

# QCM-I

## Quartz Crystal Microbalance with Impedance Measurement



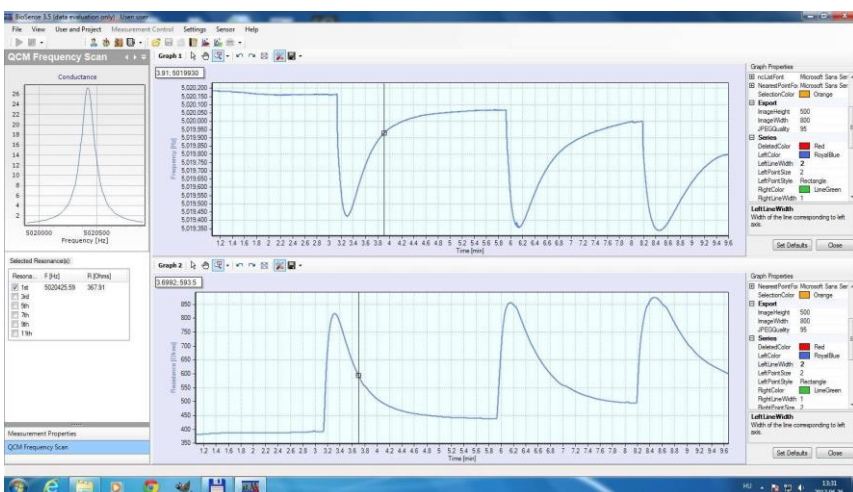
The QCM-I measuring unit is a high-sensitivity mass sensor, which measures the change in frequency of a quartz crystal resonator and as a label free biosensor it measures the "wet mass" of the adsorbed layer in processes occurring at or near the sensor surface.

The measuring principle is based on impedance analysis of the quartz crystal. The resonant frequency and the bandwidth of the resonant conductance curve are determined. The bandwidth or full width at half maximum, ( FWHM ) is direct correlation with the quality factor ( Q ) which is by definition the inverse of the well known dissipation ( D ).

### Main features:

- Measures frequency and the quality of resonance (FWHM or bandwidth or dissipation)
- Fundamental frequency and overtones are measured (up to the 13th overtone at 5MHz crystals)
- Temperature control from 4°C to 80°C (± 0,02 °C)
- EC measurement module is optionally available with ITO-QCM sensors
- Modular sensor holder up to 4 measuring channels
- External PC with MS Windows® 10; communication with QCM-I via USB.

### Control & Measurement



The BioSense software performs full control of the QCM-I instrument. Two measurement modes are available:

- Resonance: Measurement of resonance curve and calculation of the resonance frequency & FWHM up to 80 MHz
- QCM-t: Continuous measurement of resonance parameters and the temperature of the flow-cell.

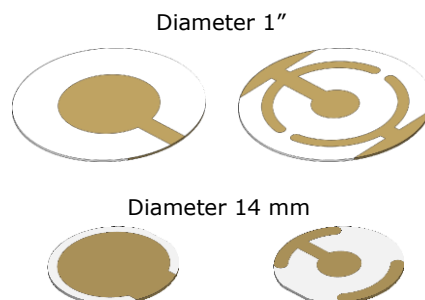
Calculation: various QCM and ad-layer parameters can be calculated using standard or custom made models. All these parameters can be displayed on the screen, printed, saved or can be exported for further evaluation.

### QCM sensors

The heart of the Quartz Crystal Microbalance (QCM) instrument is a thin AT-cut quartz crystal with an electrode on each side.

Quartz crystal sensors with Au or with ITO electrodes and a variety of pre-coatings are available. The modular sensor holder allows using either 14 mm diameter or 1" diameter quartz crystals.

In conventional QCM, the electrodes are typically made of gold which is an ideal electrode material except when applying for electrochemical measurements or for optical investigations using inverse optical microscopes. On the QCM-ITO sensor, transparent ITO electrodes are used and hence providing a more stable electrochemical measurement and can be used for optical investigation as well. *For sensor details see separate sensor data sheet.*



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# SPECIFICATION OF QCM-I UNIT

## Technical information

Measuring Principle	The QCM-I unit is a high sensitivity mass sensor which measures the change in frequency of a quartz crystal resonator and as a label free biosensor it measures the "wet mass" of the adsorbed layer in processes occurring at or near the sensor surface. The measuring principle is based on impedance analysis of the quartz crystal. The resonant frequency $f_{res}$ and the bandwidth of the resonant conductance curve are determined. The bandwidth or full width at half maximum (FWHM) is in direct correlation with the quality factor (Q) which is by definition the inverse of the well known dissipation (D).
Measurement Channels	1-4
Frequency Range	1-80 MHz, up to the 13 <sup>th</sup> overtone for a 5 MHz Crystal
Working Temperature	4 °C to 80 °C, controlled manually or via software, stability $\pm 0.02$ °C
Sample Loading	Sample injection with external syringe or peristaltic pump unit controlled manually or by BioSense software, and Rheodyne Model 9725 manual injector valve, or Rheodyne MX series semiautomatic switching valve. Optional external Auto sampler unit is available.
Flow Cell Volume	$\sim 40$ $\mu$ l (typical with $\varnothing 14$ mm crystals)
Typical Flow Rates	0.01 $\mu$ l/min - 35ml/min with external syringe pump, Syringe size 1-60 ml
Sample Volume	1 to 2000 $\mu$ l (depends on installed loop volume)
Wetted parts	PTFE, PEEK, SS, VITON or Kalrez

## Measurement Sensitivity

Standard Resonance Frequency sensitivity	$\sim 2 \times 10^{-1}$ Hz
Standard Dissipation Sensitivity in Liquid	$\sim 1 \times 10^{-7}$
Mass Sensitivity in Liquid	$\leq 1$ ng/ $\text{cm}^2$

## Sensors

Sensor Crystal	5 MHz, AT-cut, modular sensor holder accommodates either 14 mm or 1" inch diameter crystals - see more details in QCM sensor datasheets.
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## Software

BioSense	Universal software platform for OWLS, QCM & EC measurements - see more details in BioSense datasheet.
Import/Export of the measured data	Between separate BioSense software and export to third party software Excel, JPG, BPM, WMF etc.
PC Requirement	USB 2.0, works with MS Windows <sup>®</sup> 7 or 8 or 10

## Electrical

Supply Voltage	DC power supply with universal input voltage from 100V to 240V AC & 50 to 60 Hz.
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