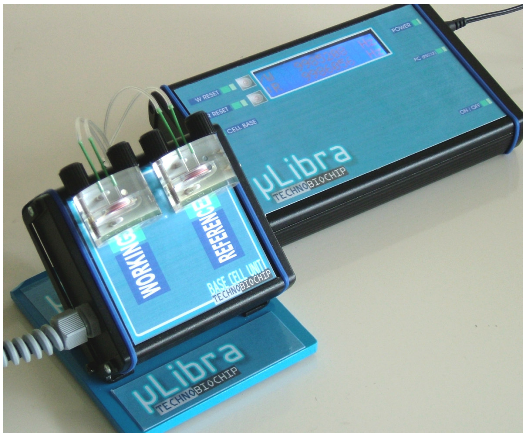
μLibra



μLibra is a Quartz Crystal Microbalance (QCM) system, composed by a Main Unit and a Cell Base Unit which can support two measuring chambers.

μLibra allows experiments from biology to chemistry, to physics. As biosensor, it can monitor ligand-receptor interactions. The instrument offers a rapid and easy way to detect and measure mass deposition or adsorption as well as film thickness. Alternatively, density and viscosity variation of fluids can be measured, if mass deposition/adsorption is known.

μLibra Introduction

Quartz crystals are widely used to build up resonators. In a QCM instruments the resonator frequency is sampled in order to measure mass deposition/adsorption or viscosity variations. For this applications, AT-cut quartz are suited, because of their great temperature stability, few ppm in a range of 0 C° to 40 C°. For an AT-cut quartz crystal the oscillation frequency f_0 is given by the following equation:

$$f_0 = \frac{n}{2l}\sqrt{\frac{\rho_q}{\mu_q}}$$

where n is the overtone number, l is the thickness of the quartz, ρ_q and μ_q are respectively the density (2.648 g/cm^3) and shear modulus (2.947 10^{11} g/cm s^2) of the quartz.

Theoretical backgrounds for using quartzes as mass sensors take origin in Sauerbrey equation, witch takes into account the frequency shift due to mass deposition on quartz surfaces.

$$\Delta f = -2nf_0^{\,2}\frac{\Delta m}{A\sqrt{\rho_q \mu_q}}$$ **Sauerbrey equation**

where Δf is the frequency shift, f_0 is the unloaded quartz frequency, A is the piezoelectric *active* area and Δm is the mass deposited/adsorpted.

For liquid phase working quartzes, Kanazawa equation focuses on frequency shift dependence on liquid's density-viscosity product.

$$\Delta f = -f_0^{\frac{3}{2}} \sqrt{\frac{\rho_l \eta_l}{\pi \rho_q \mu_q}}$$ **Kanazawa equation**

where ρ_l and η_l are respectively the density and viscosity of the liquid.

For example, according to Sauerbrey equation, for a 10 MHz crystal, a Δf of 1 Hz corresponds to a $\Delta m/A$ of 4.41ng/cm^2. Mass resolution of a QCM instrument can be therefore much greater of a precision balance, making this technique very attractive for a large range of applications.

When a quartz works in liquid phase, several physical phenomena, such as dielectric constant and conductibility variations, can result into frequency variation. Great care has been taken in oscillators design, in order to ensure good sensitivity while maintaining small dependence on environmental factors. **μ*Libra*** oscillators force quartzes at fundamental series frequency (Fs) oscillation, assuring the best reliability and minimizing effects of unwanted parasitic phenomena. The oscillators are well suitable for use in viscous liquids and have been tested for viscosity greater than 20 mPa♥s (70% Glycerol in water solution @25°).

μ*Libra* Applications of QCM

A QCM is a mass sensing instrument, which is able to measure in real time very small mass changes. The sensitivity of a QCM can be 100 higher than an electronic balance with a resolution of 0.1mg, allowing extremely small measurements in physical, chemical and biological fields. This technique offers a rapid and easy way to detect and measure mass deposition or adsorption as well as film thickness. The possibility to extend measurements to the liquid phase have increased the interest in this technique during last years. The use of QCM as biosensors allows high sensitivity label-free detection of molecules and take benefits from the small amount of sample needed. **μ*Libra*** cells have a chamber volume as small as only 25 μl.

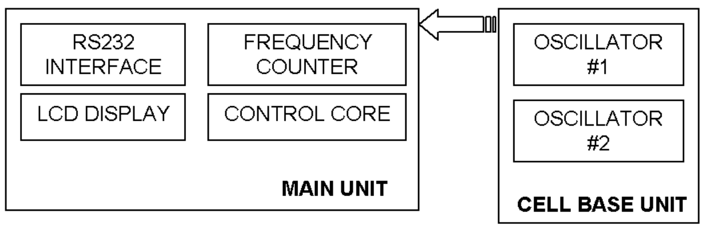
Below there is a list of possible applications.

- real time monitoring of ligand/receptor interactions
- measure of kinetics and affinity constants
- monoclonal antibody characterization
- kinetic studies in DNA hybridisation
- thin film measurement
- viscosity tracking

µ*Libra* Working principle of µ*Libra* instrument

The µ***Libra*** measuring principle is based on quartz fundamental frequency sampling.

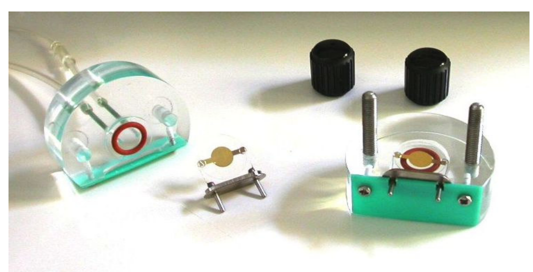
µ***Libra*** is composed by a Main Unit and a Cell Base Unit which contains oscillators circuitry and can support one or two measuring chambers. The oscillators force quartzes in each measuring chamber at fundamental series frequency oscillation. Frequency is sampled by an high precision and high stability frequency counter, ensuring resolution of 1 Hz and temperature stability of less than 0.1ppm in the range 0° - 60°. Control electronics and frequency counter are housed in the Main Unit.



Double channel acquisition system allows single cell operation as well as working/reference measurements. Whatever the experimental set up, **LibraVIEW** software represents a powerful tool to track and record frequency values data.

µ*Libra* Cells

µ***Libra*** can be equipped with two low-volume flow-through cells. Housing the transducers inside the cells is rapid and secure. The provided cells have been designed for a wide range of static and flow measurement experiments, however, on requests, custom measuring cells can be made on design.



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