all the standard static and flow cells, but which can be located in environmental chambers or glove boxes.
- Optional thermocouple input for external temperature measurement
- Windowed flow cell for Raman spectroscopy, optical transmission and microscopy
- Upgradable to eQCM for electrochemical measurements with a range of electrochemical cells

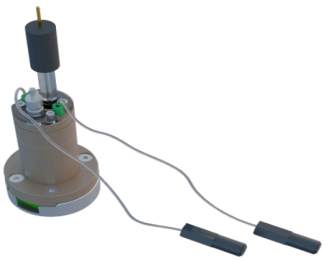
Selection of sensor holders



Flow cell

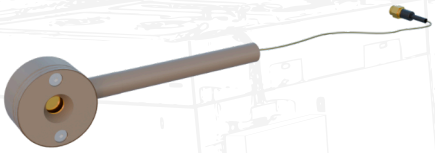


EC flow cell

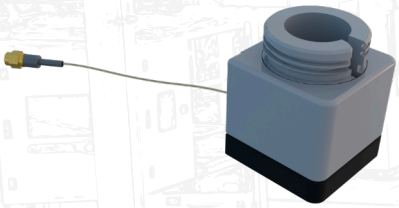


EC static cell

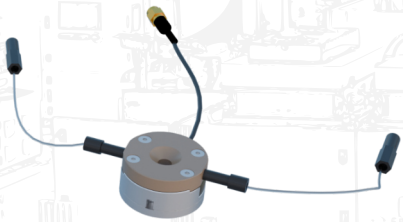
External holders:



QSH dip



QSH ext



Windowed flow cell

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Technical specifications

Channels	Two; 1st channel: temperature-controlled 2nd channel: connection for various external sensor holder modules
Temperature range	15 - 65°C
Frequency range	0.05 - 80 Mhz up to the 13th overtone Automatic frequency scan Multiple overtone measurement
Resonance frequency sensitivity in liquid (f/n)	$\leq 2 \times 10^{-1}$ Hz
Dissipation sensitivity in liquid (1/n)	$\leq 1 \times 10^{-7}$ Hz*
Mass sensitivity in liquid	≤ 1 ng / cm^2*

*: using a 5 MHz crystal