Application Note

Performing a measurement on the qCell T

The following protocol will describe setting up the qCell T, performing measurements, save and display data. Please refer also to the printed qCell T User's Manual or the online version which can be found under "Help" of the qGraph software, by selecting "Manual Device".

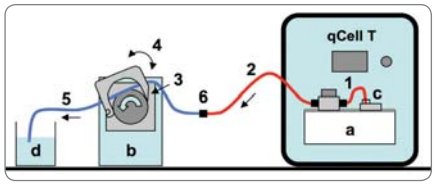
1 Unpack the qCell T, peristaltic pump and accessories.

2 Use the enclosed "RS232" cable and connect "RS232" port on qCell T with "RS232 IN" port on the peristaltic pump.

3 Connect the enclosed Ethernet cable from the "LAN" port on the qCell T to the Ethernet port of the computer.

4 Plug power cable into the socket labeled with "Power".

5 Arrange the qCell T (a), the peristaltic pump (b), sample (c) and waste compartments (d) as shown in the figure below (note: The peristaltic pump is a REGLO Digital 4 channel ISM597D).



6 Attach the PTFE tubings to the flow cell. Hold the flow cell with its lug pointing towards you. The short tubing (1) is fitted on the right hand side, the longer tubing (2) on the left. Caution! Attach the tubing only hand-tight! If the tubes are attached too firmly, the inside of the flow cell will be damaged.

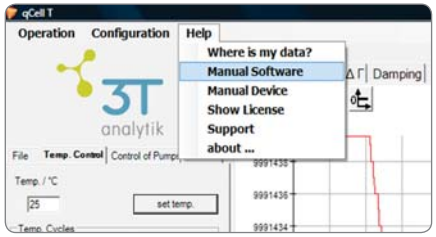
7 **Setting up the peristaltic pump:** Remove the cassette by slightly pressing the fixing-tongue (3) and lifting it simultaneously (4). Insert the white-black/white-black color coded tubing (5) into the cassette (for more details, see inclosed manual of pump). Reinsert the cassette into the roller-head, choose position two or three. Slip the screw connector (barbed adapter, 6) onto the right end of the Tygon tubing of the pump and tighten the connector with the counter connector of the Teflon tube coming from the QCM flow cell. The pump is now installed for drawing the liquid/analyte from the flow cell to the waste container.

Important: On the peristaltic pump, make sure the correct tubing size is selected. For this purpose, switch the pump off and wait for 5 seconds. Keep the settings key pressed and switch the pump on. Then select the basic settings by using the ▼/▲ keys. Scroll down and select "Tube" (inner diameter). Set the value to 1.02. Select "OK" and switch off the peristaltic pump.

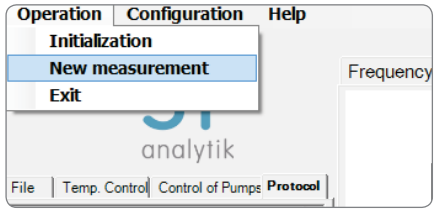
8 On the qCell T, unscrew the static temperature conditioning unit (static TCU) placed on the right to the flow cell and fill the integrated water bath with approx. 30 ml of deionized water adjusting the filling level between the "min." and "max." indicators. Reassemble the static TCU by tightening the screws only hand-tight.

9 Switch on the peristaltic pump and the qCell T (note: the qCell T is powered on by pressing the round Easy Control Button (ECB) below the 3T logo for at least two seconds).

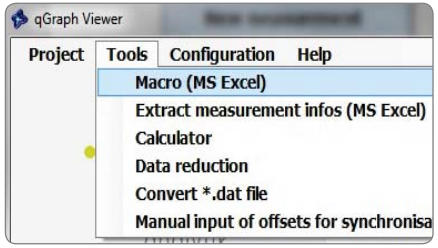
10 To install the qGraph qCell T software and the qGraph Viewer, insert the software CD and follow the instructions. Start the installed qGraph qCell T software on the computer; a comprehensive description of its functions can be found under "Help", by selecting "Manual Software" *(see below)*.



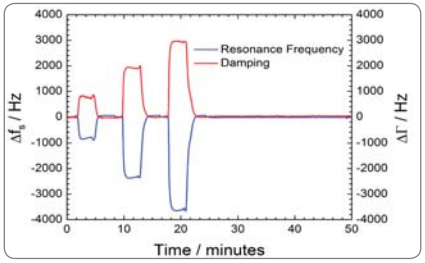
17 **New measurement.** The command "Operation" followed by "New measurement" instantaneously clears the display and generates a new data file in the directory. The previous measurement data are automatically saved. When exiting the program, a backup copy of the data files is written into the user's data directory of the system.



18 **Displaying the data.** For redisplaying data, the qGraph Viewer software is used. It offers functions for data processing such as offset subtraction and processing of multiple data sets. If MS Excel™ is available, the qGraph Viewer facilitates the export of data by selecting "Macro (MS Excel)" from the "Edit" menu as shown below.



The example below shows frequency (blue, left y-axis) and damping (red, right y-axis) of three different water-glycerol mixtures.



19 **Shutting down the instrument.**

- Flush the flow cell with deionized water prior to shut down.
- Exit/shut down the qGraph software (note: Any remaining data will be saved automatically). This step releases the pump and qCell T from the software control and enables their individual operation menus.
- Empty the flow cell by manually pumping air. Open the flow cell and collect the sensor. Dry the flow cell with clean nitrogen gas. Insert first the enclosed cleaning chip and the flow cell head without turn.
- On the peristaltic pump, unbuckle the cassette with the Tygon tubing in order to prevent the tubing from excessive denting when being clamped prolonged times on the roller.
- Power down the peristaltic pump.
- Power down the qCell T: In the "Main Menu" on the display of the instrument, dial the ECB to the left and highlight the command "Standby" at the bottom of the menu. Pressing the ECB powers down the instrument but still keeps the oscillation electronics on standby and ready for measurement. By highlighting the command "Power down" and pressing the ECB all electronic units are shut down. In this case, after turning on the instrument, user should wait 2 hours before measurements.

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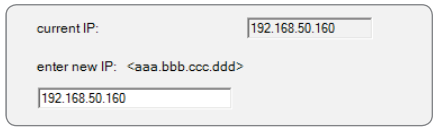
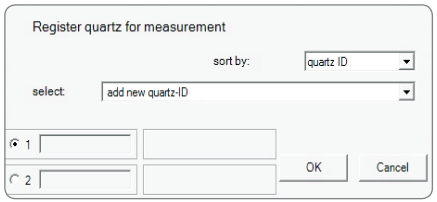
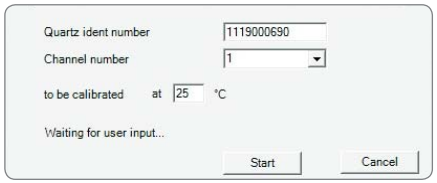
11 The computer communicates with the qCell T via Ethernet link. The IP address can be selected/changed directly on the qCell T's "Main Menu" under "Settings" via the ECB. The identical IP address value must be written into the qGraph software under "Configuration" and "Change Interface" *(see below)*. **Note:** This communication architecture has the advantage that the qCell T can be operated remotely via network connection. Please refer to the software and instrument manual for more details.



12 Open up the flow cell with a quarter turn to the left and store the flow cell head in the provided flow cell support. On the software, select "add new quartz ID" and click OK. User can also select registered quartz ID from the dropdown menu.

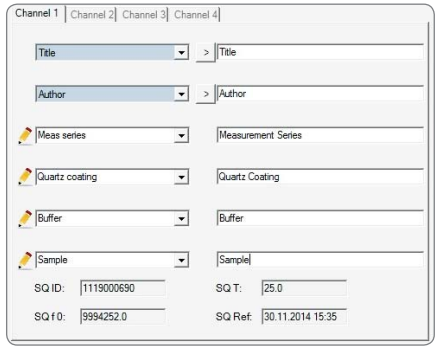


Unpack a sensor sheet from the plastic container using the enclosed tweezers. Enter the sensor ID number which is on the top of the chip as well as the measurement temperature into software. This process is to reference each sensor in air as a initial "Zero" state. Once registered, user will be able to track frequency and damping changes made by either real-time measurement or external sensor surface modification.

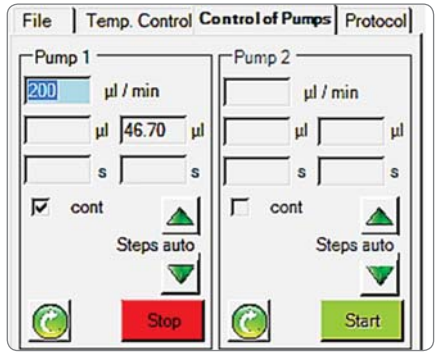


After entering the ID number and temperature, put the sensor flat into the open trench base and replace the flow cell head. Lock the flow cell with a quarter turn to the right. Click "Start" in the software.

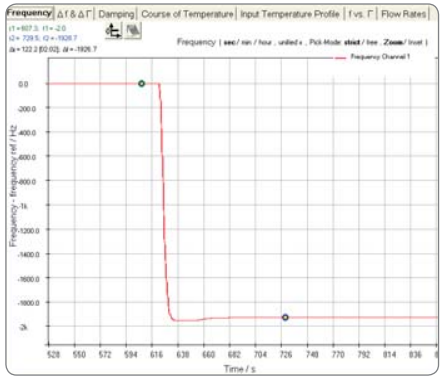
13 After the referencing process is complete. It's required to enter measurement information including Title and Author. User can enter further items like Measurement Series, Quartz Coatng, Buffer, etc. or editing the item to keep good recording of experiment. The window will appear again at the end of measurement for further revise.



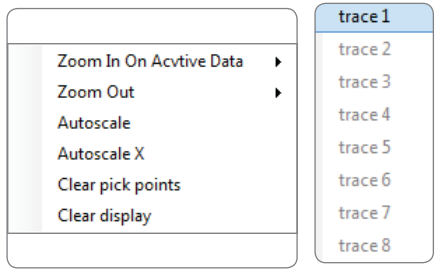
14 **Priming the flow cell.** The peristaltic pump can be directly controlled with the qGraph software. First, fill an enclosed rolled rim glass vial with deionized water and place it in to the position in the static TCU. On the "Control of Pumps" tab, type a flow rate of e.g. 200 µl/min. Select the "cont" check mark for continuous flow and click "Start".



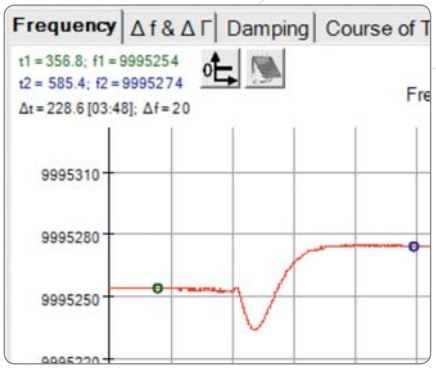
The liquid will now be drawn from the glass vial to the flow cell and ultimately into the waste container. The delivered liquid volume is added and displayed in real time. When the liquid enters into the flow cell, the propagating film is visible through the transparent window. The flow of the liquid can be followed via the moving meniscus. At the same time, a characteristic drop of the frequency of occurs, *see below*



15 **Graphic display of data.** Right clicking into the window of the real time frequency graph displays several options to "zoom in & out of active data", "autoscale" and "clear display".



Graphic areas of interest can be better visualized by dragging a window over selected data portion. A pick point function is activated by single clicking on the graph. By double clicking at another selected position the absolute difference in y-axis, e.g. frequency, and x-axis, e.g. time, is displayed near the upper left corner of the graph *(see below)*. The graph can be extended respectively compressed by moving the cursor near the x- or y-axis scale and clicking on the appearing blue arrows in either direction.



16 **Managing data files.** As soon as the software is started, all corresponding traces (frequency, damping/dissipation, temperature and flow rates) will be automatically saved to a data file and all protocol items will also automatically be saved in a separate ASCII file in the same folder. File name and path are visible throughout the ongoing experiment at the bottom of the active qGraph window. A blinking green dot (lower left corner) confirms that the data acquisition is active and the data is being saved. The file size increases steadily throughout the experiment and can be monitored. When clicking this area, MS Windows Explorer pops up and displays the folder in which the data file is being saved.

Alternatively, the (same) path & file name can be directly accessed by selecting "Help", then "Where is my data?". The command immediately opens MS Windows Explorer displaying the active directory with corresponding .dat and .bak file.