QCM OPEN

THE NEXT GENERATION OF OPEN SOURCE QUARTZ CRYSTAL MICROBALANCE

SOFTWARE USER GUIDE

openQCM devices are released as scientific open hardware instruments, and they are intended solely for use for SCIENTIFIC, RESEARCH and DEVELOPMENT APPLICATION, DEMONSTRATION, OR EVALUATION PURPOSES and are not considered to be finished end- products fit for general consumer use.

openQCM by Novaetech Srl
Piazza Bartolo Longo, 28
80045 Pompei (NA)
Italy
https://openqcm.com

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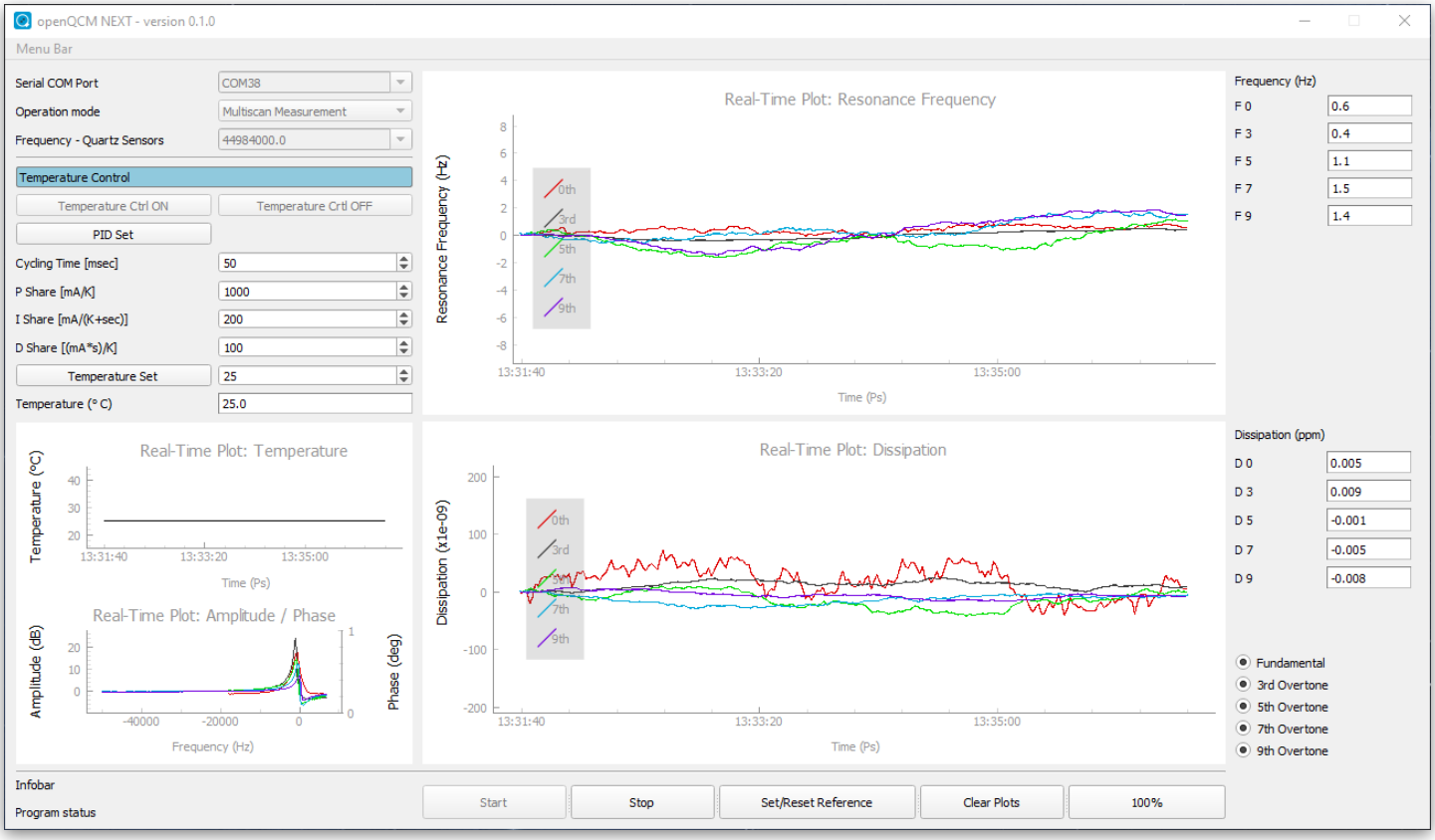
openQCM NEXT Software Application

The openQCM Next software user interface able to exploit all the functionalities of the device. Developed in Python programming language to ensure open source approach in scientific application

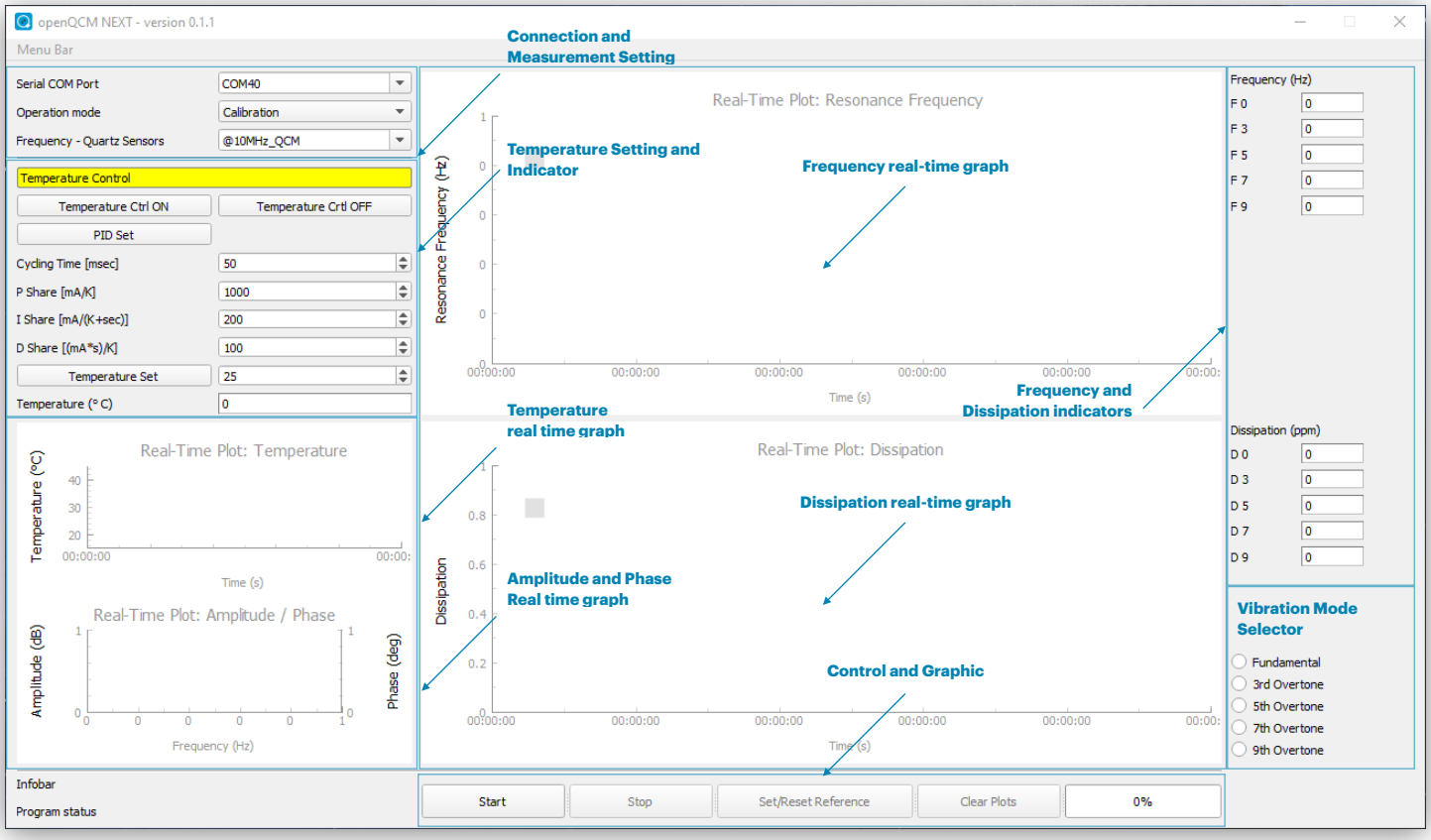


openQCM NEXT python software application version 0.1.1

The opeQCM NEXT software application is developed in Python programming language, which is open source, object - oriented and suited for scientific application. Python makes the software program easy to modify and develop for custom application.

The new opeQCM NEXT software is able to exploit all the main functionalities of the device. Real time monitoring of frequency and dissipation on the fundamental mode and overtone harmonics. It is possible to acquire almost simultaneously 5 sweep signals and elaborate the frequency and dissipation measurement in roughly 700 msec. In addition, the application allows to control and monitor the sensor module temperature in real time.

Software Graphic User Interface: General Description



openQCM NEXT software user interface general description

Connection and Measurement Setting

Serial COM Port	Drop-down menu for selecting the COM port connected to the openQCM Next device
Operation Mode	Calibration: record the quartz resonator calibration signal for resonance peak detection
	Single Measurement: real time monitoring of frequency and dissipation on a single frequency of the quartz resonator spectrum
	Multiscan Measurement: real time monitoring of frequency and dissipation on fundamental and overtone harmonics of the quartz resonator
Frequency / Quartz Resonators	Calibration operation mode: Select 10 MHz or 5 MHz quartz resonator fundamental frequency
	Single Measurement mode: Select the quartz resonator frequency to monitor

Temperature setting and indicator

Temperature Ctrl ON	Enable the temperature control (Note: the temperature control can be switched on only before start the measurement session)
Temperature Ctrl OFF	Disable the temperature control (Note: each time measurement session is stopped, the temperature control is switched off by default)
PID Set	Press the button to change the PID parameters of the TEC control
P Share	Proportional parameter. Default value 1000 mA/K Range: (0 to 100000 mA/K)
I Share	Intergral parameter. Default value 200 mA/(K*sec) Range: (0 to 100000 mA/(K+sec))
D Share	Proportional parameter. Default value 100 (mA*s)/K Range: (0 to 100000 (mA*s)/K)
Temperature Set	Press the button to change in real time the set temperature Default value 25° C Temperature Range: (5 to 45° C)
Temperature (°C)	Current value of the temperatrure

Temperature Real Time Graph

Real Time Plot: Temperature	Real time plot of temperature data measured in °C

Amplitude and Phase Real Time Graph

Real Time Plot: Amplitude / Phase	Calibration: plot of amplitude and phase signals over all frequencies ranging from 1 MHz to 51 MHz
	Single Measurement: plot of amplitude and phase signals around the selected single resonance frequency (fundamental or harmonic overtones)
	Multiscan Measurement: plot of amplitude of all resonance frequencies detected, fundamental and harmonic overtones

Frequency and Dissipation real time plot

Real-Time Plot: Resonance Frequency Real-Time Plot: Dissipation	Single Measurement: real-time plot of frequency and dissipation of selected single vibration mode (fundamental or harmonic overtones)
	Multiscan Measurement: real-time plot of frequency and dissipation for al vibration modes detected, fundamental and harmonic overtones

Control and graphic buttons

Start	Start a session of measurement, applies for each operation modes
Stop	Stop a session of measurement, applies for single and multiscan operation modes
Set/Reset Reference	Press the button to set the current value of frequency and dissipation as the reference value to measure variations, applies for single and multiscan operation modes
Clear Plots	Clear the history of each real time graph
Progress bar	Calibration: indicator showing the progress of the frequency scan over all frequencies ranging from 1 MHz to 51 MHz
	Single and Multiscan Measurement: indicator showing the accumulation of initial raw data before frequency and dissipation data processing

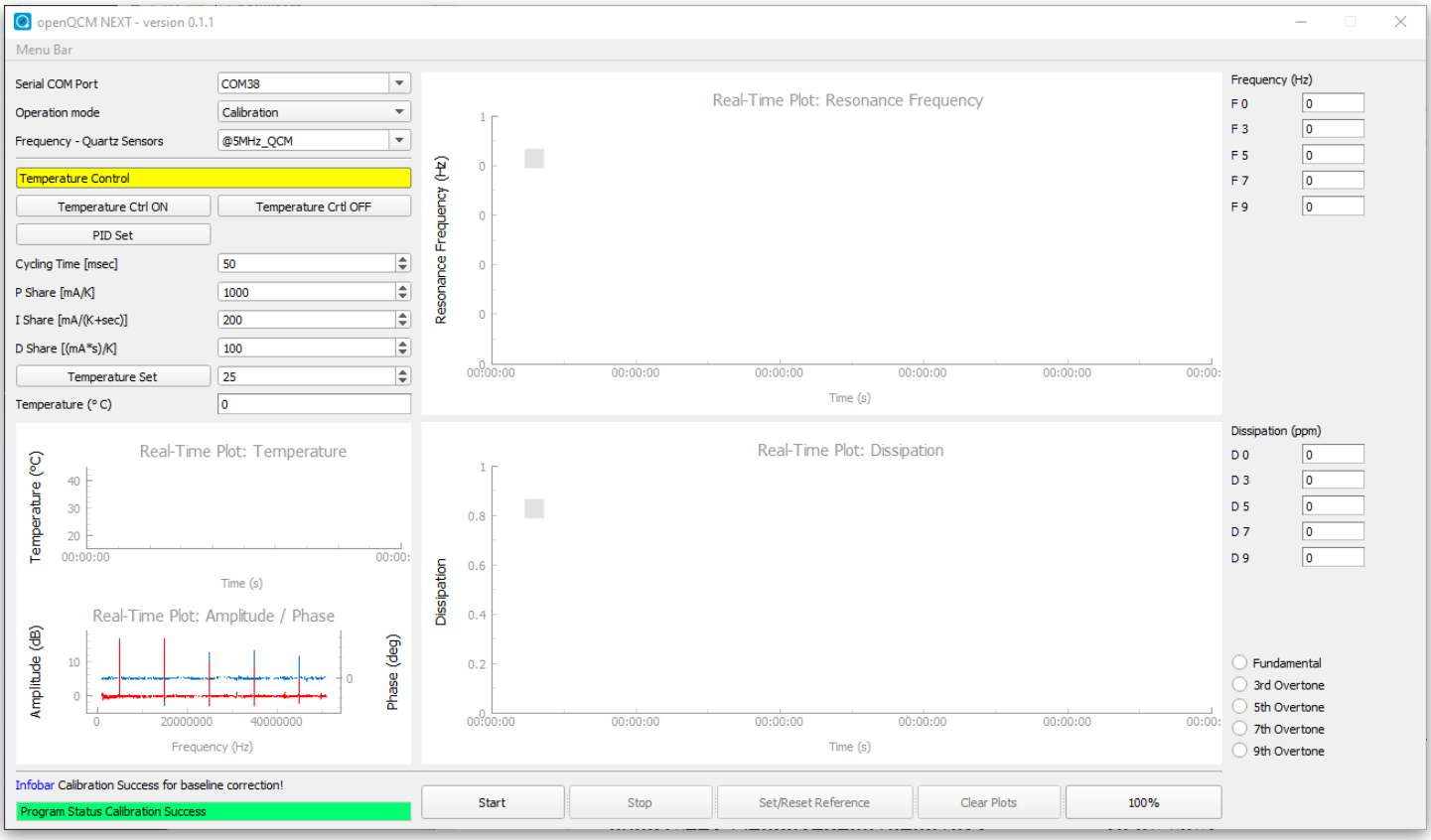
Frequency and Dissipation Indicator

Frequency and Dissipation Indicator	Single Measurement: real time indicator of current value of frequency (Hz) and dissipation (ppm) of selected single vibration mode (fundamental or harmonic overtones)
	Multiscan Measurement: real time indicator of current values of frequency (Hz) and dissipation (ppm) for all vibration modes detected, fundamental and harmonic overtones

Vibration Mode Selector

Fundamental and harmonic overtones	Multiscan Measurement: select radio buttons for showing frequency, dissipation and amplitude real time plot of the corresponding mode of vibration

Calibration Mode of Measurement



Calibration measurement of a 5 MHz quartz resonator in contact with air. The Amplitude real time graph shows the detection of the resonance frequencies up to the 9th overtone

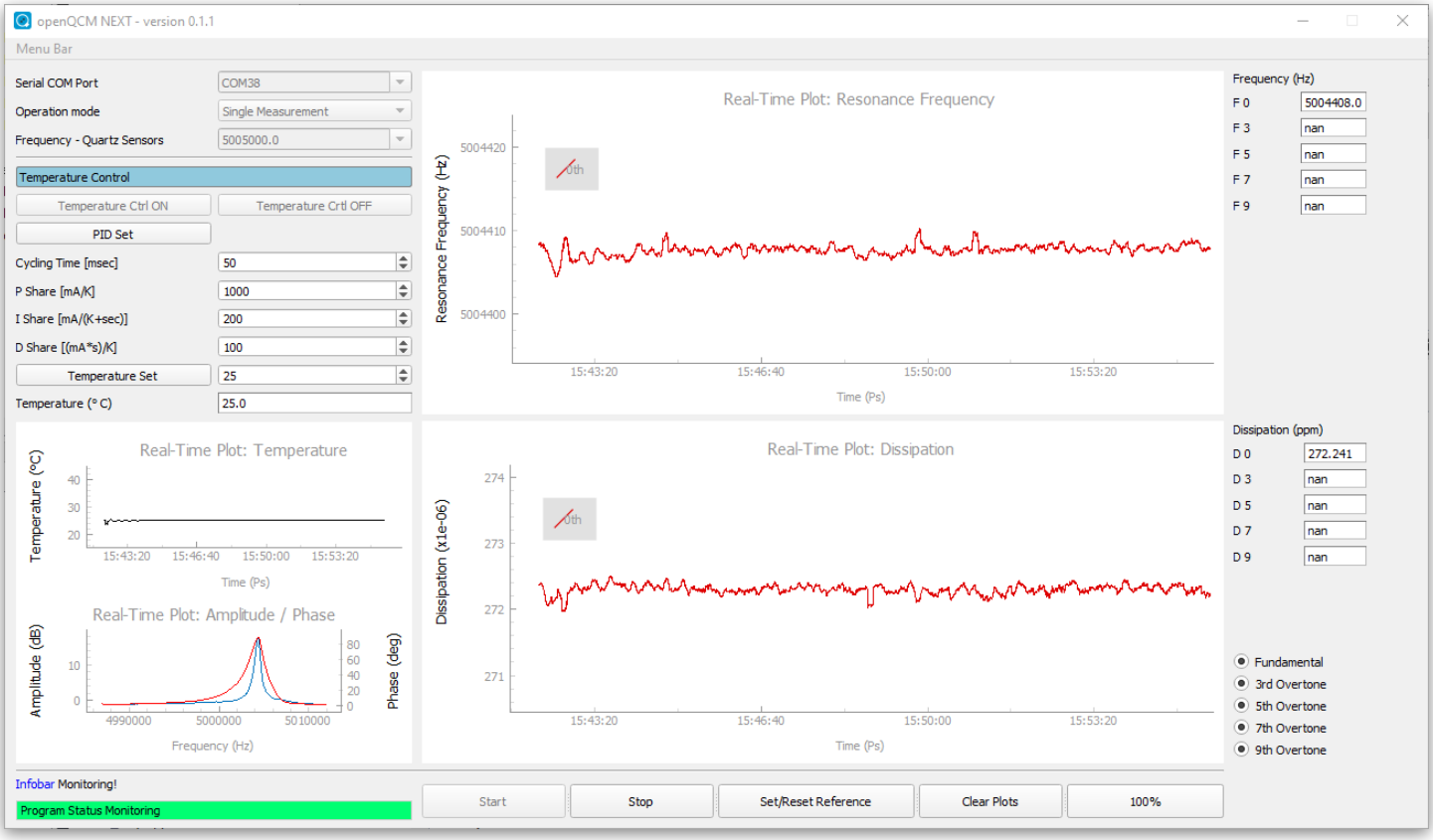
The Calibration mode of measurement perform a frequency sweep over all the available range from 1 MHz to 51 MHz. It is acquired the quartz resonator amplitude and phase spectrum. The main goal is to detect the resonance frequencies, fundamental mode and harmonic overtones, of the quartz resonators. It is also necessary to remove the baseline signal in the wide frequency range, for frequency and dissipation post-processing.

It is necessary to select the fundamental mode of the quartz resonator under test, using Frequency / Quartz Resonators drop down menu in order to facilitate the resonance peak detection algorithm.

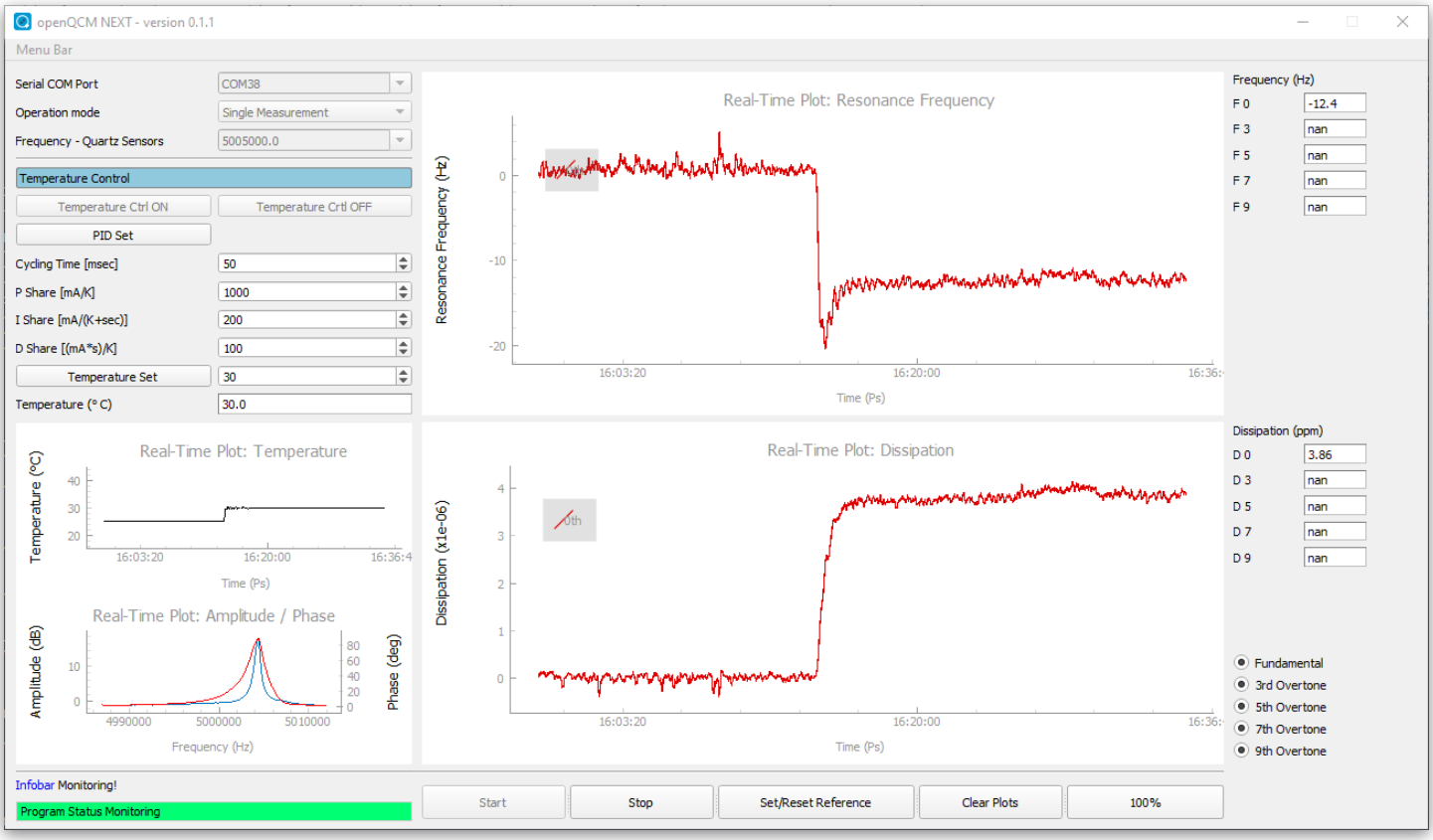
The data processing ensure to calibrate the device when the quartz resonator is in contact with both air and liquid.

The calibration measurement must be started each time the quartz resonator or sample in contact with quartz resonator is changed

Single Mode of Measurement



Single mode measurement of a 5 MHz quartz resonator in contact with air at fundamental mode of vibration



Single mode measurement of a 5 MHz quartz resonator in contact with air at fundamental mode of vibration, active temperature control from 25°C to 30°C

The Single measurement mode perform a frequency sweep around a selected single vibration mode (fundamental or harmonic overtones), and retrieves in real - time the frequency and dissipation data.

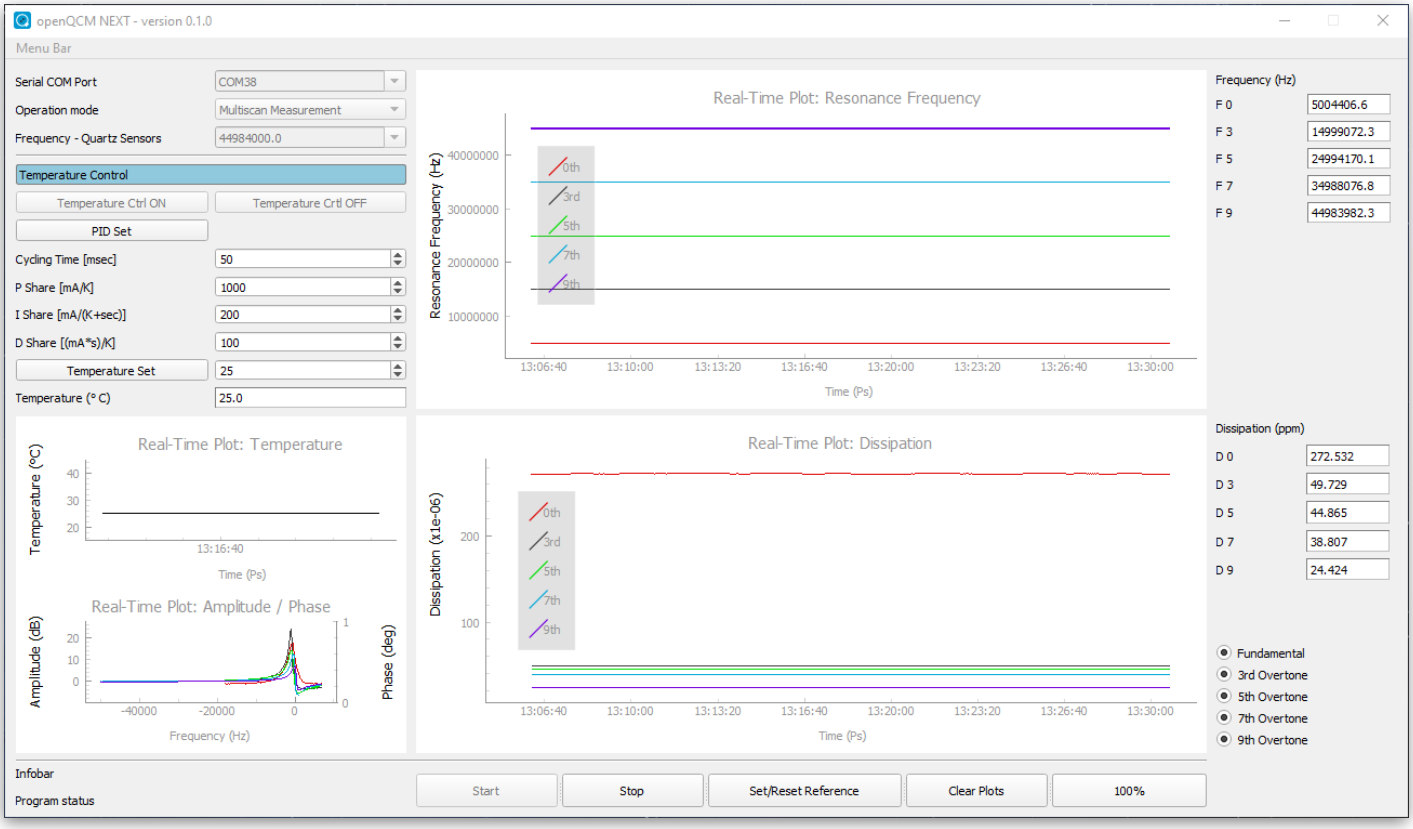
The vibration mode is selected using Frequency / Quartz Resonators drop down menu.

A new measurement session begin by pressing the Start button.

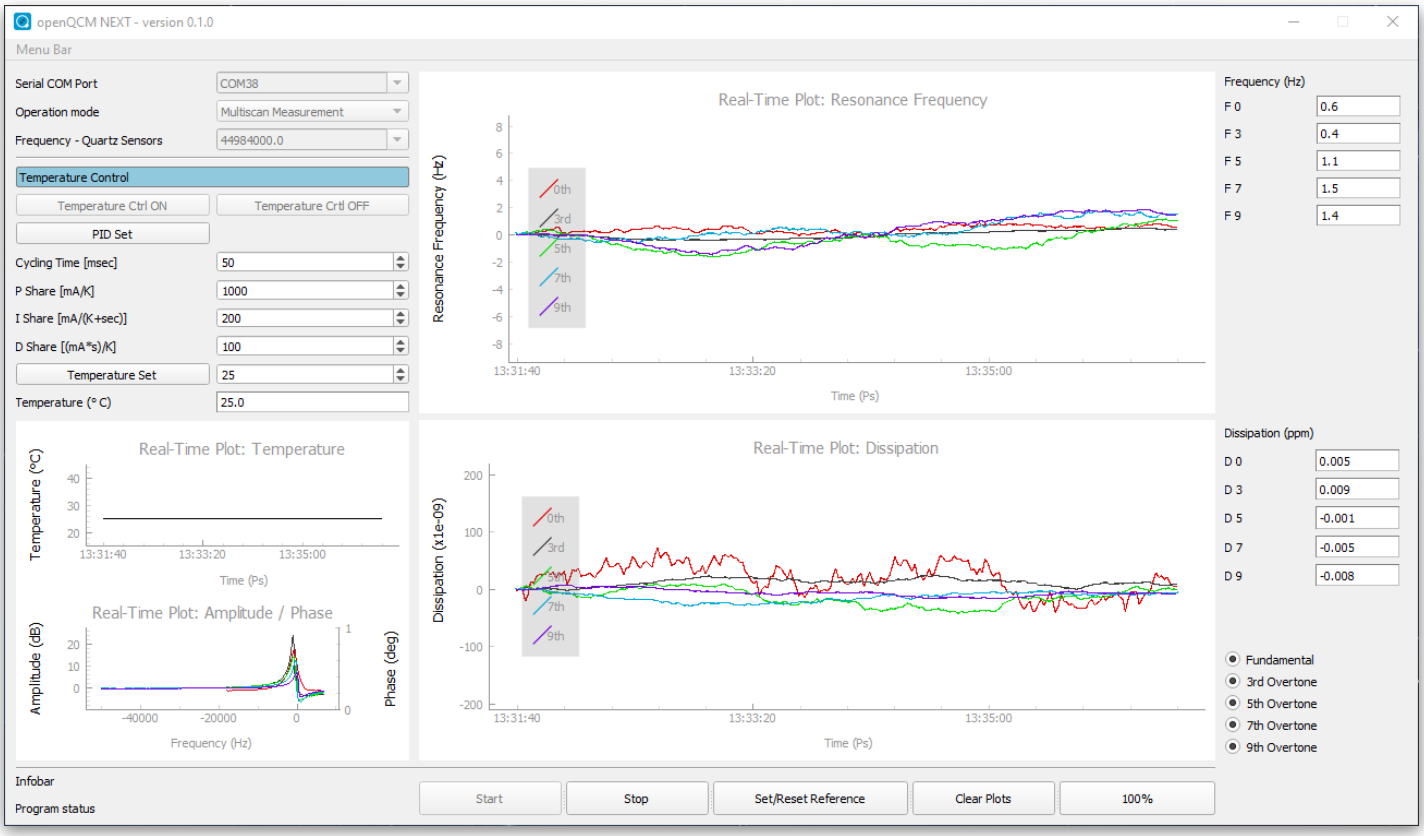
The temperature set point can be changed on the fly, by changing Temperature Set value and pressing the Temperature Set button.

The thermal control must be activated before start a measurement session, the control is switched off by default.

Multiscan Mode of Measurement



Multiscan mode of measurement of a 5 MHz quartz resonator in contact with air, from fundamental to 9th overtone mode of vibration



Multiscan mode of measurement of a 5 MHz quartz resonator in contact with air, from fundamental to 9th overtone mode of vibration. Frequency and dissipation variation referred to the initial reference values

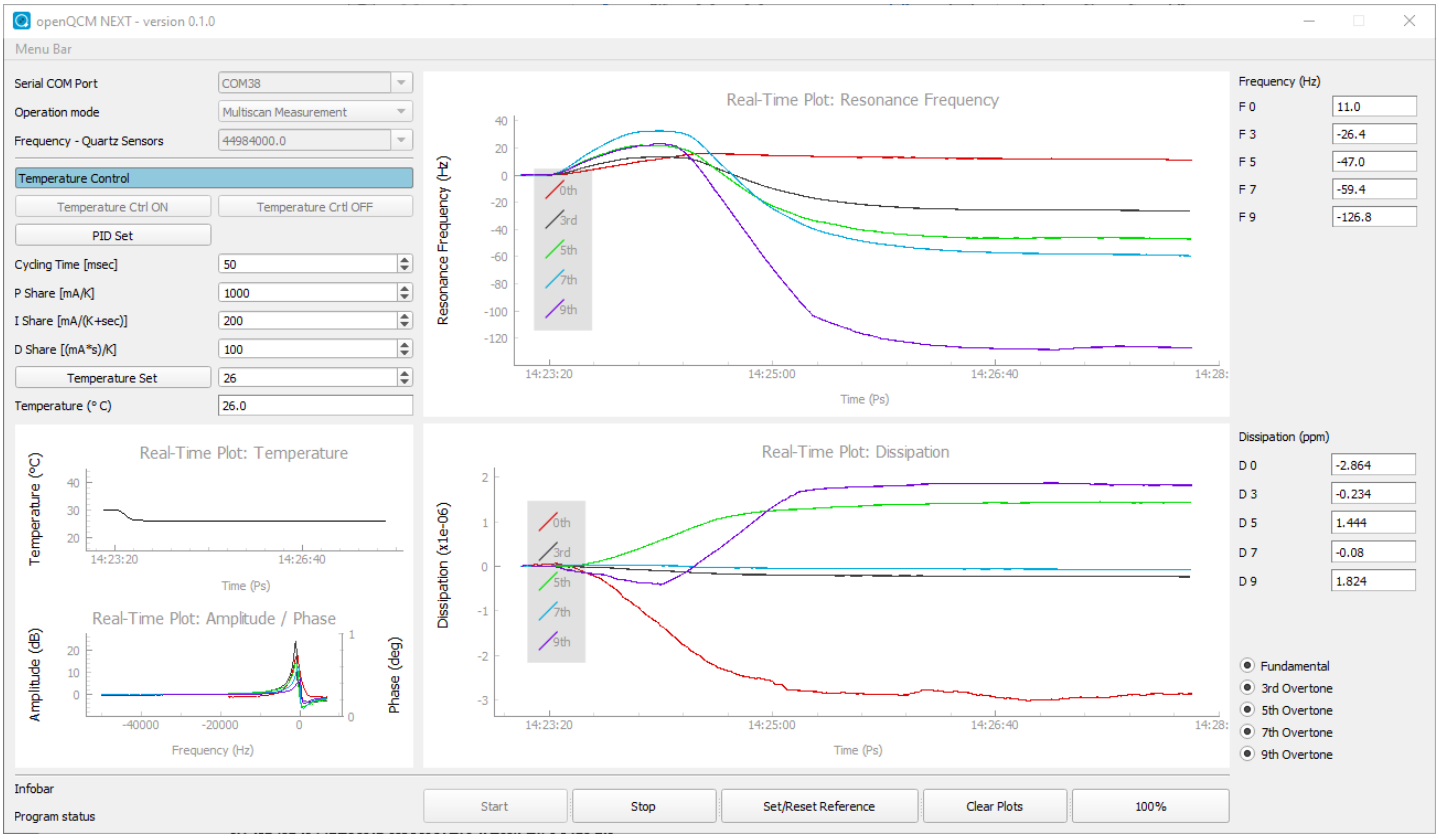
The Multiscan mode of measurement mode perform a frequency sweep around each mode of vibration fundamental and harmonic overtones one after another, in a reasonable short time in the range of 500 msec. It retrieves in real - time the frequency and dissipation over all harmonics almost at the same time.

A new measurement session begin by pressing the Start button.

Visualisation of frequency and dissipation multi plot graph can be enhanced by pressing Set/ Reset reference, so that the current value of frequency and dissipation is the reference value to measure variations. In addition, by selecting radio buttons vibration mode selector it is possible to visualise just the harmonics of interest.

The temperature set point can be changed on the fly, by changing Temperature Set value and pressing the Temperature Set button.

The thermal control must be activated before start a measurement session, the control is switched off by default.



Multiscan mode measurement of a 5 MHz quartz resonator in contact with air, from fundamental to 9th overtone, active temperature control from 30°C to 26°C