

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 scaleable, 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

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

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.

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	$<0.4 \text{ ng/cm}^2$ (0.014 Å Aluminum)
Capacitance Compensation Range	40 to 200 pfd

ACHIEVABLE CAPACITANCE

Compensation	$\pm 0.3 \text{ pfd}$
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 $\pm 10^\circ$ C

Crystal Drive Voltage, open circuit

125 mV RMS

Crystal Drive Source Impedance

20 ohms $\pm 1\%$

Crystal Power

200 micro watt, maximum

Crystal Face Isolation

Transformer, $\pm 200 \text{ VDC}$ maximum

SPECIFICATIONS CONTINUED

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
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 in. H x 13 in. W x 9.75 in. D
Weight 7 lb.
Shipping Weight 10 lb.

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

Maxtek RQCM

Base Unit

RQCM – 3.8 to 6 MHz Frequency Range (for 5 MHz crystals) 1
RQCM – 5.1 to 10 MHz Frequency Range (for 9 MHz crystals) 2

Base Unit Voltage

100V 0
120V 1
220V 2
240V 3

Additional 3.8 to 6 MHz Measurement Board (for 5MHz crystals)

NONE 0
1 Additional 3.6 to 6 MHz Measurement Board 1
2 Additional 3.6 to 6 MHz Measurement Board 2

Additional 5.1 to 10 MHz Measurement Board (for 9MHz crystals)

NONE 0
1 Additional 5.1 to 10 MHz Measurement Board 1
2 Additional 5.1 to 10 MHz Measurement Board 2

Additional I/O Board

NONE 0
1 Additional Passive I/O Board 1

Data Acquisition Card (Adds temperature inputs, analog inputs)

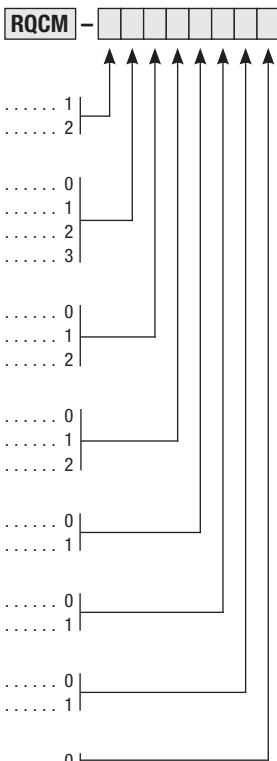
No 0
Yes 1

IEEE Communications Board

No 0
Yes 1

RS232 to RS485 Conversion Kit (no longer available, so always a 0)

No 0



Accessories

172205	CHT-100, Teflon® Crystal Holder. (1 in. dia. crystal. SMB termination.)
173205	CHC-100, CPVC® Crystal Holder. (1 in. dia. crystal. BNC termination.)
184204	CHK-100, Kynar® Crystal Holder. (1 in. dia. crystal. SMB termination.)
603216-2	Cable, SMB plug to SMB plug, 2 ft. 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.

** A maximum of three measurement boards can be installed. Therefore, the following combinations are not available: RQCM-xx21xxx, RQCM-xx22xxxx, RQCM-xx12xxxx.

