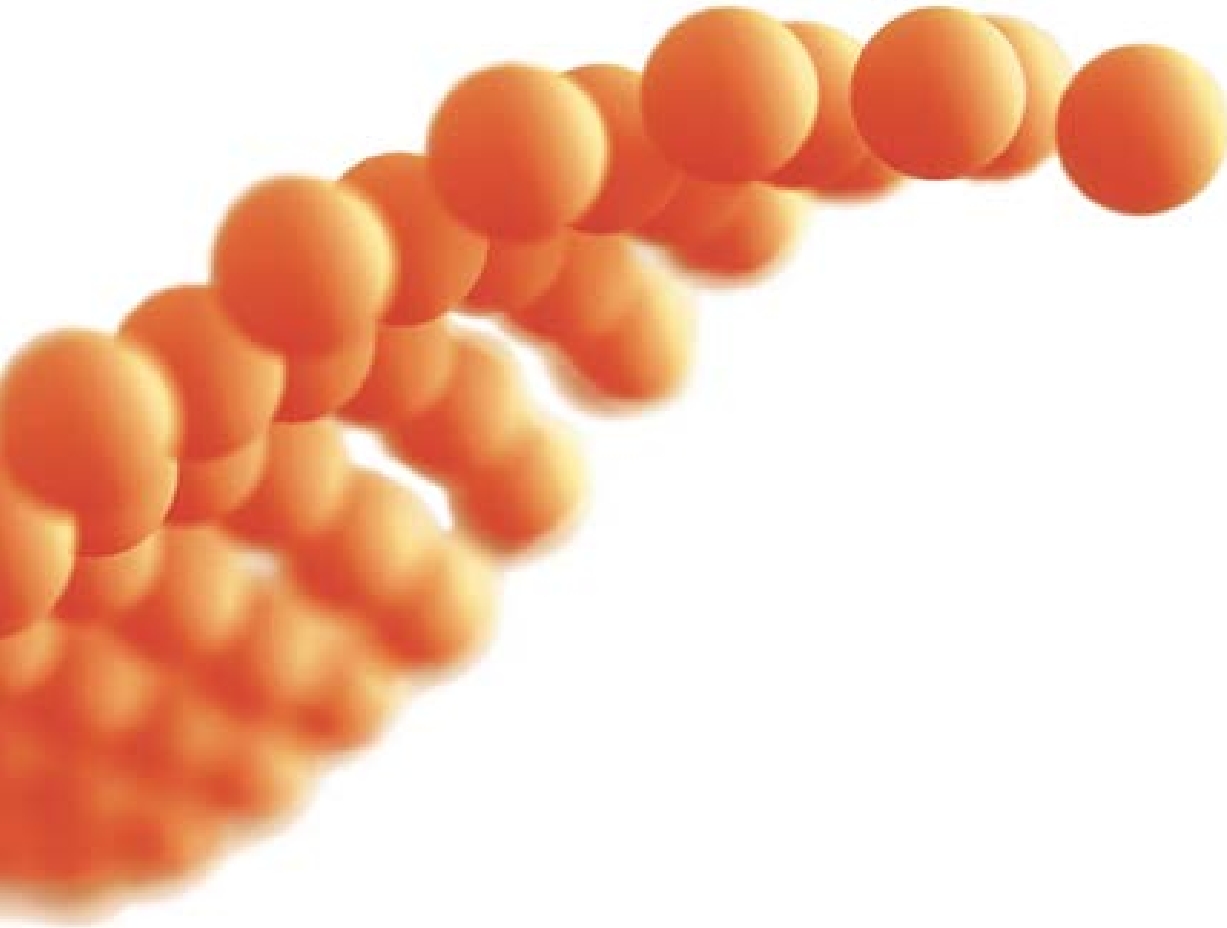


*Sensing the nanoworld*



**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 on the market** in terms of frequency- and sensitivity range, flexibility, and value-for-money, thanks to its **PATENTED HIGHLY SENSITIVE QCMD TECHNOLOGY**.

AWSensors 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**.
- Seamless integration of different sensors and/or different operation modes in one instrument for exhaustive interface characterization.
- **User friendly** systems, with **integrated temperature, fluidics, and potentiostat control\***.
- **Parallelization** with **multi-channel** systems.
- **Modular** and **customizable** design to fit a variety of budgets and user needs.

\*Only compatible BioLogic Potentiostats are integrated.

## **AWSensors Instruments**

[X1 Single Channel QCMD](#)

[X4 Advanced Multichannel QCMD](#)

[FCU: Flow Control Unit](#)

[FCU-Pro Advanced Flow Control Unit](#)

## **Cells (QCM & eQCM)**

[Flow cells](#)

[In-batch cells](#)

[Airtight cells](#)

[Immersion probe cells](#)

## **Sensors**

[HFF-QCM sensors](#)

[QCM sensors](#)

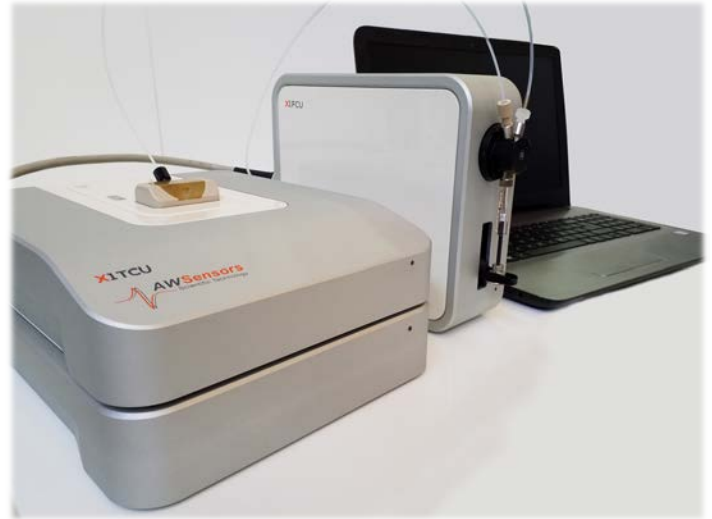
[LOVE-SAW sensors](#)

## **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 on multiple overtones. The system offers superior sensitivity in frequency and dissipation for measuring the amount of material and characterizing the properties of submolecular films in a wide range of applications, including biosensors and electrochemistry. Its high acquisition rate allows monitoring fast kinetics, such as electrochemical transients. Measurements in air, gas and liquid are possible with a variety of acoustic sensors (classical and High-Fundamental Frequency QCM sensors and LOVE-SAW sensors). Modular design consisting of optional Temperature Control Unit (TCU) and Flow Control Unit (FCU) and FCU-Pro fits a variety of budgets and needs.



## The first in the nanosensing race

### Fast and highly sensitive

- Allows high fundamental frequency 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).

## 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**

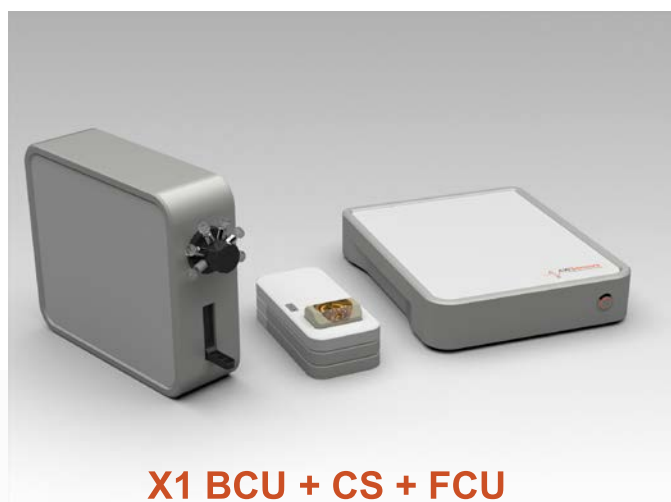
**FCU: Flow Control Unit**



**Basic package: X1 BCU + CS**



**X1 BCU + CS + TCU**



**X1 BCU + CS + FCU**



**X1 BCU + CS + TCU + FCU**

# 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 (TCU)</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)



# X4 Advanced Multichannel QCMD system

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) or FCU-Pro 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).



## Technical Specifications

<b>Measurement channels (cell units)</b>	4 independent channels
<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 (independent in each channel)
<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)



# Flow Control Unit (FCU)

The Flow Control Unit (FCU) is a syringe system compatible for use with AWSensors QCMD instruments: the X1 and the X4.

Continuous flow can be generated and controlled via AWS Suite. It can be set up in two different configurations (Pull flow and Push flow) for optimal sample delivery.

Two versions are available: Standard and Smooth Flow.



## 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>Syringe volume options (µL)</b>	12.5, 25, 50, 100, 125, <b>250*</b> , 500, 1000, 1250, 2500, 5000 <i>*Default syringe</i>	
<b>Flow rate range (µL/min)</b>	0.625-290000	0.03125-21250
<b>Flow range with default syringe (µL/min)</b>	12.5 – 14500	0.625 – 1062.5

## 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**

# FCU-Pro Advanced Flow Control Unit

The FCU-Pro is an advanced version of the FCU. It was designed for improved injection control and for handling multiple carrier fluids. Multiple fluids are handled with a 6 port Distribution Valve, an in-line Degasser keeps bubble trouble at bay, and the Injection Valve with a fixed volume sample loop allows precise sample delivery for reproducible measurements.



## Flow-through modular unit for flow operation and sample injection

### Integration

- Fully integrated with AWSensors X1 and X4 systems.
- Control and monitoring with AWS Suite software.

### Modularity and versatility

- Sleek, space-saving and portable design.
- Basic configuration with 1 fluidic channel.
- Multiple FCU-Pro units can be simultaneously controlled (with X4).
- Fluidics can be combined in different configurations: measurement cells connected in series, or in parallel, or a combination of both (with X4).











### Quality

- FPLC industry-standard components.

### Robustness and comfort

- In-line degasser for avoiding bubble generation.
- Semi-automatic injection of samples, controlled via software.
- Smooth Flow operation.

# Wide range of Cells

APPLICATION	AWSensors CELLS					
	IN-FLOW	IN-BATCH	EQCM	EQCM/FLOW	AIRTIGHT	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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**Sensors:**

Cells available for:

- HFF-QCM (50,100,150 MHz)
- Classical QCM (14 mm, wrapped electrodes; 5,10 MHz)

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**Type of measurements:**

For EQCM measurements under flow conditions

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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).

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**Materials:**

Cell base: Aluminum

Cell cover: PEEK

O-ring: FFKM

Electrode holder: PMP + porous glass

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**Volume:**

From only 5.5  $\mu$ L for AWS HFF-QCM sensors to 35  $\mu$ L for QCM 14mm.

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**Dimensions (mm):**

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

<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></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 electrochemical measurements in stagnant conditions
<b>Materials:</b>	Cell base: Aluminum Cell cover: PEEK, PTFE O-ring: FFKM Electrodes holder: PTFE
<b>Dimensions (base):</b>	47(L) x 33 (W) x 44 (H) mm
<b>Dimensions (electrodes holder):</b>	28 (D) x 48 (H) mm



# Airtight / Li Cell



## Product Specifications

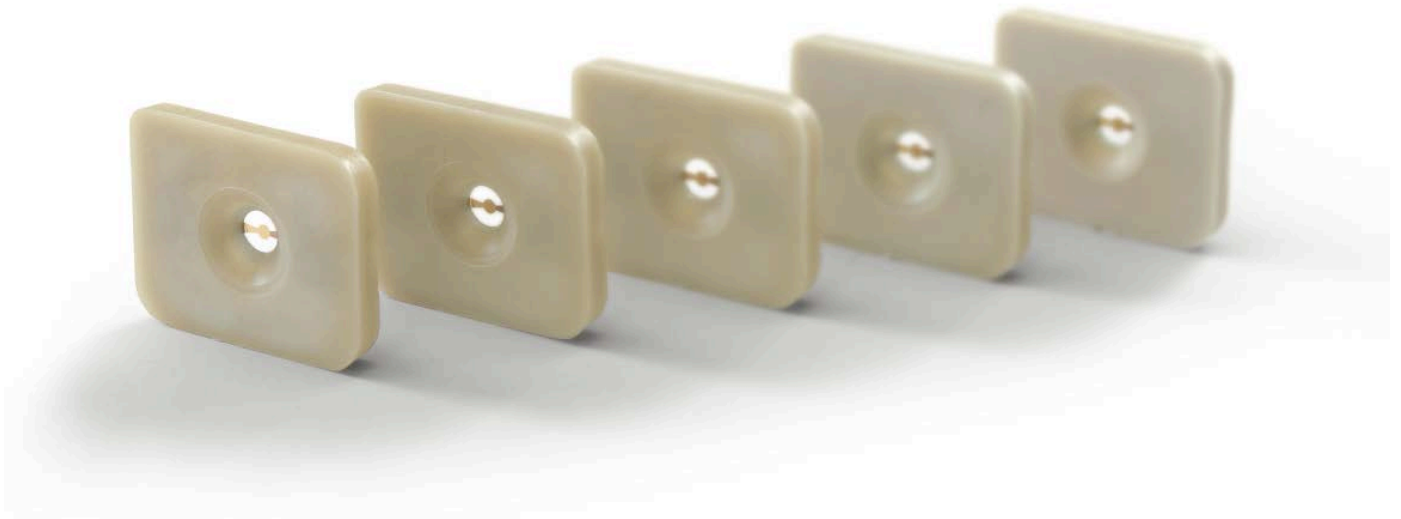
<b>Sensors:</b>	Cells available for: <ul style="list-style-type: none"> <li>• Classical QCM (14 mm, wrapped electrodes).</li> </ul>
<b>Assembly mechanism:</b>	Quick-Lock, our patented design that ensures rapid and straightforward handling and reproducible measurements. Window lid fixed by rotating a quarter of a turn.
<b>Type of measurements:</b>	For airtight operation, allows assembly inside glovebox.
<b>Materials:</b>	Cell base: Aluminum Cell cover: PEEK & Stainless steel O-ring: FFKM Window: Fused silica
<b>Volume:</b>	3 mL (max.)
<b>Dimensions:</b>	47(L) x 33 (W) x 44.5 (H) mm

# Immersion (Probe) Cell



## 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

- 
- Materials:**
- AT-cut quartz material
  - Other materials, such as Gallium Orthophosphate ( $\text{GaPO}_4$ ) or Langasite ( $\text{La}_3\text{Ga}_5\text{SiO}_{14}$ ) available upon request
- 

- Blank diameter:**
- 14 mm
  - 1 inch (25.4 mm)
- 

- Electrode layout:**
- Wrapped (contacts on one side)
  - Keyhole (contacts in both sides)
- 

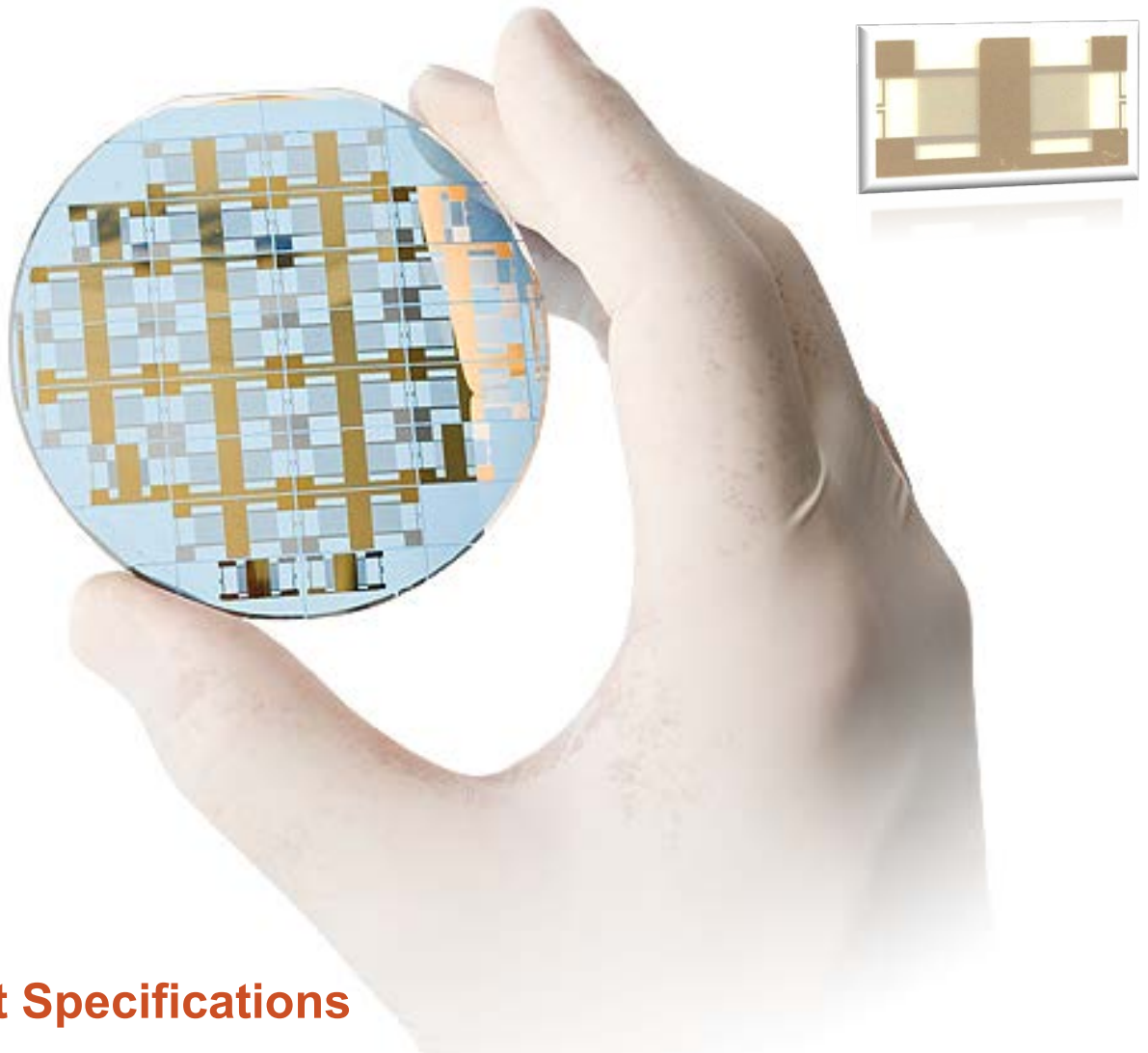
- Resonant frequency:**
- 5 MHz and 9 MHz (1 inch wrapped)
  - 5 MHz and 10 MHz (14 mm wrapped)
  - 9 MHz (14 mm keyhole)
- 

- Electrodes material:**
- Cr/Au and Ti/Au
  - $\text{SiO}_2$
  - Pt
  - C
  - Fe
- 

\*Contact us about the current availability of other metals and coatings

- 
- Surface finish:**
- Polished
  - Rough
-

# 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)



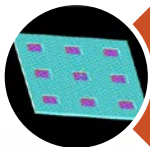
Integrated fluidics, electronics, and software



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



**Advanced Wave Sensors, S.L.**

<https://awsensors.com/>

[awsensors@awsensors.com](mailto:awsensors@awsensors.com)

+34 961 336 899

Parque Empresarial Táctica  
C/ Algepser, 24-1  
46988 Paterna (Valencia)  
Spain

