Model QA-CL3, QA-CL4, QA-CL5, QA-CL6

QUARTZ CRYSTAL RESONATOR CELL

Model QCM934-300

OSCILLATION CIRCUIT UNIT

Model QCA922-10

QA-CL ADAPTER CABLE

Instruction Manual

Rev. 1.20.0.0
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Princeton Applied Research

Table of Contents

1. General Description

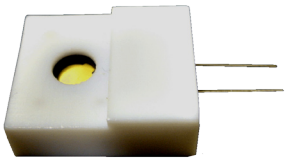
The QA-CL3, QA-CL4, QA-CL5 and QA-CL6 Quartz Crystal Resonator Cells are used in conjunction with our QCM934, QCM922 and QCA917. The purpose of the cells is twofold. One is to hold the quartz crystal resonator and make the electrical connection with the QCM. The quartz crystal resonator connects to the electrical circuit of the QCM main unit via the oscillation circuit unit (QCM934) or the QA-CL adapter cable (QCM922).

Another purpose is to insulate one electrode from the environment to prevent short-circuiting in the solution, which would cause the resonator not to oscillate. The other side electrode is exposed to the solution and used as the sensing surface that enables measurements of small changes in mass and in the viscosity of liquids.

Installation of the quartz crystal resonator is quick and easy. The suppression cap on the back of the cell is removed and the quartz crystal resonator is inserted into the body and held in place by tightening the screws. The case of the cell is made of Teflon in order to increase the resistance to chemicals such as acid and alkali solutions.

QA-CL3: Dip Cell

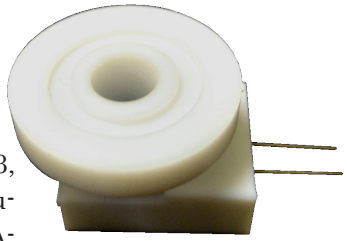
One of the quartz crystal resonator electrodes is exposed in the measurement window of the dip cell and works as the sensing surface. The lower portion of the cell is immersed directly in the sample solution (there are two lead wires coming out of the upper portion of the cell, DO NOT immerse these wires). The dip cell may also be used in air.



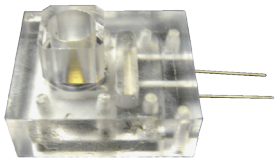
QA-CL3: Dip Cell

QA-CL4: Well Cell, QA -CL5: Transparent Well Cell

The basic structure of the QA-CL4 and QA-CL5 is the same as the QA-CL3, however a well pot has been added. The well is filled with the sample solution making only a very small volume necessary. The well pot of the QA-CL4 is a flange structure with an O-ring ditch. The cell can also be used in conjunction with a specially designed cell kit that holds larger volumes (see section 8). The QA-CL5 is the same design made of a transparent chloridized vinyl material.



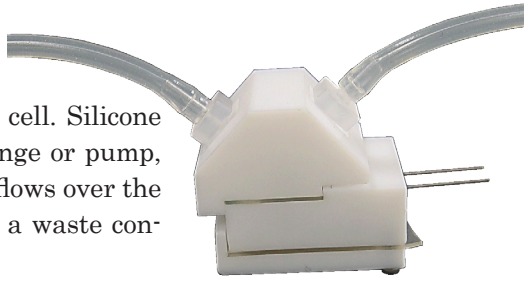
QA-CL4: Well Cell



QA-CL5: Transparent Well Cell

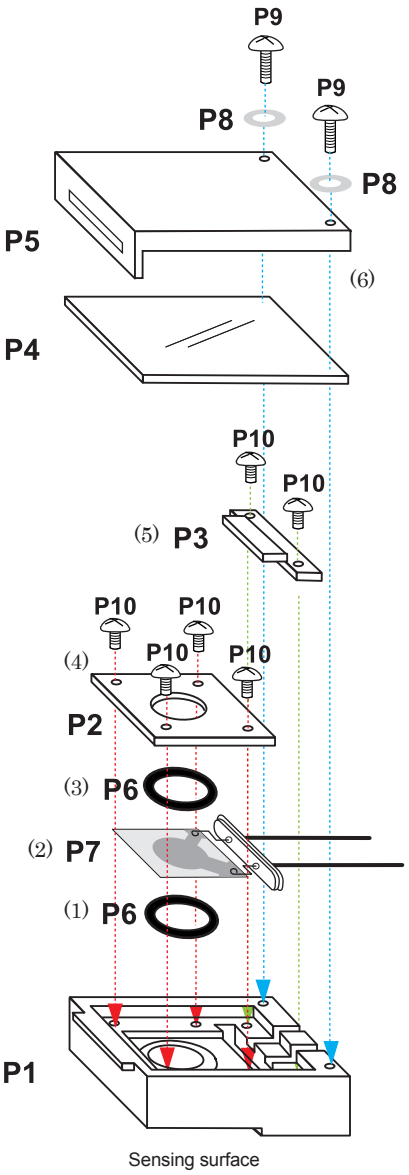
QA-CL6: Flow Cell

The basic structure of QA-CL6 is the same as the QA-CL3, however a flow cell cover has been added to the surface of the cell. Silicone tubing is inserted in the minifitting of the cell and with a syringe or pump, the sample solution is injected into one piece of tubing where it flows over the quartz crystal resonator and out the other piece of tubing into a waste container. The flow cell requires 90 µL or less of solution.



QA-CL6: Flow Cell

2. Dip Cell (QA-CL3) Assembly



How to assemble

(1) Insert the O-ring (**P6**) into the body (**P1**).

(2) Place the quartz crystal resonator (**P7**) on the O-ring (**P6**).
Note: Either one of the electrodes may be placed up.

(3) Place another O-ring on the quartz crystal resonator.

(4) Put the large plate (**P2**) on the O-ring (**P6**) and attach it to the body with four screws (**P10**). The electrode should be centered on the round hole of the body.

(5) Put the small plate (**P3**) on the metal support of the resonator and attach it with two screws (**P10**).

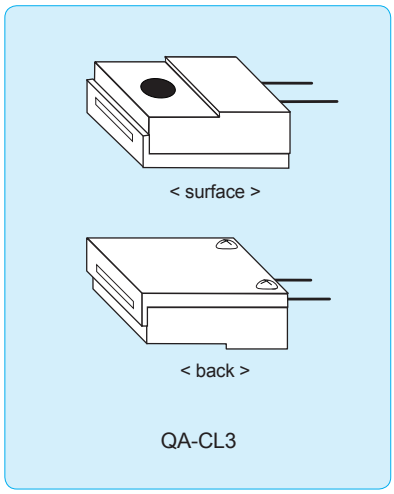
(6) Put a silicone rubber sheet (**P4**) on the body, then put the rear cover on the silicone rubber and attach it with two screws (**P9**) and washers (**P8**). The lip on the body fits into the rectangular hole on the rear cover (**P5**).

(7) The electrode exposed on the bottom side (round hole) of the body (**P1**) is the sensing surface.

Parts List

Part No.	Name	Description	Quantity
P1	Body	Teflon	1
P2	Plate (large)	Teflon	1
P3	Plate (small)	Teflon	1
P4	Silicone Rubber Sheet	Silicone	1
P5	Rear Cover	Teflon	1
P6	O-ring	S5/Viton	2
P7	Quartz Crystal Resonator	——	on request
P8	Washer	Plastic	2
P9	Screw (Long)	M2 × 5.5	2
P10	Screw (Short)	M2 × 3	6

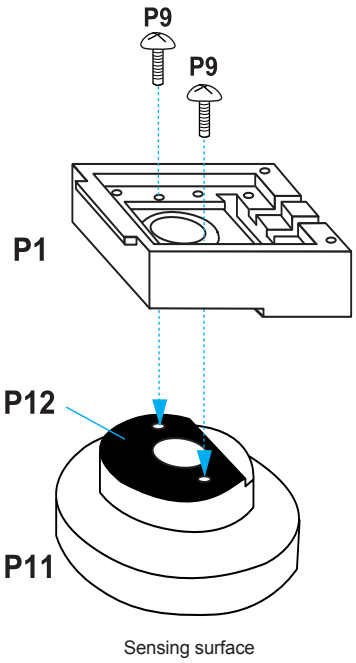
Note: The Viton O-ring may be replaced by a Kalrez (Dupont's trade mark) O-ring depending on type of solvent used for the application.



⚠ Caution

- Adjust the position of the electrode in the dip cell ensuring that it is centered on the round opening on the bottom side of the body.
- Do not over tighten screws.
- Do not touch the electrode surfaces of the resonator in order to keep them clean. Handle a resonator by holding the metal support with tweezers.
- All the parts can be cleaned in a sonicator. Use alcohol or acetone to remove organic materials.

3. Well Cell (QA-CL4) Assembly



How to assemble

(1) Spread a thin layer of liquid gasket (**P12**) on the bottom surface of the flange cup (**P11**).

(2) Fix the flange cup (**P11**) to the body (**P1**) using two screws (**P9**).

(3) Follow steps (1)-(6) in Section 2.

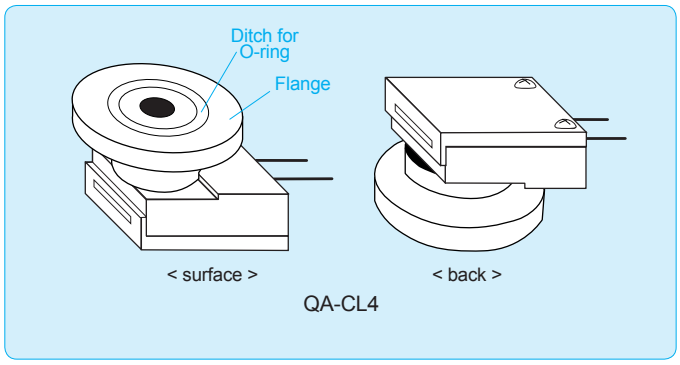
(4) Leave the cell until fully dry.

(5) Fill the well with sample solution (**P11**) or join the flanges of the cell to the special cell kit shown in Section 8.

Parts List

Part No.	Name	Description	Quantity
P1	Body	Teflon	1
P9	Screw (Long)	M2 × 5.5	2
P11	Flange Cup	Teflon	1
P12	Liquid Gasket	(*)	on request

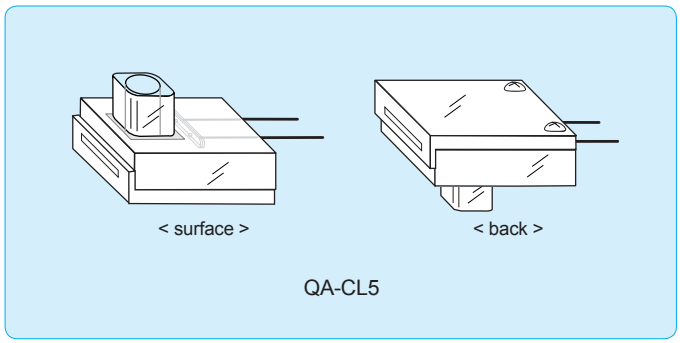
(*) *Tree Bond #1209 is recommended.*



⚠ Caution

Refer to section 2.

4. Transparent Well Cell (QA-CL5) Assembly



How to assemble

Refer to section 2.

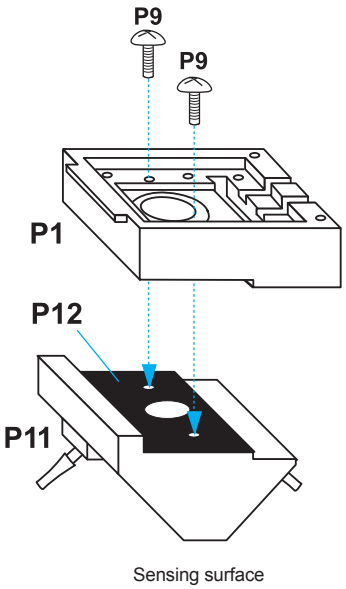
Parts List

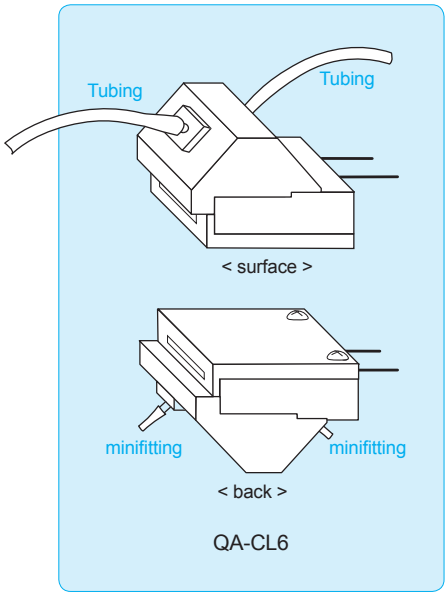
The parts are the same as the QA-CL4 except for the shape and body material. It is made of chloridized vinyl.
Refer to Section 2.

⚠ Caution

Refer to section 2.

5. Flow Cell (QA-CL6) Assembly





How to assemble

(1) Spread a thin layer of liquid gasket (**P12**) on the bottom surface of the flow cell cover (**P11**).

(2) Fix the flow cell cover (**P11**) to the body (**P1**) using two screws (**P9**).

(3) Follow steps (1)-(6) in Section 2.

(4) Leave the cell until fully dry.

(5) Tubing (**P13**) is inserted in the minifitting (**P11**) and the sample solution is poured into the cell.

Parts List

Part No.	Name	Description	Quantity
P1	Body	Teflon	1
P9	Screw (Long)	M2 × 5.5	2
P11	Flow Cell Cover	Teflon	1
P12	Liquid Gasket	(*)	on request
P13	Tubing	Silicone 0.5, 1.0, 1.5 mm φ	on request

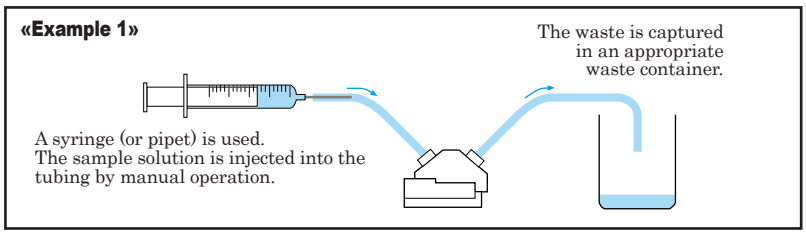
(*) *Tree Bond #1209 is recommended.*

⚠ Caution

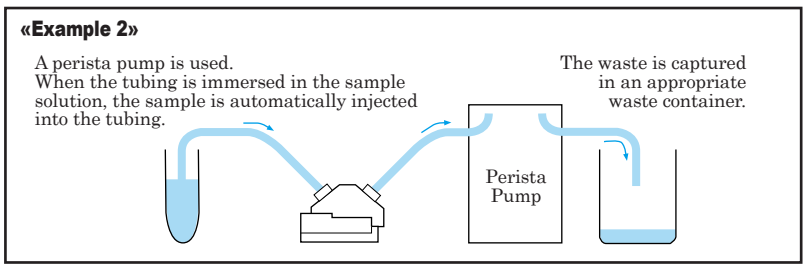
Refer to section 2.

How to pour sample solution

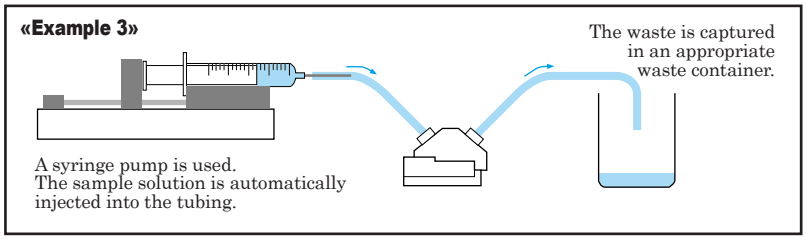
«Example 1»



«Example 2»

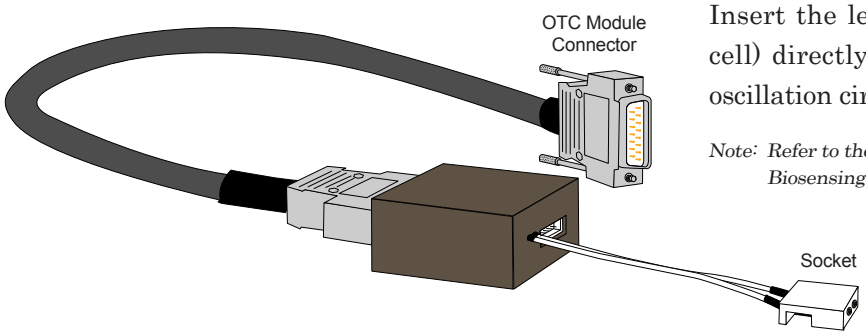


«Example 3»



6. Oscillation Circuit Unit (QCM934-300)

The oscillation circuit unit oscillates the quartz crystal resonator at the series resonance frequency.
It connects the quartz crystal resonator cell (model QA-CL3, CL4, CL5 or CL6) and the main unit of the QCM934.



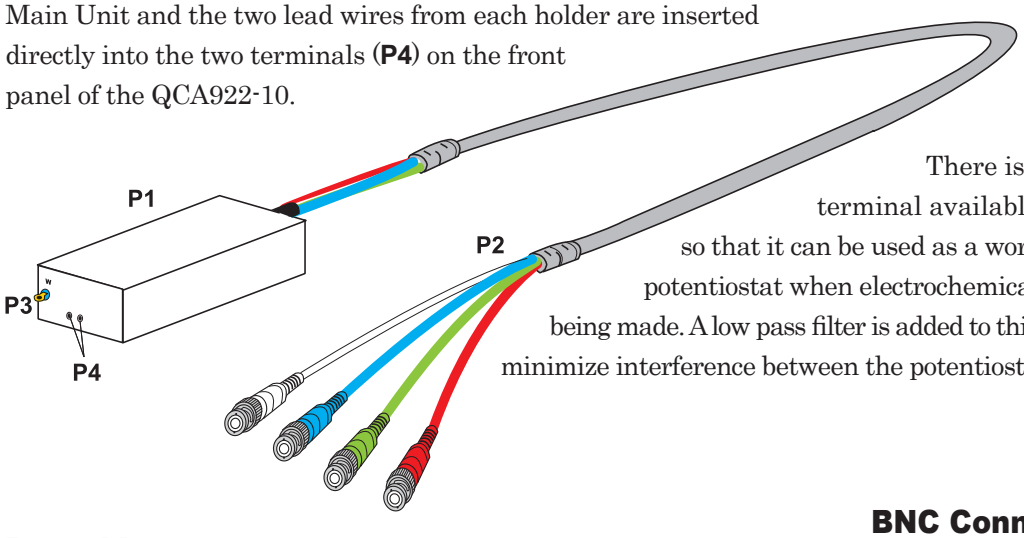
Insert the lead wires (coming out from the cell) directly in the socket and connect the oscillation circuit unit to the QCM934-200.

Note: Refer to the QCM934 Quartz Crystal Resonator Biosensing System Instruction Manual

Note: When making an EQCM measurement, the working electrode is connected to the lead wire of the quartz crystal resonator.

7. QA-CL Adapter Cable (QCA922-10)

The optional QA-CL Adaptor Cable can be used to connect the model QA-CL3, CL4, CL5 or CL6 to the QCM922 main unit. The four BNC connectors (**P2**) from the QCA922-10 are connected to the QCM922 Main Unit and the two lead wires from each holder are inserted directly into the two terminals (**P4**) on the front panel of the QCA922-10.



There is another connection terminal available on the front panel so that it can be used as a working electrode of the potentiostat when electrochemical measurements are being made. A low pass filter is added to this terminal in order to minimize interference between the potentiostat and the QCM922.

Parts List

Part No	Name	Description	Quantity
P1	Body	PVDF	1
P2	Connection Cable	1.5D-2V(50ohm)/BNC	4
P3	Terminal for connecting working electrode	Gold-plated	1
P4	Connecting Pins	Gold-plated	2

BNC Connector Signal Assignments

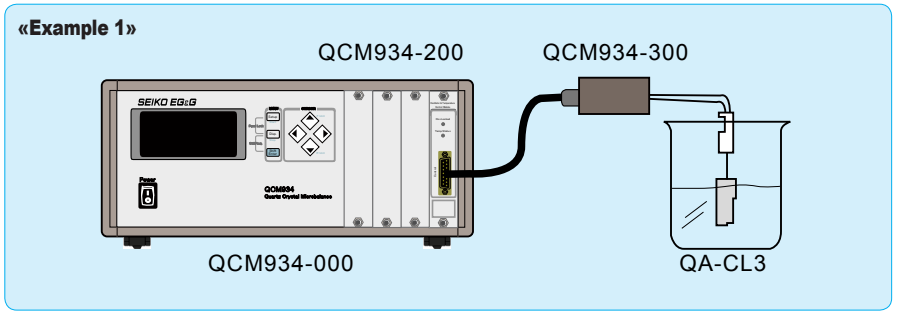
Cable color	Signal
Red	Hi-current
Green	Hi-potential
Blue	Lo-potential
White	Lo-current

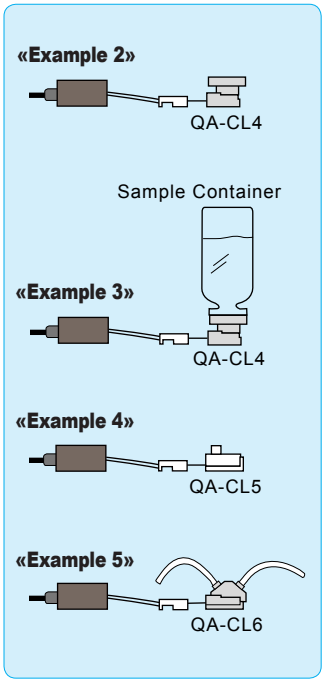
⚠ Caution

- Use working electrode terminal (**P3**) when you connect the working electrode cable from the potentiostat to the quartz crystal resonator. A low pass filter is added to this terminal in order to minimize interference between the potentiostat and the QCM922.

8. Connection to the QCM Main Unit

Connection to the QCM934 (QCM Measurement)





(1) Connect the oscillation circuit unit (QCM934-300) to the OTC module (QCM934-200).

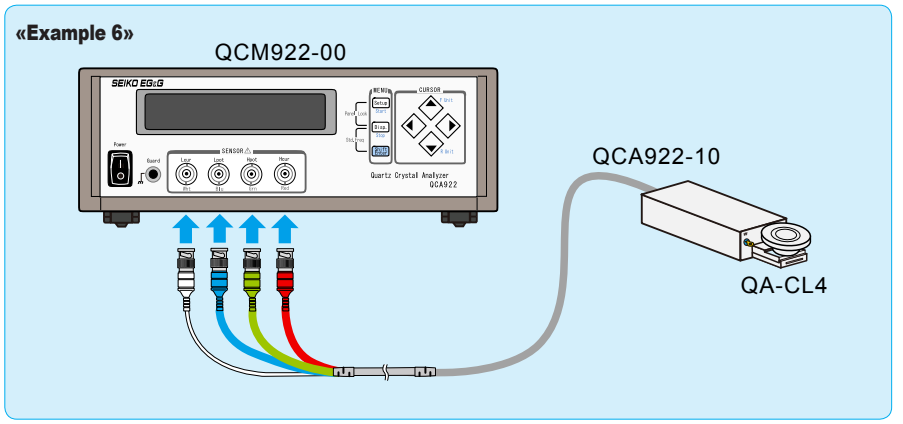
(2) Set a quartz crystal resonator into the dip cell (QA-CL3). (Refer to Section 2)

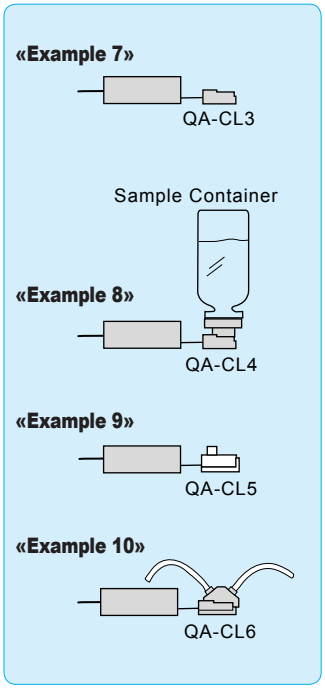
(3) Insert the two lead wires of the resonator into the connecting pins of the oscillation circuit unit.
Note: Refer to the QCM934 Quartz Crystal Resonator Biosensing System Instruction Manual.

(4) When the system is used in solution, adjust the position of the OTC module using a Ring stand or Jack as needed and immerse the cell in the solution. Lead wires may also be bent if necessary. Do not immerse lead wires in the solution, as they are not insulated.

QA-CL4, QA-CL5 and QA-CL6 may also be used. Refer to the figure at right.

Connection to the QCM922 (QCM Measurement)





1) Connect the four BNC cable connectors of the QCA922-10 adapter cable to the SENSOR connectors on the front panel of the QCM922 main unit. The adapter cable colors should match the SENSOR connector colors on the front panel of the main unit.

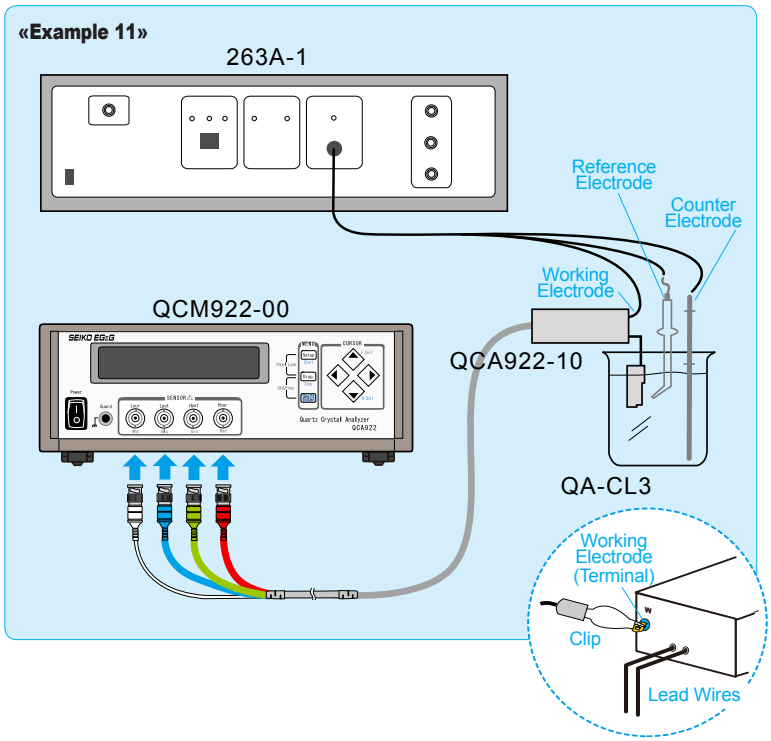
(2) Set a quartz crystal resonator into the well cell (QA-CL4). (Refer to Section 3)

(3) Insert the two lead wires of the resonator into the connecting pins of the adapter cable body.

(4) Fill the well with solution.

QA-CL4, QA-CL5 and QA-CL6 may also be used. Refer to the figure at right.

Connection to the QCM922 & Potentiostat (EQCM Measurement)



(1) Connect the four BNC cable connectors of the QCA922-10 adapter cable to the SENSOR connectors on the front panel of the QCM922 main unit. The adapter cable colors should match the SENSOR connector colors on the front panel of the main unit.

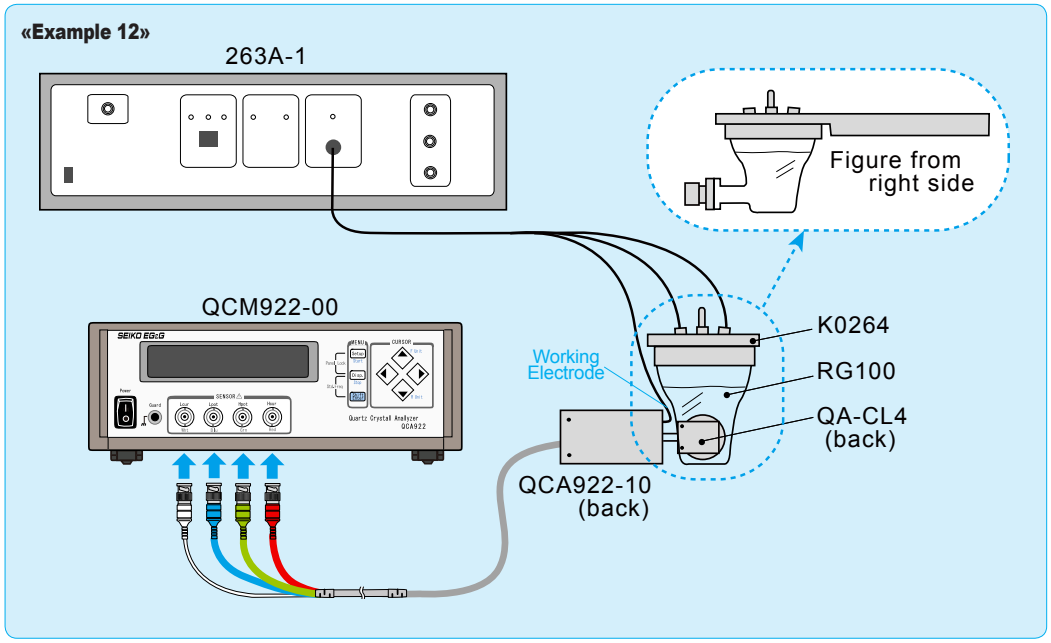
(2) Set a quartz crystal resonator into the dip cell (QA-CL3). (Refer to Section 2)

(3) Insert the two lead wires of the resonator into the connecting pins of the adapter cable body.

(4) Put the dip cell, reference electrode and counter electrode into solution. A ring stand or lab jack may make adjustment of the setup easier. Lead wires may be bent if necessary. Do not immerse lead wires in the solution, as they are not insulated.

(5) Connect the electrodes to the potentiostat. Connect the working electrode lead to the W terminal of the adaptor cable body with the clip.

Connection to the QCM922 & Potentiostat (EQCM Measurement)



(1) Connect the four BNC cable connectors of the QCA922-10 adapter cable to the SENSOR connectors on the front panel of the QCM922 main unit. The adapter cable colors should match the SENSOR connector colors on the front panel of the main unit.

(2) Set a quartz crystal resonator into the well cell (QA-CL4). (Refer to Section 3)

(3) Connect the QA-CL4 to the K0264 & RG100 cell.

(4) Insert the two lead wires of the resonator into the connecting pins of the adapter cable body.

(5) Then connect the electrodes to the potentiostat. Connect the working electrode lead to the W terminal of the adaptor cable body with the clip.

9. Specifications

QA-CL3: Dip Cell

Quartz crystal resonator:	9 MHz AT-cut quartz crystal resonator (QA-A9M series) When QCM934 is connected, it oscillates at 27 MHz (the third over tone).
Materials:	Main body: Teflon, O-ring: Viton, Stop screw: Stainless steel
Dimensions:	25.5 mm × 20 mm × 12 mm
Ambient temperature:	0 to 40 °C
Usage:	Liquid or air

QA-CL4: Well Cell

Quartz crystal resonator:	9 MHz AT-cut quartz crystal resonator (QA-A9M series) When QCM934 is connected, it oscillates at 27 MHz (the third over tone).
Materials:	Main body: Teflon, O-ring: Viton, Stop screw: Stainless steel
Dimensions:	25.5 mm × 20 mm × 22 mm
Capacity:	Max. 750 µL
Ambient temperature:	0 to 40 °C
Usage:	Cell is filled with solution.

QA-CL5: Transparent Well Cell

Quartz crystal resonator:	9 MHz AT-cut quartz crystal resonator (QA-A9M series) When QCM934 is connected, it oscillates at 27 MHz (the third over tone).
Materials:	Main body: Chloridized vinyl,, O-ring: Viton, Stop screw: Stainless steel
Dimensions:	25.5 mm × 20 mm × 17 mm
Capacity:	Max. 250 µL
Ambient temperature:	0 to 40 °C
Usage:	Cell is filled with solution.

QA-CL6: Flow Cell

Quartz crystal resonator:	9 MHz AT-cut quartz crystal resonator (QA-A9M series) When QCM934 is connected, it oscillates at 27 MHz (the third over tone).
Materials:	Main body: Teflon, O-ring: Viton, Stop screw: Stainless steel
Dimensions:	28.0 mm × 20 mm × 22 mm
Capacity:	Max. 90 µL
Ambient temperature:	0 to 40 °C
Usage:	Solution is poured into the cell.

QCM934-300: Oscillation Circuit Unit

Oscillation stability level:	1 Hz/min or less
External connector:	D-Sub connector with 15 cm lead
Cable:	50 cm cable for OTC module connection
Dimensions:	54 mm × 48 mm × 24 mm (Cable excluded)
Ambient temperature:	0 to 40 °C

QCA922-10: QA-CL Adapter Cable

Materials:	Main body: PVDF, Stop screw: Stainless steel
Connecting Cable:	Connectors: BNC (Male) × 4 Cable: coaxial (50 ohm) × 4
W Terminal:	Used to connect the working electrode of the potentiostat. A low pass filter has been added to minimize interference between the potentiostat and QCM.
Dimensions:	35 mm × 65 mm × 20 mm
Weight:	Approx. 200g
Ambient temperature:	0 to 40 °C

QA-A9M Series: Quartz Crystal Resonator

Resonance frequency:	9 MHz
Cutting type:	AT-cut
Electrode materials:	14 kinds such as Au, Pt, SUS, ITO and SiO_2
Electrode thickness:	Gold approx. 3000 Å, Titanium approx. 100 Å
Electrode area:	5 mm φ: 0.196 cm^2
Ambient temperature:	-20 to 70 °C
Package:	50 or 25 Resonators

Note: The electrodes are uniform on both sides of the quartz crystal resonator. Therefore, both sides may be used in experimental work.

Note: Electrodes of other quality materials can also be made. Please ask our sales division.

The data and specifications contained herein are subject to change without prior notice because of product improvement.