Crystal Resonator Chemistry Measurement System

Model : QCA922

Crystal Resonator Chemistry Measurement System QCA922 is Quartz Crystal Microbalance (QCM) that our company recommends with oneself, and “Resonance frequency” and “Resonance resistance” can be measured simultaneously. Various measurements are possible in the system that connects QCA922 not to mention the standalone operation with Potenshostat/Galbanostat and accessories, etc.

- Data measurement from WinEchem software
- EQCM measurement that connects Potenshostat/Galbanostat
- Eight channel measurement simultaneously at the time of connected multiplexer
- Measurement of resonance frequency, resonance resistance, and temperature in which thermometer is connected simultaneously
Quartz Crystal Analyzer Main Unit

Measure resonance frequency and resistance simultaneously

The QCA922, an instrument developed for piezoelectric gravimetry in the ng-
µg regions, monitors both resonance frequency and resonance resistance of a
Pt or Au coated AT-cut crystal resonator. The measurement of the resonance
frequency and the resonance resistance simultaneously was achieved
by adopting the detection method of scanning the frequency of the crystal
resonator directly.

Highly accurate, steady measurement value

Measurements of the resonance frequency improve the straight line and the
range of the maximum load has been improved greatly well. The measurement
value is very highly accurate and steady.

Measure mass change and viscoelasticity change simultaneously

The resonance frequency changes by both the mass change and the
viscoelasticity change in the surface of the crystal resonator, and the resonance
resistance reflects a viscous change in this strongly chiefly while measuring it.
Therefore, past unit that measured only the resonance frequency was not able
to distinguish whether it was the one that in which a mass change or a viscous
change in the surface of crystal resonator the change in the frequency originates
for the sample with the viscoelasticity. However, analyzing the contribution of
a mass change and a viscous change from the correlation became possible,
because it was able to measure the resonance frequency and the resonance
resistance at the same time in this unit.

Wide frequency pulling range

This unit can correspond to a wide frequency without the circuit change because
the oscillation signal is generated with the oscillator of the DDS
method in the main unit.

Data measurement from computer with WinEchem

The unit can be set directly from the computer through the GPIB interface of
standard equipment, and data can be measured.

Cells

Dip Type & Well Type

The cell is used to connect the crystal resonator with the main unit of the QCA922.
The purpose to use the cell is to connect the crystal resonator with the electric circuit
of the main unit. Moreover, to insulate either electrode from solution electricity and
chemically, the crystal resonator is mechanically maintained.

Dip cell

QA-CL3 is connected with the main unit through the adaptor cable (QCA922-20 or
QCA922-10).

Well cell

QA-CL4 is connected with the main unit through the adaptor cable (QCA922-10).
QA-CL5 made from a transparent material can confirm the state of the solution put in a
Well. Dip type cell QCA922-20 can use it by
installing QCA917-30 as Well type cell.

Cell kit for EQCM

Additionally, the cell kit for the EQCM measurement that combines QA-CL4 with
microcell kit K0264 etc. made by Princeton
Applied Research is prepared.

Quartz Crystal Resonator

9MHz AT-cut

QCA922 is measured by using the crystal resonator of 9MHz
and the AT cutting. The crystal resonator of a lot of types is
prepared; ten kinds of electrode materials including gold and
platinum, rectangle or round type shape, specular finish and
separation type, etc.

Potenshostat/Galbanostat

for EQCM

The QCA922 is connected with Potenshostat/Galbanostat,
and can be applied to the EQCM measurement. In this case,
terminal W of the cell is connected with the working electrode
cable of Potenshostat/Galbanostat. Made of Princeton
Applied Research 263A-1 and 263A-2 are prepared.

Note: Another maker’s Potenshostat/Galbanostat can be prepared.
Please consult.
WinEchem controls QCA922 and Potenshostat/Galbanostat (made by Princeton Applied Research) on Windows XP/2000/98/95, measures the resonance frequency, the resonance resistance, potential, the current, and the temperature, etc., and displays the graph on four screens or less in real time. Because data can be preserved in the file format of the binary or CSV, it is possible to output also to Excel not to mention reading with WinEchem easily, and it is possible to use it as data affered to the report.

Note: This software can also control product QCA917 so far.

Temperature controlled bath
QCA922-60 is a micro temperature controlled bath. (made by Nippon Blower company) This prevents the change according to the temperature that brings the influence to the resonance frequency and the resonance resistance measured with QCA922.

Temperature measurement unit
QCA922-70 measures the temperature simultaneously while QCA922 is measuring the resonance frequency and the resonance resistance. (made by T&D Corporation Japan)

Multiplexer
QCA922-90 can measure the crystal resonator of eight channels or less sequentially.

The main usage
QCM measurement: QCA is controlled alone. Adsorption detaching and viscoelasticity change of the protein at the elapsed time are examined from the resonance frequency and the resonance resistance.

EQCM measurement: QCA and Potenshostat/Galbanostat are controlled. The state of a chemical kind in the liquid is examined from the measurement such as the currents by fixed potential, movement potential, and natural potential.

EC measurement: Potenshostat/Galbanostat is controlled alone. CV, CA, CE or the corrosion measurement is done, and the interaction of the electrode and the solution is examined.

Other usages
Schedule mode: In this mode, when the gate time and the number of measurement points of three steps are set, it is possible to measure it continuously.

Multi mode: In this mode, the multiplexer is controlled, and the data of 8 channels or less can be taken. (The display is four screens or less.)

Temperature monitor: The resonance frequency can be corrected by the temperature change by measuring QCA and the thermometer simultaneously.

Example of System Configuration

The QCA922 system can be used by the following eight combinations.

Equipment

- QCA922-20
- QA-CL3
- QA-CL4
- QA-CL5

Example

1. QCA922-20
2. QA-CL3
3. QA-CL4
4. QA-CL5

Connection

- RS-232C
- GPIB

Note: QCA922-70 cannot be used together with the EQCM measurement. QCA922-60 can be used by example 1-8 all. In a multichannel measurement of example 1, the lead line of custom-designed is needed.

Example of displaying four screens

A left chart shows the measurement result at Fe(CN)6- 4 that used 9kHz Pr for the working electrode:

1. Voltaorganph (Voltaorganph)
2. Chrono-rezonance-frequency (CF)
3. Chrono-rezonance-resistance (CR)
4. Chrono-potenshometory (CE)

Applications

Application to electrochemical reaction
Electrochemistry extraction, Formation of Polymer film of electrode, Corrosion, Adsorption, Analysis of electrochemistry reaction mechanism etc.

Gas sensor
Measurements of NOx, SOx, humidity, organic, and smell material, etc.

Biosensor
Antigen and antibody reaction, Measurement of microorganism and cell adsorption phenomenon, Fixed quantity of density of protein, DNA analysis(Immunoassay)

Viscosity measurement
Viscosity information on liquid, Analysis of gel reaction(fixed quantity of end toxin and blood coagulation factor), Measurement of phase transition, Heat analysis
Specifications

**Quartz Crystal Analyzer Main Unit** QCA922-00

- **Measurements** (Series) Resonance frequency and Resonance resistance
- **Resonance frequency** Measurement resolution: 0.1 D: Measurement range: 10 D - 16 kHz
- **Resonance measurement** Output voltage range: ±10 V (12 bits)
  - Output range: ±200 Hz, ±2 kHz, or ±20 kHz selectable
- **Res. analog output** Output range: ±10V
  - Output range: 16kΩ, 4Ω, 8Ω, or 16Ω selectable
- **Gate time** 0.1 μs, 1.0 usec or 10.0 μsec selectable
- **Display** VF D of 4 digits × 2 rows
  - Display of series resonance frequency and resonance resistance simultaneously
- **External interface** IEEE488 (GPIB) or RS-232C
- **Power-supply voltage** AC 100 V, 120 V, 230 V or 240 V selectable, 50 Hz or 60 Hz selectable
- **Fuses** 1A or 2.5A slow blow (AC 100V/120V/230V/240V)
- **Power consumption** normally approx. 15 W, (Max. 20 W)
- **Dimensions** 260 mm × 230 mm × 88 mm
- **Weight** Approx. 3.3 kg (cable excluded)
- **Ambient temperature** 0 to 40 °C

**Adaptor Cable for QA-CL Series** QCA922-10

- **Materials** Substrate case: PVDF, Stop screw: Stainless steel
- **Connected cable** Connector: BNC plug (male) × 4, Cable: Coaxial compound cable about 0.9 m
- **Terminal W** Connects with the measurement side electrode of crystal internally through Low Pass Filter, or connects with the working electrode cable.
- **Dimensions** 35 mm × 65 mm × 20 mm
- **Weight** 200 g (cable included)
- **Ambient temperature** 0 to 40 °C

**Dip Cell & Well Cell** QCA922-90

- **Materials** QA-CL3 & CL4: Main body: PVDF, O-ring: Viton, Stop screw: Stainless steel
  - QA-CL5: Main body: Chlorinated vinyl, O-ring: Viton, Stop screw: Stainless steel
- **Dimensions** QA-CL3-25.5 mm × 20 mm × 17 mm
  - QA-CL4-25.5 mm × 20 mm × 22 mm
  - QA-CL5-25.5 mm × 20 mm × 17 mm
- **Well capacity** QA-CL3-75 μℓ
  - QA-CL5-250 μℓ
- **Usage** QA-CL3: Liquid or air
  - QA-CL4 & CL5: Cell is filled with sample solution

**Quartz Crystal Resonator** QA9-9M-PT, QA9M-AU

- **Resonance frequency** 9 kHz
- **Cutting type** AT-cut
- **Electrode materials** Co-crystal (Pt/NiAu/AlSi)
  - 300 nm of electrode material is sputtered onto a Ti film groundwork.
- **Area of electrode** 5 mm × 5 mm (A special area is possible in the option.)
- **Ambient temperature** 20 °C ± 7 °C
  - Note: Sold in packages of 50 or 25 resonators.

**Multiplexer for QCA922** QCA922-90

- **Number of channels** Eight channels or less
- **Adjustment control** Well cell: QA-CL4 or QA-CL5, Dip cell: QA-CL3 or QCA922-20
- **Sampling time** 0.1 sec, 1 sec or 10 sec selectable
- **Connected cable** Signal: ABCD compound coaxial cable, about 90 cm
  - Control: Nine pin D-SUB male male connector, about 1.4 m
- **Material** PVDF (excluding screws and connectors)
- **Dimensions** Main body: 200 mm × 90 mm × 20 mm
  - Base plate: 282 mm × 147 mm × 5 mm
- **Weight** Approx. 1 kg

**WinEchem Electrochemistry Software** PS-P500/W32EA

- **File** Saves and reads measurement data and setup parameters: Binary (BDF) or CSV (comma delimiter) (* .csv)
  - MS-DOS version PS-P300/MS file (* .dat) can be read.
- **Printout** Prints out setup parameters.
- **Memory backup** Saves data in the backup file (Backup.bmf) each time the application is closed.
  - Saves current state and addressing of instruments in the WinEchem.ini.
- **Control** Specified the power supply and resetting and saves measurement conditions in the file.
- **Sampling rate** 100 ms to 1 sec selectable, 4 ms to 10 sec selectable.
- **Scanning rate** 1 sec to 10 sec selectable
- **Control potential** ±10 V (scanning ranges from ±1 V to ±4 V)
- **Current range** 1 nA to 1 A (10 ranges) or AUTO
- **Control current** ±20% of the current range
- **Number of points** 2 to 32767, 2 to 6144 (when the potential is used)
- **Number of cycles** 1 to 4 graphs in REMOTE and LOCAL files can be displayed.
  - The window size can be changed and the display is possible.
  - The measurement data is graphed, then real-time graphs appear on the screen during measurements.
- **X, Y-axis** Can be specified.
  - Each label for the parameters is specified within 20 characters.
- **Expand/Contract** Expand/Contract is possible in each X-axis and Y-axis.
  - The display can be changed up to 32767 graph.
  - The expanded display can be used with the scroll bar.
  - Any data selected by dragging the mouse can be expanded.
- **Cursor** The cursor can be moved when you left-click the mouse or shift the arrow mark key.
  - Cursor coordinates are displayed on the screen.
- **Graph** The data is automatically specified according to the view range and view position.
- **Data file** The data name is specified according to the range and view position.
- **Graphical** Up to 4 graphs in REMOTE and LOCAL files can be displayed.
  - The display color is changed for each cycle during CV and CA measurements.
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  - The display color is changed for each cycle during CV and CA measurements.
  - The display color is changed for each cycle during CV and CA measurements.
- **Measurement resolution** 0.1 Ω, Measurement range: 10 Ω - 16 kΩ
  - Measurement resolution: 0.1 Hz, Measurement range: 1 Hz - 10 MHz
- **Power-supply voltage** normally approx. 1.4 m
  - Connector: BNC plug (male) × 4, Cable: Coaxial compound cable about 0.86 m
- **Weight** 200 g (cable included)
- **Ambient temperature** 0 to 40 °C

**Temperature Controlled Bath for QCA** QCA922-60

- **Model** LS-SP (made by Nippon Boiler company)
- **Input** AC 100 V, 1.5 A (50 Hz or 60 Hz)
- **Cooling capacity** 25 W (±10 °C)
- **Range of control temperature** 2 °C to 70 °C (at 20 °C in temperature and a no load in the surrounding.)
- **Cooling overheating method** Cooling and heating by effect of Peltier
- **Control method** Pulse width modulation method by PID control (auto tuning having)
- **Set accuracy** Either of ±0.5 % (30 °C) or ±0.1 % (60 °C)
- **System requirements** Temperature: 0.1 °C, Humidity: 3% to 85%
- **Size of bath on inside** 150 mm × 200 mm × 100 mm
- **Alarm output** Relay output, 12 kinds of events
- **Telecommunication facility** RS-485 conforming
- **Setting at stop time** 99 hours and 59 minutes or less
- **Control mode** Fuzzy PID with auto tuning

**Temperature Measurement Unit for QCA** QCA922-70

- **Model** TR-71U (made by T&D corporation Japan)
- **Number of channels** Two channels (combination from built-in 15th or external sensor 2th)
- **Built-in temperature sensor** -10°C to +60°C
- **Built-in sensor heat time constant** 12 minutes
- **Measurement accuracy** Average ±0.3 °C (to 80 °C), Average ±0.5 °C (to 20 °C or to 80 °C to 110 °C)
- **Temperature display and resolution** 0.1 °C
- **Sensor** Thermally sensitive resistor
- **Liquid crystal display** Measurements, State of measurement record, Battery longevity warning, Time base range exaggerated, Amount of recorded data, Unit
- **Power supply** AA alkaline battery (LR6)
- **Battery longevity** About one year
- **Data backup** When the voltage of the battery decreases or switch OFF
- **Interface** Serial communications (RS-232C)
- **Dimensions** 77 mm × 18 mm × 55 mm
- **Weight** 1/2 oz (12 mm) or 1/2 oz (12 mm)

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Specifications are subject to change without prior notice.