

## Tracking changes at the surface



# QSense modules product specifications

## Window Module QWM 401

The QSense window module is an optional flow cell compatible with both the Explorer and Analyzer systems. The window module allows optical access to the sensor surface enabling experiments with UV-induced reactions and combination with fluorescence detectors.

Additionally, the Explorer chamber's compact design enables microscopic analysis of the sensor surface as the unit will fit on most microscope stages.



Specifications: QWM 401	
Sensor crystals	Compatible with all QSense 14 mm sensor crystals
Internal volume	100 µl (above the sensor crystal)
Type of measurements	Flow or stagnant liquid measurements
Materials exposed to liquid	Viton (o-ring), titanium
Cleaning	All parts may be disassembled for separate cleaning
Working distance	3.3 mm
Bench to lens distance	35 mm
Glass	Sapphire
Clearing	All parts may be disassembled for separate cleaning
Dimensions	Height: 32 mm Width: 35 mm Depth: 63 mm

## Humidity Module QHM 401



The Humidity Module is an optional module compatible with both the QSense Explorer and Analyzer systems. The module has a GORE™ membrane that separates

a small air pocket above the sensor crystal from a flow system for liquid. By using different saturated salt solutions above the membrane, the relative humidity in the air above the sensor can rapidly be changed and controlled without using other equipment.

The technical design enables measurements of vapor uptake and release from thin films coated on the sensor. Measurements are conducted in two steps; first your film of interest is applied to the sensor by, for example, spin-coating. In the next step, the coated sensor is placed in the chamber and vapor uptake or release is measured. A typical application is to measure swelling of polymer or cellulose films.

Specifications: QHM 401	
Sensor crystals	Compatible with all QSense 14 mm sensor crystals
Internal volume	100 mm <sup>3</sup> between the crystal and the membrane Liquid flow system: 1 20 µl from inlet to outlet above membrane
Type of measurements	Vapor sorption / desorption
Materials exposed to liquid	Viton® (O-ring), titanium, membrane
Cleaning	All parts may be disassembled for separate cleaning
Dimensions	Height: 35 mm Width: 35 mm Depth: 63 mm

# QSense modules product specifications

## Open Module QOM 401

The open module is an optional module compatible with both the QSense Explorer and QSense Analyzer systems. It is designed to enable pipetting of sample directly to the sensor surface in order to minimize sample use.

One application example is the measurement of bulk viscosity which can be calculated directly in QSense analysis software by looking at the frequency and dissipation responses while going from air to liquid.

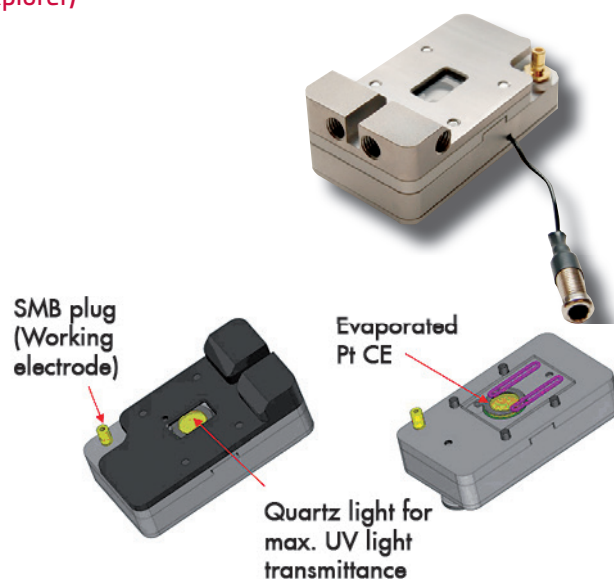
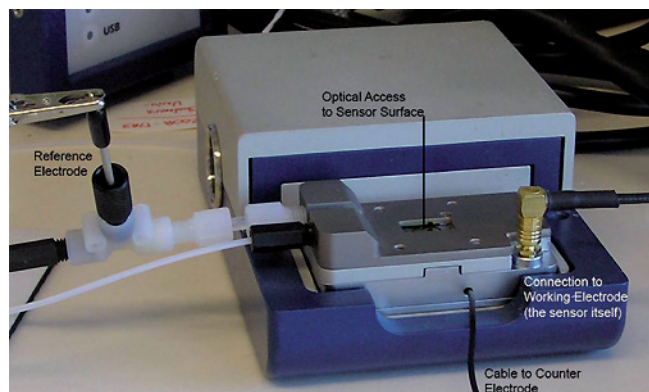
The open module comes with a lid to avoid evaporation of samples and to improve measurement stability.



Specifications: QOM 401	
Sensor crystals	Compatible with all QSense 14mm sensor crystals
Sample volume	Application dependant due to wetting of the surface, typical range is 10-50 $\mu$ l
Type of measurements	Stagnant liquid measurements
Materials exposed to liquid	Viton (o-ring), teflon
Cleaning	All parts may be disassembled for separate cleaning
Dimensions	Height: 34 mm Width: 35 mm Depth: 63 mm

## EQCM-D with optical access QWEM401 (placed in a QSense Explorer)

Construction based on QWM401 with a reference electrode placed in the outlet tubing  
Counter electrode: a sputtered ring of platinum on the glass window.



Specifications: QWEM 401	
Sensor crystals	Compatible with all QSense 14 mm sensor crystals
Internal volume	100 $\mu$ l (above the sensor crystal)
Type of measurements	Flow or stagnant liquid measurements
Materials exposed to liquid	Viton (O-ring), titanium
Cleaning	All parts may be disassembled for separate cleaning
Working distance	3.3 mm
Bench to objective distance	35 mm
Glass	Standard microscopy slides
Dimensions	Height: 32 mm Width: 35 mm Depth: 63 mm

# QSense modules product specifications

## QTM 401 PTFE Flow module

The PTFE Flow module is suitable for flow or stagnant measurements where the reagents or molecules are sensitive to interactions with Titanium. The PTFE Flow module is similar to the QSense Flow module QFM 401 but the Titanium flow part is here exchanged for PTFE (Teflon-like).



Specifications: QTM 401	
Sensors	Compatible with all QSense 14 mm sensors
Internal volume	100 $\mu$ l (above the sensor)
Type of measurements	Flow or stagnant liquid measurements**
Materials exposed to liquid	Viton (O-ring and sealing), teflon
Cleaning	All parts may be disassembled for separate cleaning
Dimensions	Height: 37 mm; Width: 35 mm; Depth: 63 mm
** Note that the flow part design of QTM 401 is different as compared to QFM 401.	

## Ellipsometry Module QELM 401

The QSense Ellipsometry module, QELM 401, enables simultaneous QCM-D and ellipsometric measurements on the same substrate.

### Please note the following:

**Dimensions:** The module, together with the Explorer chamber, has fixed dimensions and thus requires a specific amount of space on the ellipsometer stage. All dimensions are available in a separate PDF.

**Design:** QELM 401 has a fixed angle of incidence; 65 degrees. The hole for the laser beam from the ellipsometer to the sensor is 2.5 mm in diameter. Please note that the QELM 401 requires a pump with 3 or more channels since there are three outlets to get a good flow profile.



**Optical characterization of sensors:** Sensors supplied by QSense do not necessarily have the same optical response from sensor to sensor. Therefore, it is recommendable to individually measure the optical properties of each sensor. An example of characterization of QSX 301 (Gold) and QSX 335 ( $\text{SiO}_2$  with thicker opaque titanium layer) is available in a separate technical note.

Specifications: QELM 401	
Sensor crystals	QSX 301 (Gold) and QSX 335 ( $\text{SiO}_2$ with thick Ti adhesion layer). Other QSX sensors can be used but may be difficult to optically characterize
Internal volume	100 $\mu$ l (above the sensor crystal)
Type of measurements	Flow or stagnant liquid measurements
Pump requirement	3 or more channel pump, e.g. Ismatec IPC N4
Materials exposed to liquid	Viton® (O-rings), Teflon® and Titanium
Cleaning	All parts may be disassembled for separate cleaning
Angle of incidence	65 degrees
Glass	Diameter 5 mm, thickness 2 mm
Dimensions	Height: 44 mm Width: 53 mm Depth: 63 mm

# QSense modules product specifications

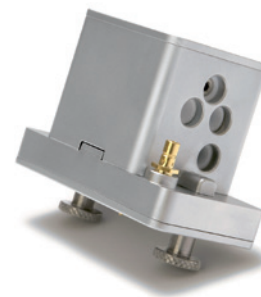
## Electrochemistry Module QEM 401

QSense Electrochemistry Module, QEM 401, allows for simultaneous QCM-D electrochemistry or QCM-D/EIS measurements. The design enables flow measurements, and withstand the harsh conditions necessary for some electrochemistry applications. Its compact design makes it possible to use up to four modules simultaneously on the QSense Analyzer system and the module also fits the QSense Explorer system.

The QCM-D sensor doubles as a working electrode for electrochemistry measurements. A platinum counter electrode above reduces the volume above the sensor to about 100  $\mu\text{l}$ .

A no-leak Ag/AgCl reference electrode is included in the outlet flow channel. Besides the electrodes, Viton® (o-rings) and Teflon® (flow channels inside the module) are the only additional materials exposed to liquid.

QEM 401 is delivered complete with all necessary accessories including cables, and fittings. The QEM 401 is compatible with most potentiostats.



Specifications: QEM 401	
Sensor crystals	Compatible with all QSense 14 mm sensor crystals
Internal volume	~100 $\mu\text{l}$ (above the sensor)
Type of measurements	For flow or stagnant liquid measurements
Materials exposed to liquid	Teflon®, Viton® (O-ring), electrodes
Cleaning	All parts may be disassembled for separate cleaning
Dimensions	Height: 46 mm Width: 35 mm Depth: 63 mm
Included Electrodes	
Working electrode	The sensor crystal itself
Counter electrode	Platinum plate
Reference electrode	WPI, Dri-REF™, customized length

## Flow Module QFM 401



This standard QSense flow module is included with the Explorer (one module) and Analyzer (four modules) instruments.

QSense flow modules are made of aluminum and titanium and the o-rings and sealing are viton. More chemically resistant materials are available upon request. Liquid samples only contact titanium and viton during experimentation.

Additionally, the flow modules can be completely disassembled, allowing thorough cleaning of the module components e.g. ultrasonic bath. Additional flow modules are available to reduce the risk of contamination in a multi-user environment and to thus improve reproducibility and reliability.

Specifications: QFM 401	
Sensor crystals	Compatible with all QSense 14mm sensor crystals
Internal volume	Total ~140 $\mu\text{l}$ , Flow channel ~100 $\mu\text{l}$ , above sensor crystal ~40 $\mu\text{l}$
Type of measurements	Flow or stagnant liquid measurements
Materials exposed to liquid	Viton (o-ring and sealing), titanium
Cleaning	All parts may be disassembled for separate cleaning
Dimensions	Height: 37 mm Width: 35 mm Depth: 63 mm



# QSense modules product specifications

## QHTC 101 High Temperature Chamber



QHTC 101, allows for measurements to be performed at an extended temperature interval. This stand alone chamber is compatible with the QSense E-series and includes a Flow Module 401. It allows for measurements both under flow and stagnant conditions. In room temperature (RT),

the working temperature of the chamber is  $RT + 60\text{ }^{\circ}\text{C}$  (i.e. at a RT of  $20\text{ }^{\circ}\text{C}$  it is possible to reach  $80\text{ }^{\circ}\text{C}$ ). By placing the chamber on an external cooling device or a laboratory hot plate, working temperatures between  $4$  and  $150\text{ }^{\circ}\text{C}$  can be used.

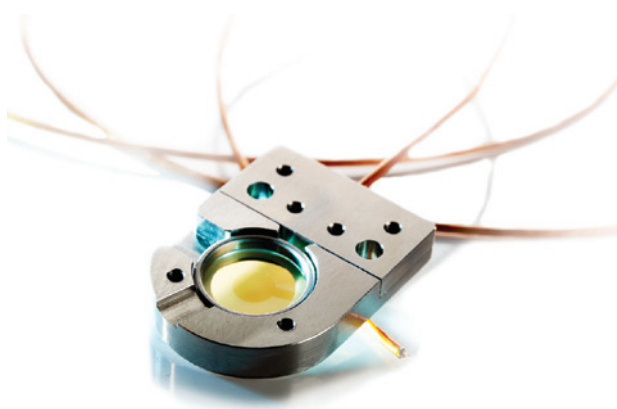
### Please note

In high temperature measurements in general the frequency (and to some extent the Dissipation) varies more at higher temperatures than at RT. Additionally, heating of the sample inside the chamber increases the risk of gas development which may influence the reproducibility of the results. Hence, pre-heating of samples as well as degassing, if applicable, is desired.

Specifications: QHTC 101	
Temperature range	Ambient + $60\text{ }^{\circ}\text{C}$ , i.e. $80\text{ }^{\circ}\text{C}$ in normal RT.
Temperature range with cooling device/ laboratory hot plate	$4 - 150\text{ }^{\circ}\text{C}$
Materials exposed to liquid	Viton (o-ring and gasket), titanium
Dimensions	Height: $80\text{ mm}$ ; Width: $90\text{ mm}$ ; Depth: $110\text{ mm}$ ; Weight: $2\text{ kg}$
Includes	QFM 401 (see separate product sheet)

## QVH 401 High Vacuum Holder

The QSense Vacuum holder is designed to enable QCM-D measurements in a vacuum chamber. The holder is open on both sides of the sensor to prevent uneven pressure changes. Cables are provided to connect the Vacuum holder to the vacuum chamber both inside the chamber and to connect the vacuum chamber to the QCM-D electronics unit.



Specifications: QVH 401	
Sensors	Compatible with all QSense $14\text{ mm}$ sensors
Type of measurements	Gas measurements in vacuum and high pressure chambers
Materials exposed to gas	Stainless steel, macor, aluminum, kapton
Maximum temperature	$250\text{ }^{\circ}\text{C}$
Dimensions	Height: $5\text{ mm}$ ; Width: $24\text{ mm}$ ; Depth: $32\text{ mm}$
Other	Customer installation / adaption required

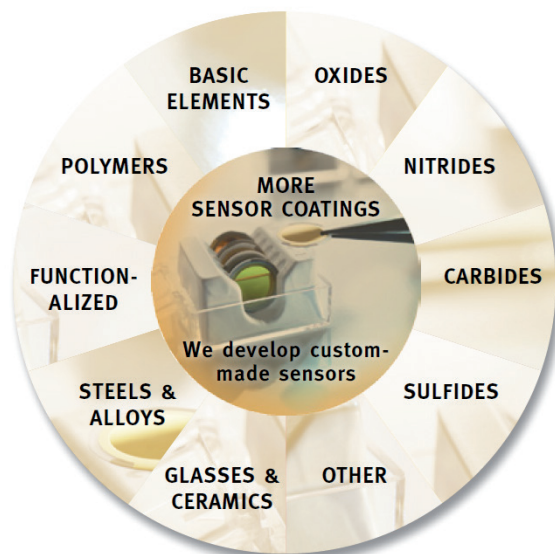
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## Standard selection of sensors

In principle, sensors can be coated with any material that can be applied as a thin homogeneous film. We strive to meet customer specific needs both by offering a wide standard selection and by developing custom-made sensors.



Sensors	
Basic elements	Aluminum, Cobalt, Chromium, Copper, Gold, Iridium, Magnesium, Molybdenum, Nickel, Palladium, Platina, Silica, Silver, Tantalum, Titanium, Tungsten, Zirconium
Oxides	Silicon dioxide, rough Silicon dioxide, Aluminium oxide, Iron oxides, Zirconium oxide, Zinc oxide, Silver oxide, Magnesium oxide, Titanium dioxide, Indium-tin oxide
Nitrides	Tantalum nitride, Silicon nitride, Titanium nitride
Carbides	Iron carbide, Silicon oxycarbide, Silicon carbide
Sulfides	Copper sulfide, Iron sulfide, Nickel sulfide, Zinc sulfide
Polymers	Polystyrene, Amorphous Fluoropolymer 1600 (Teflon® like), Nylon, Polyethyleneterephthalate, Polyurethane, Polymethylmetacrylate, Polyvinylidenedifluoride, Polyiminoethylene
Functionalized	Biotin, His-tag capturing, Amine coupling
Glasses	Borosilicate, Soda-lime, Lead
Steels & Alloys	SS2343, L605 Steel, SS2348, Cobalt-chromium-tungsten-nickel-manganese alloy, Nickel-chromium alloy
Other	Hydroxyapatite, Au with Ti-adhesion, Cellulose, Aluminum silicate, Barium titanate, Calcium phosphate, Aluminum silicate, rough Gold, Calcium carbonate

Sensor specifications	
Frequency	4.95 MHz ±50 kHz
Cut	AT
Electrode layer	40 nm – 1 µm
Size	Diameter: 14 mm, Thickness: 0.3 mm
Finish	Optically polished, surface roughness of electrode less than 3 nm (RMS)

Standardized soils (Note: deposited on SiO <sub>2</sub> . Limited shelf life.)	
QS-QSX342	Standardized used cooking oil
QS-QSX343	Mixed starch, coloured (CFT DM 77)
QS-QSX344	Egg Yolk, double (CFT DM 22)
QS-QSX345	Coffee with milk (CFT DM 83)