

Maxtek RQCM

Quartz Crystal Microbalance Research System



REAL-TIME CRYSTAL FREQUENCY, MASS AND RESISTANCE MEASUREMENT

RQCM is a highly advanced method of measuring film properties during processes such as deposition, dissolution or permeation. Up to three crystals can be measured simultaneously with $< 0.4 \text{ ng/cm}^2$ mass resolution. All data is logged and graphically displayed using integrated Windows® based software in real time.

The heart of this system is a performance, phase lock oscillator with measurement frequency from 3.8 to 6 MHz or 5.1 to 10 MHz. The circuit also incorporates adjustable crystal capacitance cancellation, reducing error caused by parasitic capacitance of the crystal. This is essential for accurate measurement of lossy (soft) films. The crystal face is electrically isolated from earth ground allowing an external current or voltage source to be connected to it.

An optional data acquisition card accommodates RTD, thermocouple and thermistor data, as well as five scale-able, analog inputs. One can, for example, combine the potential and current outputs of a potentiostat with the mass, frequency and crystal resistance data of the QCM. The software permits a view of either time or an analog variable along the X-axis for studies under cyclic conditions.

An optional input/output card allows control of external devices (such as pumps, heaters, valves) with eight remote inputs and eight relay outputs.

FEATURES AT A GLANCE

- Integrated Windows® based software included
- Measures up to three crystals simultaneously
- $< 0.4 \text{ ng/cm}^2$ measurement resolution
- Frequency range: 3.8 to 6 MHz, 5.1 to 10 MHz
- Supports heavily loaded crystals
- Capacitance cancellation
- Electrically isolated crystal electrode
- Onboard data acquisition
- Control inputs and outputs

SPECIFICATIONS

CRYSTAL MEASUREMENT

Crystal Measurement Channels	One standard. Three max.
Frequency Ranges - Dual	3.8 to 6.06 MHz, 5.1 to 10 MHz
Frequency Resolution	0.03 Hz @ 6.0 MHz
Mass Resolution	<0.4 ng/cm ² (0.014 Å Aluminum)
Capacitance Compensation Range	40 to 200 pfd

ACHIEVABLE CAPACITANCE

Compensation	± 0.3 pfd
Crystal Resistance Range	5 to 5000 ohms
Phase Angle Accuracy	± 2 degrees
Phase Angle Stability	± 0.5 degrees
Frequency Error Vs. Phase Error and Crystal Q	Q = 100,000 - 0.087 ppm per degree Q = 10,000 - 0.87 ppm per degree Q = 1,000 - 8.7 ppm per degree

Measurement Update Rate	From 0.5 to 20 updates/sec.
Operating Temperature Range	0 to 50°C
Operating Temperature for Stated Stability	20 ± 10°C
Crystal Drive Voltage, open circuit	125 mV RMS
Crystal Drive Source Impedance	20 ohms ± 1%
Crystal Power	200 micro watt, maximum
Crystal Face Isolation	Transformer, ± 200 VDC maximum

DATA ACQUISITION INPUTS

Number of Voltage Channels	5
Resolution	16-bit
Selectable Range	0-5V, ± 5V, 0-10V, ± 10V
Gain Accuracy	± 0.01%, ± 0.02%, ± 0.01%, ± 0.02%
Zero Offset	± 2 mV
Gain Nonlinearity	<2 LSB
Single Ended Input Impedance	1 Megohm
Differential Input Impedance	2 Megohm
Input Protection	± 200V
Common Mode Range	± 200V
Common Mode Rejection	70db up to 200 Hz

COMMUNICATIONS

RS-232 Serial Port - standard
RS-485 Serial Port - optional
IEEE-488 Port - optional

DISCRETE I/O

Passive I/O Card	Eight ground true 4.7 kohm pulled up to 5 volts
	Eight SPST Relays, 120 VA, 2 Amp maximum

FRONT PANEL INDICATORS

RS-232 / IEEE-488 status
LEDs
System Ready LED

POWER REQUIREMENTS

100, 120, 220, 240 VAC
50/60 Hz, 25 watts

PHYSICAL

Size	4"H x 13"W x 9-3/4"D
Weight	7 lbs.
Shipping Weight	10 lbs.

THERMOCOUPLE INPUT

Type	Type "T" Thermocouple
Temperature Range	0 to 371°C
Accuracy	± 2°C + Sensor Error

RTD INPUT

Type	100 ohm Thin Film Platinum
Temperature Range	0 to 600°C
Accuracy Range	± 4°C + Sensor Error

THERMISTOR INPUT

Type	100 kohm
Temperature Range	0 to 150°C
Accuracy	± 0.5°C + Sensor Error

ORDERING INFORMATION

Part # Description

603200	(RQCM) Research Quartz Crystal Microbalance (3.8 to 6 MHz Frequency Range)
603200-2	(RQCM) Research Quartz Crystal Microbalance (5.1 to 10 MHz Frequency Range)

Available Options

603208	Crystal Measurement Card (3.8 to 6 MHz Freq. Range) RQCM crystal measurement assembly (2 additional cards max.)
603208-2	Crystal Measurement Card (5.1 to 10 MHz Freq. Range) RQCM crystal measurement assembly (2 additional cards max.)
603209	Data Acquisition Card. Provides 5 analog inputs and 3 temperature inputs
603210	Passive Input/Output Card. Provides 8 active low TTL level (0-5 volt) inputs, 8 programmable relay outputs and 1 dedicated abort relay output.
179217	IEEE-488 Card. Provides IEEE-488 communication port.
179219	RS-232 to RS-485 Conversion Kit. Upgrades the standard RS-232 port to RS-485

Accessories

172205	CHT-100, Teflon® Crystal Holder. (1" dia. crystal. SMB termination.)
173205	CHC-100, CPVC® Crystal Holder. (1" dia. crystal. BNC termination.)
184204	CHK-100, Kynar® Crystal Holder. (1" dia. crystal. SMB termination.)
603216-2	Cable, SMB plug to SMB plug, 2' length
888023	Adapter, BNC plug to SMB jack
184208	FC-550 Flow Cell. Easily attaches to any CHx-100 series Crystal Holder. Kynar body with Viton® o-ring.



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