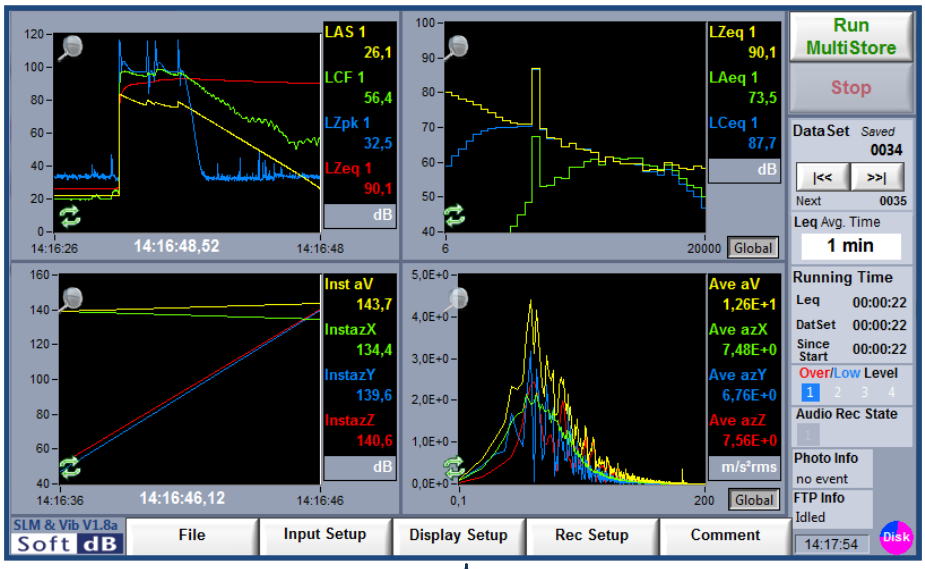
Opus Suite

SLM & 3Vib Module

User Guide – v2.6b
2014-01-21



Compatible Hardware:

Alto

Concerto

Conductor

Soft dB Inc.
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CONTENTS

1 Introduction

Congratulations on your purchase of the ***Opus SLM & 3Vib module***.

The ***Opus Software Suite*** is a sound and vibration software that contains several modules:

- SLM 4-ch module : 4-channels, Class 1 (IEC 61672 and ANSI S1.43)
- **SLM & 3Vib module : 1 SLM channel (same as SLM 4-ch module) and 3 vibration channels (ISO 8041 and ISO 2631)**
- Data Logger module
- Building Acoustics Suite
  - Sound Transmission (ASTM E 336/ISO 140-4)
  - Impact Insulation (ASTM E 1007/ISO 140-7)
  - Room Noise (ANSI/ASA S12.2-2008)
  - Reverberation Time (ISO 3382)
  - Speech Privacy (ASTM E 2638 and ASTM E 1130)
- Building Vibration module (DIN 45669-1 and ANSI S2.46)
- Intensity module (IEC 1043)
- Hammer Impact module
- Power Transformer Suite

The ***Opus Suite*** is intended to run on a ***Concerto.*** The software can also be installed on a Conductor unit or on any PC if using an Alto unit. Moreover, some post-processing functions are available on a PC even if no compatible unit is detected.

The current user's manual presents the **SLM & 3Vib Module**.

General measurements Specifications

	Sound Level Meter	Vibration
General description	1-channel Class 1 Integrating SLM Conform IEC 60561/60804/61672; ANSI S1.42	3 vibration channels for tri-axial human vibration analysis. Conforms to ISO 2631-1
Input Range	Linearity range (at 50mV/Pa) : 25-119 dBA (low range) 37-130 dBA (high range)	± 15 g = ± 147 m/s² @ 100 mV/g:
Frequency	20 kHz bandwidth	Adjustable 200 Hz to 1 kHz bandwidth
Signal weighting	Frequency weighting: A, C, Z Time weighting: Slow, Fast, Impulse, Peak, Leq, SEL Instant, min or max value during the averaging period	Frequency weighting: c, d, e, j,k or none. Instant or average value during the averaging period.
Measurement Type	Global level history, resolution starting at 10 ms 1/3 octave band spectrum (IEC 1260 Type 1), 6.3 Hz to 20 kHz frequency span FFT spectrum, 1 kHz to 20 kHz bandwidth with 854 lines Audio Recording on triggered level Programmable measurement period Post-processing software	Global level history FFT spectrum, 200 Hz to 1 kHz bandwidth with adjustable resolution from 0.05 to 1 Hz.
Real-time display	Display up to 4 zones with up to 4 items per zone. Each zone can be one of the following types:	
	Historic graph (SLM) 1/3 octave spectrum graph (SLM) FFT Spectrum graph (SLM) Cumulative statistics graph (SLM) Numeric Indicator (SLM) Cumulative statistics graph (SLM)	Historic graph (vib) FFT Spectrum graph (vib)
Miscellaneous	Audio Recording and Photo (on trigger or periodic) Web Station mode with FTP transfer for Web monitoring Multi-Purpose output generators	

2 Compatible Hardware

Every hardware option has an embedded state of the art Soft dB SR-MK3 DSP board allowing real-time and precise measurement with very low energy consumption.

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Concerto

Handy, lightweight, fully rugged military tablet
All in one instrument
WLAN communication allows using the Concerto as a monitoring station with remote access.
http://www.softdb.com/en/acoustic/products/concerto.php

Alto

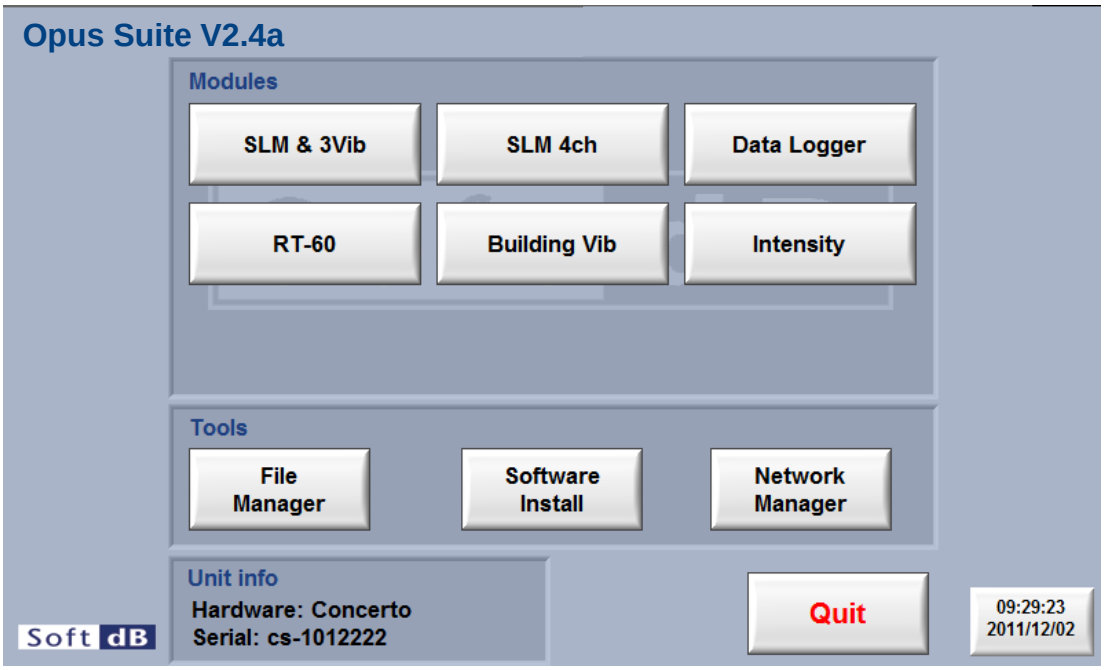
6 or 4 24-Bit asynchronous inputs and 2 outputs
Compact, low-consumption, and flexible
Needs to be connected to a PC.
Competitive price.
http://www.softdb.com/en/acoustic/products/alto.php

Conductor

Rugged platform for acoustics and vibration measurements.
Mainly used for the I-Track sound intensity mapping system.
http://www.softdb.com/en/acoustic/products/conductor.php

3 Opus Environment

The ***Concerto*** unit comes equipped with the **Opus** Environment. This environment acts as a main interface that gives access to the different modules and tools.

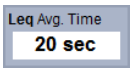


Modules	The modules buttons will launch the associated module. When a module is opened, a license verification check is done. If no license is found for that module, a message will indicate the limitations.
File Manager	The **File Manger** button will launch the File Manager Utility (see section 0, p. 66)
Software Install	The **Software Install** button will launch a browser from which an Opus software installer can be launched.
Network Manager	The **Network Manager** button will launch the Network Manager interface. This tools is only available on a Concerto hardware
Unit info Hardware: Concerto Serial: cs-1100001	The **Unit info** gives the information about the hardware type (Concerto, Alto or Conductor) and the serial number of the unit. The refresh button allows resetting the connection with the acquisition board (useful with an Alto unit).
09:29:23 2011/12/02	The **Clock** indicator displays the time and date on the unit. To change time, simply click on the indicator to display a dialog window.
Quit	The **Quit** button will quit the application differently according to the hardware used. Concerto hardware: • Press and hold (5 sec) to shut down the unit. • Press and release to enter standby mode. Alto or Conductor hardware: • Press and hold (5 sec) to close the application and return to Windows.

4 Quick Start

The **AutoStore Setup** is presumed to set to **OFF.**

Step 1 Set the Averaging Time

Click on the 

field to change the **Leq Averaging Time**. A numerical key pad will appear to allow this change.

Step 2 Start the Measurement

Click on the 

button to start a measurement. The measurement will be performed according to the current measurement setup.

The measurement can be paused by clicking the 

button and can be resumed by clicking the 

button.

Step 3 Stop the Measurement

The measurement will stop at the end of the **Leq Averaging Time**. However, the user can stop the measurement at any time by clicking the 

button.

Step 4 Save the Measurement

Click on the 

button to save the measurement. The measurement will be saved in a **DataSet** in the **Record Directory** (see section 8.1, p. 42) and its ID is specified in the **Current ID Indicator** (see section 5.2, p. 10).

Once the measurement is saved in a dataset, the 

button is disabled.

The next table shows the left pane appearance before, during and after a measurement.

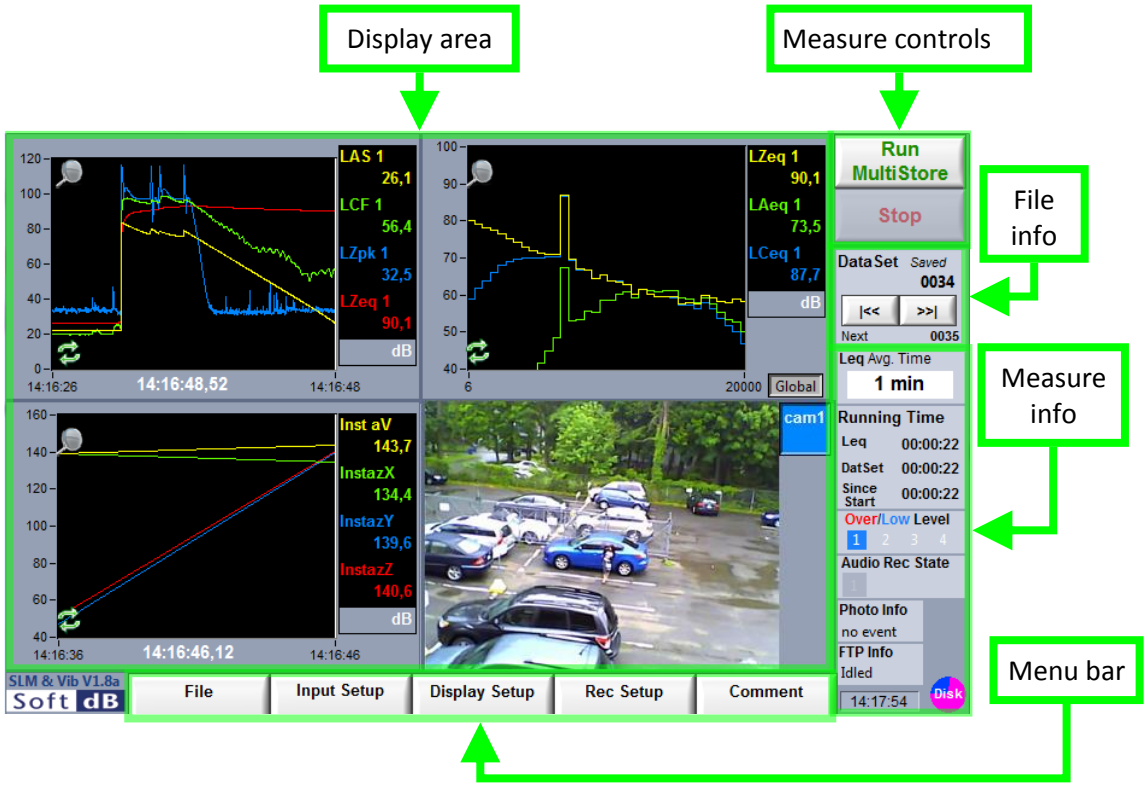
Before Measurement	During Measurement	After Measurement	
			← **Run** / **Pause** / **Continue** Button ← **Stop** / **Save** Button ← **Current DataSet** ← **Previous / Next DataSet** ← Next DataSet To Be Saved[1] ← **Leq Averaging Time** ← **Running Time** ← Current Leq Period Time ← Current Dataset Time ← Time from Start ← **Over** / **Under Range** Indicator ← **Audio Recording** Indicator ← **Photo Information** Indicator ← **FTP Information** Indicator

[1] This indicator flashes red for 10 seconds when the measurement has stopped but has not been saved.

5 Main Interface

The main interface is divided in five areas:

1) Measure controls (see section 5.1, p. 10)
2) File Info (see section 5.2, p. 10)
3) Measure Info (see section5.3, p. 12)
4) Menu bar (see section 5.4, p. 12)
5) Display area (see section 5.5, p. 14)



On the main interface, the following actions are possible:

- Perform a measurement according to the current measurement setup,
- Save, Export and Open DataSets using the File menu,
- Modify the setup using the Input Setup, Display Setup and Rec Setup menu (see next table).

The setup is divided into three parts:

Input Setup	Input enable (on or off), Input type (ICP or AC), Sensor sentitivity, Decibel reference, Input range. Decibel reference, Input range.	
	FFT frequency bandwidth (SLM) FFT high pass filter (SLM)	Frequency weigthing (vib) FFT bandwidth and resolution (vib) Frequency weigthing (vib)
Display Setup	1-, 2- or 4-zone display. Each zone with a selectable display type (Historic, 1/3 octave Spectrum, FFT Spectrum. Numerical Indicator or Statistics). Each zone can display up to 4 distinct data elements. Horizontal and vertical graph scales. Unit display.	
Record Setup	Record destination folder, FTP Transfer Setup, DataSet format and increment, Data selection to record in a DataSet, Audio Recording Setup, AutoStore Setup.	

The resulting configuration setup can be saved and recalled using File → Save Config and File → Open Config.

5.1 Measure Controls

Run / Pause / Continue

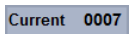
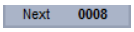
	This button starts the acquisition. The **Run** button then automatically becomes the **Pause** button if the **AutoStore** is off or single mode.
	This button suspends the acquisition. The **Pause** button then automatically becomes the **Continue** button. Pause is only available if the **AutoStore** is off or in single mode.
	This button continues the acquisition. The **Continue** button then automatically becomes the **Pause** button again.

Stop / Save

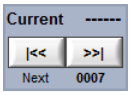
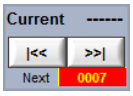
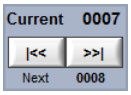
	This button stopped the measurement. The button then automatically becomes the **Save** button if the **AutoStore** setup is off).
	This button saves the active measurement in a **DataSet**. This button is then disabled until another measurement starts. This button is disabled when the **AutoStore** is enabled.

5.2 File Info

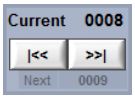
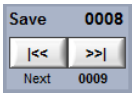
File Info

	This indicator displays the actual **DataSet ID**.
	These two buttons are used to open the previous/next **DataSets** in the **Record Directory**.
	This indicator displays the next **DataSet** to be saved.

File Info Appearance – Auto-Store Off (see section8.3, p.49)

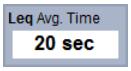
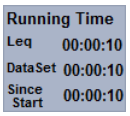
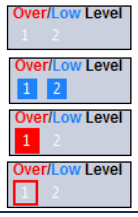
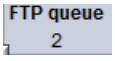
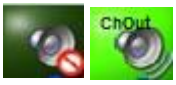
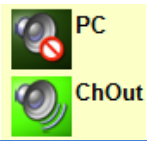
During Measurement		No **Current DataSet ID** is displayed during a measurement. The **Next ID** indicates the next **DataSet** to be saved.
After Measurement		At the end of the measurement the **Next ID** flashes red for 10 seconds, unless the user clicks the **Save** button.
After Save		If the **DataSet** is saved, the **Current DataSet ID** is updated with the **Next DataSet ID**.

File Info Appearance – Auto-Store On (see section8.3, p.49)

During Measurement		During a measurement, the **Current DataSet ID** indicates in which **DataSet** the current data is saved**.** The **Next DataSet ID** is disabled until the end of the measurement.
After Measurement		When the measurement is stopped, the **Next DataSet ID** is enabled and indicates the **DataSet ID** in which the next measurement can be saved.

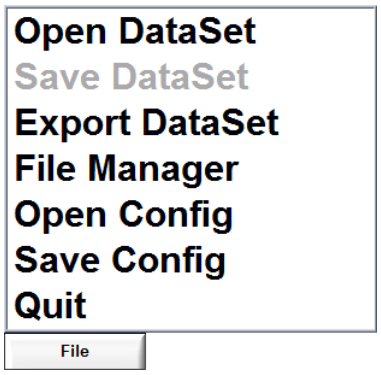
5.3 Measure Info

Measure info

	Indicates the average duration. Click on the indicator to modify the **Leq Averaging Time** value.
	Leq: Elapsed time since the beginning of the current averaging period. Dataset: Elapsed time since the beginning of the current DataSet. Since Start: Elapsed time since the start of the measurement. When using the **AutoStore Setup** in **Multiple Mode**, a new average will start at the end of each Leq period. Those average data are stored in a **DataSet**, which may be referred as a data file. Also, a measurement is sometimes partitioned into several DataSets (usually one day each) to avoid very large files and to facilitate the post analysis.
	**Audio Recording State** Transparent background: Input active, but audio recording disabled. Green background: Audio recording enabled, but currently not recording. Red background: Audio recording in progress on this input.
	**Over/Under Range** Transparent background: Input level is between the dynamic range limits. Blue background (low level): Input level is below the dynamic range lower limit. Red background (overload): Input level is above the dynamic range upper limit. Red outline (overload memory): Input level above the dynamic range upper limit during the active Leq average period.
	**Photo Info**: During the acquisition, it shows the number of photo events. **Photo Viewer**: After the acquisition, the button gives access to the Photo Viewer interface.
	The **FTP queue** indicates the number of elements that are still to be transferred to the FTP server.
	The **Output Generation** indicator turns on when at least one of the generators is activated. The **ChOut** and **PC** are also displayed to indicate what generator is activated. When the cursor passes over the indicator, the following control appears. This control allows the user to manually control both generators independently. 

5.4 Menu Bar

File Menu



Open DataSet	Opens a **DataSet**.
Save DataSet	Saves a **DataSet** if not saved yet.
Export DataSet	Exports **DataSets** in a spreadsheet file. (see section 0, p. 65)
File Manager	Launches the **File Manager** (see section 0, p. 66)
Open Config	Restores a saved software configuration.
Save Config	Saves the software configuration.
Quit:	Quits the **SLM module** and to returns to the **Opus Suite Interface**.

Input / Display / Record Setup Buttons

Input Setup	Launches the **Input Setup** (see section6, p. 18)
Display Setup	Launches the **Display Setup** (see section 7, p. 25)
Rec Setup	Launches the **Record Setup** (see section 8, p.41)

Comment / Tag Button

Comment	Allows the user to write a comment on the measurement before it starts. When the measurement starts, this button becomes the Tag button.
Tag	Tags events during a measurement.

5.5 Display Area

One, two or four graph areas can be displayed in the Display Area. During a measurement, data is displayed in real-time.

For each graph area, five types of display can be selected:

- **Historic** Graph (see section 7.2.1 p. 26)
- **1/3 Octave** Band Spectrum Graph (see section 7.2.2 p. 29)
- **FFT** Spectrum Graph (see section 7.2.3 p. 30)
- **Numerical** Indicators (see section 7.2.4 p. 31)
- **Statistics** Graph (see section 7.2.5 p. 32)

Each of these displays can show up to four different elements. The Display Setup button allows selecting the desired display configuration (see section 7, p. 25).

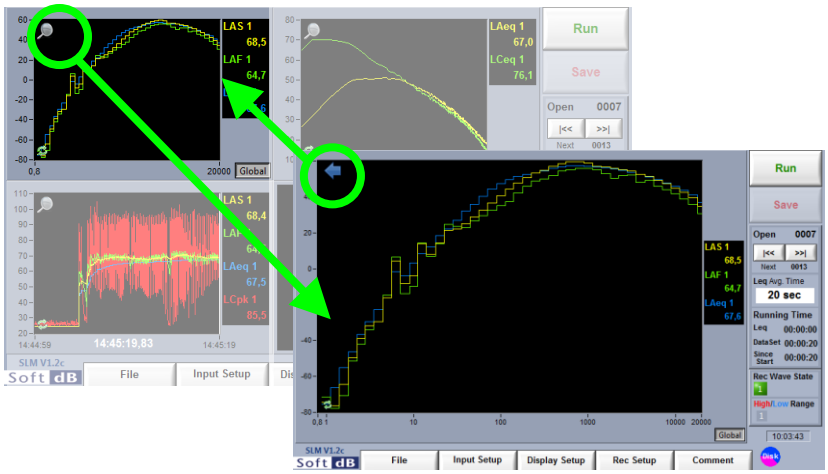
Note: The display updates up to every 1/4 s.

5.5.1 Magnifier

Each graph has a  icon at the top left corner. Clicking on this icon makes the graph appear on a **magnified** display.

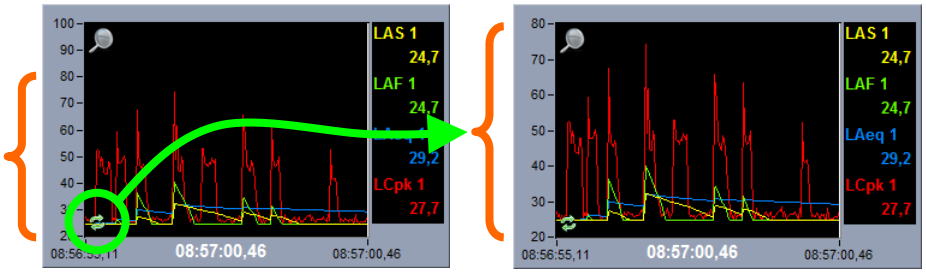
The **magnified** display has a  icon at the top left corner. Clicking on this icon returns the graph to its initial size and position.

The **magnified** view of a **Historic graph** contains the controls allowing listening to audio files (see section 5.5.4, p. 17).



5.5.2 Y Axis Scaling

Each graph has a  icon at the bottom left corner. Clicking on this icon adjusts the Y scale to the graph data.

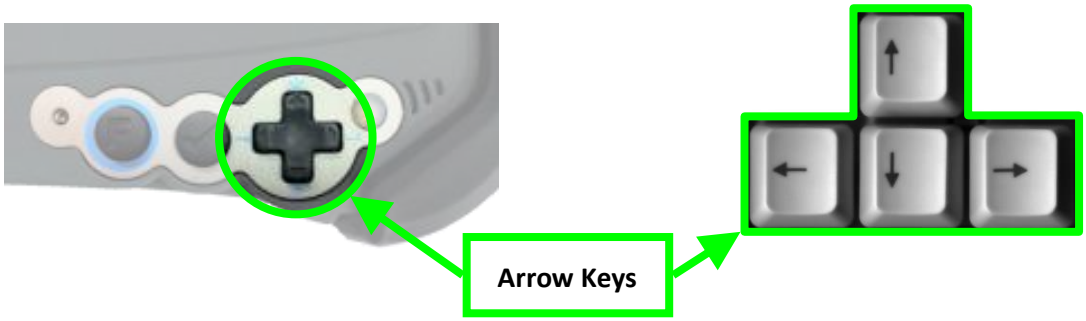


5.5.3 Cursors

A cursor can be used on each graph to help the user access an individual datum. However, the cursor on a historic graph is only available when the acquisition is stopped.

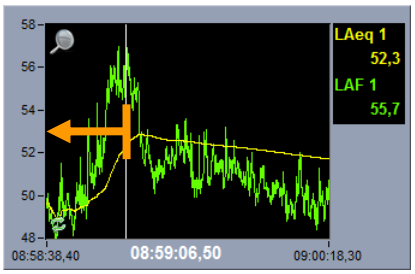
Cursor Actions

Get Cursor	Click on graph to position the cursor.
Cursor Value	Cursor X value is displayed below the graph. Cursor Y values are displayed in the legend on the right side of the graph.
Move Cursor	Change cursor position by clicking on the graph at the desired position. Change cursor position by using the arrow keys. Pressing left or right on the arrow keys allows moving the cursor one value at a time.

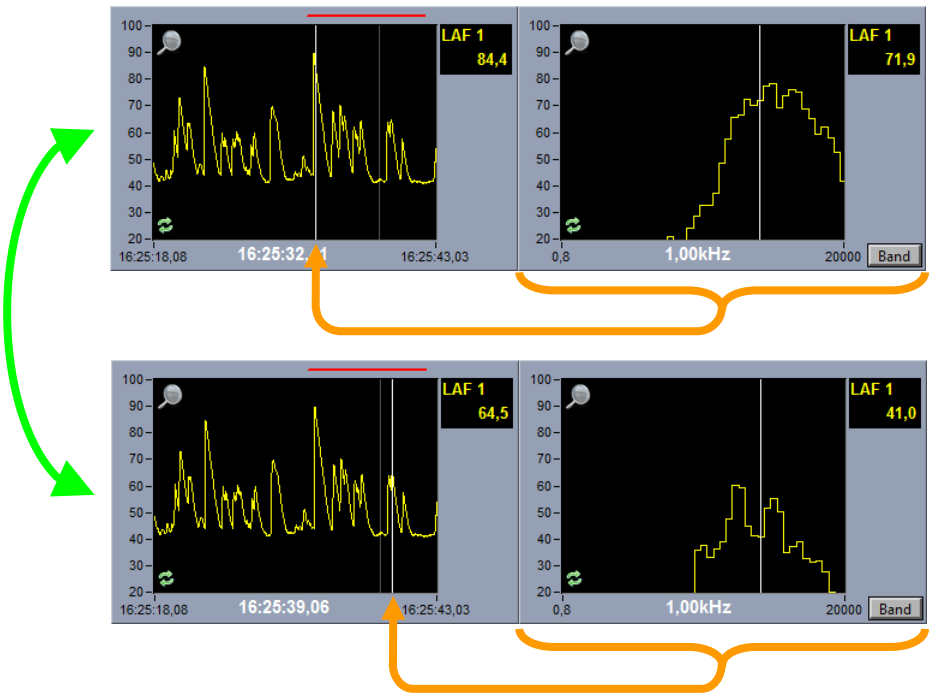


5.5.3.1 Complementary Actions Associated to the Cursors

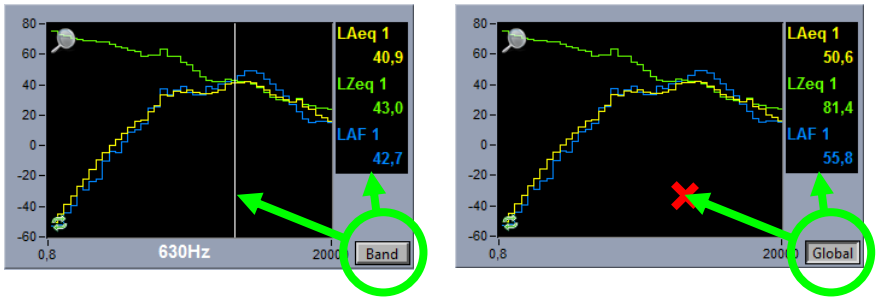
1) The length of the **Historic** graph is limited to 1000 values. When the number of values excides 1000, the graph slides on the left so that only the most recent data is displayed. Moving the cursor on the left of the graph moves the time window back in time to display past values.



2) When the cursor on the **Historic** graph is moved, the values displayed in other graph areas will update to the current **Historic** cursor position.



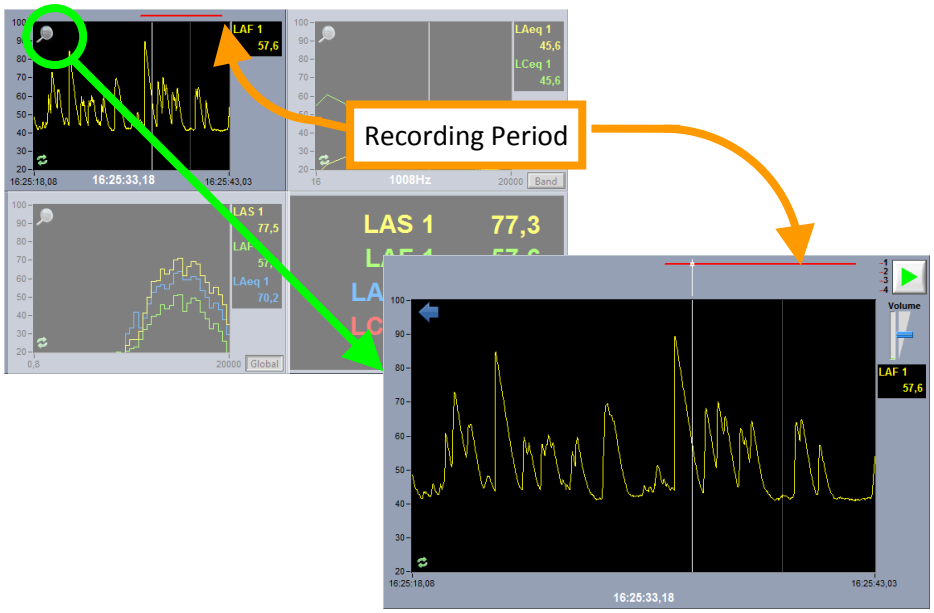
3) Selecting Global versus Band on a **Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend**.



5.5.4 Listening to Audio Records

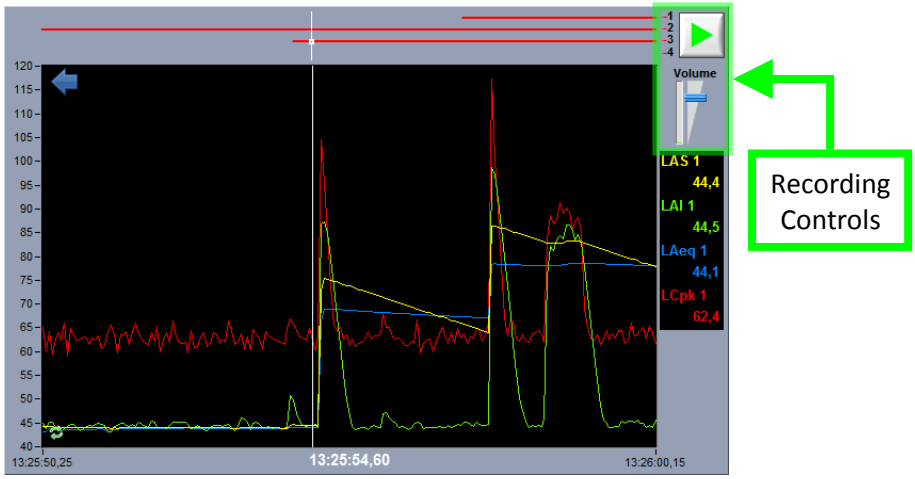
When audio signals have been recorded during a measurement (see section 8.5, p. 56), a red line is displayed on the top of the **Historic** graph. The start position and length of the line corresponds to the recording period.

To listen to the recording, the **Historic** graph must be **magnified**. Click on the  icon on the top left corner of the graph to magnify the graph.



5.5.4.1 Selecting the record

The **Audio Recording Indicator** is displayed on the top of the magnified **Time History** graph. In the case of simultaneous recordings on different channels, multiple red lines will be displayed on the **Audio Recording Indicator**. The top line represents channel 1 and the bottom line represents channel 4. Click on the red line of your choice at the desired position. The **Record Cursor** appears with a dot located on the chosen channel.



5.5.4.2 Playing the record

Click the  button at the right end of the **Audio Recording Indicator** to start playing the record.

Adjust the **volume** with the 

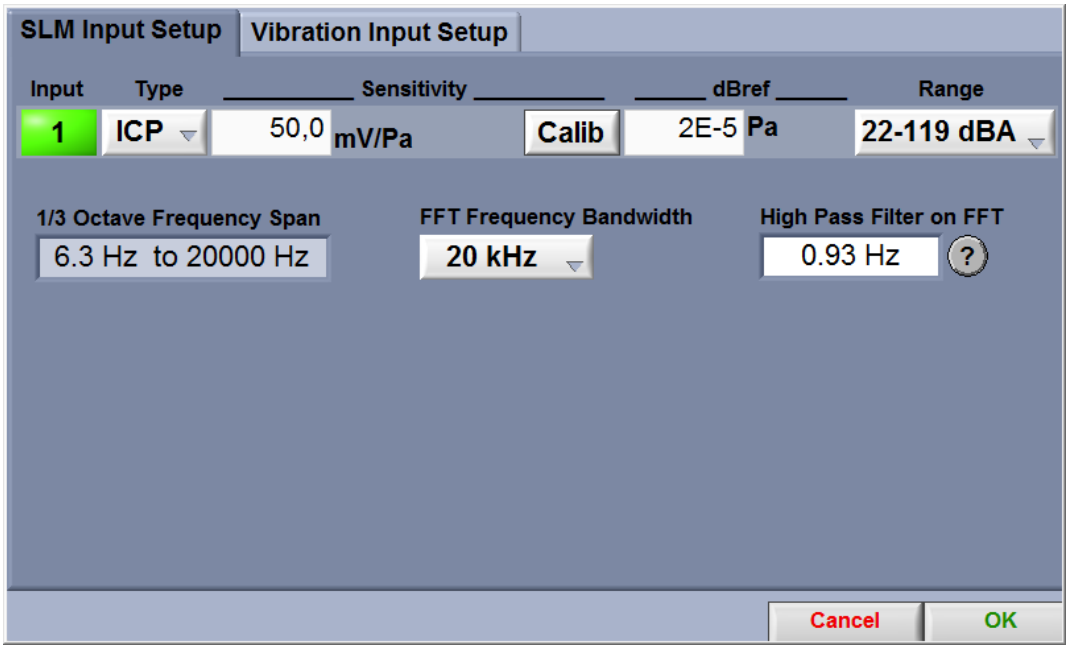
control.

6 Input Setup

Click the Input Setup button on the main interface to launch the **Input Setup** interface.

The **Input Setup** includes the **SLM Input Setup** (section 6.1, p.19) and the **Vibration Input Setup** (section 6.2, p.22).

6.1 SLM Input Setup



6.1.1 SLM Input Selection

The SLM and Vib application uses its first input to perform SLM measurements. Click on the input button (at the right of the window) to enable (light green) or disable (dark green) the SLM input.

6.1.2 SLM Input Type

The available input types are AC and ICP sensors. The sensors provided by Soft dB are normally ICP microphones.

6.1.3 SLM Input Sensitivity and Calibration

The input sensitivity can be manually changed in the text field or it can be calibrated using the calibration function and a sensor calibrator. Click the Calibrate button to launch the **Calibration Interface**.

6.1.3.1 SLM Calibration Interface

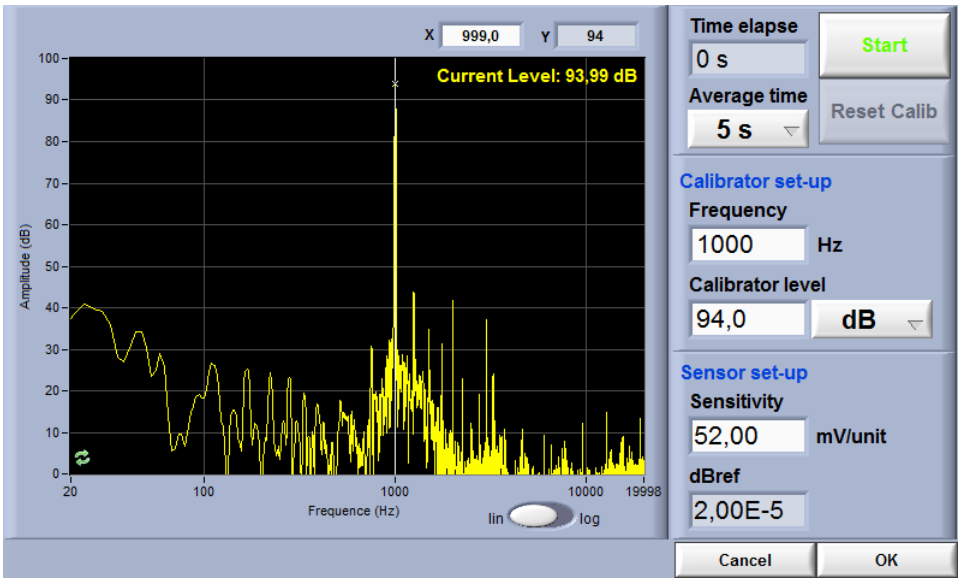


Figure 1 SLM Calibration Interface

Step 1 Adjust the calibration parameters

The defaults values are:

- Averaging time: 5 s
- Frequency: 1 kHz
- Calibrator Level: 94 dB

Step 2 Install the calibrator device on the microphone

Step 3 Click START

After the average time is elapsed, the sensitivity value will update.

Step 4 Click OK to accept the sensitivity value

6.1.4 SLM dBref value

The **dBref** value is the reference value that is used to establish the zero decibel (dB) level. In the application, the decibel level will be based on this reference. The standard dBref value for SLM measurements is 2E-5 Pa.

6.1.5 SLM Dynamic Range

The dynamic range of the SLM input is around 94 dB. Two ranges are available (Low or High)[2]. The table below provides examples of the dynamic ranges for given sensitivities of 40 and 50 mV/Pa.

Microphone Sensitivity	40 mV/Pa	50 mV/Pa
Low Range	27 to 121 dB(A)	25 to 119 dB(A)
High Range	39 to 132 dB(A)	37 to 130 dB(A)

6.1.6 SLM FFT High Pass Filter

Several frequency bandwidths are available with the FFT spectrum:

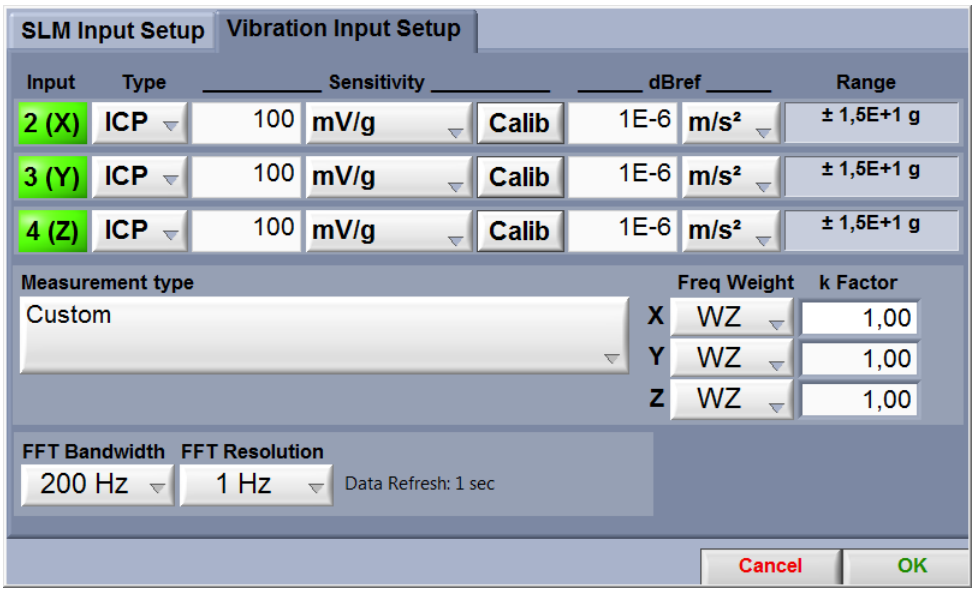
Bandwidth	**FFT Lines**	**Frequency Resolution**
20 kHz	854	23.4 Hz
10 kHz	854	11.7 Hz
5 kHz	854	5.85 Hz
3.33 kHz	854	3.90 Hz
2 kHz	854	2.34 Hz
1 kHz	854	1.17 Hz

An electronic high-pass filter set at 0.9 Hz is applied on the input to block any DC. However, another filter can be applied to the FFT Spectrum to match the 1/3 octave spectrum frequency span, which is 6.3 Hz to 20 kHz.

The high pass filter **cut-off frequency** can be **lowered** but the global level resulting from the sum of the FFT lines may be different than the SLM global levels (LS, LF, LI, Leq and SEL) and their associated 1/3 Octave Spectrum.

[2] Both low and high range should be available on the SLM input of a Concerto unit. Other hardware (such as Alto and Conductor) may only have the low range available.

6.2 Vibration Input Setup



6.2.1 Vib Input Selection

The SLM and Vib application uses its inputs 2, 3 and 4 (X, Y and Z axis) to perform vibration measurements. Click on the input button (at the right of the window) to enable (light green) or disable (dark green) the corresponding input.

If the **Measurement Type** is set to one of the ISO 2631 measurements, the three vibration channels will be enabled or disabled as a whole.

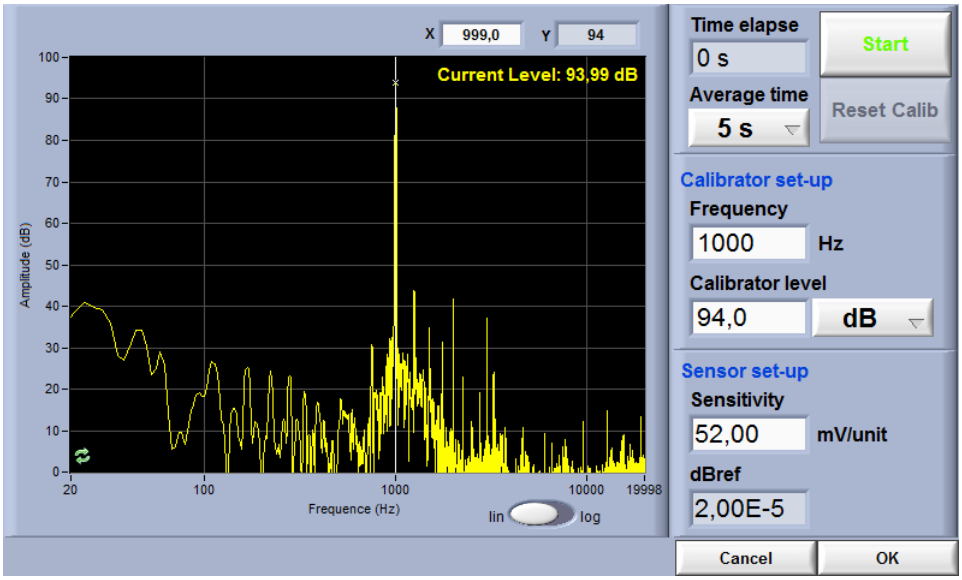
6.2.2 Vib Input Type

The available input types are DC, AC and ICP sensors.

6.2.3 Vib Input Sensitivity and Calibration

The input sensitivity can be manually changed in the text field or it can be calibrated using the calibration function and a sensor calibrator. Click the **Calibrate** button to launch the **Calibration** interface.

6.2.3.1 Vib Calibration Interface



Step 1 Adjust the calibration parameters

The defaults values are:

- Averaging time: 5 s
- Frequency: 157 Hz
- Calibrator Level: 1 g rms

Step 2 Install the calibrator device on the microphone

Step 3 Click START

After the average time is elapsed, the sensitivity value will update.

Step 4 Click OK to accept the sensitivity value

After the average time is elapsed, the sensitivity value will update.

6.2.4 Vib dBref value

The **dBref** value is the reference value that is used to establish the zero decibel (dB) level. In the application, the decibel level will be based on this reference. The dBref value for vibration measurements is normally 1E-6 m/s².

6.2.5 Vib Dynamic Range

The dynamic range of the vibration inputs is around 94 dB. Only one range is available for vibration inputs. The table below provides examples of the dynamic range limits for given sensitivities of 100 mV/g.

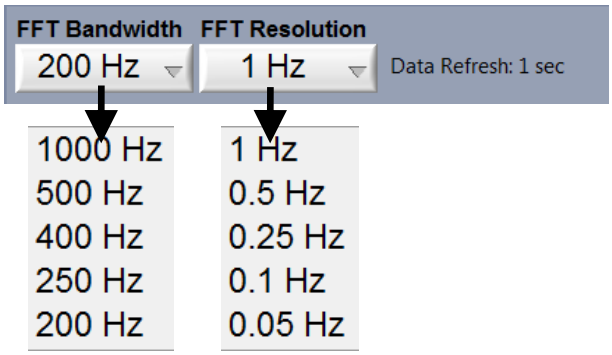
Microphone Sensitivity	100 mV/g = 10.2mV/(m/s²)
Range	± 15 g = 1.53 m/s²

6.2.6 Vib Measurement Type

The **Measurement Type** menu provides predefined settings for ISO 2631 measurements. For a given ISO 2631 measurement, specific frequency weightings will be used for each axis. A specific **k Factor** for each axis will also be used in the vector summation of the three axes.

It is also possible to set the **Measurement Type** to "Custom" and use user defined values of frequency weighting and **k Factor**.

6.2.7 Vib FFT Setup



The **FFT Bandwidth** is adjustable from 200 to 1000 Hz.

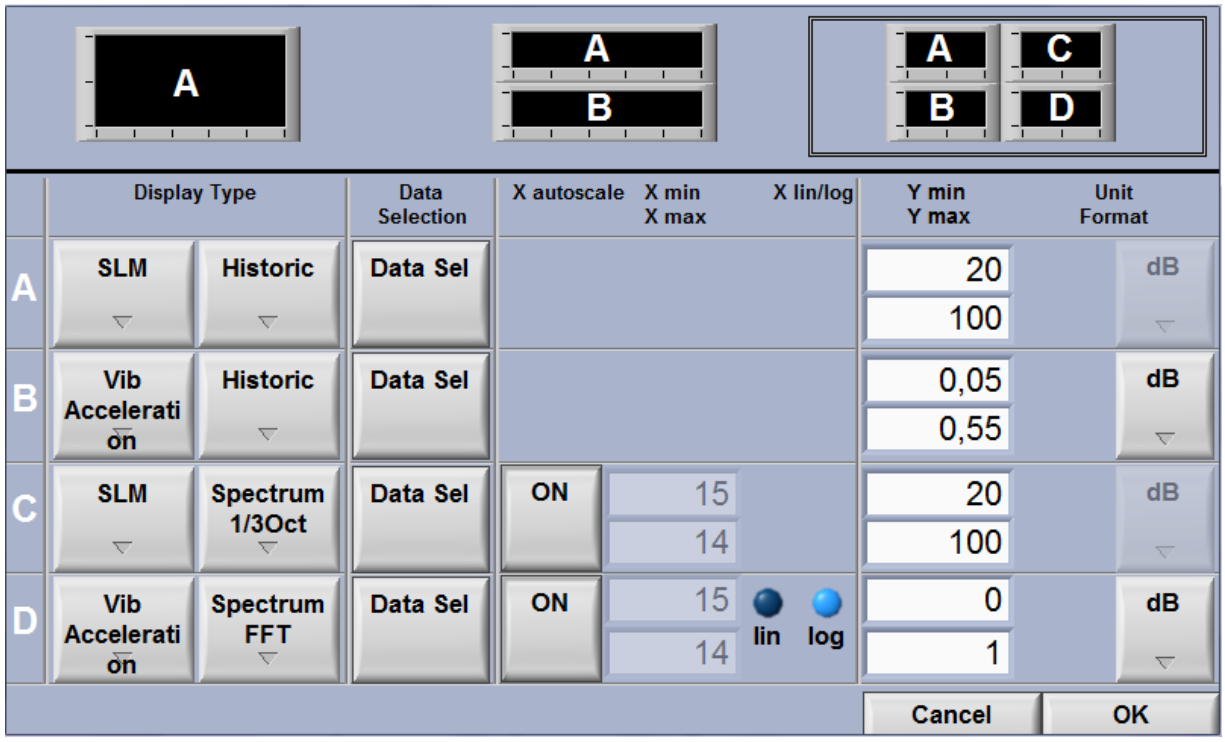
The **FFT Resolution** is adjustable from 0.05 to 1 Hz. The refresh time of the data (display and record) directly depends on this resolution as the RefreshTime = 1/Resolution. Therefore the refresh time will vary from 1 to 20 seconds.

7 Display Setup

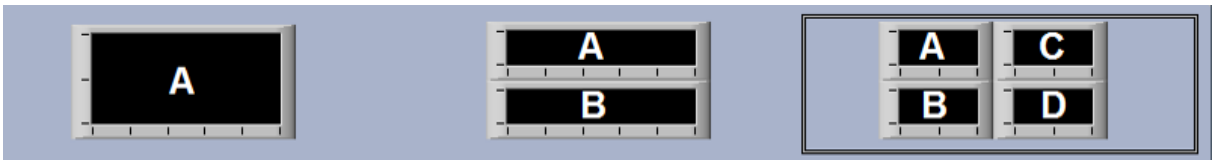
During a measurement, all acoustical parameters are calculated and available for display.

The Display Setup button launches the **Display Setup** interface used to define:

- Display Area Disposition (see section 7.1, p. 26)
- Display Type (see section 7.2, p.26)
- Display Data Selection(see section 7.3, p. 37)
- X axis and Y axis properties (see section 7.4, p.40)



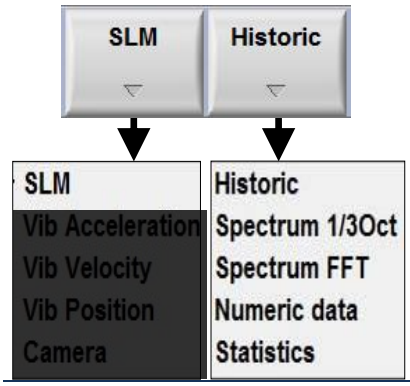
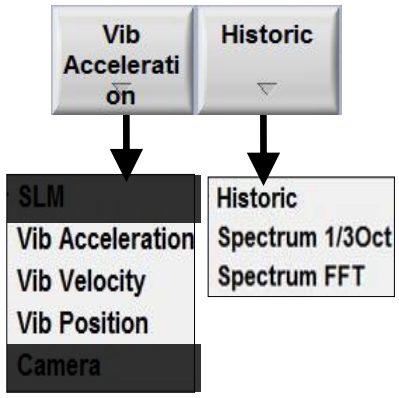
7.1 Display Area Disposition

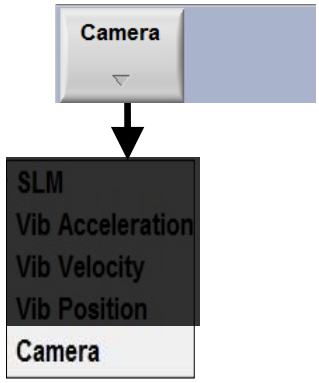


1, 2 or 4 graphs can be displayed at the same time. Click one of the icons in the upper part of the Display Setup to select the desired number of graphs for display.

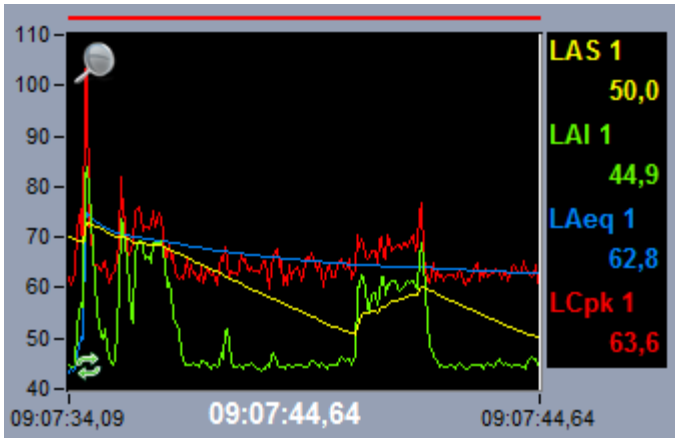
7.2 Display Type

For each zone, the **Display Type** controls allow the user to select the type of display. A display zone will either display SLM data, vibration data or Camera according to the leftmost menu ring of the display type. Then a display type can be selected from the rightmost menu ring.

	SLM display. - SLM Historic Graph of global levels (see section 7.2.1) - SLM 1/3 Octave Spectrum Graph (see section 7.2.2) - SLM FFT Spectrum Graph (see section 7.2.3) - SLM Numeric indicator of global levels (see section7.2.4) - SLM Statistics Graph of SPL global levels (see section 7.2.5)
	Vibration display (acceleration, velocity or position) - Vib Historic Graph of global levels (see section 7.2.6) - Vib 1/3 octave Spectrum Graph (see section 7.2.7) - Vib FFT Spectrum Graph (see section 7.2.8)

	Camera display (see section 7.2.9).

7.2.1 SLM Historic Graph



Available data

Data Type	Time Weighting	Freq Weighting	Display Type
SLM Global level	SPL Slow	A, C or Z	Instant, Max or Min
	SPL Fast		
	SPL Impulse		
	SPL Peak		
	Leq	A, C or Z	Running Average
	SEL		

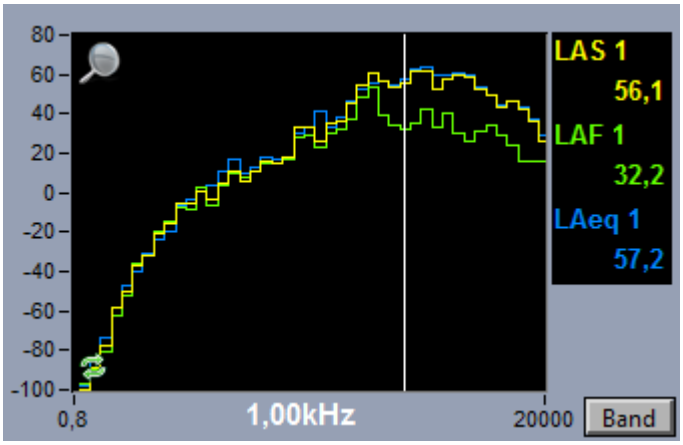
Length of the historic graph

The historic displays the last 1000 measured samples. Past samples may be displayed once the acquisition has been stopped (see section 5.5.3.1, p. 16).

Wav recording indicator

If an audio record was recorded during the measurement, a red line will be displayed on the top of the historic graph. To listen to the recorded file, click on the  icon to access the magnified view of the Historic Graph and its audio record controls (see section 5.5.4, p. 17).

7.2.2 SLM 1/3 Octave Spectrum Graph



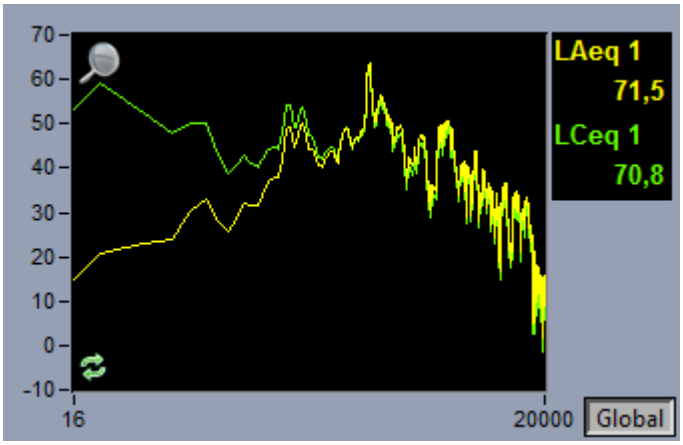
Available data

Data Type	Time Weighting	Freq Weighting	Display Type
SLM 1/3 Octave Spectrum	SPL Slow	A, C or Z	Instant, Max or Min
	SPL Fast		
	SPL Impulse		
	SPL Peak		
	Leq	A, C or Z	Running Average
	SEL		

Legend Values

Selecting Global versus Band on a **1/3 Octave Band Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend** (see section 5.5.3.1, p. 16).

7.2.3 SLM FFT Spectrum Graph



Available data

Data Type	Time Weighting	Freq Weighting	Display Type
SLM FFT Spectrum	Leq	A, C or Z	Running Average
	SEL		

Legend Values

Selecting Global versus Band on a **FFT Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend** (see section 5.5.3.1, p. 16).

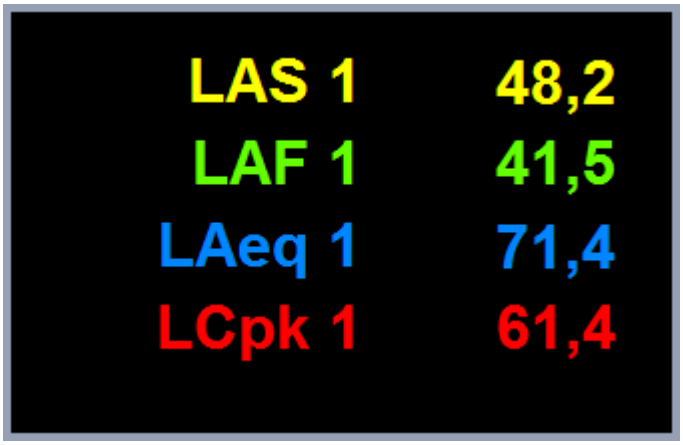
FFT High Pass Filter

A high pass filter is applied on the FFT spectrum to match the **1/3 Octave Spectrum** frequency span, which is 6.3 Hz to 20 kHz (see section 6.1.6, p.21).

Averaging Period

The FFT spectrum being a Leq FFT, its averaging time is the same as the **Leq Averaging Time** (see section 0, p. 12).

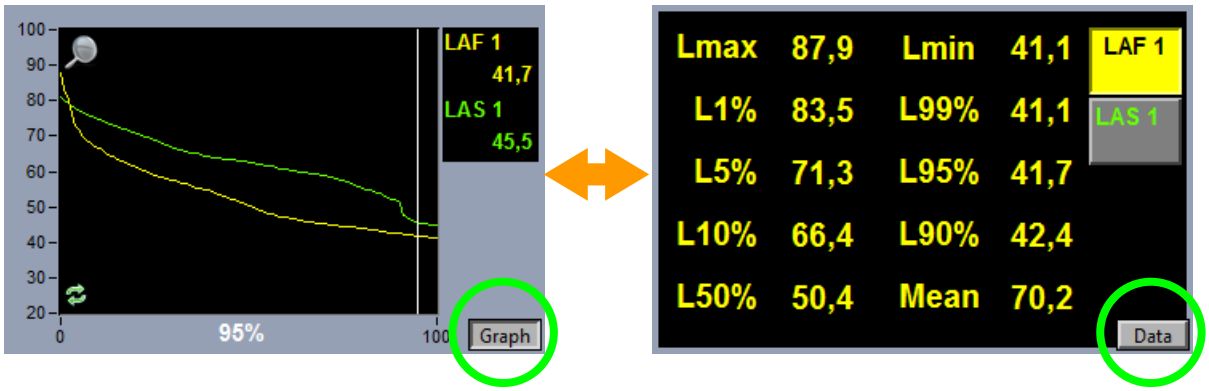
7.2.4 SLM Numeric Indicators



Available data

Data Type	Time Weighting	Freq Weighting	Display Type
SLM Global level	SPL Slow	A, C or Z	Instant, Max or Min
	SPL Fast		
	SPL Impulse		
	SPL Peak		
	Leq	A, C or Z	Running Average
	SEL		

7.2.5 SLM Statistic Graph



Available data

Data Type	Time Weighting	Freq Weighting	Display Type
SLM Global level	SPL Slow	A, C or Z	Max, Min and Statistics
	SPL Fast		
	SPL Impulse		
	SPL Peak		

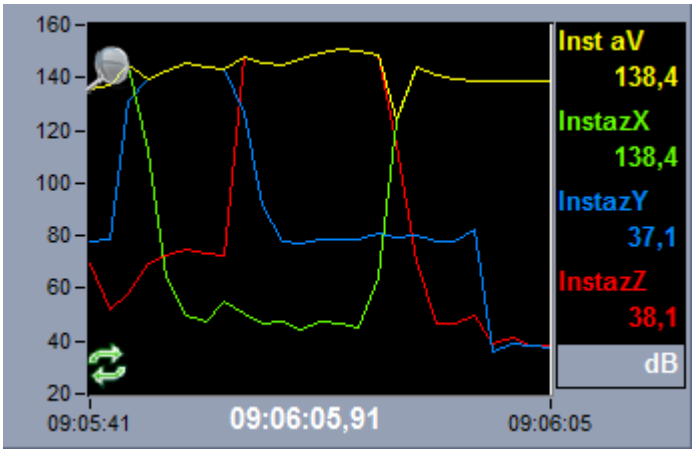
Graph / Data Display

Selecting Graph versus Data on a **Statistic** graph displays either the **Cumulative Statistic Graph** or a **Table** of most common **Percentiles**.

Calculation Period

The calculation period on which the statistics are computed is the same as the **Leq Averaging Time** (see section 0, p. 12).

7.2.6 Vibration Historic Graph



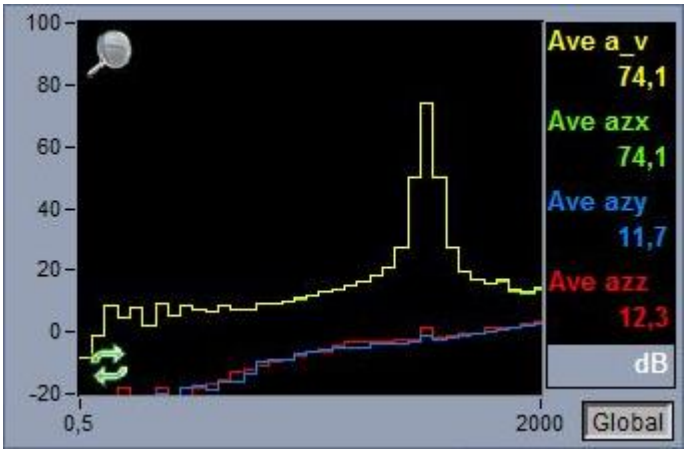
Available data

Data Type	Input	Display Parameter	Freq Weighting
Vibration Global level	X, Y, Z or SUM XYZ	Instant	For details, see the section 6.2.6, p.24
		Average	

Length of the historic graph

During the acquisition, the historic only displays the last few samples. The time span is adjusted to match the SLM historic graph. Past samples may be displayed once the acquisition has been stopped (see section 5.5.3.1, p. 16).

7.2.7 Vib 1/3 Octave Spectrum Graph



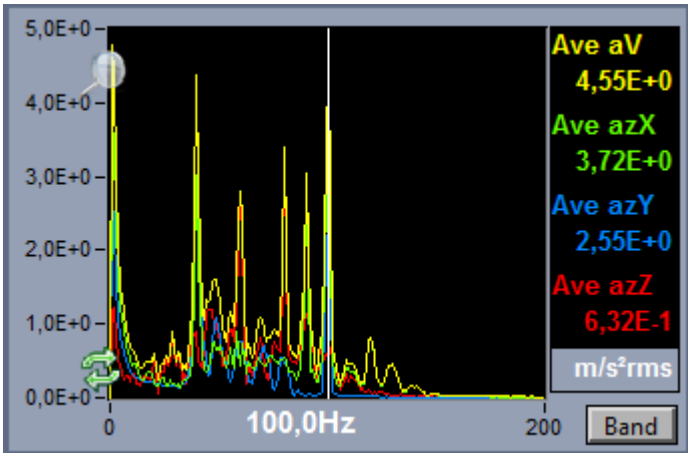
Available data

Data Type	Input	Display Parameter	Freq Weighting
Vib 1/3 Octave Spectrum	X, Y, Z or SUM XYZ	Instant	For details, see the section 6.2.6, p.24
		Average	

Legend Values

Selecting Global versus Band on a **1/3 Octave Band Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend** (see section 5.5.3.1, p. 16).

7.2.8 Vibration FFT Spectrum Graph



Available data

Data Type	Input	Display Parameter	Freq Weighting
Vibration FFT spectrum	X, Y, Z or SUM XYZ	Instant	For details, see the section 6.2.6, p.24
		Average	

Legend Values

Selecting Global versus Band on a **FFT Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend** (see section 5.5.3.1, p. 16).

7.2.9 Camera display

The camera display can be used to display the life video captured by a webcam. The camera settings can be adjusted from the Photo Setup within the Record Setup interface (section 0, p.60). The software manages up to 4 cameras (acquires one at once). However, no more than one camera should be used on a Concerto unit to ensure real-time acquisition.

Camera buttons

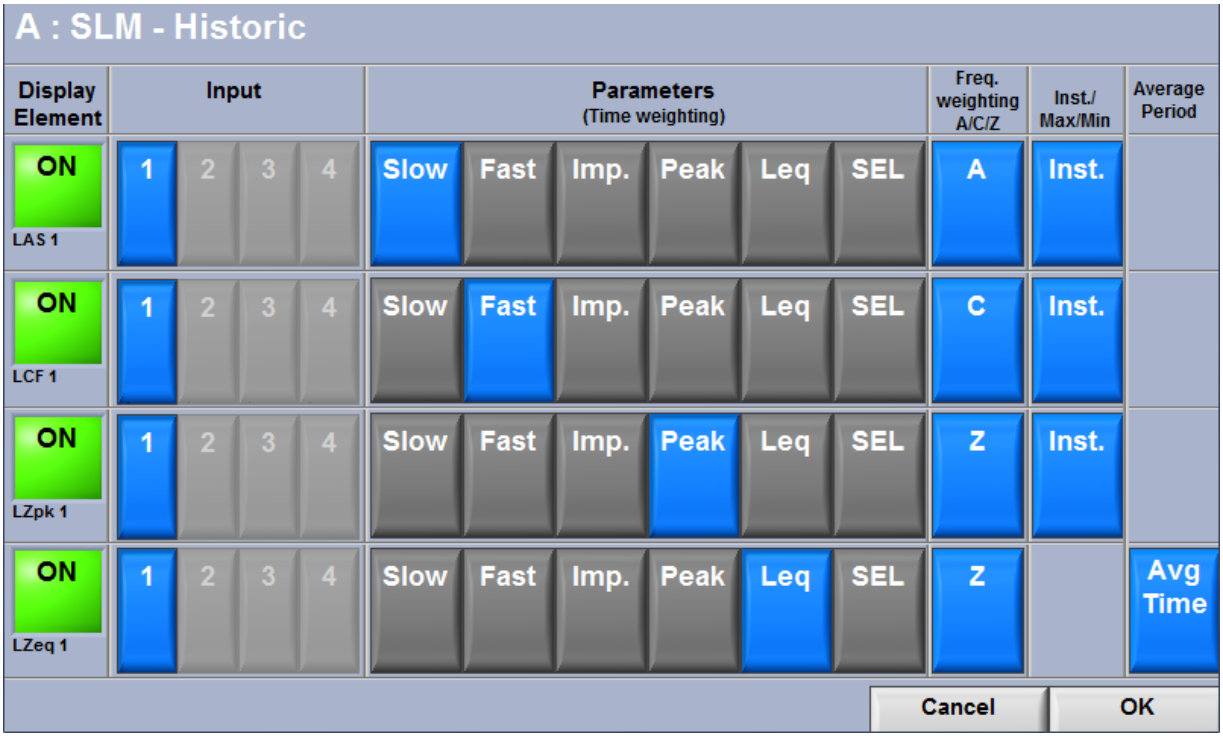
cam1	Indicates that the camera is being displayed.
cam1	Indicates that the picture is being taken and recorded.
cam1	Indicates that the camera is detected, but another camera is being displayed.
cam1	Indicates that the camera is not detected, but it is enabled in the Photo Setup.

7.3 Display Data Selection

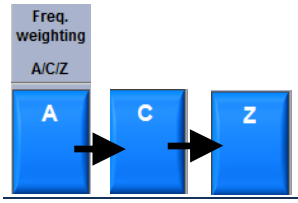
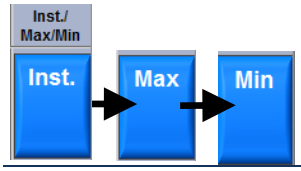
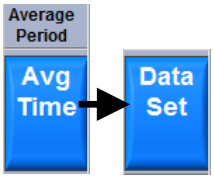
The **Edit** button of the **Data Selection** allows selecting the data to display on each display zone.

The data selection panel is different for a SLM display (section 7.3.1) and for a vibration display (section 7.3.2).

7.3.1 SLM Data Selection



ON / OFF	The **Display Element Enable** enables or disables an element in the display. Each display zone can have up to four elements.
Input 1 2 3 4	The **Input Channel** select input to display. Only enabled inputs will be available (see section 6.1.1). In the SLM & 3Vib application, only the input 1 is available for the SLM part.

	The Time Weighting selects the parameter for each element. Some parameters may be restricted depending on the display type (see section 0 to 7.2.5).
	The Frequency Weighting selects the weighting among the A, C or Z.
	The user can choose to display the maximum or minimum value of the period or the instantaneous values. There are cases where only the instantaneous value is available (see section 0 to 7.2.5).
	The Average Period selects the reference period of the element. By default, the average period is set to Avg Time, which is the Leq Average Time of the measurement. The average period can optionally be set to DataSet, which is the time since the beginning of the DataSet (for details on DataSets, see section 0).

7.3.2 Vibration Data Selection

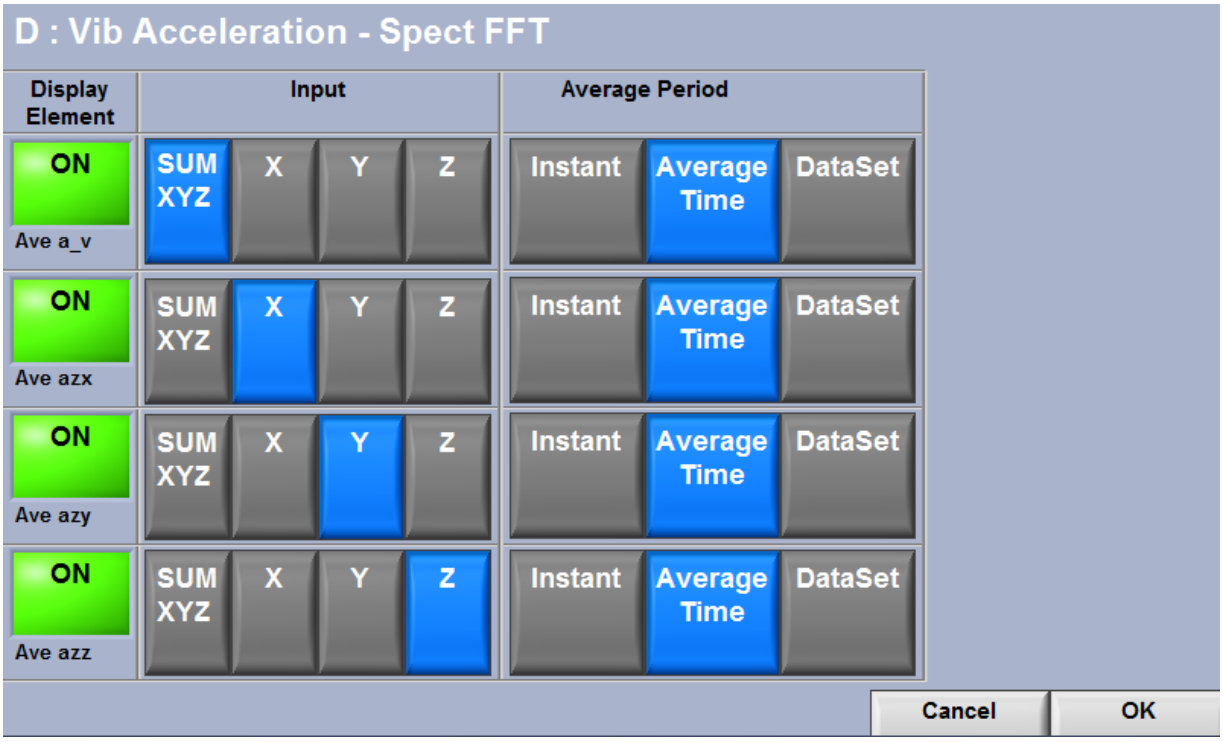
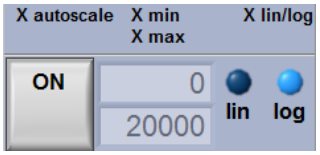


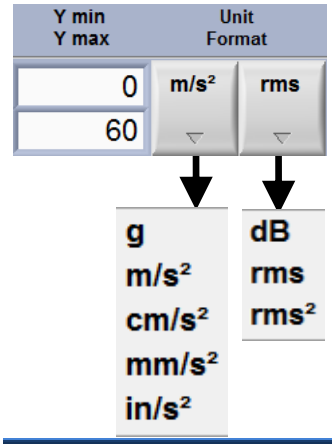
Figure 2 : Vibration Data Selection Interface

ON / OFF	The **Display Element Enable** enables or disables an element in the display. Each display zone can have up to four elements.
SUM XYZ X Y Z	The **Input Channel** select input to display. In the SLM & 3Vib application, only the inputs 2, 3 and 4 (X, Y and Z) are available for the vibration part. (see section 6.2.1). Moreover, the quadratic sum of the X, Y and Z axis can also be display
Instant Average Time DataSet	The Parameter selects whether the instant, average or DataSet value will be display. The average value resets at the beginning of a Leq Averaging Time period while the DataSet value resets on creation a new DataSet.

7.4 X axis and Y axis properties



The X axis range automatically adjusts to the contained data. However, the 1/3 octave spectrum and FFT spectrum graphs X axis (frequency axis) range can be set manually to zoom in on a specific portion of the spectrum. For FFT spectrum specifically, the X axis (frequency axis) mapping can be set to linear or logarithmic.



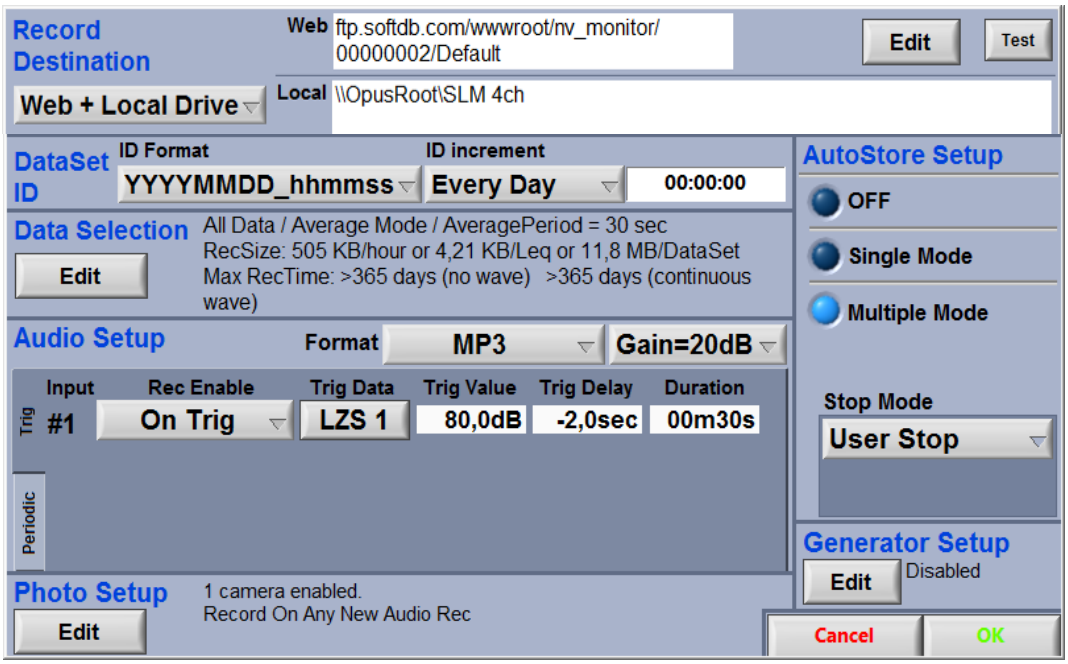
The Y axis range is automatically adjusted to contained data by clicking on the button at the bottom left corner of a graph display (see section 5.5.2, p. 15). However, the Y axis range can be manually adjusted in the display interface.

The unit format of the vibration level can be set in the display interface. The format of SLM data is always dB while the format of vibration data can vary: dB, g rms, m/s² rms, (m/s² rms)², etc.

8 Record Setup

The **Record Setup** allows the user to define:

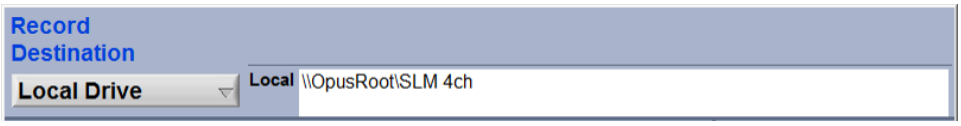
- Record Destination (see section 8.1, p. 42)
- Dataset ID (see section 8.2, p. 47)
- Auto-Store Setup (see section 8.3, p. 49)
- Data Selection (see section8.4, p. 50)
- Audio Setup (see section8.5, p. 56)
- Photo Setup (see section 8.6, p. 60)
- Generator Setup (see section 8.7, p. 62)



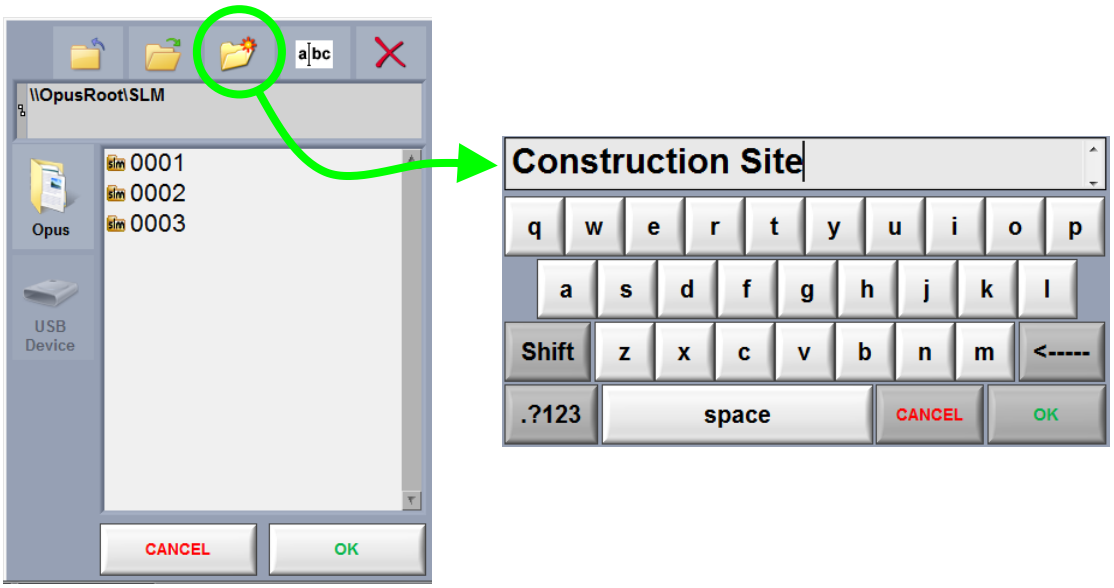
8.1 Record Destination

Obviously, the measurements can be saved on the local drive. These data are recorded in a format compatible for post-processing (either the Opus SLM-4ch module or the SLM Data Analyzer). A more advanced feature also allows saving the measurements on remote location on the Web. The data sent to the Web use a dedicated format for easier Web monitoring, but the data are also compatible with the SLM Data Analyzer.

8.1.1 Record on the local drive



When **Local Drive** is selected, only the local record directory is available to modify. This directory contains the recorded **DataSets**. To edit the directory, simply click on the field. It is a good practice to create a new directory for each measurement session by clicking on the  icon of the explorer dialog.



8.1.1.1 Data Format on the local drive

Each set of data saved in the **Record Directory** are saved under a specific folder called **DataSet** that contains:

- Measurement data file (.slm4)
- Associated audio files (.wav or .mp3)
- Associated photo files (.jpg)

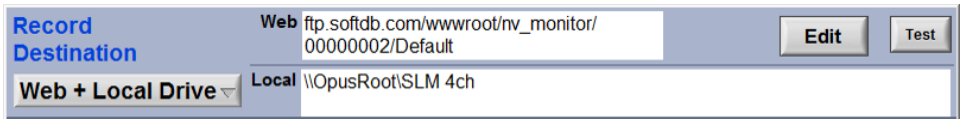
These **DataSets** are displayed as  on the **explorer window**.

The **File/Open** function in the main interface opens these **DataSets** to display them on the **Main Interface**.

On the **Opus SLM 4ch** software, access to the **DataSet** content is prohibited to avoid suppression of any attached file. However, on a stand alone computer the access to the **DataSet** content is allowed to enable user to access the **Data File** and associated audio and photo files individually. Deleting any of these elements will cause information to be lost.

8.1.2 Record on the Web

Notice: The vibration data of this module is not yet supported by the Web mode. Only the SLM data are transferred to the FTP server.

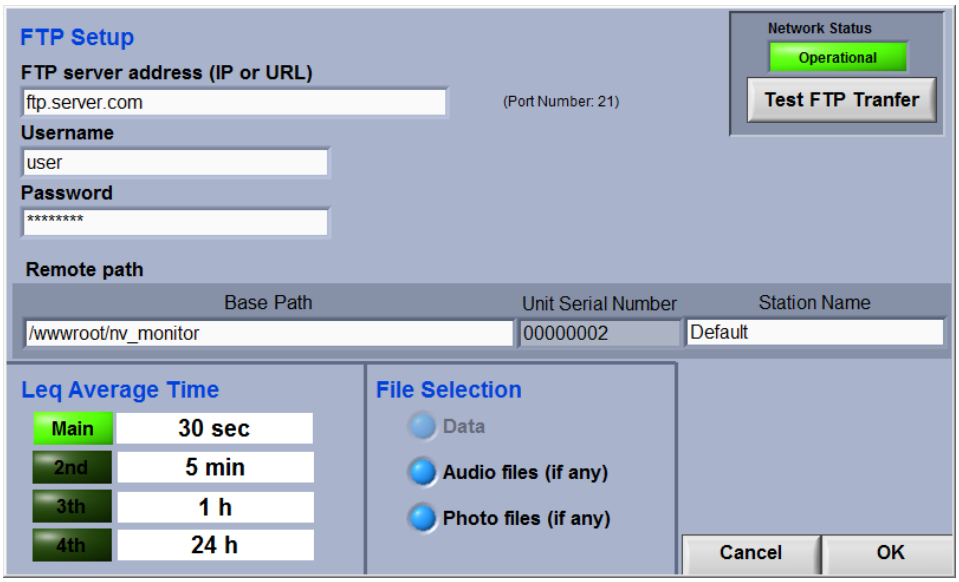


When **Web + Local Drive** is selected, the data are saved both locally (see above) and remotely. New controls appear on the panel to configure the Web transfer.

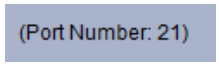
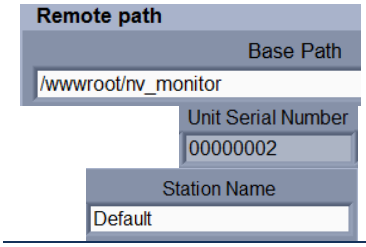
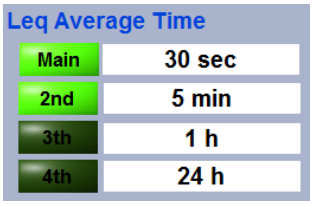
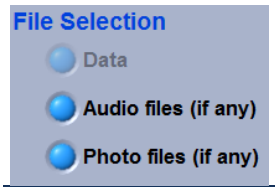
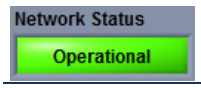
This is an advanced mode intended for web monitoring. It is also possible to post-process the data sent on the Web (FTP server) with the post-processing software (SLM Data Analyzer).

In this mode, the data are store locally for one full month before newer data replace older ones. Notice that audio and photo files may be deleted prior the one month of age if disk space is missing. This way, the more important data recording are preserved.

Use the **Test** button to validate the whole FTP transfer process used in Web mode. Click on the Web path or the **Edit** button to call the Web Setup interface (figure below).



FTP server address (IP or URL) ftp.server.com	Specifies the server address used to transfer the data to. This address can be a URL or an IP address (e.g.: 212.85.150.134)
Username user	Login user name

	Login password
	Port number of the FTP server. The default value is 21. To unlock the control, press and hold the port number indicator for 5 sec.
	The combination of the **Base Path**, **Unit Serial Number** and **Station Name** form the record path on the FTP server. The **Unit Serial Number** is related to the hardware used. Therefore, it cannot be changed by the user.
	When recording to the Web, up to 4 different averaging periods can be enabled. The Main one is also the averaging period seen elsewhere in the module (Leq Average Time in the main panel of the module). Therefore, it can be seen as duplicated controls of the same parameter. The Main period cannot be disabled. The 2nd, 3rd and 4th periods are entire multiples of the Main period. Using these periods will avoid heavy data processing when alternative periods are needed in a Web monitoring application.
	The **File Selection** selects which measurement files will be transferred to the Web. When recording to the Web, the selected data are transferred. The audio and photo files are optionally transferred. By default, all files are transferred.
	This indicators shows the network status (operational or not operational)
	Use this test button to validate the whole FTP transfer process used in the Web mode.

8.1.2.1 Data Format on the Web

Each measurement store on the Web has its own directory formed with the remote path (see the FTP Setup) and the measure name. The measurement name is the start date and time of the measurement with format *YYYYMMDD_hhmmss* (example: *20120831_14h56m15*). So the full path of the measurement directory should look like the following:

FTPaddress/BasePath/UnitSerialNumber/StationName/YYYYMMDD_hhmmss

While measurements on the local drive are stored per DataSet folder, measurements on the Web are stored per measurement. As on local drive, data are partitioned into DataSet files (new DataSet once a day) but all DataSet files are stored in the same measurement directory.

The filename format of a DataSet is the

- The Start time of the DataSet (YYYYMMDD_hhmmss)
- The period number (Per1, Per2, Per3 or Per4)
- The DataSet index (DS0, DS1, DS3, …)

For example:

- *20120831_14h56m15_Per1_DS0.dat*: DataSet started on 2012-08-31 at 14:46:15, averaging period 1 (the main one), the first DataSet of the measurement.
- *20120901_00h00m00_Per3_DS1.dat*: DataSet started at the beginning of the day on 2012-09-01, averaging period 3 (the 3rd one), the second DataSet of the measurement.

The measurement directory can contain the followings:

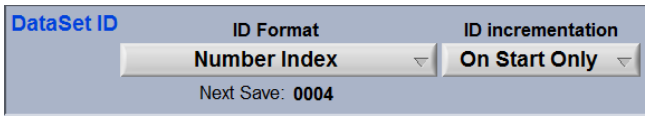
- header.txt, contains the setup information of the measurement
- Data files (.dat), one file per period (up to 4) and per day
- audio directory that contains the audio files (.mp3)
- photo directory that contains the photo files (.jpg)

8.1.2.2 Limitations with the Web mode

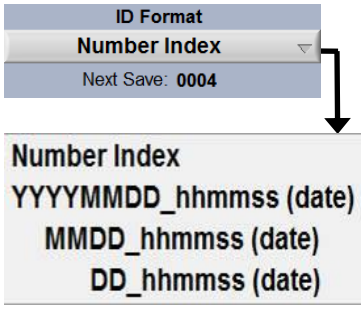
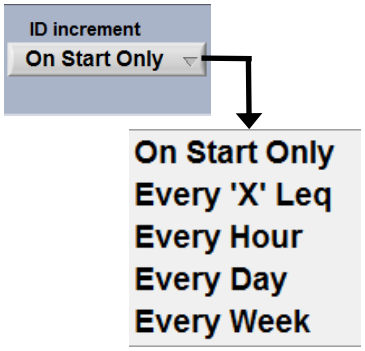
The Web mode shows some limitations compared to the local drive mode.

- DataSet ID: always format **YYYYMMDD_hhmmss** with **Every Day** increment
- Data Selection: Average Mode only
- Audio Setup: MP3 format only (max 30 sec, continuous and Multi-Trig are prohibited)
- User tags and comments are not saved on the web
- Low levels and overload warning are not saved on the web

8.2 Dataset ID



DataSet ID

	The ID Format allows the user to choose the name format of dataset files to be recorded. • Four-digit increment of the **DataSet** in the **Record Directory** • DataSet start time in format YYYYMMDD_hhmmss • DataSet start time in format MMDD_hhmmss • DataSet start time in format DD_hhmmss
	The **ID increment** allows the user to choose when to switch to a new measurement file. This control is enabled only when **AutoStore** is in **Multiple Mode** (see section 8.3, p. **Erreur ! Signet non défini.**). • All the data in a single file (unless maximum size is reached) • New file after a specified quantity of 'X' Leq average periods • New file once an hour (according to the specified alignment) • New file once a day (according to the specified alignment) • New file once a week (according to the specified alignment) Upon selection of the Every 'X' Leq, a control will appear below to select the appropriate quantity of Leq. Similarly, a time alignment control will appear upon selection of Every Hour/Day/Week.
	The **Align Leq Period on Clock Time** control allows the user to force the Alignment of the Leq Period to match the time on the clock. This control is only visible with **ID increment** set to **On Start Only** or **Every 'X' Leq.** The alignment with clock is always forced when **Every Hour/Day/Week** modes are selected.

8.2.1 DataSet and Leq Alignment

In several cases, it is useful to align the Leq measurements to match the time on the clock. For example, it may be useful to align the 1 hour Leq periods of a 24 hours acquisition (in **Multiple Auto-Store Mode**) in order for the Leq to start exactly at the beginning of a new hour on the clock. A measurement started at 7:35 AM would then start a new Leq at 8:00 and every hour afterward.

Moreover, using the **Every Day** mode of **ID increment** would allows the user to switch to a new file every day on a specified time. With time alignment being set to 06:00:00, the data recording would change to a new file every day at exactly 6:00 AM. All the Leq period would represent one full hour on the clock except for the first Leq period when the acquisition was started on the first day. The alignment is forced to the time alignment specified. It is common to use an exact hour as alignment, but one could want to align the measurement on the middle of the hour. Indeed, the user could specify an alignment of 6:30:00. The first Leq of the example would than goes from 7:35 to 8:30. The following Leq periods would last one hour afterward until 6:30 AM the next day. A new DataSet would than be created and would normally include 24 one-hour Leq spanning from 6:30 AM to 6:30 AM the next day.

In order to achieve the Leq alignment to the clock it is necessary for the **Leq Average Period** to be a common multiple of the **DataSet** period. With the **Every Hour/Day/Week** modes, the **Leq Average period** will be forced to the nearest common multiple. With the **On Start Only** and the **Every 'X' Leq** modes, the alignment parameter also limits the **Leq Average period** to match with the clock unit.

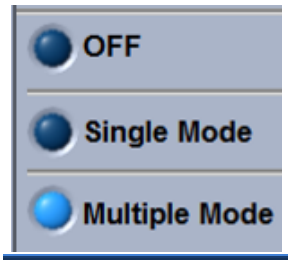
8.2.2 DataSet File Size

Multiple **DataSets** are useful when performing a long term measurement lasting several days and it is desirable to have a separate **DataSets** for each day or for each hour. Moreover, the application limits the DataSet file size to 200 MB. Therefore, the user is informed of the limitations as the parameters of the measurement are modified. The size limitation also applies when the **ID increment** is set to **On Start Only**. This means that the application will automatically switch to a new DataSet before the size limitation is reached.

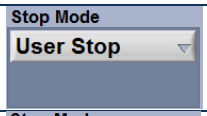
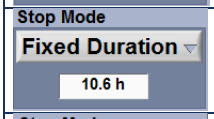
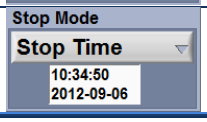
8.3 Auto-Store Setup

The Auto-Store Setup provides several options for saving measurements.

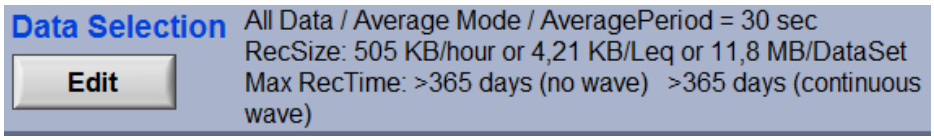
AutoStore Modes

	The measurement will stop after the **Leq Average Time** elapses. The resulting **DataSet** must be stored manually by pressing the SAVE button.
	The measurement will stop after the **Leq Average Time** elapses. The resulting **DataSet** is stored automatically.
	The measurement continues after the **Leq Average Time** elapses, averaging is reset and each period data is stored automatically**.**

Multiple Mode Setup

		The **Align Leq Period on Clock Time** forces the alignment of the Leq periods to match the time on the clock. This control is only visible with **ID increment** set to **On Start Only** or **Every 'X' Leq.** The alignment with clock is always forced when **Every Hour/Day/Week** modes are selected.
Stop Mode		The measurement will stop when it is stopped manually by the user.
		The measurement will stop automatically when the **fixed duration** has elapsed. It can also be stopped manually by clicking the STOP button.
		The measurement will stop automatically when the **stop time** is reached. It can also be stopped by clicking the STOP button.

8.4 Data Selection

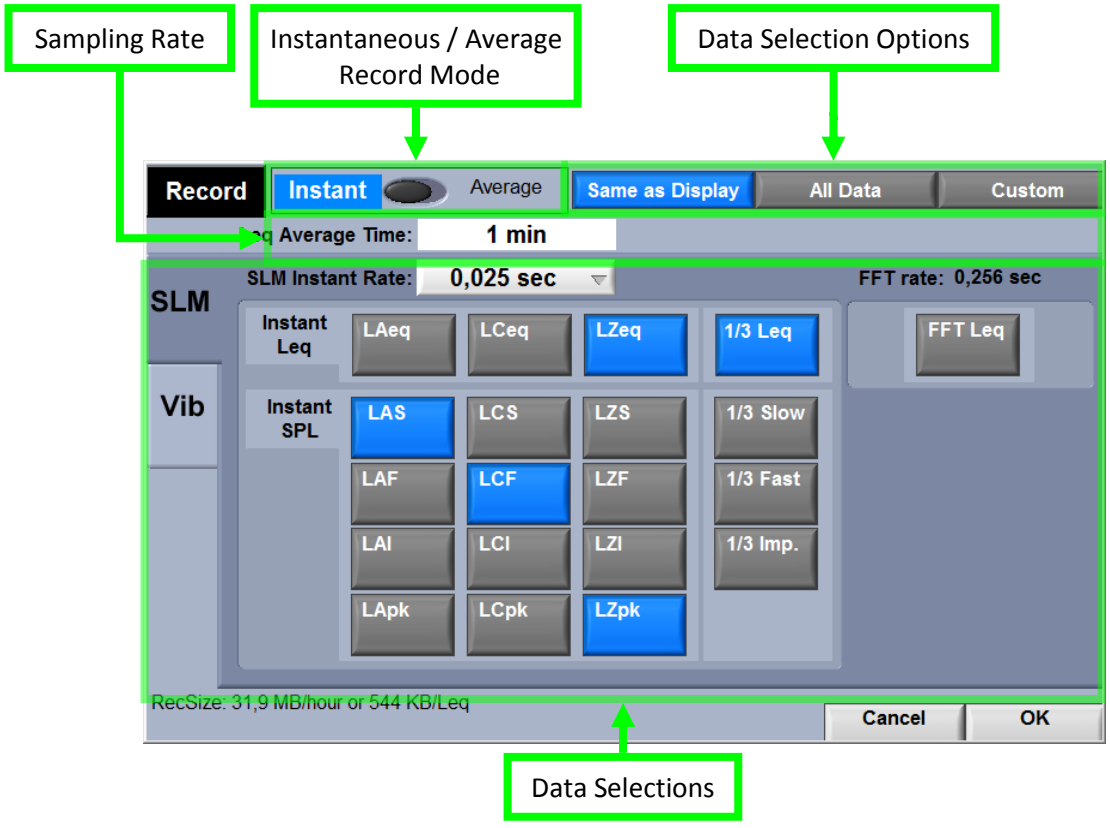


The **Data Selection** area of the **Record Setup Interface** displays a summary of the options selected by the user. It also displays some relevant data size information.

The 

button launches the **Record Data Selection** interface that defines:

- Data Recording Mode (see section 8.4.1, p. 50)
- Data Record Rate (see section 8.4.2, p. 54)
- Values to Record (see section 8.4.3, p. 54)



8.4.1 Instantaneous / Average Record Mode

The 

switch defines the record mode.

8.4.1.1 Instantaneous Record Mode

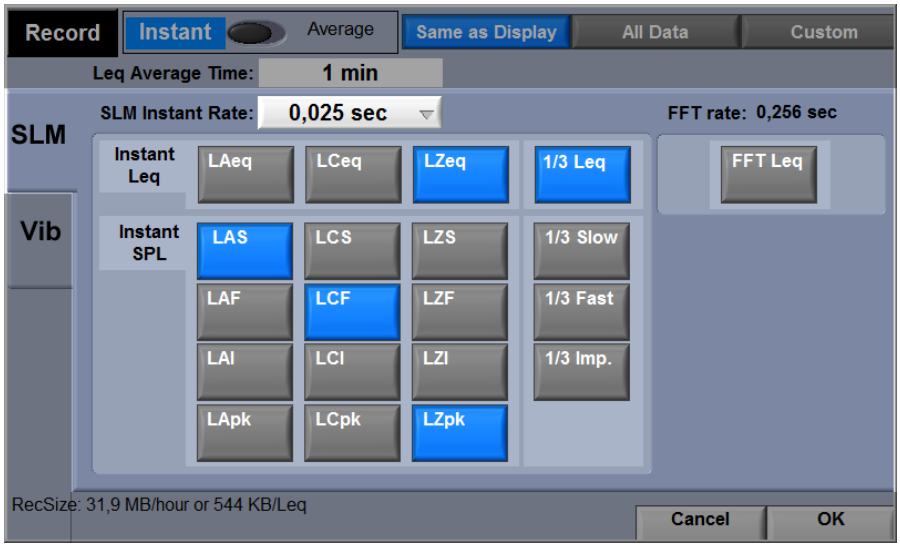
The **Instantaneous Record Mode** records the instantaneous values at a relatively high rate. The SLM record rate is defined by the **SLM Instant rate** while the vibration record rate depends on the frequency resolution (Input Setup, section 6.2.7, p.24). This record mode allows for more flexibility in post-processing, but creates large files. It is recommended for short measurements that require high temporal resolution like impulsive events. The average data can be recompiled from the instantaneous data.

Post-Processing Options

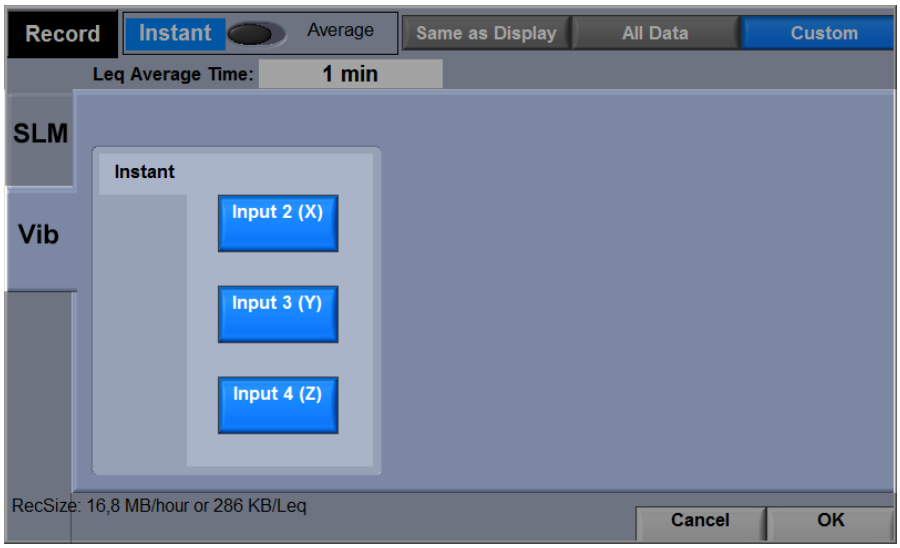
The available operations for this record mode on post-processing are:

- Free event masking on the time-history
- Free redefinition of averaging periods
- Calculating stats on Global SPL and 1/3 Octave SPL Spectrum

The following images show the data that are available when the **Instantaneous Record Mode** is selected.



Only the Z weighting of the SLM spectrums can be recorded. The other frequency weightings can be easily applied on the recorded spectrum in post-processing.



In the same way, the recorded vibration data consist of the spectrums of each input without any frequency weighting. All the vibration data will be extracted from those spectrums in post-processing.

8.4.1.2 Average Record Mode

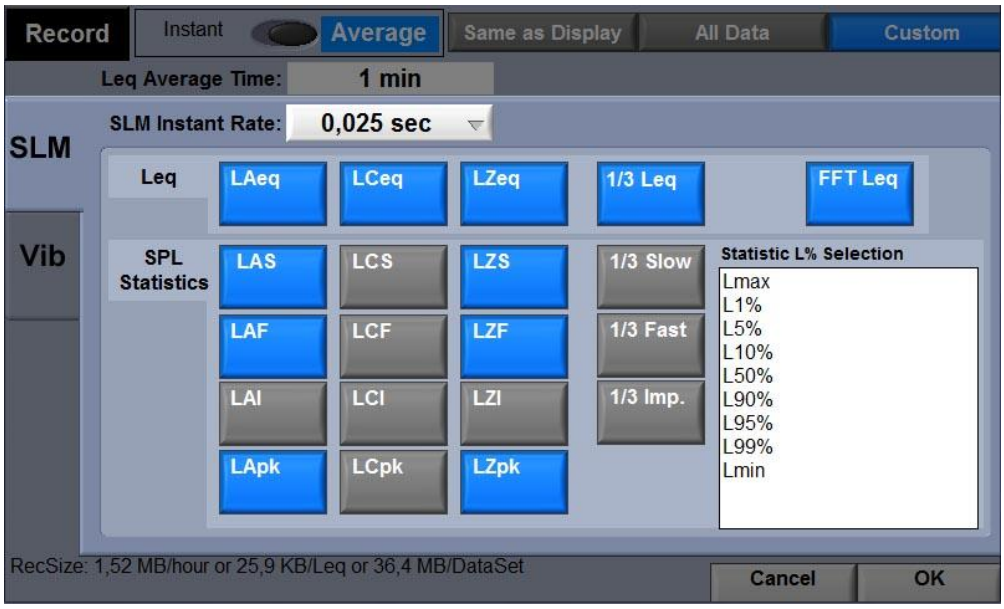
The **Average Record Mode** records the average values at a relatively low rate. The record rate is defined by the **Leq Average Time** for both SLM and vibration data. This record creates smaller files, but allows for less flexibility in post-processing. It is recommended for taking long measurements that do not require high temporal resolution such as environmental noise measurements.

Post-Processing Options

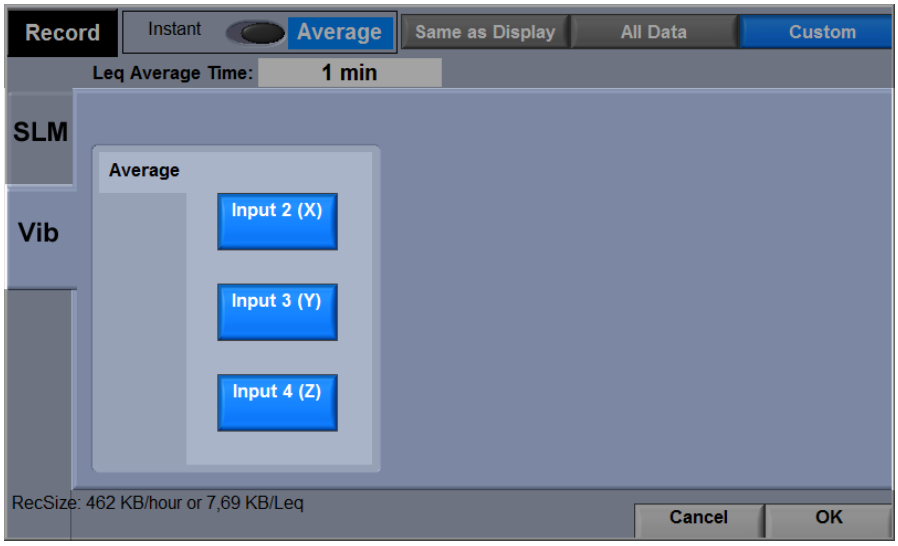
The available operations for this record mode on post-processing are:

- Limited event masking on the time-history
- Limited redefinition of averaging periods
- Calculating statistics on SPL

The following images show the data that are available when the **Average Record Mode** is selected.



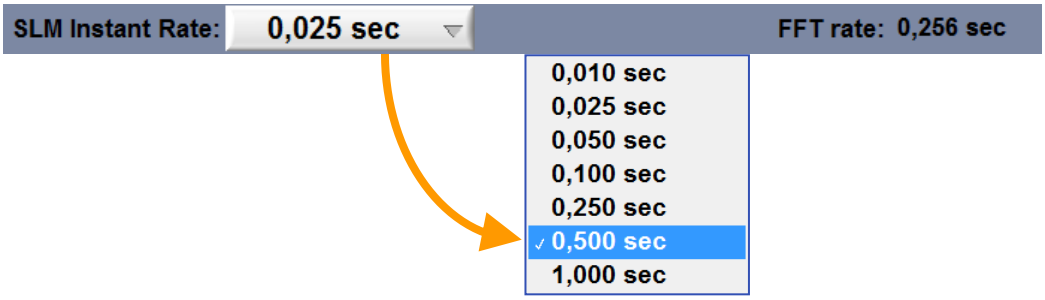
Only the Z weighting of the SLM spectrums can be recorded. The other frequency weightings can be easily applied on the recorded spectrum in post-processing.



In the same way, the recorded vibration data consist of the spectrums of each input without any frequency weighting. All the vibration data will be extracted from those spectrums in post-processing

8.4.2 Sampling Rate

8.4.2.1 SLM Instantaneous Rate



The SLM Instantaneous Rate spans from 10 ms to 1 s. This parameter defines the rate at which the SLM data are managed in the application in general. This impacts the sampling of the SLM historic graph as well as the record rate of SLM data in Instantaneous Record Mode.

Some sampling rates may not be suitable for some measure types. If such a combination occurs, a warning is displayed but does not prevent the user from proceeding with measurement. For example, a sampling rate of 1 s is not suitable to correctly reproduce the Fast SPL as it is subject to vary more rapidly in time.

The FFT rate is set automatically from 256 ms, 512 ms or 1024 ms according to the selected Sampling Rate.

8.4.2.2 Leq Average Time

The Leq Average Time can be set between 1 s to 24 hrs. Simply click on the field to modify this value. This value can also be modified on the Leq Averaging Time indicator on the main interface.

The Leq Average Time defined the average period for the evaluation of Leq data. The same period is used to evaluate the minimum, the maximum and the statistics. This average time also drive the rate that the data are saved in Average Record Mode.

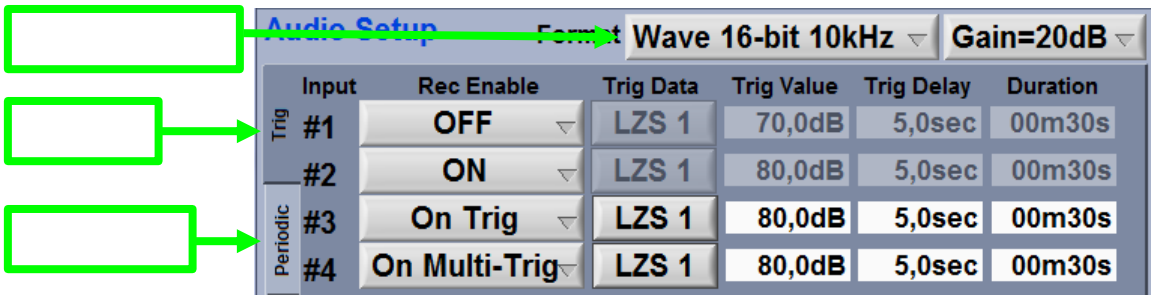
8.4.3 Data Selection Options

The **Data Selection Presets** automatically selects the data to be recorded. The table below summarizes these options, as well as their advantages and drawbacks.

Option	Advantage	Back-draw
Same as Display All parameters used in the **Display Setup** are recorded in **Instantaneou**s mode	Records what is displayed on the **Main Interface Display Area**. (Minimises the errors and oversights in data selection)	File size in instantaneous mode can sometimes be significantly larger than in average mode.
All Data All acoustical parameters are recorded.	Ensures the availability of data should advanced post-processing is required.	File size can be significantly large.
Custom Only desired data is recorded	Maximizes flexibility of recorded content as well as the efficiency of file size.	The user must ensure that the recorded data will correspond to its needs.

8.5 Audio Setup

Notice: In the SLM&3Vib module, only the SLM input (input #1) is supported for the audio recording. Do not take into account any reference to input 2, 3 and 4 in this section.

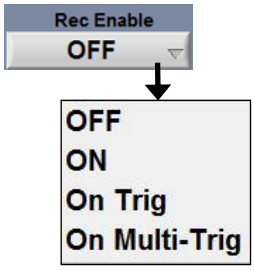


The audio recordings are useful to identify the source of the noise that was measured. Recordings can be done on a level trigger and/or periodically.

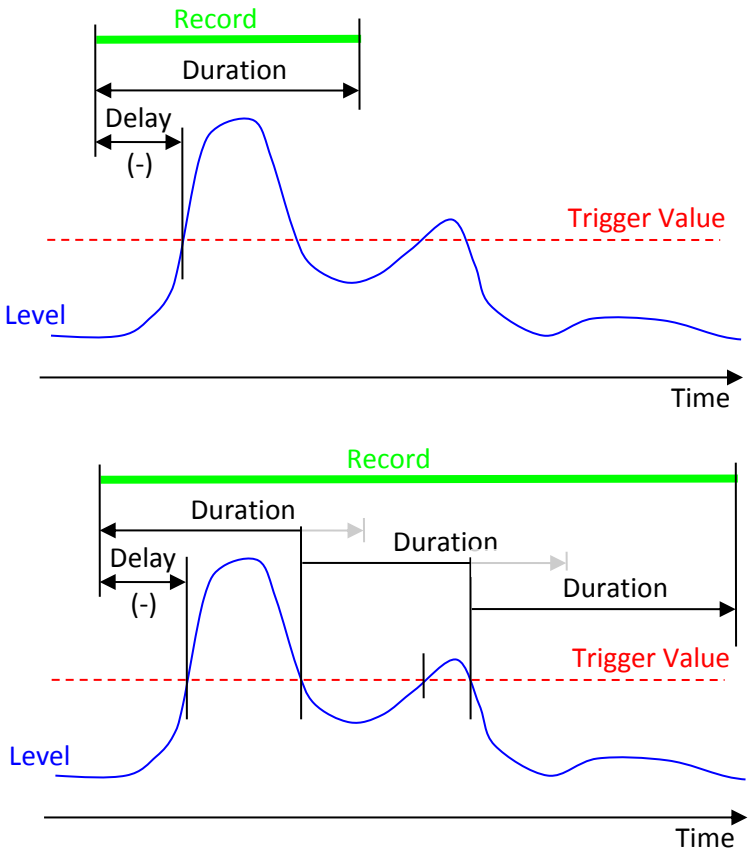
Audio Format

Wave 10kHz MP3 (32 Kbps) Wave 16-bit 10kHz bandwidth (384 Kbps) Wave 16-bit 20kHz bandwidth (768 Kbps) Wave 32-bit 10kHz bandwidth (768 Kbps) Wave 32-bit 20kHz bandwidth (1536 Kbps)	The file format of the audio recordings. - .mp3 file, 16-bit & 24 kHz sampling rate compressed to 32 kbps - .wav file, 16-bit, 24 kHz sampling rate (10 kHz usable bandwidth) - .wav file, 16-bit, 48 kHz sampling rate (20 kHz usable bandwidth) - .wav file, 32-bit, 24 kHz sampling rate (10 kHz usable bandwidth) - .wav file, 32-bit, 48 kHz sampling rate (20 kHz usable bandwidth) As the Kbps (kilobits per seconds) rate indicates, the MP3 format is interesting since the file size is 12 times smaller than its Wave file equivalent. However, artefacts resulting from the compression may be perceptible. When using MP3 compression, the maximum file duration is 30 sec. Also the Record Enable mode ON and On Multi-Trig are disabled.
Gain=20dB Gain=0dB (levels>90dB) Gain=20dB (level around 70dB) Gain=40dB (level around 50dB)	The gain is applied on the audio signal before recording to the file. - No gain: for very high level or to avoid numeric saturation - 20 dB gain: for better listening of mid-range levels (around 70 dB) - 40 dB gain: for better listening of low levels (lower than 70 dB) This option is useful to facilitate the listening of files that the levels are low. Such files are otherwise almost impossible to heard in common audio players. Applying a gain exposes the audio signal to numerical saturations.

Trig Tab

	The file format of the audio recordings. - OFF: No audio recording is performed. - ON: Continuous audio recording is performed from the start to the end of a measurement. - On Trig: Recording is triggered by a noise event and lasts the specified duration. - On Multi-Trig: Recording is triggered by a noise event and the duration resets on every trigger value.

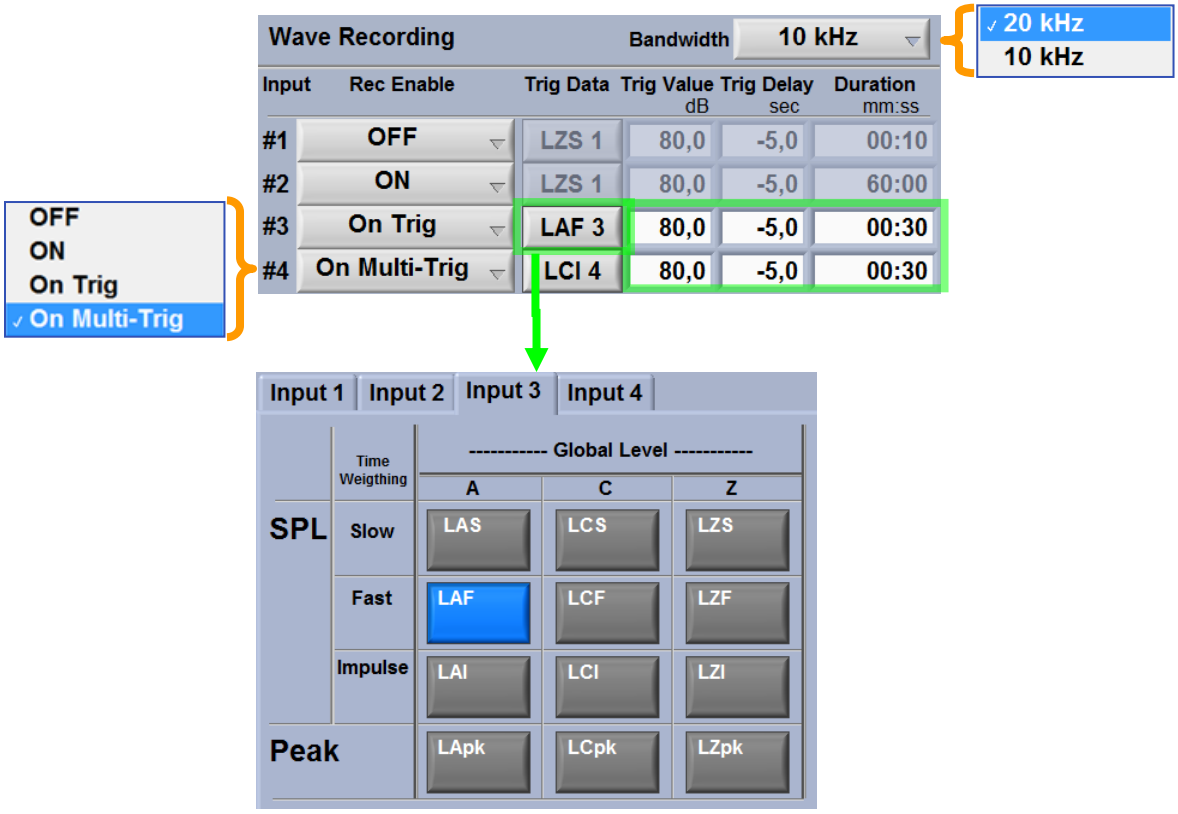
8.5.1 Recording Mode and Trigger Settings



The recording mode sets how the recording is done:

OFF	No audio recording is performed.
ON	Continuous audio recording is performed from the start to the end of a measurement.
On Trig	Recording is triggered by a noise event and stops after the user-specified duration.
On Multi-Trig	Recording is triggered by a noise event and the duration is reset if the trigger value is exceeded before the duration has elapsed.

The trigger value, the trigger level, the trigger delay and the duration for the **On Trig** and **On Multi-Trig** record modes can be selected on the **Audio Recording section** on the **Record Setup** Interface.

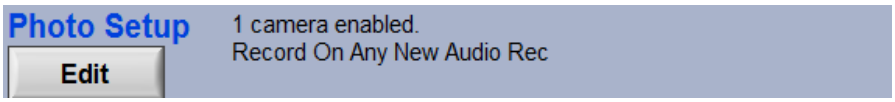


8.5.2 Effect of Channel Selection and Sampling Rate on Audio Recordings

Audio recording is prohibited under certain conditions

1 or 2 enabled inputs	Sampling rate ≤ 25 ms
3 or 4 enabled inputs	Sampling rate ≤ 50 ms

8.6 Photo Setup



Along with the audio recordings, photos can be taken as an event occur or periodically. If activated, a camera will record a photo every time a new audio file is created. Virtually all webcams are compatible (use DirectShow interface).

Press the Edit button to access the Photo Setup interface.

8.6.1 Photo Setup Interface

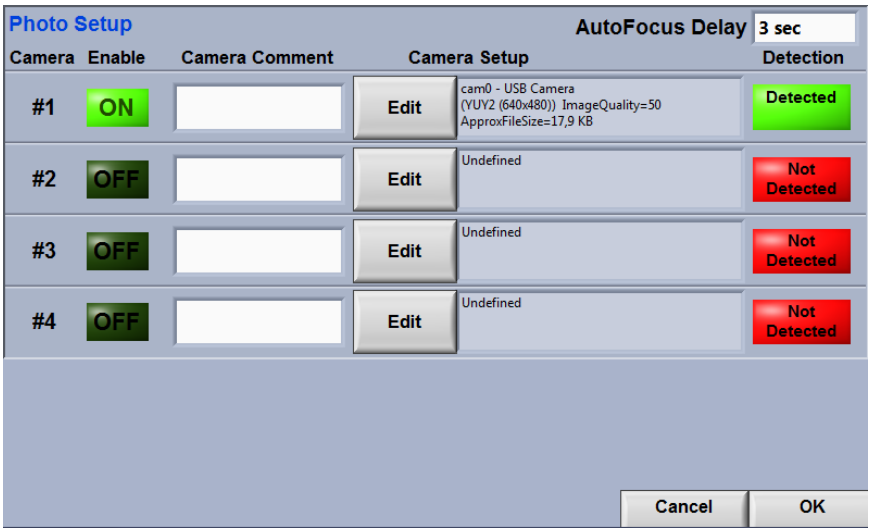
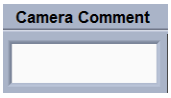
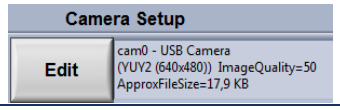
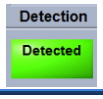
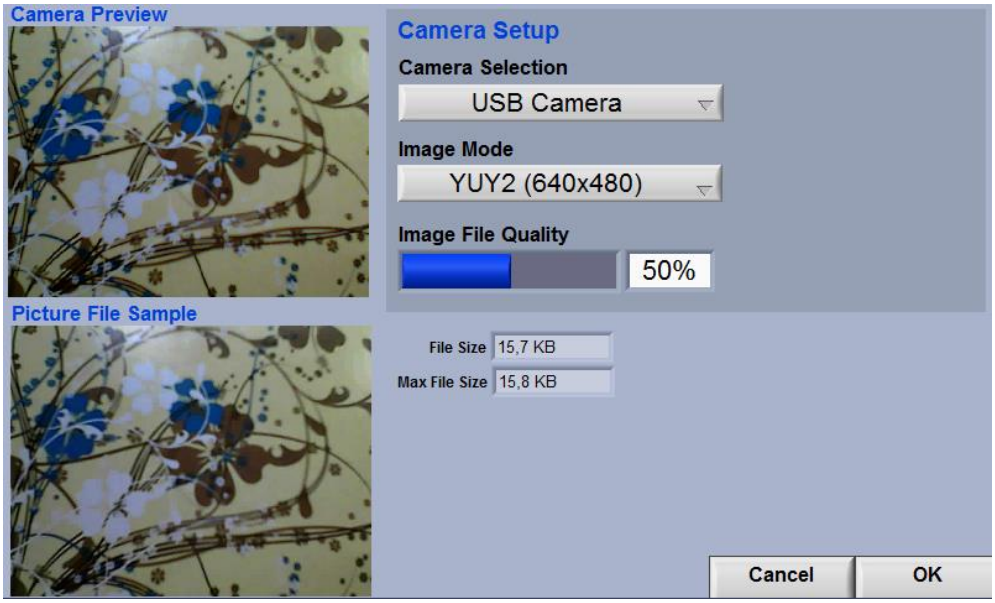


Photo Setup Interface

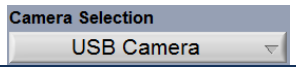
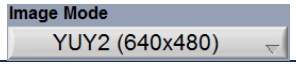
	The Autofocus Delay should be adjusted to the time the camera takes to properly set its focus once it is powered. This parameter is important if several cameras are used during a measurement.
	This button enables or disables the related camera. Using several cameras on a Concerto platform is not recommended.
	A comment can be attached to one camera to help identifying it.
	The Edit button loads the Camera Setup interface (section 8.6.2).
	This indicator is on if the specified camera is detected.

8.6.2 Camera Setup Interface

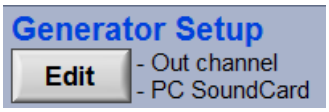
The **Camera Setup** interface is available from the **Photo Setup** interface.



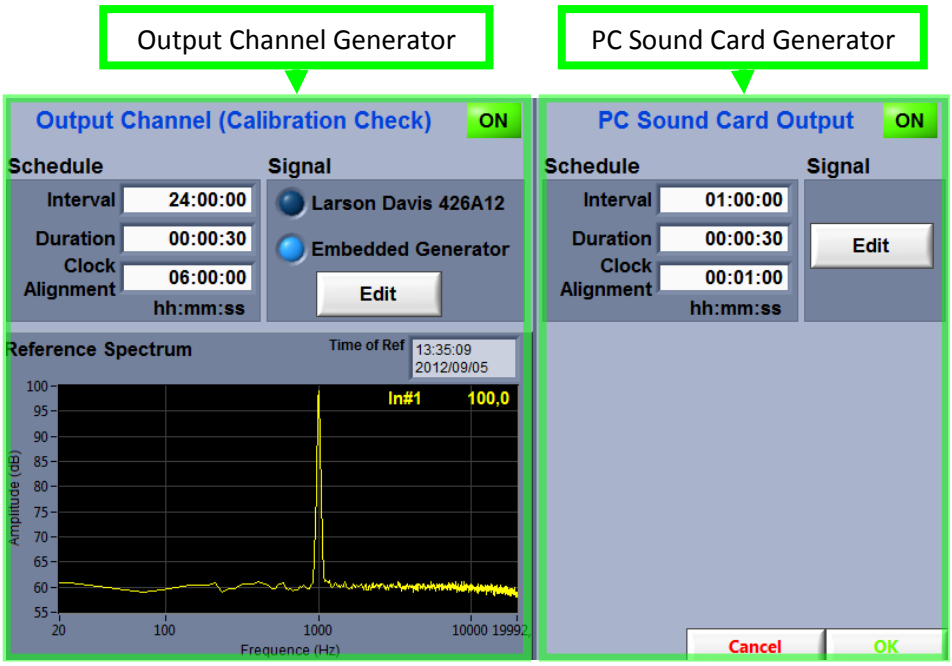
Camera Setup Interface

	The Camera Preview is the video streaming that outputs the camera.
	The Picture File Sample is a sample of the file that is recorded with the current camera setup.
	Select a camera from the Camera Selection menu.
	Select the image definition from the Image Mode menu.
	Adjust the Image File Quality from 0 to 100%. This quality factor is used in the jpeg compression process. A quality factor of 100% will create the biggest files and 0% the smallest files.
	The File Size is the file size of the current Picture File Sample. The Max File Size tries to estimate the worst file size that the current setup can produce.

8.7 Generator Setup



To edit the **Generator Setup**, press the corresponding button on the **Record Setup** interface. There are two independent generators that can be used.



Output Channel Generator	PC Sound Card Generator
Uses the output channels 1 and 2 of the unit.	Uses the sound card line out of the PC.
Embedded generator with tone, white noise and DC offset. The optional Larson Davis 426A12 signal will output 2 VDC.	Signal comes from a specified wave file. If necessary the generator will loop the file until stopped. Press the **Edit** button to change the source file and volume.
Can be used for periodic **Calibration Check** (see section 8.7.1 p.63) or for general use. The reference spectrum is saved for further level comparison.	For general use.
The generation can be scheduled by specifying the interval, duration and clock alignment.	The generation can be scheduled by specifying the interval, duration and clock alignment.

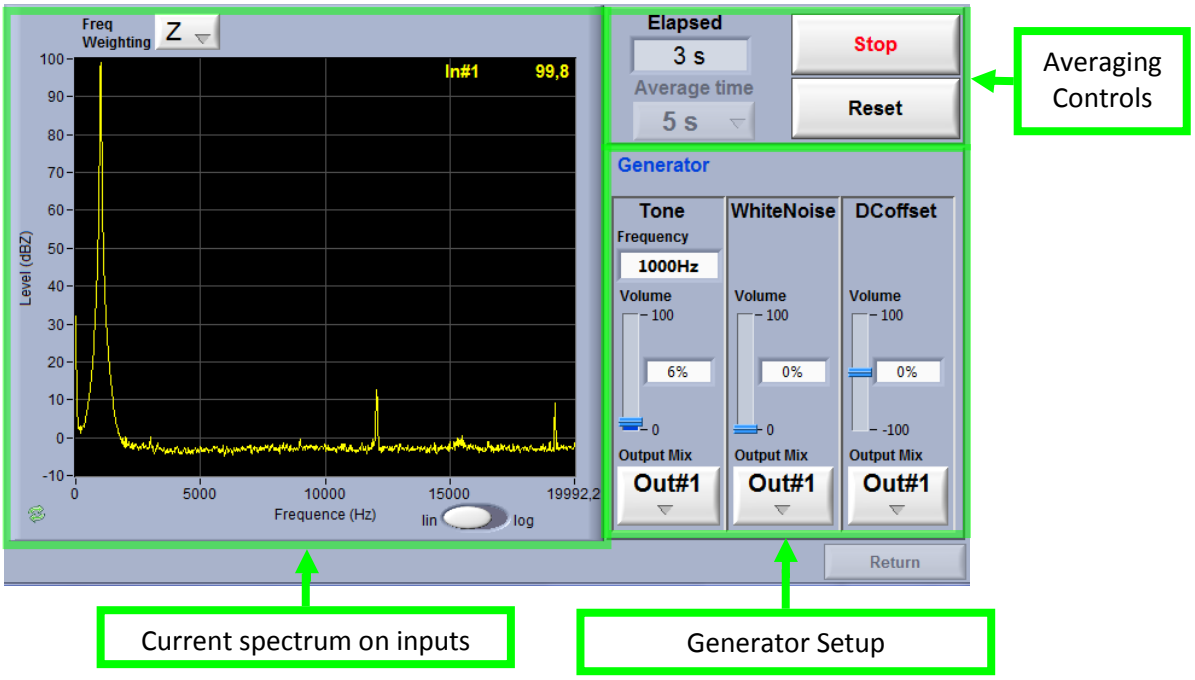
8.7.1 Calibration Check

The calibration check is generally used in long term or permanent environmental system. It is intended to periodically verify that a system is working properly and that the acquisition level is adequate. To achieve this goal, an actuator has to be installed near the input sensor. Prior the measurement, the actuator will be exited to provide a reference signal at the input and the obtained reference spectrum will be saved. During the acquisition, the actuator will be activated periodically. A comparison of the spectrum during the measurement and the reference spectrum, allows the user to conclude on the proper operation of the acquisition system.

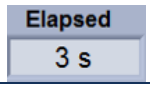
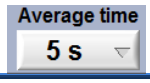
The generated signal should be loud enough to be way over the normal signal being measured. Ideally, the generated signal should be a few dB below the maximum range of the input. For example, the Larson Davis 426A12 actuator typically generates 91 to 97 dB at the input.

The following sections explain how to configure the generator and how to define the reference spectrum.

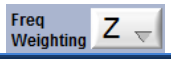
8.7.2 Reference Spectrum Interface



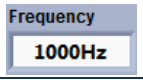
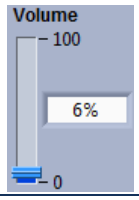
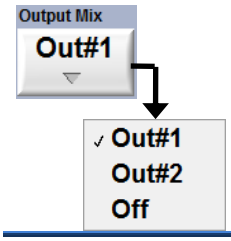
Averaging Controls

	Starts and stops the average of the averaging of the spectrum. Once the **Average Time** in completed, the user is asked if the current spectrum should be used as the reference.
	Resets the averaging of the spectrum**.**
	The elapsed time since the beginning of the averaging.
	The duration of the averaging.

Current spectrum on inputs

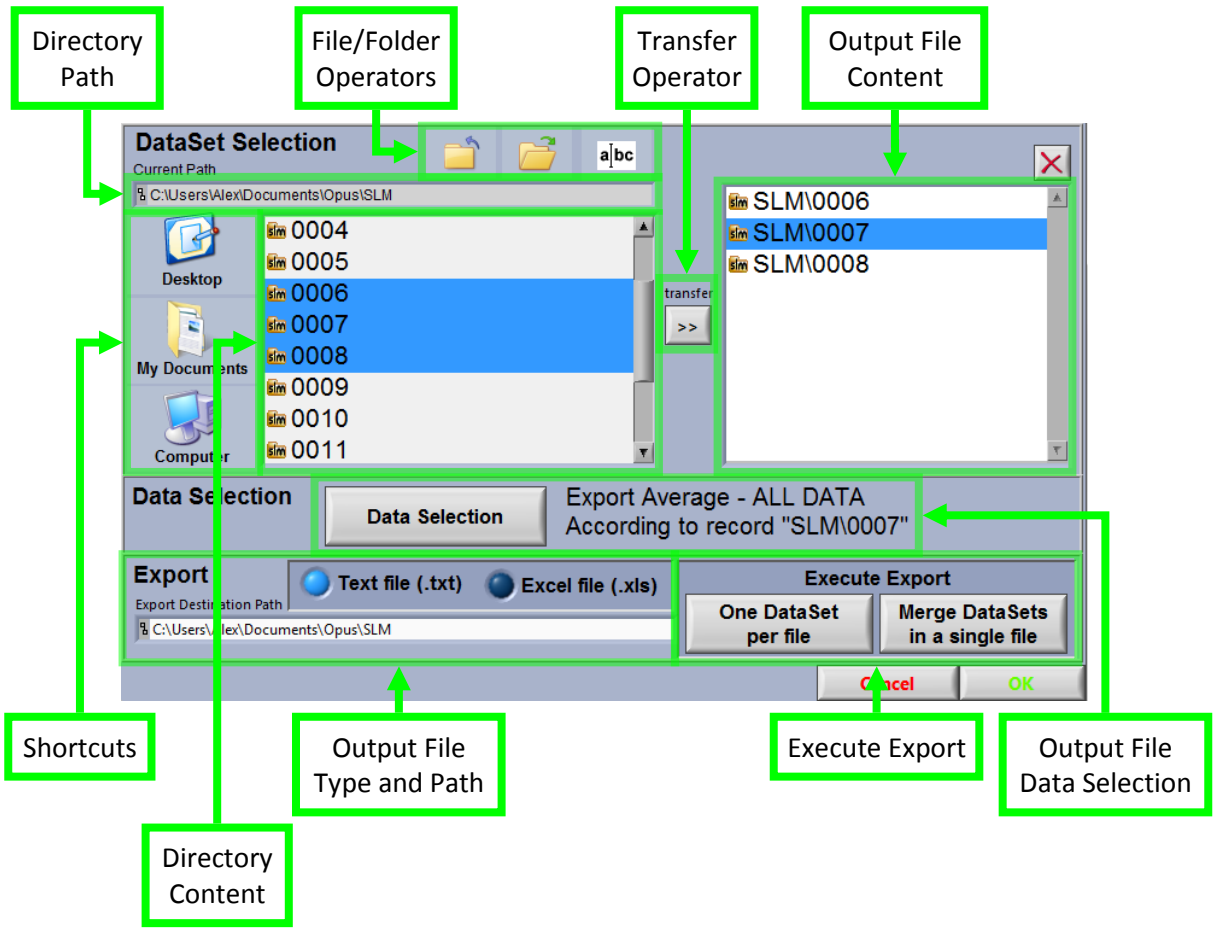
Spectrum Graph	The FFT spectrum of the enabled inputs.
	The legend of the plots and the global levels of are displayed in the upper right corner.
	Sets the frequency axis in linear or logarithmic mapping.
	Rescales the amplitude axis.
	The frequency weighting selects the unit of the spectrum (dBA, dBC or dBZ).

Generator Setup

	Sets the tone generator frequency.
	Sets the tone generator output level, white noise generator and DC offset. The level is a fraction of full output range, which is around 2.1 V.
	Maps each signal (tone generator, white noise generator and DC offset) to the specified output (output 1, output 2 or none). If several parts of the generator are mapped to the same output, parts will sum up to form the output signal. If the absolute sum of the levels that form a given output exceeds 100%, saturation may occur at the output.

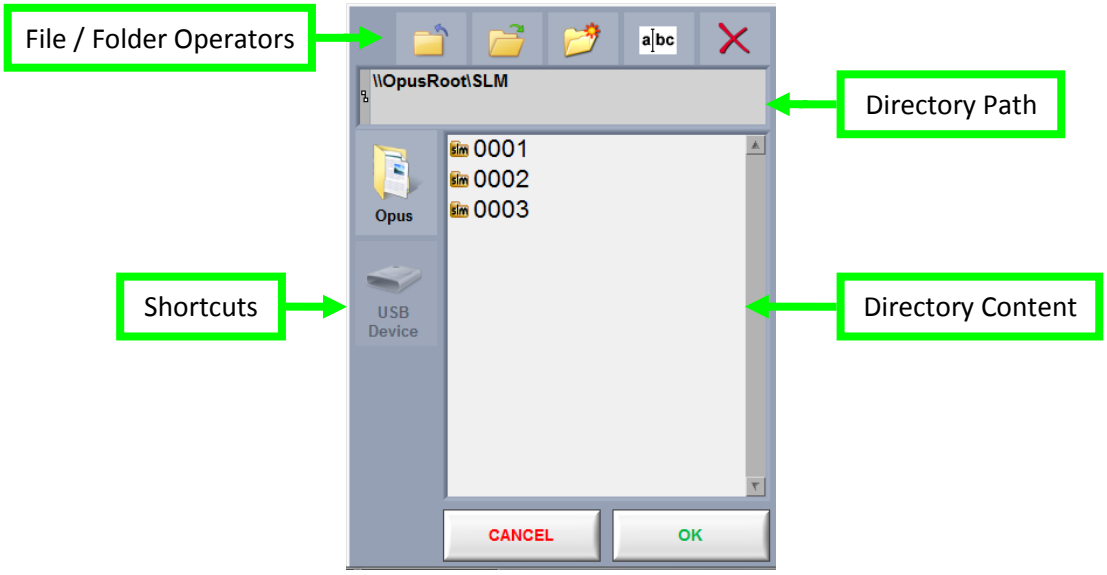
9 Data Exporter

The Data Exporter utility is used to export data contained in a dataset in a .txt or .xls file



Directory Path	Displays the path of the active directory.
File/Folder Operators	Can be used to: • Go to parent directory • Open directory • Rename folder or file
Transfer Operator	Transfers the **Dataset** content to the output data file.
Export File Content	Displays the content of the output file. To add data, drag **DataSets** from the **Directory Content** to the **Output File Content** or click on the **Transfer Operator** to transfer selected **DataSets**.
Shortcuts	Allows easy access to common directories. When the **Data Exporter** is used on a stand-alone computer, these shortcuts are linked to: • Desktop • My Documents • Computer When the Data Exporter is used on a Concerto, the shortcuts are linked to: • Opus Root • USB Device.
Directory Content	Displays the content of a directory and responds to common actions from the user: • Single clicking on an element will select it • Double clicking on a directory will open it • Dragging an element from one side to the other will perform a transfer.
Export File Type and Path	Allows the user to select the output file type (.txt or .xls) and select the output file directory.
Execute Export	Creates the output file: • **One Dataset Per File** creates different files for each datasets in the **Output File Content** • **Merge Datasets in a Single File** creates a single file with each datasets on separate columns.
Output File Data Selection	Launches an interface that allows the user to select the data to be used when writing the output file. Available choices will depend on the selected dataset in the **Output File Content**.

10 Explorer Dialog



Explorer Window Controls and Indicators

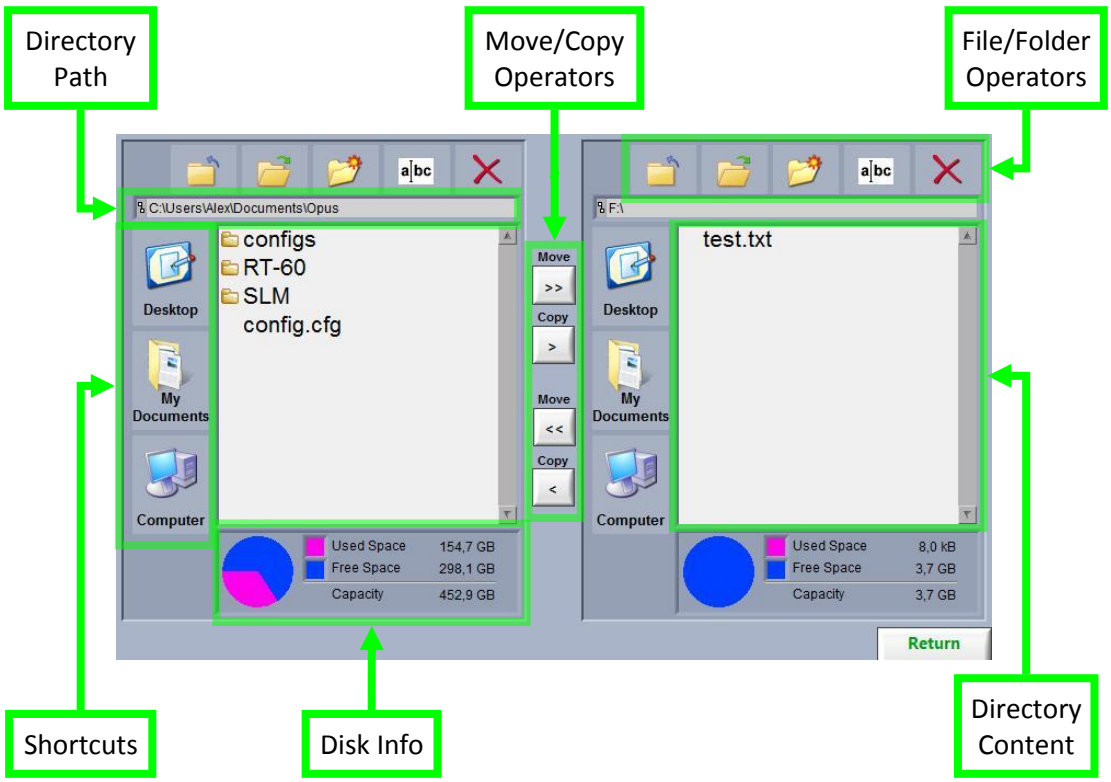
File/Folder Operators	• Go to parent directory • Open directory • Create new folder • Rename folder or file • Delete folder or file
Directory Path	Displays the path of the active directory.
Shortcuts	Accesses to **common directories**. When used on a stand-alone computer, those shortcuts are linked to: • Desktop • My Documents • Computer When used on a ***Concerto***, the shortcuts are linked to: • Opus Root • USB Device.
Directory Content	Displays the content of a directory and responds to common actions: • Single clicking on an element selects it. • Double clicking on a directory opens it.

11 File Manager

The File manager is used to perform most file operations:

- Navigate the directory structure
- Create folders
- Rename files and folders
- Move or copy files and folders from one place to another
- Delete a file or a folder

Although not very useful on a stand-alone computer, this manager is necessary on the *Concerto,* on which Windows explorer is unavailable. Its primary function is to allow the user to manage the *Concerto* directory structure and to export files and folders to a USB memory stick.



Directory Path	Displays the path of the active directory.
Shortcuts	Allows easy access to common directories. When the **File Manager** is used on a stand-alone computer, these shortcuts are linked to: • Desktop • My Documents • Computer When the **File Manager** is used on a ***Concerto***, the shortcuts are linked to: • Opus Root • USB Device.
Move/Copy Operators	Copies or moves a file or folder from a source to its destination.
File/Folder Operators	Allows user to: • Go to parent directory • Open directory • Create new folder • Rename folder or file • Delete folder or file
Directory Content	Displays the content of a directory and responds to common actions from the user: • Single clicking on an element will select it • Double clicking on a directory will open it • Dragging an element from one side to the other will copy it.
Disk info	Displays the disk information of the associated hardware.

Appendix 1: Concerto Hardware

Connections

Power on/off

Turn On	Press the trigger button located at the back of the unit This key has two (2) functions: 1. To turn the unit ON. 2. Start a measurement once the SLM Module is loaded After a few seconds, the **Opus Environment Interface** will appear.
Stand-by	The **stand-by** mode allows fast load time. • To put the unit on **stand-by**, click the **Turn Off** button. Note: The unit can be in stand-by for more than three days without recharging, provided batteries are fully charged prior to storage.
Shutdown	To **Shut down** the unit, click and **hold** the **Turn Off** button for five seconds.

Power Reset

If the Concerto happens to crash and it is not possible to take back the control, a power reset might be necessary. To complete the power reset, the three buttons on the front of the Concerto must be used.

Here is the procedure:

Step 1 ***Press and hold the Function, Enter and Down Arrow button for 5 seconds until the Concerto shuts down***

Step 2 ***Wait 5 seconds and press the power button***

Step 3 ***Wait 5 seconds and press the power button a second time to restart the Concerto from a power reset.***

Step 1

Press and hold to trigger the power reset

Step 2 and 3

Press 2 times to restart from power reset

Inputs and Signal Processing Specifications (Embedded Signal Ranger MK3 DSP Board)

DSP Processor	Texas Instruments TMS320C6424
Inputs	4
Outputs	2
Linear Range	2 x (25-120 dBA or 30-130 dBA) + 2 x (25-120 dBA)
Conditioning	AC, DC, ICP (4 mA)

Physical (DAP Tech 9000 Tablet PC)

Operating system	Intel Atom E660T 1.3 GHz
Storage	16 GB SSD
Data Transfer	USB
Display	180 mm (7 inches) WVGA (800 x 480)
Dimensions	230 x 185 x 60mm (9.0 x 7.3 x 2.4 inches)
Weight	1350 g (2.96 lb)
Battery	2 x Li-ion battery, 7.4 V, 3100 mAh, (1 internal + 1 hot-swappable)
Power	10-20 VDC, 2A
Protection rating	IEC 68-2-32 method 1 (Multiple 1m drops on concrete) IP67 (Rain, Humidity, 1 meter immersion) MIL-STD-810F method 506.4 procedure I (windblown rain) Humidity: 95% non-condensing Temperature: MIL-STD-810-F (-20 °C ... +50 °C); Vibration: MIL-STD 810E 514.5

Appendix 2: 1/3 Octave Filters – IEC 61260 Class 1/ANSI S1.11

1/3 Octave Filters

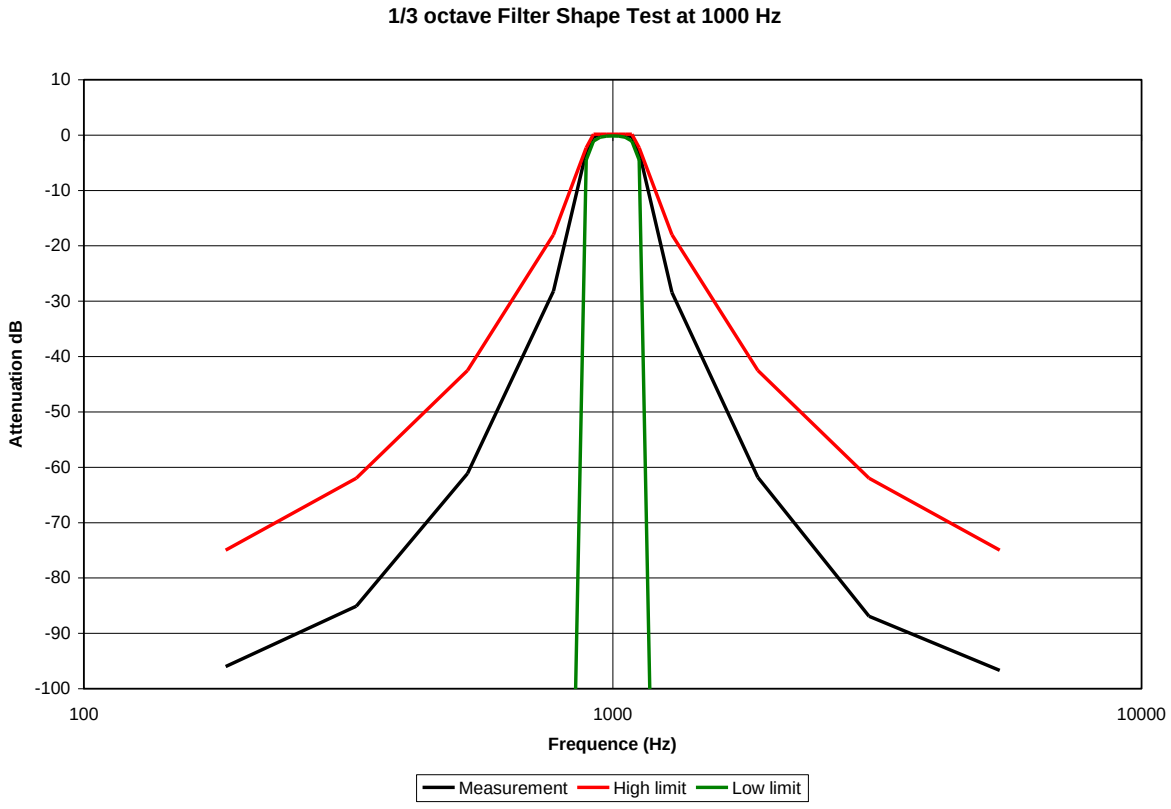
The 1/3 octave filters are computed at low-level in real time (at 48 kHz) on the digital signal processor (DSP) of the Concerto system. The filters comply with all requirements of IEC 61260 for Class 1.

Frequency Range

20 Hz to 20 kHz.

Filter Shape

The following curve presents the filter shape test done for the 1000 Hz 1/3 octave band. The red and green curves represent the limits associated with the IEC standard (Class 1).



Shape Test Numerical Results at 1 kHz

The following table presents the numerical results of the shape test at 1 kHz:

Frequency (Hz)	Low limit (dB)	Measurement (dB)	High limit (dB)
185.5	-inf	-96.0	-75.0
327.5	-inf	-85.1	-62.0
531.4	-inf	-61.1	-42.5
772.6	-inf	-28.2	-18.0
891.3	-4.5	-3.0	-2.3
919.6	-1.1	-0.3	0.15
947.0	-0.4	0.0	0.15
974.0	-0.2	0.0	0.15
1000.0	-0.15	0.0	0.15
1026.7	-0.2	0.0	0.15
1055.8	-0.4	0.0	0.15
1087.5	-1.1	-0.3	0.15
1122.0	-4.5	-3.0	-2.3
1294.4	-inf	-28.4	-18.0
1881.7	-inf	-61.8	-42.5
3053.7	-inf	-86.9	-62.0
5392.0	-inf	-96.7	-75.0

1/3 Octave Filter Linearity

The linearity of the 1/3-octave filter has been measured for both ranges (low and high). The experimentation is done with an adaptor (ADP092) and an electric signal. The results in dB are for an input sensitivity of 50 mV/Pa. The maximum and the minimum linear levels are measured for each 1/3 octave band along with the noise floor.

Filter Linearity (Low Range)

Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
20	120.5	39.5	81.0	1.3
25	120.5	34.2	86.3	0.7
31.5	120.5	33.2	87.3	2.0
40	120.5	30.6	89.9	1.2
50	120.5	30.0	90.5	1.1
63	120.5	28.1	92.4	3.2
80	120.5	27.8	92.7	0.4
100	120.5	27.4	93.1	-0.4
125	120.5	27.2	93.3	1.4
160	120.5	27.0	93.5	0.0
200	120.5	26.7	93.8	0.4
250	120.5	23.4	97.1	0.7
315	120.5	24.1	96.4	1.3
400	120.5	23.5	97.0	1.8
500	120.5	23.5	97.0	2.3
630	120.5	24.0	96.5	3.2
800	120.5	24.1	96.4	3.4
1000	120.5	24.1	96.4	4.3
1250	120.5	24.5	96.0	5.2
1600	120.5	24.5	96.0	6.1
2000	120.5	24.2	96.3	7.1
2500	120.5	24.5	96.0	8.2
3150	120.5	24.6	95.9	9.2
4000	120.5	24.7	95.8	10.1
5000	120.5	25.1	95.4	11.3
6300	120.5	25.2	95.3	12.6
8000	120.5	25.8	94.7	14.0
10000	120.5	26.3	94.2	16.9

Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
12500	120.5	27.0	93.5	17.5
16000	120.5	27.6	92.9	19.5
20000	120.5	28.3	92.2	19.7

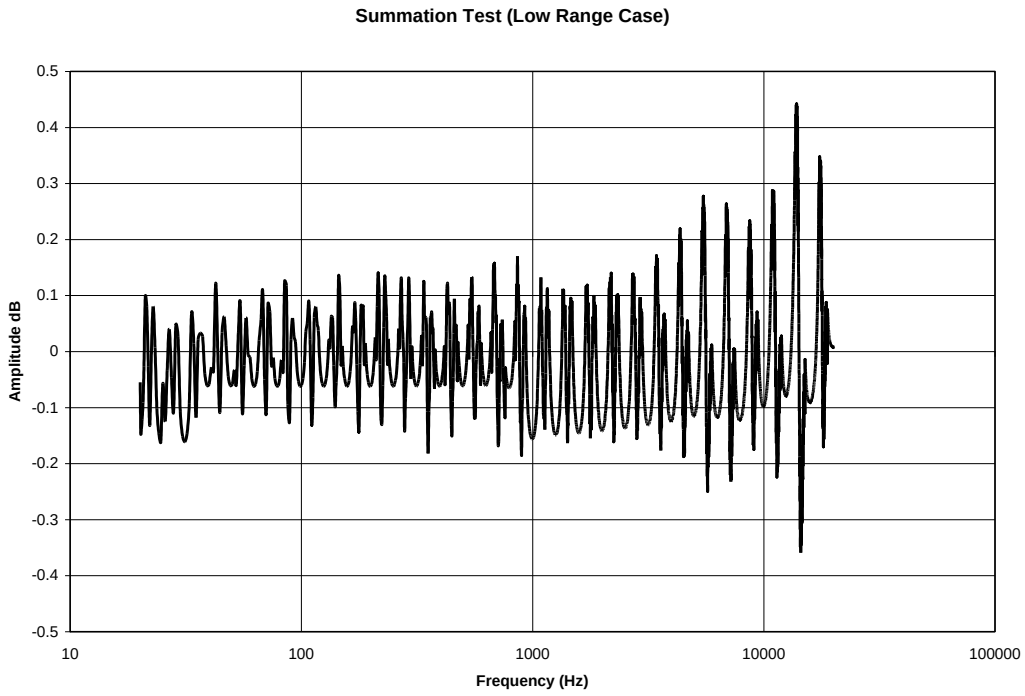
Filter Linearity (High Range)

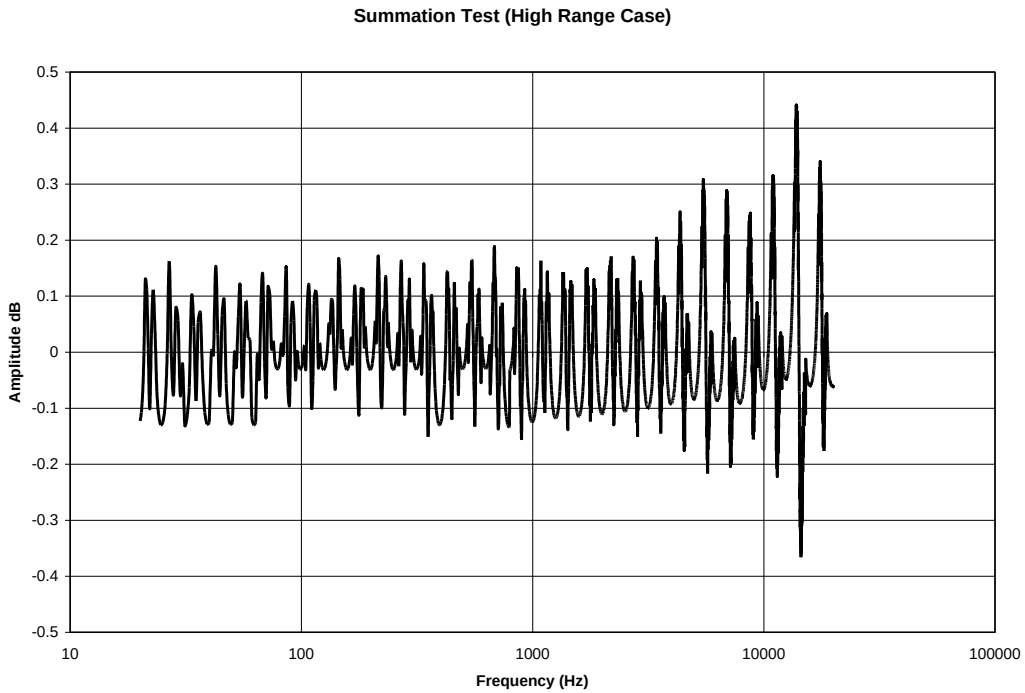
Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
20	132.5	51.5	81.0	7.3
25	132.5	49.2	83.3	5.3
31.5	132.5	47.1	85.4	2.0
40	132.5	44.2	88.3	7.9
50	132.5	41.8	90.7	9.3
63	132.5	39.1	93.4	9.1
80	132.5	37.1	95.4	10.6
100	132.5	32.6	99.9	10.6
125	132.5	31.4	101.1	11.6
160	132.5	31.0	101.5	11.9
200	132.5	30.7	101.8	12.7
250	132.5	30.1	102.4	12.8
315	132.5	28.7	103.8	12.9
400	132.5	28.5	104.0	13.5
500	132.5	28.2	104.3	13.4
630	132.5	27.2	105.3	13.6
800	132.5	27.0	105.5	13.6
1000	132.5	26.8	105.7	14.1
1250	132.5	27.1	105.4	14.8
1600	132.5	27.0	105.5	15.4
2000	132.5	27.4	105.1	16.2
2500	132.5	27.6	104.9	17.0
3150	132.5	28.1	104.4	18.0
4000	132.5	30.1	102.4	19.1
5000	132.5	30.4	102.1	20.1
6300	132.5	31.8	100.7	21.0
8000	132.5	32.7	99.8	22.4

Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
10000	132.5	33.5	99.0	23.5
12500	132.5	34.1	98.4	25.2
16000	132.5	35.8	96.7	27.3
20000	132.5	37.1	95.4	27.7

1/3 Octave Filter Summation

For this test, sine waves from 20 Hz to 20 kHz are measured with the Concerto system. For each sine wave the summation of the 1/3 octave filters is computed to form the following curves. The sine waves are electrical signals at 1 VRMS. The next figures present the results for both input range.




Summation Test (High Range Case)
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
Amplitude dB
10
100
1000
10000
100000
Frequency (Hz)