Princeton Applied Research

QCM922

Quartz Crystal Microbalance

Measure Resonant Frequency and Resistance Simultaneously!

- Sensitive enough to measure weight changes in a monolayer
- Quantify elastic and viscous changes in your system simultaneous with mass changes
- Front Panel display of both Resonant Frequency and Resistance
- Analog outputs for ΔFrequency and Resistance
- Frequency Range of 1 MHz to 10 MHz (calibrated for 9 MHz crystals)
- Designed for EQCM with a potentiostat or stand alone operation
- WinEchem Software available for computer control and data acquisition

General

Princeton Applied Research is proud to offer the QCM922 Quartz Crystal Microbalance. The QCM922, an instrument developed for piezoelectric gravimetry in the ng-µg regions, monitors both the resonant frequency and resonant resistance of a Pt or Au coated AT-cut quartz crystal. The resonant frequency changes with the effective surface mass on the crystal, and the resonant resistance changes with the viscosity of the material interfacing with the surface of the quartz crystal. Capable of covering a wide range of applications, the QCM922 was developed primarily for applications where it is used in conjunction with a potentiostat/galvanostat as an Electrochemical Quartz Crystal Microbalance (EQCM).

QCM922 Main Body, Cable, and Au Resonator

Applications

With the addition of a Princeton Applied Research potentiostat/galvanostat, the QCM922 system (with the Pt or Au coated resonator serving as the working electrode) can provide information on potential, current, charge, resonant frequency (mass), and resonant resistance (viscosity) simultaneously. This allows researchers to analyze electrochemical depositions, polymer films formation on electrodes, corrosion, adsorption and electrochemical reaction mechanisms. Other application areas include battery research, electroplating and biosensor development.

System Description

The QCM922 comes calibrated to operate with 9MHz AT-cut quartz crystal resonators[1]. This frequency range is sufficient to provide ng level measurements[2] while still working with a crystal thickness that is not extremely fragile. The frequency resolution is 0.1 Hz at a sampling rate of 100 ms, allowing for excellent sensitivity down into the ng region. Sensitivity is based not only on the resolution and stability of the instrument, but also on the application and experimental design (i.e., proper shielding). For instance, the QCM922 includes a crystal holder that is extremely flexible in application use. It can be used as a well cell (0.5 mL volume), a dip cell into a larger beaker, mated to a larger cell, or incorporated into a flow-through system of users design. However, for the most sensitive measurements, we have the optional Sherbrooke Cell (part # 233067), which was designed to operate with the system as a nano-balance for the greatest level of sensitivity.

QCM922 with Sherbrooke Cell

[1]Calibration for other resonator frequencies requires return to factory.

[2]Electrochemistry Communications 1 (1999) 419-424

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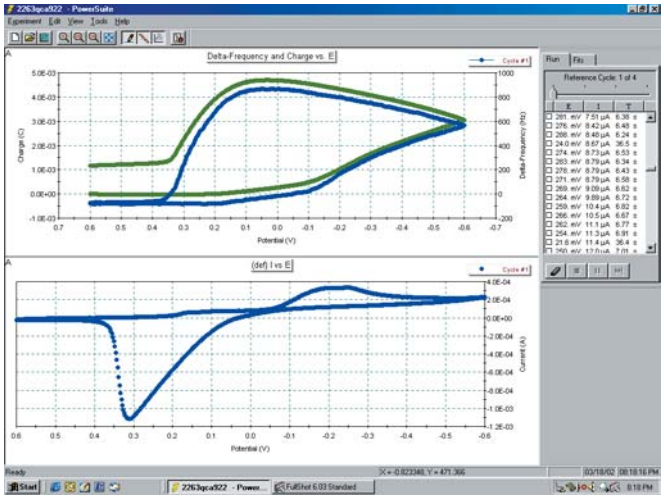
Data Collection and Software Options

Front Panel: The QCM922 has a 2-row front panel display capable of showing any two of resonant frequency, resonant resistance, or Δfrequency. There is also a setup menu that allows the user to configure the system independent of any control software.

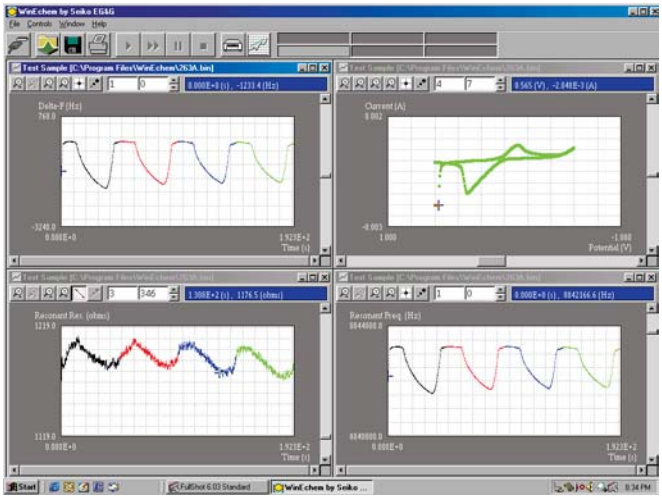


PowerCV Cyclic Voltammetry Data with QCM922 Response in 10 mM $CuSO_4$

Analog Outputs: In addition to the actual measured data appearing on the front panel, there are two analog channels on the rear panel that provide an analog voltage output that correlates with the resonant resistance and the Δfrequency values. The data from these outputs can be collected with the Auxiliary Inputs of the Princeton Applied Research potentiostat and its supporting software, PowerSuite, simultaneously with the potential, current, or charge values when performing EQCM experiments.

Computer Interface: There are two computer interface options on the rear panel, one for RS-232 and another for GPIB. The control commands are available in the documentation provided for the QCM922 for those interested in developing their own programs for computer operation.

WinEchem Software: The optional WinEchem software can control the QCM922 (or the predecessor QCA917) stand-alone, as well as the Princeton Applied Research potentiostat/galvanostat Models 263, 263A, 273, 273A and 283. The software can control the QCM922 and the potentiostat independently, or simultaneously for EQCM experiments. The electrochemical techniques available in the WinEchem software are CV, LSV, CA, CC, CE and Ecorr, with scan rates for this software from 1 mV/sec to 1 V/sec. With the WinEchem software, up to four graphs can be displayed from a single file, or a single graph can be displayed from each of four different files. The data storage format is either a binary file, or a comma delimited ASCII file that opens directly into Microsoft® Excel if needed.



WinEchem Software for QCM922 or QCA917

QCM922

Quartz Crystal Microbalance

Specifications

Main Unit

Resolution: 0.1 Hz

Interfaces: IEEE-488 (GPIB), RS-232

Gate Time: Variable (0.1 s, 1.0 s, 10.0 s)

Frequency Range: 1 MHz–10 MHz (resolution: 0.1 Hz)

Resonant Resistance Range: 10 Ω–16 kΩ (resolution: 0.1 Ω)

Display: 40 digit x 2 row

Size: 260 mm x 88 mm x 230 mm

Weight: 3.3 kg

Temperature: 0–40°C

Power Supply: 100–120 V ac, 230–240 V ac 50–60 Hz, 15 W consumption

Analog Outputs

ΔF Output: Full Scale: ±10 V (12 bit)

±200 kHz Range

±20 kHz Range

±2 kHz Range

±200 Hz Rnage

Resistance Output: Full Scale ±10 V (12 bit) 1/2/4/8/16 kΩ Ranges

Quartz Crystals

9 MHz AT-cut: Gold or Platinum sputtered on Ti (Standard or Mirror Finish)

Electrode Area: 0.2 cm^2

Electrode Thickness: Au or Pt ~300 nm

Software

Two options:

1) The **PowerSuite** software can be used to control the Princeton Applied Research potentiostat/galvanoststs, and the data collected from the QCM via the QCM922's Analog outputs into the potentiostats Aux Input. See the PowerSuite brochures for applications and computer requirements.

2) Also available, **WinEchem**, a software package capable of controlling the QCM922 stand alone, or in conjunction with certain Princeton Applied Research potentiostat/galvanostats to perform routine electrochemical techniques simultaneous with QCM measurements.

System Requirements: Windows 95 or 98, 100 MHz processor or better, at least 32 MB RAM, 10 MB HDD, 3.5" Floppy Disk Drive, National Instruments GPIB Card.

Ordering Information

Model	Description
QCM922	QCM Main body, Cable, Well Cell
QCM922-EW	Extended Warranty for QCM922
QA-CL3	Dip Cell Resonator Holder
QA-CL4	Well Cell Resonator Holder
QA-A9M-AU-50	50 Gold Resonators, Standard Finish
QA-A9M-AU(M)-50	50 Gold Resonators, Mirror Finish
QA-A9M-PT-50	50 Platinum Resonators, Standard Finish
QA-A9M-PT(M)-50	50 Platinum Resonators, Mirror Finish
PS-P500/W32E	WinEchem QCM Software
233067	Sherbrooke Cell

QA-CL4 Well Cell Resonator Holder

Specifications subject to change
092105

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