Product Information

TRACKING CHANGES AT THE SURFACE:

Q-Sense Modules & Sensors

qsense®

Q-Sense Flow module 401

This standard Q-Sense Flow module is included with the E1 (one module) and E4 (four modules) instruments. Q-Sense 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. in ultrasonic bath. Additional flow modules are available to reduce the risk of contamination in a multi-user environment and thus to improve reproducibility and reliability.

SPECIFICATIONS: QFM 401	
Sensors	Compatible with all Q-Sense 14 mm sensors
Internal volume	Total ~140 µl Flow channel ~100 µl, above sensor crystal ~40 µl
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

Q-Sense PTFE Flow module 401

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 Q-Sense Flow module QFM 401 but the Titanium flow part is here exchanged for PTFE (Teflon-like).

SPECIFICATIONS: QTM 401	
Sensors	Compatible with all Q-Sense 14 mm sensors
Internal volume	100 µl (above the sensor)
Type of measurements	Flow or stagnant liquid measurements*
Materials exposed to liquid	Viton (O-ring), 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 in QTM 401 is different as compared to QFM 401

Q-Sense Open module 401

The Open module is an optional module compatible with both the Q-Sense E1 and E4 systems. It is designed to enable pipetting of sample directly to the sensor surface in order to minimize sample usage. One application example is the measurement of bulk viscocity which can be calculated directly in Q-Sense 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	
Sensors	Compatible with all Q-Sense 14 mm sensors
Sample volume	Application dependant due to wetting of the surface, typical range is 10-50 µl
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

Please note: The open module does not have temperature stabilization of the sample before it reaches the sensor. This means that f and D will need time (how long depends on the temperature difference between the chamber and the sample) to stabilize after injection of sample.

Q-Sense Humidity module 401

The humidity module is compatible with the Q-Sense E-series. The sensor surface is separated from the liquid flow by a special GORE-membrane*. Saturated salt solutions, which give rise to a specific relative humidity, can then flow through the cell. The humidity above the crystal equilibrates almost instantly, providing the possibility of real time measurements.

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.

* GORE is a trademark of W.L. Gore & Associates

SPECIFICATIONS: QHM 401	
Sensors	Compatible with all Q-Sense 14 mm sensors
Internal volume	100 µl between the crystal and the membrane, 120 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

Q-Sense combination enabling modules

There is often a great scientific value in using different measurement techniques. The quality of data as well as time efficency is often improved by simulataneous and complementary measurements. Therefore Q-Sense offers a selection of modules that enable such combinational setups.

Q-Sense Electrochemistry module 101

Q-Sense 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 Q-Sense E4 system and the module also fits the Q-Sense E1 system. The QCM-D sensor doubles as a working electrode for electrochemistry measurements. A platinum counter-electrode also acting as top wall of the chamber reduces the volume above the sensor to about 100 µl. A 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. Please contact your local sales representative for more information about compatibility and electrochemical application possibilities.

SPECIFICATIONS: QEM 401	
Sensors	Compatible with all Q-Sense 14 mm sensor crystals
Internal volume	~100 µl (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 itself
Counter electrode	Platinum plate
Reference electrode	WPI, Dri-REF™, customized length

Q-Sense Window module 401

The Q-Sense Window Module is an optional flow cell compatible with both the E1 and E4 systems. The Window Module allows optical access to the sensor surface enabling experiments with UV-induced reactions and combination with fluorescence detectors. Additionally, the E1 chamber's compact design enables microscopic analysis of the sensor surface as the unit will fit on most microscope stages.

SPECIFICATIONS: QWM 401	
Sensors	Compatible with all Q-Sense 14 mm sensors
Internal volume	100 µl (above the sensor)
Type of measurements	Flow or stagnant liquid measurements
Materials exposed to liquid	Viton (o-ring), titanium
Working distance	3.3 mm
Bench to objective distance	35 mm
Glass	Sapphire
Cleaning	All parts may be disassembled for separate cleaning
Dimensions	Height: 32 mm; Width: 35 mm; Depth: 63 mm

Q-Sense Ellipsometry module 401

The Q-Sense 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 E1 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 Q-Sense 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 (SiO_2 with thicker opaque titanium layer) is available in a separate technical note.

SPECIFICATIONS: QELM 401	
Sensors	QSX 301 (gold) and QSX 335 (SiO2 with thick titanium adhesion layer). Others QSX sensors can be used but may be difficult to optically characterize.
Internal volume	100 µl (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
Dimensions in E1 chamber	See separate PDF or contact us

Q-Sense High Temperature Chamber 101

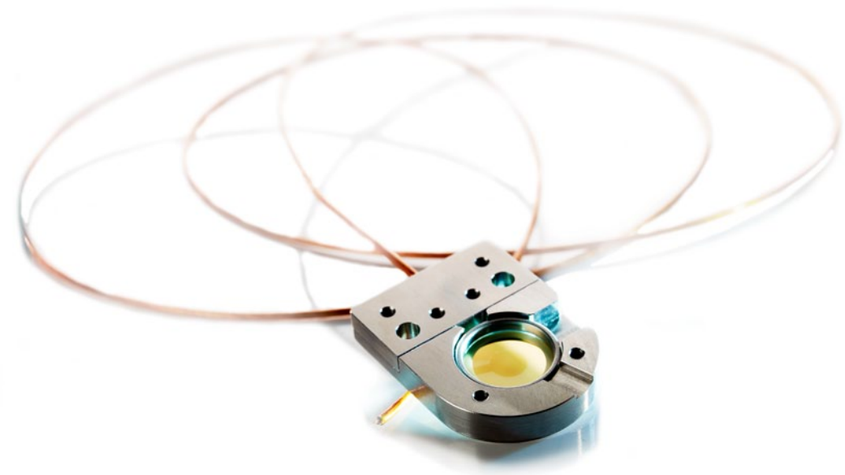
QHTC 101, allows for measurements to be performed at an extended temperature interval. This stand alone chamber is compatible with the Q-Sense E-series and includes a Flow Module 401. It allows for measurements both under flow and stagnant conditions. In room temperature (RT), the working temperature of the chamber is RT +60 °C (i.e. at a RT of 20 °C it is possible to reach 80 °C). By placing the chamber on an external cooling device or a laboratory hot plate, working temperatures between 4 and 150 °C can be used.

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

Complementary Products: Q-Sense offers a laboratory hot plate from Stuart Scientific, model SD300, ESA 011, which is compatible with the QHTC 101. Additionally, Q-Sense offers a sample heater from Grant, ESA 003.

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.

Q-SENSE COMBINATION ENABLING MODULES



Q-Sense Vacuum Holder 401

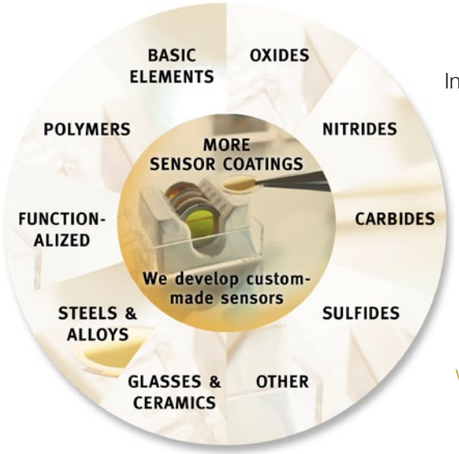
The Q-Sense Vacuum holder is designed to enable QCM-D measurements in a vacuum chamber. The holder is open on both sides of the sensor to prevent uneven pressure changes. Cables are provided to connect the Vaccum holder to the vacuum chamber both inside the chamber and to connect the vacuum chamber to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

SPECIFICATIONS: QVH 401	
Sensors	Compatible with all Q-Sense 14 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 °C
Dimensions	Height: 5 mm; Width: 24 mm; Depth: 32 mm
Other	Customer installation / adaption required

Quality Sensors

Q-Sense takes pride in the extensive range of high quality sensors developed and produced in our world class in-house facilities. All sensors are quality tested and come with a specification to ensure reliability. Q-Sense Sensors are quality guaranteed for QCM-D studies and referred to in many publications.

Our 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. You can easily request a quote for sensors at:
www.q-sense.com/order-sensors

Q-SENSE SENSORS

Basic elements	Aluminum, Cobolt, Chromium, Copper, Gold, Iron, Iridium, Magnesium, Molybdenum, Nickel, Palladium, Platina, Silica, Silver, Tantalum, Titanium, Tungsten, Zirconium
Oxides	Silicon dioxide, rough Silicon dioxide, Aluminium oxide, Iron oxides, Zirconium oxide, Cerium 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 Flouropolymer 1600 (Teflon® like), Nylon, Polyethyleneterephtalate, Polyethylene, Polyurethane, Polymethylmetacrylate, Polyvinylidenediflouride, Polyiminoethylene
Functionalized	Biotin, His-tag Capturing
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

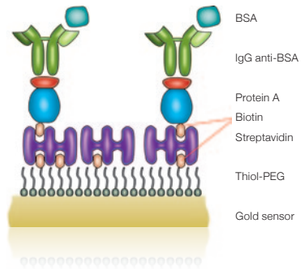
Please note: We regularly add new coatings so to get the latest news on sensor development, contact your representative.

SENSOR SPECIFICATIONS

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

Q-Sense Biotin Functionalized Sensor

Label-free measurement of biomolecular interactions can be conveniently performed by immobilizing one of the interacting species onto the surface of a sensor. Q-Sense Biotin Functionalized Sensor, QSX 339, enables immobilization via the commonly used high affinity interaction between Biotin and Streptavidin.

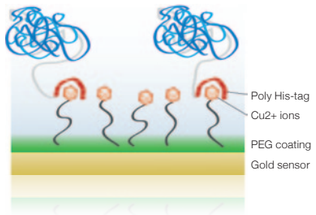


The affinity between Biotin and Streptavidin is the highest of any known biological ligand pair, Ka=2.3x10^{13} M^{-1}.

Q-Sense His-tag Capturing Sensor

Q-Sense His-tag Capturing Sensor, QSX 340, enables immobilization of His-tagged recombinant proteins. The His-residues display a high-affinity for the Cu^{2+} ions on the sensor surface.

- His-tagged molecule of interest
- Maximum access to protein interaction site by controlled steric orientation
- Surface regeneration possible
- Usage include antibody optimization, protein-protein interactions and probing of conformational changes



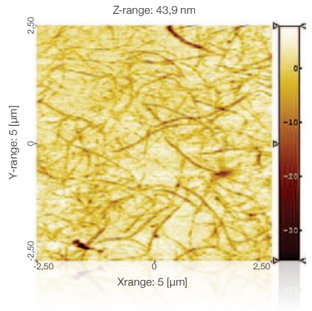
The QSX 340 consists of chelated Cu^{2+} ions coupled to a passivating PEG background coating. Areas of use include antibody optimization, protein-protein interactions and probing of conformational changes.

Q-Sense Cellulose Coated Sensor

Q-Sense Sensor QSX 334 is a representative model surface of native cellulosic fibers, thanks to the native type of cellulose used during coating.

CELLULOSE SPECIFICATIONS	
Cellulose type	Microfibrillated cellulose [1, 2]
Crystallinity	Crystalline cellulose I and amorphous regions
Fibril diameter	5-6 nm
Fibril aggregates	Some aggregates of 10-20 nm
Fibril length	Up to several µm

[1] Pääkkö et al. (2007) Biomacromolecules, 8, 1934-1941
[2] Also referred to as nanofibrillar cellulose in literature



AFM image of Q-Sense Cellulose Sensor

Can my surface of interest be custom-made?

The number of applications for QCM-D is constantly growing and so is the need for new and high quality sensor coatings suitable for these applications.

To meet the demand Q-Sense has in-house development of sensors as well as collaborations with universities and companies to explore new applications.

Your inquieries to explore new possibilites for sensor coatings are of great interest to us. Please contact us at *info@biolinscientific.com* or contact your local office to learn more.

qsense®

Q-Sense is a pioneer in Quartz Crystal Microbalance with Dissipation, QCM-D, technology. Founded in 1996 by world recognized researchers at Chalmers University of Technology in Sweden, Q-Sense is now part of Biolin Scientific. We continue developing QCM-D to explore new possibilities and improve the technique. Q-Sense works closely with leading scientists at universities throughout the world to ensure that QCM-D is at the forefront of development.

www.q-sense.com

Please note that specifications in this brochure may be subject to change without notice.