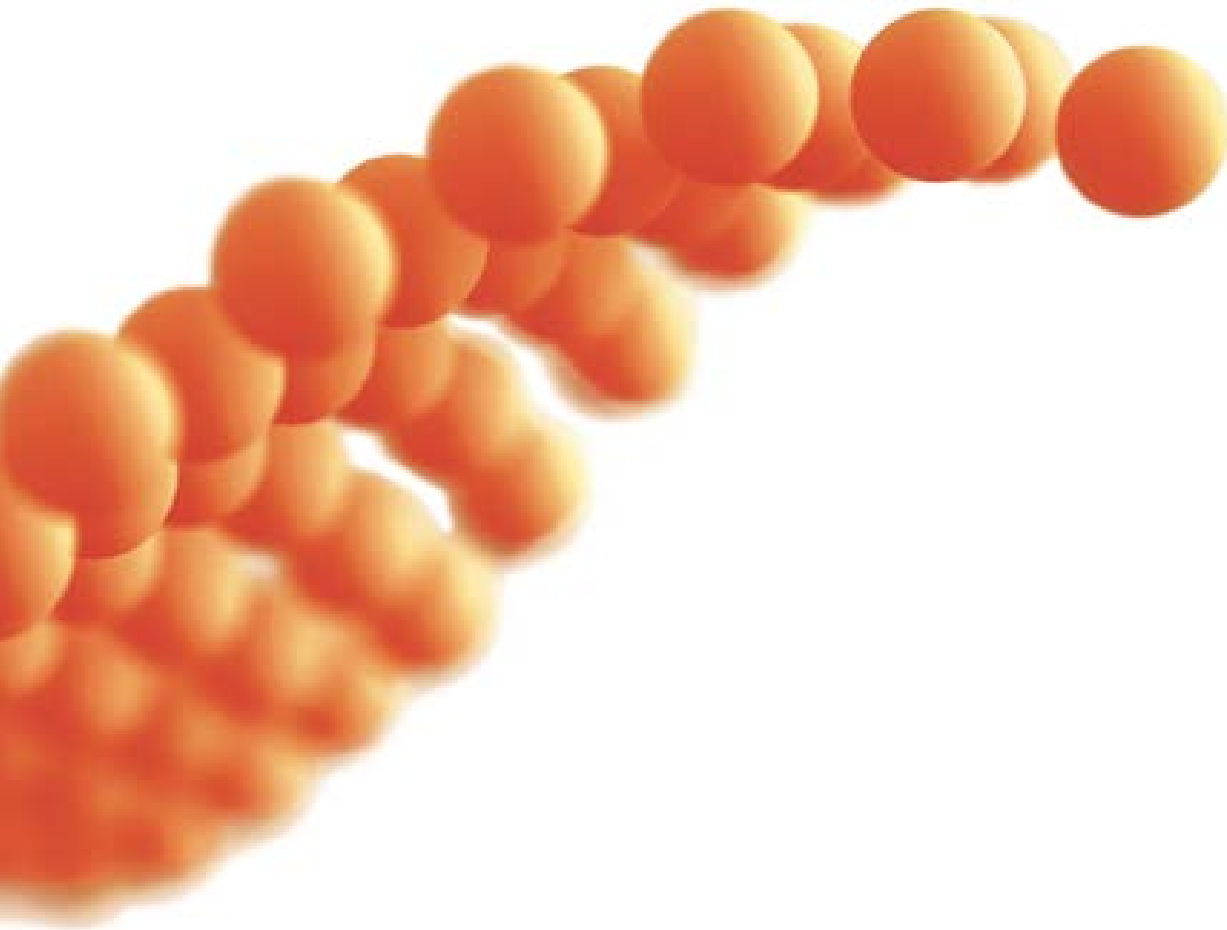


*Sensing the nanoworld*



**AWSensors** designs, manufactures and markets the **most versatile** scientific instruments for **acoustic wave sensor characterization**. AWS technology gives you access to a **wider experimental landscape than any other system in the market** in terms of frequency- and sensitivity range, flexibility, and value-for-money, thanks to its **PATENTED HIGHLY SENSITIVE QCMD TECHNOLOGY**.

AWS equipment is tailored to research applications in fields that include biomedicine; analytical-, bioanalytical-, biophysical- and interfacial chemistry; energy storage, battery research and catalysis; soft matter physics.





## KEY BENEFITS

- **High sensitivity** – proprietary **high-frequency QCM** sensors.
- **Real time, label-free** detection of the amount of material.
- Analysis of organization of material at **solid-liquid** and **solid-gas interfaces**.
- **More data for better-informed decision making** by combining different sensors or different operation modes.
- **Easy to use** systems, with **integrated control** of operational Temperature, fluidics system and potentiostats.
- **Parallelization** with **multi-channel** systems.
- **Modular** and **customizable** design to fit a variety of budgets and user needs.

## **AWSensors Instruments**

X1 Single Channel QCMD

X4 Advanced Multichannel QCMD

## **Cells**

### **For AWS Equipment**

Flow cells

In-batch cells

### **For Impedance/Network Analyzers**

Flow cells

In-batch cells

Immersion probe cell

## **Sensors**

AWS HFF-QCM sensors

QCM sensors

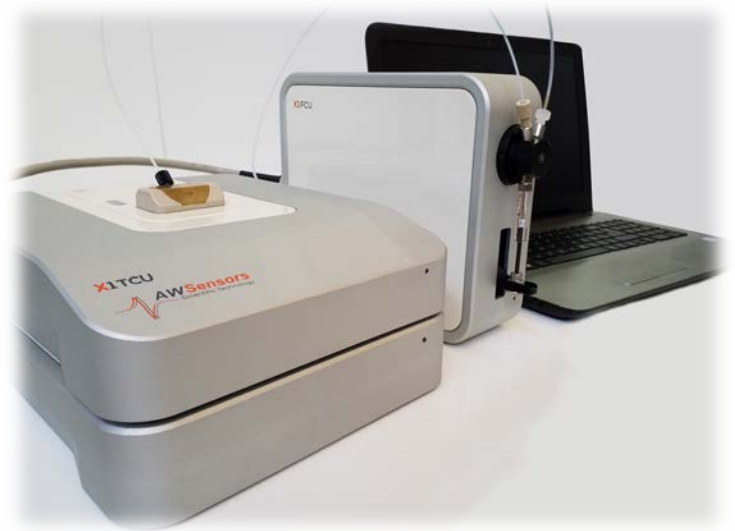
LOVE-SAW sensors

## **Custom products**

Get in touch with us directly to discuss your specific needs.

# X1 Single Channel QCMD

Single channel Quartz Crystal Microbalance with Dissipation (QCMD) measurements for multiple overtones. This system is capable of measuring highly accurate changes in the mass of thin rigid layers, as well as determining the properties of viscoelastic films which makes it suitable for a wide range of applications, including biosensors and electrochemistry. Measurements in air, gas and liquid are possible with a wide range of acoustic sensors (classical and High-Fundamental Frequency QCM sensors and LOVE-SAW sensors). Its fast acquisition rate allows monitoring fast kinetics and electrochemical transients. It has two optional units: Temperature Control Unit (TCU) and Flow Control Unit (FCU) for budget flexibility.



## The first in the nanosensing race

### Fast and highly sensitive

- Allows high frequency fundamental operation to achieve low limits of detection.
- The highest time resolution and mass sensitivity in the market.

### Versatility

- Measurements in gas and in liquids.
- A range of measurement cells for measuring under flow conditions or under stagnant conditions.
- A wide range of sensors, including classical QCM, HFF-QCM, and Love-SAW.
- Up to 7 overtones simultaneous measurements for 5 MHz classical QCM.

### Modularity

- Allows flexible solutions, adaptable for various budgets and applications.
- Sleek, space-saving and lightweight design.

### Integration, robustness and comfort

- Comfortable handling and robust measurements with quick-lock cells.
- Integrated temperature and flow control.
- Integrated software control of the experimental features (AWS Suite).
- Integrated potentiostat control for electrochemical measurements (AWS Suite).

# X1 Single Channel QCMD

## Modules

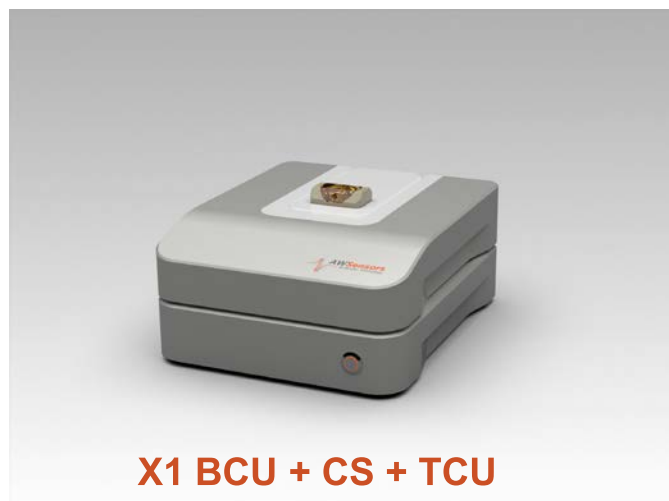
A remote Cell Station (CS) helps give the device its compact footprint and enables use in glove boxes. Temperature Control Unit (TCU) is available for enhanced stability and Flow Control Unit (FCU) allows comfortable semi-automatic fluid exchange and sample loading on top of the sensor.

**BCU: Base Control Unit**

**CS: Cell Station**

**TCU: Temperature Control Unit**

**FCU: Flow Control Unit**



# X1 Single Channel QCMD

## Technical Specifications

<b>Measurement channels (cell units)</b>	1
<b>Type of sensors</b>	<ul style="list-style-type: none"><li>• HFF-QCM (50,100,150 MHz)</li><li>• Classical QCM (1 inch and 14 mm; 5,9,10 MHz)</li><li>• Love-SAW (120 MHz)</li></ul>
<b>Measurement modes</b>	<ul style="list-style-type: none"><li>• High resolution (single and multiple overtones)</li><li>• Tracking (single and multiple overtones)</li></ul>
<b>Number of overtones</b>	Up to 7 (fundamental + 6 overtones). Measurements possible up to 13 <sup>th</sup> harmonic.
<b>Frequency range</b>	4 MHz – 160 MHz
<b>Max. Frequency resolution</b>	0.1 Hz
<b>Frequency accuracy</b>	± 0.5 Hz
<b>Temperature control range</b>	15 °C to 45 °C
<b>Temperature stability</b>	± 0.05 °C
<b>Max. Time resolution</b>	250 measurement points(samples) per second
<b>Mass sensitivity</b>	8 pg/cm <sup>2</sup> (in air), 0.6 ng/cm <sup>2</sup> (in liquid)
<b>Dissipation sensitivity</b>	1.71x10 <sup>-10</sup> (in air), 3.5x10 <sup>-8</sup> (in liquid)



## Technical Specifications

	Standard Flow Option	Smooth Flow Option
<b>Components</b>	<ul style="list-style-type: none"> <li>• A positive displacement syringe pump</li> <li>• A 2-port Distribution Valve</li> </ul>	
<b>Flow rate range (µL/min)</b>	0.625-290000	0.03125-21250
<b>Syringe volume options (µL)</b>	12.5, 25, 50, 100, 125, <b>250*</b> , 500, 1000, 1250, 2500, 5000 *Default syringe	
<b>Flow range with default syringe (µL/min)</b>	12.5 – 14500	0.625 – 1062.5
<b>Dimensions (H x W x D) (cm)</b>	19.5 x 7.0 x 25.0	
<b>Weight (kg)</b>	0.75	

## Optional Flow Kits

<b>Cleaning kit</b>	For proper tubing and system cleaning (includes chemicals and flow elements)
<b>Small volume experiment kit</b>	For small volume samples injection (less than 1000 µL)



**A flexible, software-controlled flow system**



# X4 Advanced Multichannel QCMD

The X4 is an Advanced Quartz Crystal Microbalance with Dissipation (QCMD) instrument for simultaneous measurements of multiple overtones in up to four channels. This system retains the measuring capabilities of the X1 while offering the user four times the productivity.

Low- and High-Fundamental Frequency QCM sensors and LOVE-SAW sensors can be tested simultaneously in a single experiment for the same application and equal conditions. Temperature Control is integrated in the instrument and independently controlled in each channel via the AWS Suite software. The X4 can be connected to a Flow Control Unit (FCU) to generate liquid flow over your sensors surfaces, or to multiple FCUs for more versatile flow configurations.



## Speed-up your work

### High throughput

- Up to 4 simultaneous measurements for 4 different sensors (with multiple overtones)
- Sleek, space-saving and lightweight design.

### Fast and highly sensitive

- Allows high frequency fundamental operation to achieve low limits of detection.
- The highest time resolution and mass sensitivity in the market.









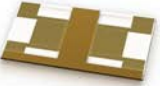

### Versatility

- Measurements in gas and in liquids.
- A range of measurement cells for measuring under flow conditions or under stagnant conditions.
- A wide range of sensors, including classical QCM, HFF-QCM, and Love-SAW.
- Up to 7 overtones simultaneous measurements for 5 MHz classical QCM.

### Integration, robustness and comfort

- Comfortable handling and robust measurements with quick-lock cells.
- Integrated channel-independent temperature and flow control.
- Integrated software control of the experimental features (AWS Suite).
- Integrated potentiostat control for electrochemical measurements (AWS Suite).

# Wide range of Cells

		AWSensors CELLS					
APPLICATION		IN-FLOW	IN-BATCH	EQCM	EQCM/FLOW	Li CELL	PROBE
							
SENSOR							
	QCM 14mm WRAPPED	✓	✓	✓	✓	✓	✓
	QCM 1" WRAPPED	✗	✓	✓	✗	✗	✓
	LOVE-SAW	✓	✓	✓	✗	✗	✗
	HFF-QCM	✓	✓	✓	✓	✗	✗

## For AWSensors Equipment

Various ways to set up experiments with multiple combinations of sensor types for a broad range of applications.

Our patented Quick-Lock assembly design makes for a fast and easy assembly method, for more reliable and reproducible measurements.

## For Impedance / Network Analyzers

Measurement cells adapted to work with standard impedance and network analyzers featuring the benefits of our patented Quick-Lock design.

Affordable way to test different acoustic wave sensor technologies.



## Product Specifications

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<b>Sensors:</b>	Cells available for: <ul style="list-style-type: none"><li>• HFF-QCM (50,100,150 MHz)</li><li>• Classical QCM (14 mm, wrapped electrodes; 5,10 MHz)</li><li>• Love-SAW (120 MHz)</li></ul>
<b>Assembly mechanism:</b>	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors). For Love-SAW sensors, thumbscrew assembly.
<b>Type of measurements:</b>	Measurements in applications requiring a flow of liquid passing over the sensor surface.
<b>Materials:</b>	Cell base: Aluminum Cell cover: PEEK, PSU Seal: FFKM O-ring or PDMS gasket
<b>Volume:</b>	From only 5.5 $\mu$ L for AWS HFF-QCM sensors to 44 $\mu$ L for QCM 14mm.
<b>Dimensions (mm):</b>	33 (L) x 47 (W) x 33 (H)

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## Product Specifications

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<b>Sensors:</b>	Cells available for: <ul style="list-style-type: none"><li>• HFF-QCM (50,100,150 MHz)</li><li>• Classical QCM (14 mm, wrapped electrodes; 5,10 MHz)</li></ul>
<b>Type of measurements:</b>	For EQCM measurements under flow conditions
<b>Assembly mechanism:</b>	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors).
<b>Materials:</b>	Cell base: Aluminum Cell cover: PEEK O-ring: FFKM Electrode holder: PMP + porous glass
<b>Volume:</b>	From only 5.5 $\mu\text{L}$ for AWS HFF-QCM sensors to 44 $\mu\text{L}$ for QCM 14mm.
<b>Dimensions (mm):</b>	47(L) x 33 (W) x 33,75 (H)

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## Product Specifications

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<b>Sensors:</b>	Cells available for: <ul style="list-style-type: none"><li>• HFF-QCM (50,100,150 MHz)</li><li>• Classical QCM (14 mm / 1 inch, wrapped electrodes; 5,9,10 MHz)</li><li>• Love-SAW (120 MHz)</li></ul>
<b>Assembly mechanism:</b>	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors). For Love-SAW sensors, thumbscrew assembly.
<b>Type of measurements:</b>	For measurements in stagnant conditions
<b>Materials:</b>	Cell base: Aluminum Cell cover: PEEK, PTFE Seal: FFKM O-ring or PDMS gasket
<b>Dimensions (mm):</b>	47(L) x 33 (W) x 33 (H)

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## Product Specifications

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### Sensors:

Cells available for:

- HFF-QCM (50,100,150 MHz)
- Classical QCM (14 mm / 1 inch, wrapped electrodes; 5,9,10 MHz)
- Love-SAW (120 MHz)

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### Assembly mechanism:

Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors). For Love-SAW sensors, thumbscrew assembly.

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### Type of measurements:

For electrochemical measurements in stagnant conditions

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### Materials:

Cell base: Aluminum  
Cell cover: PEEK, PTFE  
O-ring: FFKM  
Electrodes holder: PTFE

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### Dimensions (base):

47(L) x 33 (W) x 44 (H) mm

### Dimensions (electrodes holder):

28 (D) x 48 (H) mm

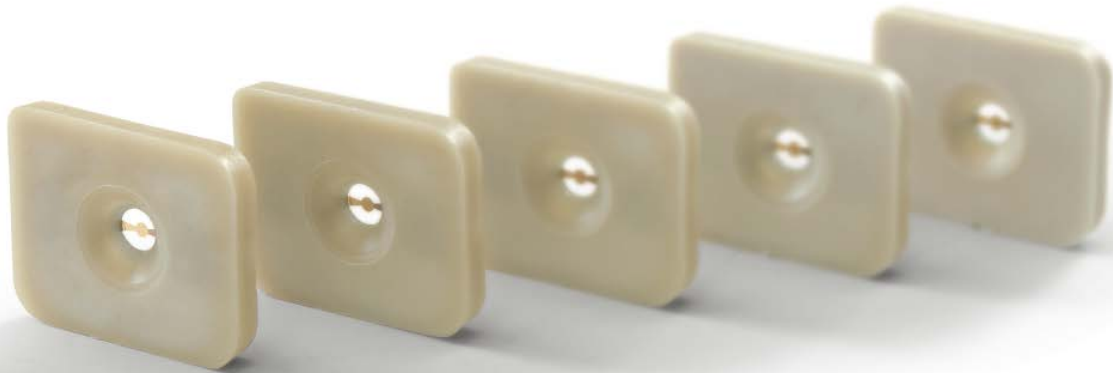
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## For Impedance Analyzers



## Product Specifications

<b>Sensors:</b>	Cells available for: <ul style="list-style-type: none"><li>• Classical QCM (14 mm / 1 inch, wrapped electrodes; 5 and 9 MHz)</li></ul>
<b>Assembly mechanism:</b>	Q-Lock assembly, a proprietary design to ensure faster and easier assembly and more reliable and reproducible measurements
<b>Type of measurements:</b>	For immersion in liquid to make EQCM or QCM measurements with external instruments such as impedance analyzers
<b>Materials:</b>	Body: PEEK O-ring: FFKM
<b>Electrical connector:</b>	SMA
<b>Vial volume (mm):</b>	46,4 (ID) x 50 (OD) x 72 (H)



## Product Specifications

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<b>Resonant frequency:</b>	<ul style="list-style-type: none"><li>• 150 MHz fundamental frequency</li><li>• 100 MHz fundamental frequency</li><li>• 50 MHz fundamental frequency</li></ul>
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<b>Design:</b>	AWS HFF sensors are based on high fundamental frequency AT-cut quartz crystal resonators manufactured through inverted mesa technology. Mounting on a PPS support provides robustness and reliability.
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<b>Chip material:</b>	PPS
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<b>Electrode layout:</b>	Keyhole
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<b>Electrodes material:</b>	Cr/Au
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<b>Surface finish:</b>	Polished (optically clear < 1 $\mu\text{m}$ )
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<b>Electrodes diameter:</b>	1 mm (50, 100 MHz); 0.5 mm (150 MHz)
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# QCM sensors

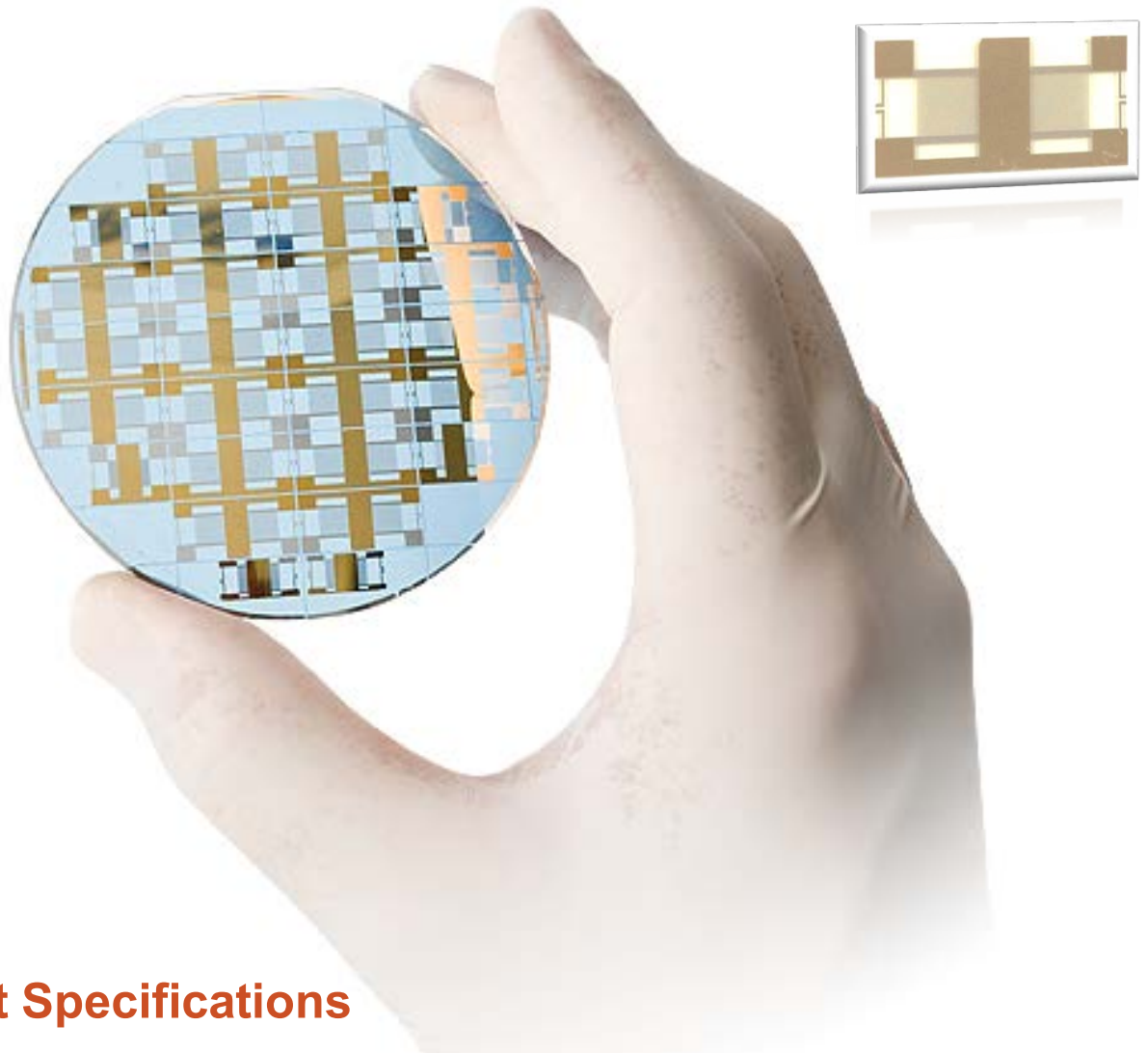


**Compatible with AWSensors  
and other QCM systems**

## Product Specifications

<b>Materials:</b>	<ul style="list-style-type: none"><li>• AT-cut quartz material</li><li>• Other materials, such as Gallium Orthophosphate (<math>\text{GaPO}_4</math>) or Langasite (<math>\text{La}_3\text{Ga}_5\text{SiO}_{14}</math>) available upon request</li></ul>
<b>Blank diameter:</b>	<ul style="list-style-type: none"><li>• 14 mm</li><li>• 1 inch (25.4 mm)</li></ul>
<b>Electrode layout:</b>	<ul style="list-style-type: none"><li>• Wrapped (contacts on one side)</li><li>• Keyhole (contacts in both sides)</li></ul>
<b>Resonant frequency:</b>	<ul style="list-style-type: none"><li>• 5 MHz and 9 MHz (1 inch wrapped)</li><li>• 5 MHz and 10 MHz (14 mm wrapped)</li><li>• 9 MHz (14 mm keyhole)</li></ul>
<b>Electrodes material:</b>	<ul style="list-style-type: none"><li>• Cr/Au and Ti/Au</li><li>• <math>\text{SiO}_2</math></li><li>• Pt</li><li>• C</li></ul> <p>*Contact us about the current availability of other metals and coatings</p>
<b>Surface finish:</b>	<ul style="list-style-type: none"><li>• Polished</li><li>• Rough</li></ul>

# LOVE - SAW sensors



## Product Specifications

<b>Resonant frequency:</b>	120 MHz fundamental frequency
<b>Design:</b>	LOVE-Mode SAW (surface acoustic wave) sensors are based on AT-Cut quartz substrate and have a special design that allows easy connection and removing.
<b>Electrodes material:</b>	Cr/Au
<b>Surface finish:</b>	Polished (optically clear < 1 $\mu\text{m}$ )
<b>Blank dimensions:</b>	17.0 mm x 8.5 mm
<b>Dimensions of the sensitive area:</b>	3.5 mm x 4.5 mm

# Custom products

Our dedicated engineering and scientific teams are able to provide customized solutions that address our customers' specific needs:



Extreme Temperatures



Controlled atmospheres (glove box cells)



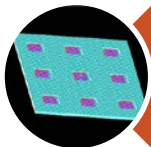
Integrated fluidics, electronics, and software



Closed loop process control



Sampling robot integration



Finite Element Method Simulations

## CONTACT US

Just e-mail or call us to tell us about your needs



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