



# QCM-I

## Quartz Crystal Microbalance with Impedance Measurement

QCM-I is a highly **sensitive** research 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 features a wide temperature range with **independently controlled sensor** chambers.

The QCM-I is a **highly sensitive** and exceptionally **versatile** surface analysis instrument. The **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 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**.

## Applications

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

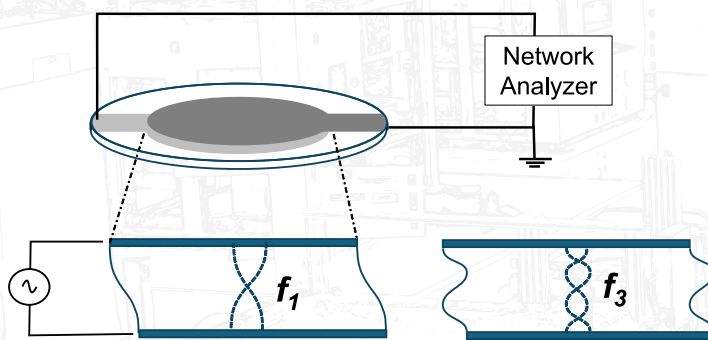
## Features

The instrument's modular design accommodates a **wide range of sensor holders** which are **compatible with industry-standard quartz crystals**.

The basic configuration is supplied with a sample injection valve, flow cell and peristaltic pump. **Sensors** are available with a **variety of coatings** such as **gold (Au)**, **silicon dioxide (SiO<sub>2</sub>)** or **indium tin oxide (ITO)**. **ITO-coated sensors** are transparent, **ideal for applications that require both optical and electrochemical measurements**.

## Benefits

- Frequency and dissipation **measurement up to the 13<sup>th</sup> overtone** (5 MHz crystal)
- Wide temperature range
- **Independent control of flow and temperature** on both channels
- Semi-automated sample injection
- Can be used to measure crystals with other resonant frequencies
- BioSense API allowing 3<sup>rd</sup> party devices to communicate and sync with the QCM measurement
- QCM-I Net controls synchronized multi-channel experiments with nearly unlimited measuring units

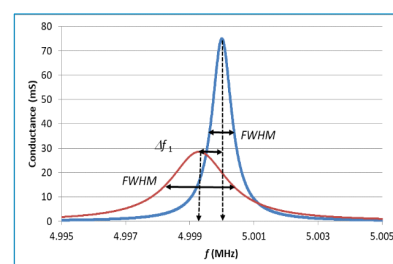
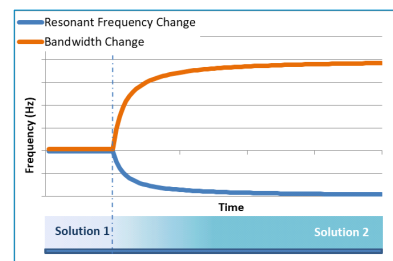
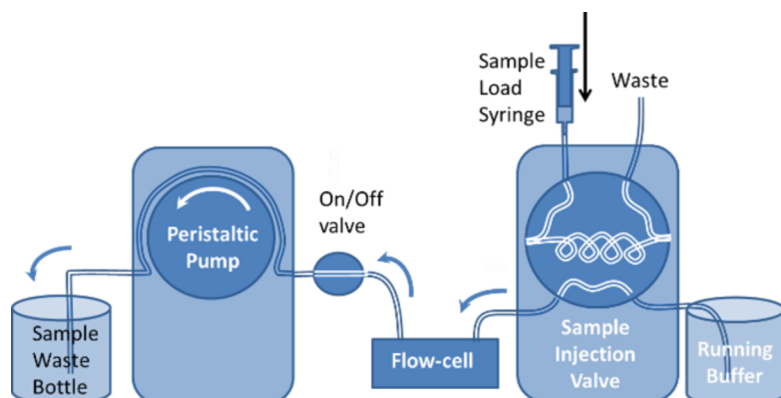


Schematic diagram of a quartz crystal sensor resonating at the fundamental and 3rd overtone frequency

## Application

QCM systems deliver **ultra-precise, non-destructive** measurements in **vacuum, vapor, gas or liquid** environments making them incredibly versatile for tracking sub-monolayer scale mass changes in real time. **From biosensing** to gas detection and from materials science to **electrochemistry**, the exploration of molecular interactions, surface dynamics, and thin film behavior is being transformed by QCM-I across a wide range of scientific fields.

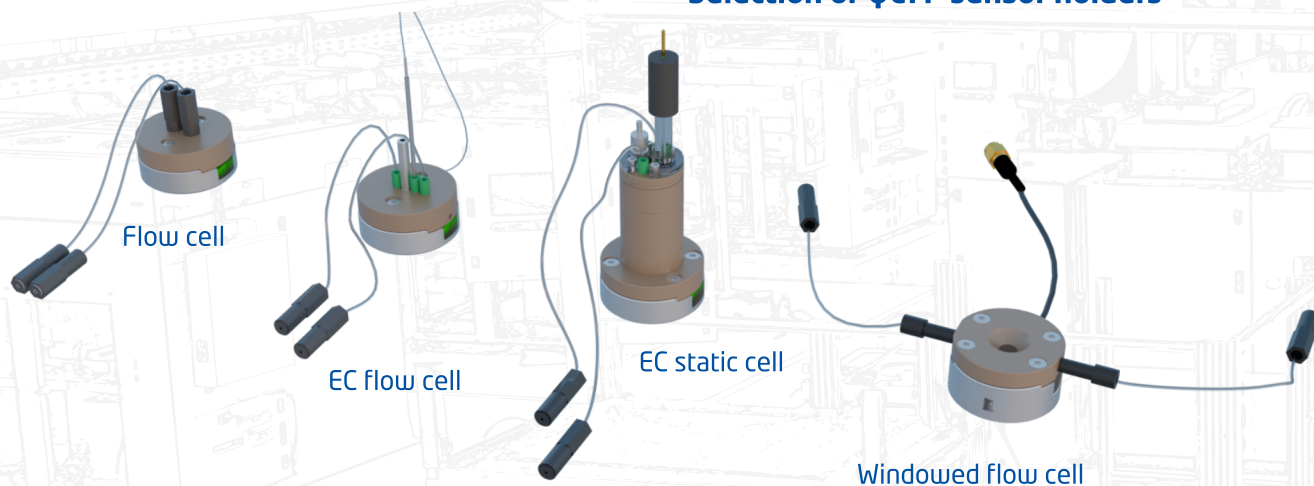
### Schematic overview of a QCM-I fluidic setup and resulting data



## Options

- Range of sensor holders and flow cells
- **External sensor holders** designed for seamless **integration into** environmental chambers, demanding conditions, or **complementary scientific instruments**
- Windowed flow cell for Raman spectroscopy, optical transmission and microscopy
- Upgradable to eQCM-I for electrochemical measurements with a range of electrochemical cells
- Upgradable to 4 channels

### Selection of QCM sensor holders



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## Technical specifications of QCM systems

<b>Channels</b>	2 (or 4)
<b>Temperature Control</b>	Independently controlled thermal chambers
<b>Temperature Range</b>	4°C to 80°C ( $\pm 0.02^{\circ}\text{C}$ )
<b>Frequency Range</b>	0.05 - 80 MHz, up to the 13 <sup>th</sup> overtone * Automatic frequency scan Multiple overtone measurement
<b>Resonance Frequency Sensitivity in Liquid (f/n)</b>	$\leq 2 \times 10^{-1} \text{ Hz}$
<b>Dissipation Sensitivity in Liquid (1/n)</b>	$\leq 1 \times 10^{-7*}$
<b>Mass Sensitivity in Liquid</b>	$\leq 1 \text{ ng} / \text{cm}^2*$

\*5 MHz Crystal

This material is for information purposes only. Equipment acceptance is based on contracted specifications.