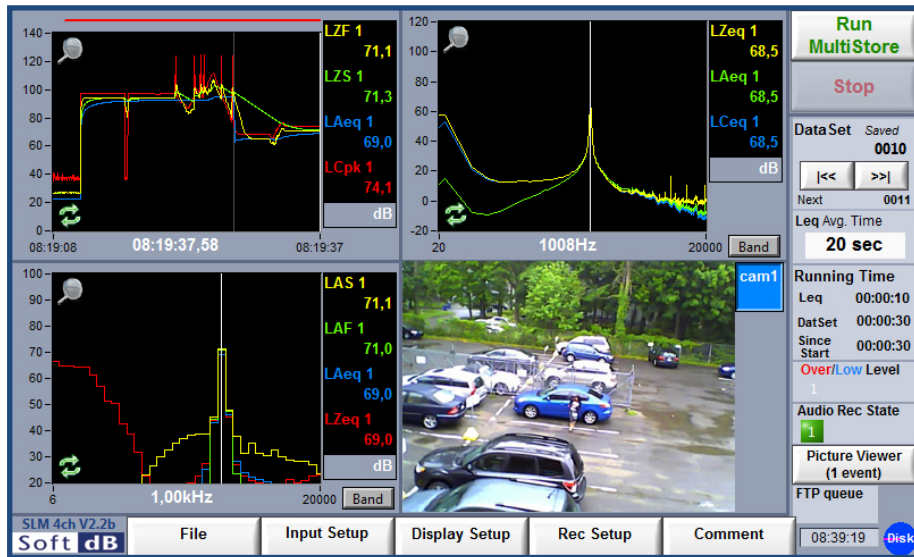


# Opus Suite

## SLM 4-Ch Module

User Guide – v2.5c

2015-07-27



### Compatible Hardware:



Alto



Concerto



Conductor

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**Soft dB**  
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## 1 Introduction

Congratulations on your purchase of the **Opus Suite SLM 4-ch 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 4ch Module**.

### General Specifications

<b>Class 1 Integrating SLM</b>	1 to 4 channels simultaneously Conform IEC 60561/60804/61672:2002; ANSI S1.42 Frequency span: 6.3 Hz to 20 kHz Linearity range (50mV/Pa) : 25-119 dBA (Low) 37-130 dBA (High)
<b>Simultaneous measurement on 4 channels</b>	LF, LS, LI & Lpk & LE & Leq (A, C & Z weightings) Real time 1/3 octave band spectrum (IEC 1260 Type 1) Time history resolution starting at 10 ms 854 lines FFT spectrum Min & Max values logged for each period Programmable measurement period
<b>Real-time display</b>	Time History, 1/3 octave spectrum, Numeric Indicator, FFT Spectrum, Statistics and Camera. Display up to 4 graphs with up to 4 plots per graph.
<b>Miscellaneous</b>	<b>Audio Recording</b> and <b>Photo</b> (on trigger or periodic) <b>Web Station</b> mode with FTP transfer for Web monitoring Multi-Purpose output <b>generators</b>

## 2 Compatible Hardware

### 2.1 Platform

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.

---

#### 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>

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#### 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>

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## 2.2 Microphones

### 2.2.1 Suggested Microphones

The SLM 4-ch software module and the platform form a class 1 instrument (IEC 61672:2002) only if it is used with a class 1 microphone (according to the IEC 651 standard). The table below shows a few suggestions. Since they are all ICP microphones, the input type must be set to ICP in the input setup of the software.

#### *Suggested Microphones*

Microphone set	Microphone	Preamplifier
BSWA 50mV/Pa	MP201	MPA231 or MA221
BSWA 40mV/Pa	MP231	MPA231 or MA221
BK 50mV/Pa	#4189	#2671

### 2.2.2 Frequency Corrections

Since the microphone is remote, there are no additional corrections besides the ones pertaining to the microphone, which are published by the manufacturers.

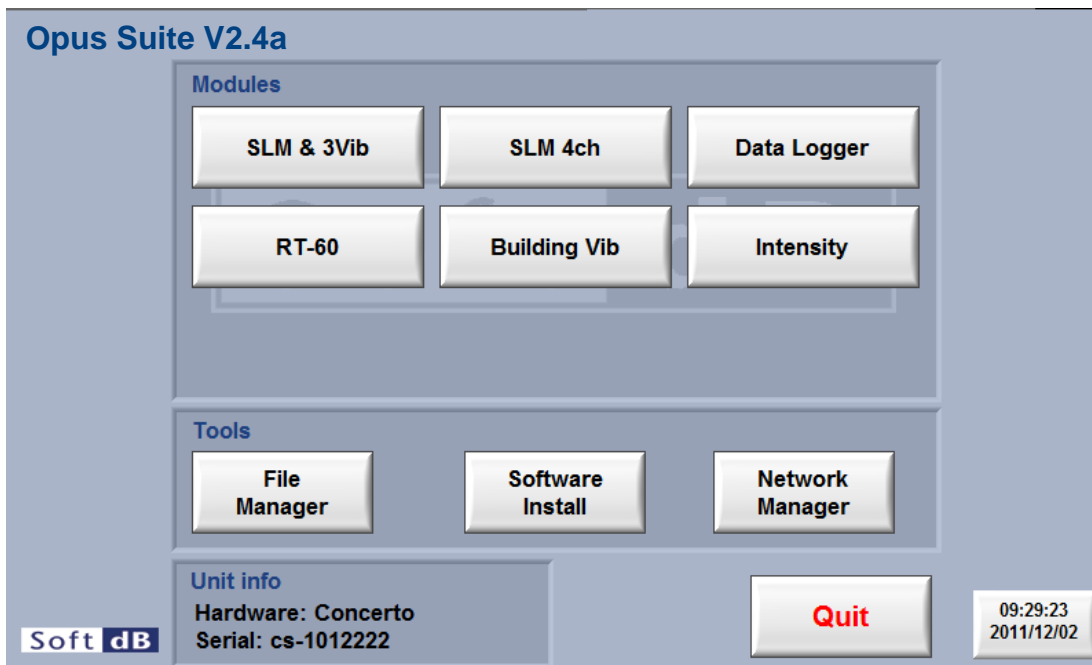
### 2.2.3 Input Specifications

The linear input range and the noise floor differ according to the platform. Indeed the Concerto has a lower noise floor than the Alto platforms and therefore shows better ranges. Refer to the specsheet of the platform to get the specific data (<http://www.softdb.com/en/acoustic/products/products.php>).

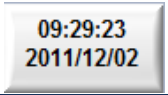

The level specifications stand for a microphone with a typical sensitivity of 50 mV/Pa. If a different sensitivity is used, the levels are offset accordingly. For example, a sensitivity of 40 mV/Pa means an offset of +2 dB on the table ( $20 \cdot \log[50\text{mV/Pa} / 40\text{mV/Pa}] = +1.94\text{dB}$ ).

## 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.



<p><b>Modules</b></p>	<p>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.</p>
<p><b>File Manager</b></p>	<p>The File Manger button will launch the File Manager Utility (see section 10, p. 56)</p>
<p><b>Software Install</b></p>	<p>The Software Install button will launch a browser from which an Opus software installer can be launched.</p>
<p><b>Network Manager</b></p>	<p>The Network Manager button will launch the Network Manager interface. This tools is only available on a Concerto hardware</p>
<p><b>Unit info</b> Hardware: Concerto Serial: cs-1100001</p>	<p>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).</p>

	<p>The <b>Clock</b> indicator displays the time and date on the unit. To change time, simply click on the indicator to display a dialog window.</p>
	<p>The <b>Quit</b> button will quit the application differently according to the hardware used.</p> <p>Concerto hardware:</p> <ul style="list-style-type: none"><li>• Press and hold (5 sec) to shut down the unit.</li><li>• Press and release to enter standby mode.</li></ul> <p>Alto or Conductor hardware:</p> <ul style="list-style-type: none"><li>• Press and hold (5 sec) to close the application and return to Windows.</li></ul>


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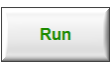
## 4 Quick Start



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**.

### 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 measurement can be stopped at any time with 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. 33) and its ID is specified in the **Current ID Indicator** (see section 0, 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	
<b>Run</b>	<b>Pause</b>	<b>Run</b>	← <b>Run / Pause / Continue</b> Button
<b>Stop / Save</b>	<b>Stop</b>	<b>Save</b>	← <b>Stop / Save</b> Button
Data Set <i>Saved</i>	Data Set <i>Current</i>	Data Set <i>Current</i>	← Current DataSet
<< >>	<< >>	<< >>	← Previous / Next DataSet
Next 0016	Next 0016	Next <b>0016</b>	← Next DataSet To Be Saved <sup>1</sup>
Leq Avg. Time <b>20 sec</b>	Leq Avg. Time <b>20 sec</b>	Leq Avg. Time <b>20 sec</b>	← Leq Averaging Time
Running Time	Running Time	Running Time	← Running Time
Leq 00:00:00	Leq 00:00:05	Leq 00:00:20	← Current Leq Period Time
DatSet 00:00:00	DatSet 00:00:05	DatSet 00:00:20	← Current Dataset Time
Since Start 00:00:00	Since Start 00:00:05	Since Start 00:00:20	← Time from Start
Over/Low Level 1	Over/Low Level 1	Over/Low Level 1	← <b>Over / Under Range</b> Indicator
Audio Rec State 1	Audio Rec State 1	Audio Rec State 1	← <b>Audio Recording</b> Indicator
Photo Info	Photo Info no event	Picture Viewer	← <b>Photo Information</b> Indicator
FTP queue	FTP queue	FTP queue	← <b>FTP Information</b> Indicator
11:34:10	11:34:42	11:36:18	

<sup>1</sup> 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. 9)
- 2) File Info (see section 5.2, p. 10)
- 3) Measure Info (see section 5.3, p. 10)
- 4) Menu bar (see section 5.4, p. 11)
- 5) Display area (see section 5.5, p. 12)



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).

<b>Input Setup</b>	Number of inputs(1 to 4) Input type (ICP or AC) Dynamic range Sensor sensitivity
<b>Display Setup</b>	Elements to display during the measurement Type of display (Time History, 1/3 octave Spectrum, FFT Spectrum, Numerical Indicator , Statistics or Camera)
<b>Record Setup</b>	Record destination (local drive and/or Web) DataSet ID management Data Selection to record Audio Setup Photo Setup AutoStore Setup Generator 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*

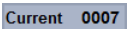


	This button starts the acquisition. The <b>Run</b> button then automatically becomes the <b>Pause</b> button if the <b>AutoStore</b> is off or single mode (see section 8.3, p. 40).
	This button suspends the acquisition. The <b>Pause</b> button then automatically becomes the <b>Continue</b> button. Pause is only available if the <b>AutoStore</b> is off or in single mode.
	This button continues the acquisition. The <b>Continue</b> button then automatically becomes the <b>Pause</b> button again.

### *Stop / Save*

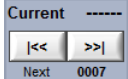
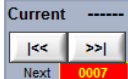
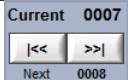
	This button stopped the measurement. The button then automatically becomes the <b>Save</b> button if the <b>AutoStore</b> setup is off).
	This button saves the active measurement in a <b>DataSet</b> . This button is then disabled until another measurement starts. This button is disabled when the <b>AutoStore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

## 5.2 File Info

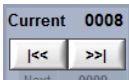

### File Info

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

### File Info Appearance – Auto-Store Off (see section 8.3, p. 40)



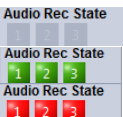
<b>During Measurement</b>		No <b>Current DataSet ID</b> is displayed during a measurement. The <b>Next ID</b> indicates the next <b>DataSet</b> to be saved.
<b>After Measurement</b>		At the end of the measurement the <b>Next ID</b> flashes red for 10 seconds, unless the user clicks the <b>Save</b> button.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


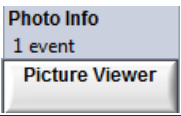
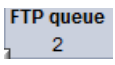
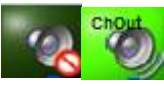

### File Info Appearance – Auto-Store On (see section 8.3, p. 40)

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

## 5.3 Measure Info

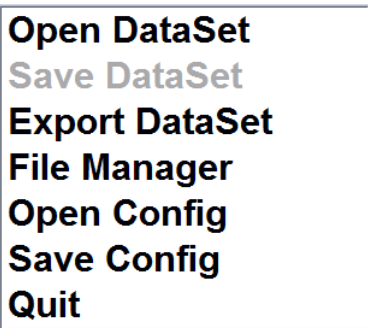
### Measure info

	Indicates the average duration. Click on the indicator to modify the <b>Leq Averaging Time</b> value.
	<p>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.</p> <p>When using the <b>AutoStore Setup</b> in <b>Multiple Mode</b>, a new average will start at the end of each Leq period. Those average data are stored in a <b>DataSet</b>, 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 (see section 8.2, p. 38).</p>
	<p><b>Audio Recording State</b></p> <p>Transparent background: Input active, but audio recording disabled.  <b>Green background</b>: Audio recording enabled, but currently not recording.</p>

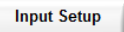
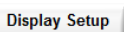
	<b>Red background</b> : Audio recording in progress on this input.
	<b>Over/Under Range</b> Transparent background: Input level is between the dynamic range limits. <b>Blue background</b> (low level): Input level is below the dynamic range lower limit. <b>Red background</b> (overload): Input level is above the dynamic range upper limit. <b>Red outline</b> (overload memory): Input level above the dynamic range upper limit during the active Leq average period.
	<b>Photo Info</b> : During the acquisition, it shows the number of photo events. <b>Photo Viewer</b> : After the acquisition, the button gives access to the Photo Viewer interface.
	The <b>FTP queue</b> indicates the number of elements that are still to be transferred to the FTP server.
	The <b>Output Generation</b> indicator turns on when at least one of the generators is activated. The <b>ChOut</b> and <b>PC</b> 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.
	

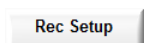
## 5.4 Menu Bar

### File Menu



	<b>Open DataSet</b>	Opens a <b>DataSet</b> .
	<b>Save DataSet</b>	Saves a <b>DataSet</b> if not saved yet.
	<b>Export DataSet</b>	Exports <b>DataSets</b> in a spreadsheet file. (see section 0, p. 54)
	<b>File Manager</b>	Launches the <b>File Manager</b> (see section 10, p. 56)
	<b>Open Config</b>	Restores a saved software configuration.
	<b>Save Config</b>	Saves the software configuration.
	<b>Quit</b>	Quits the <b>SLM 4ch module</b> and to returns to the <b>Opus Suite Interface</b> .

### Input / Display / Record Setup Buttons

	Launches the <b>Input Setup</b> (see section 0 ,p. 18)
	Launches the <b>Display Setup</b> (see section 7 ,p. 22)

	Launches the <b>Record Setup</b> (see section 8 ,p. 32)
---	---

## Comment / Tag Button

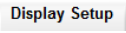
	Allows the user to write a comment on the measurement before it starts. When the measurement starts, this button becomes the Tag button.
	Tags events during a measurement.

## 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:


- **Time History** Graph (see section 7.2.1 p. 24)
- **1/3 Octave** Band Spectrum Graph (see section 7.2.2 p. 25)
- **FFT** Spectrum Graph (see section 7.2.3 p. 26)
- **Numerical** Indicators (see section 7.2.4 p. 27)
- **Statistics** Graph (see section 7.2.5 p28)

Each of these displays can show up to four different elements. The  button allows selecting the desired display configuration (see section 7, p. 22).

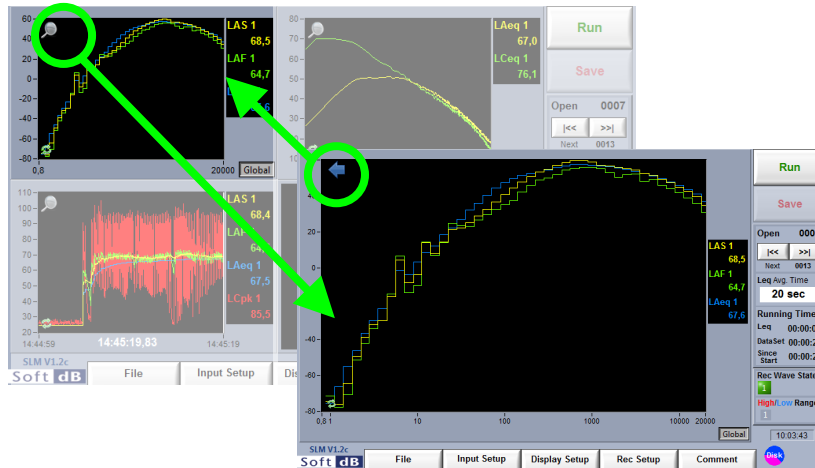
Note: The display updates up to every 1/4 s.

### 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.

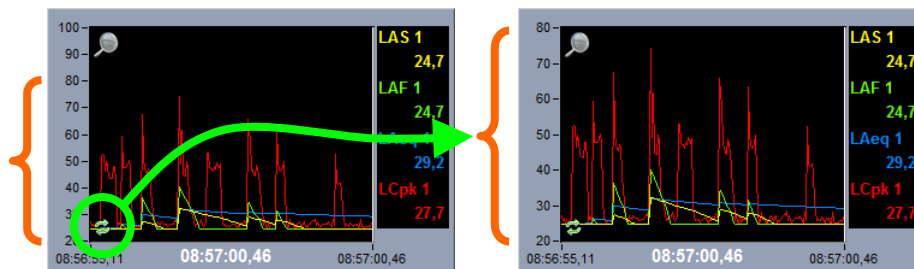
The **magnified** display has a  icon at the top left corner. Clicking on this icon returns the graph to its initial size and position.

The **magnified** view of a **time history graph** contains the controls allowing listening to audio files (see section 5.5.4 p. 15).



## 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.



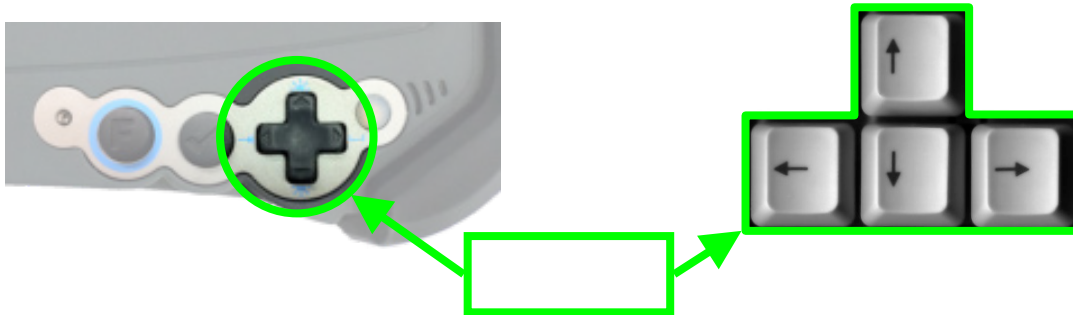
## 5.5.3 Cursors

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

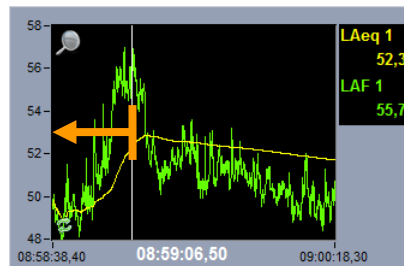
<b>Get Cursor</b>	Click on graph to position the cursor.
<b>Cursor Value</b>	Cursor X value is displayed below the graph. Cursor Y values are displayed in the legend on the right side of the graph.
<b>Move Cursor</b>	Change cursor position by clicking on the graph at the desired position. Change cursor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



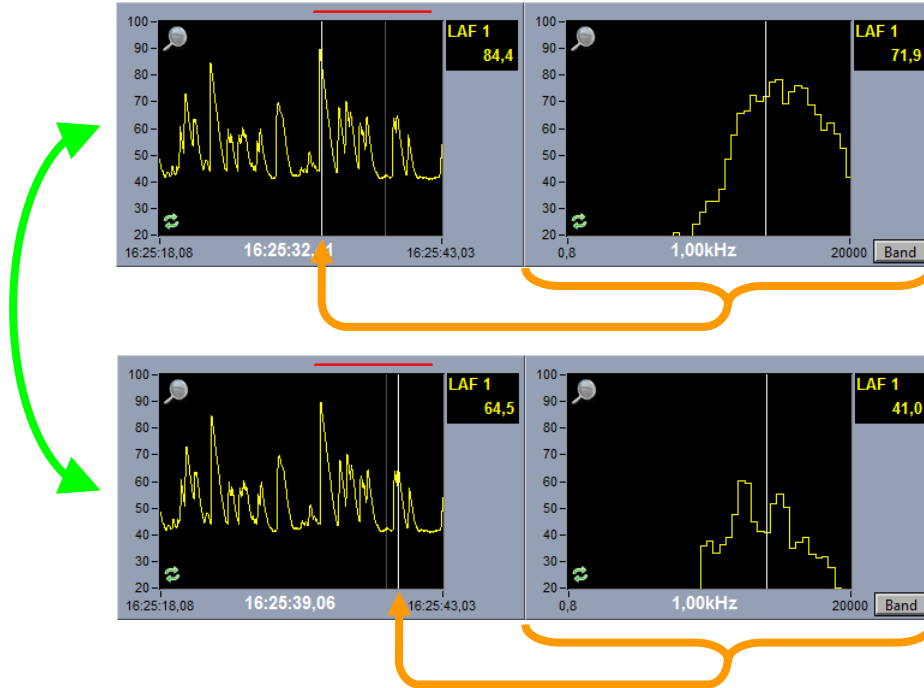


## 5.5.3.1 Complementary Actions Associated to the Cursors

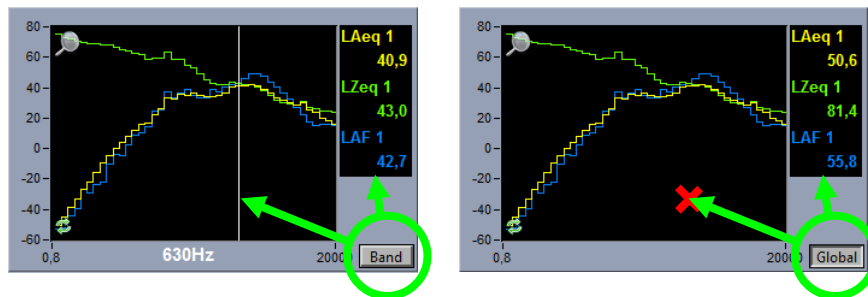
- 1) The length of the **Historic** graph is limited to 1000 values. When the number of values exceeds 1000, the graph slides on the left so that only the most recent data is displayed. Moving the cursor on the left of the graph moves the time window back in time to display past values.



- 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.




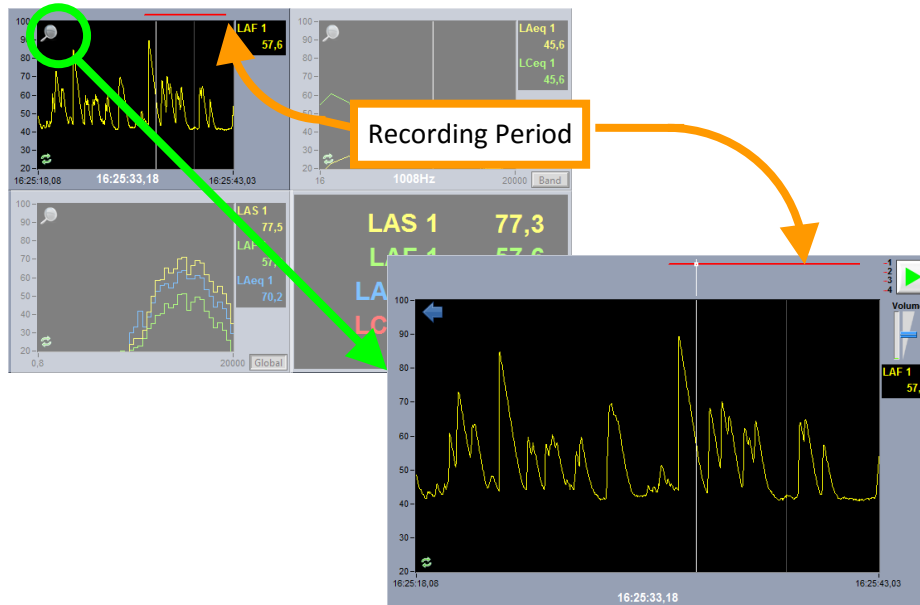
- 3) Selecting **Global** versus **Band** on a **Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend**.



## 5.5.4 Listening to Audio Records

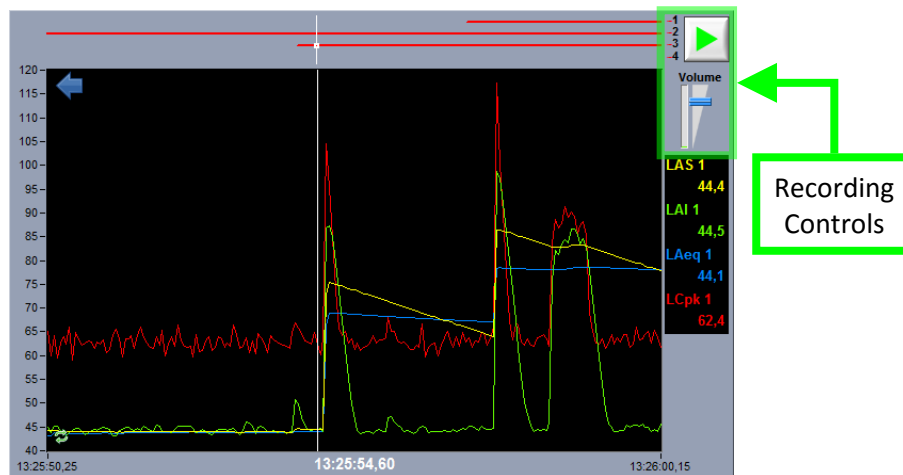
When audio signals have been recorded during a measurement (see section 8.5 p. 46), a red line is displayed on the top of the **Historic** graph. The start position and length of the line corresponds to the recording period.

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.



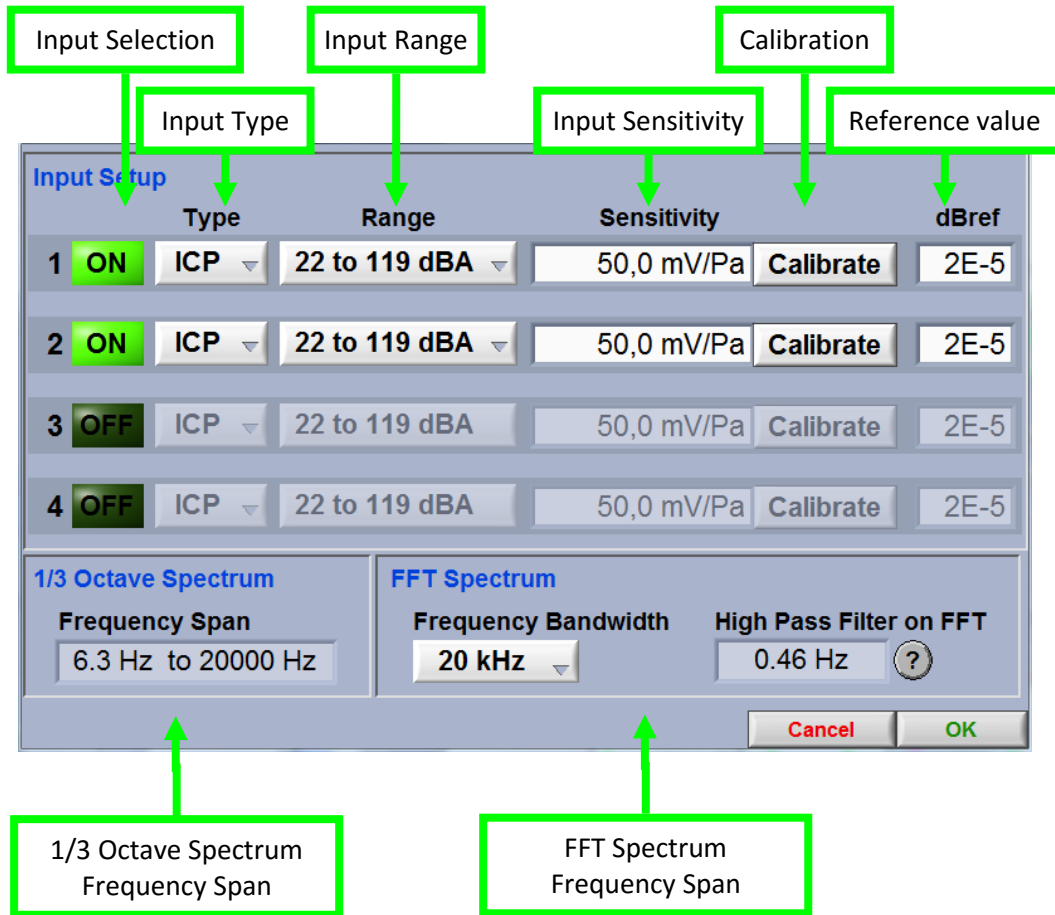
## 5.5.4.2 Playing the record

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** allows defining:

- Input Selection (see section 6.1, p. 19)
- Input Type (AC or ICP) (see section 6.2, p. 19)
- Input Dynamic Range (see section 6.3, p. 19)
- Input Sensitivity and Calibration (see section 6.4, p. 20)
- Input Reference Value (see section 6.5, p. 21)
- FFT Spectrum Frequency Span (6.6, p. 21)

## 6.1 Input Selection

The Concerto allows the user to perform measurements on 1 to 4 inputs simultaneously.

Click on the  /  button to enable or disable specific inputs.

The number of enabled inputs has an effect on the 1/3 Octave Spectrum Frequency Span:

Number of Enabled Inputs	1/3 Octave Spectrum Frequency Span
1 to 2	6.3 Hz to 20 kHz
3 to 4	20 Hz to 20 kHz

## 6.2 Input Type

The available input types are AC and ICP sensors.

## 6.3 Dynamic Range

Dynamic range of each Input is around 94 dB. Input 1 and 2 have two range settings (low or high) while inputs 3 and 4 have a single fixed range (low).

The limits of these ranges in dB depend on the sensor sensitivity. The table below provides examples of the linear dynamic range for sensitivities of 40 and 50 mV/Pa.

### *Dynamic Range of the Alto, Conductor and Concerto using DAP 9000 Tablet PC*

Microphone Sensitivity	40 mV/Pa	50 mV/Pa
Low Range	32 to 121 dB(A)	30 to 119 dB(A)
High Range	44 to 132 dB(A)	42 to 130 dB(A)

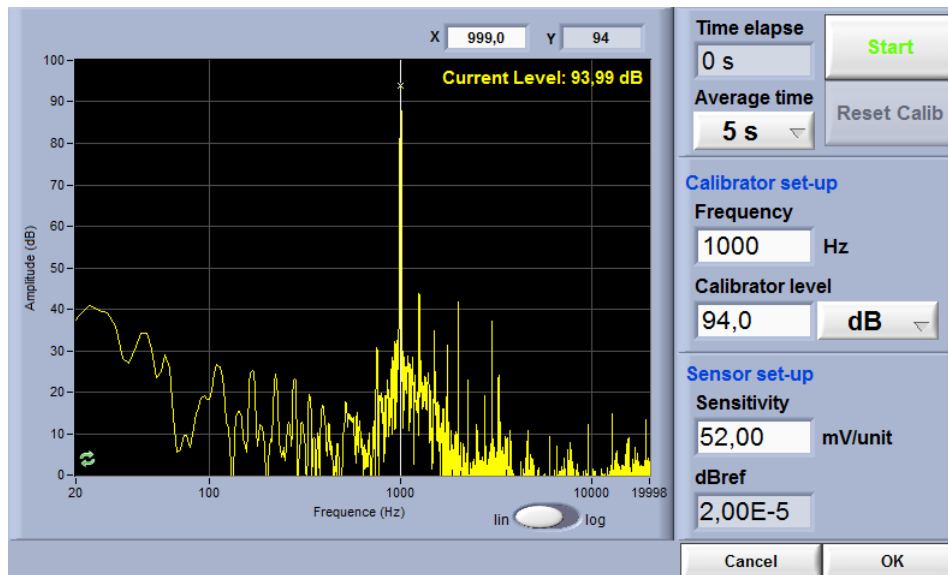
### *Dynamic Range of the Concerto using DAP 9000 Tablet PC*

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)

## 6.4 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.

### 6.4.1 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

## 6.5 Reference Value

The reference value is the unit reference from which the decibel (dB) is calculated.

## 6.6 FFT High Pass Filter

The FFT spectrum frequency bandwidth can be adjusted from a variety of choices:

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 if 1 or 2 inputs are enabled and 20 Hz to 20 kHz if 3 or 4 inputs are enabled.

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.

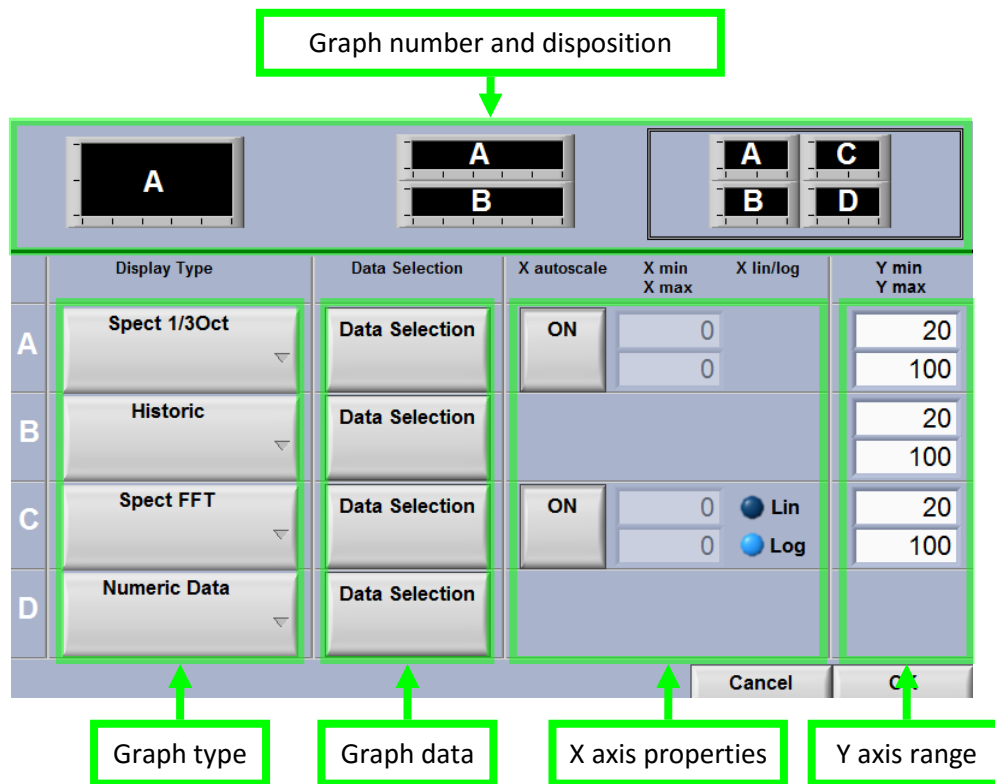


## 7 Display Setup

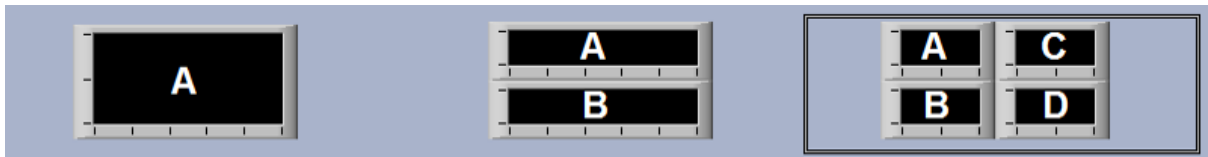
During a measurement, all acoustical parameters are calculated and available for display.

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

- Graph number and disposition (see section 7.1, p. 22)
- Graph type (see section 7.2, p. 23)
- Data to display on each graph (see section 0, p. 30)
- Graph X axis properties (see section 0, p. 31)
- Graph Y axis range (see section 7.5, p. 31)



### 7.1 Graph Number and Disposition



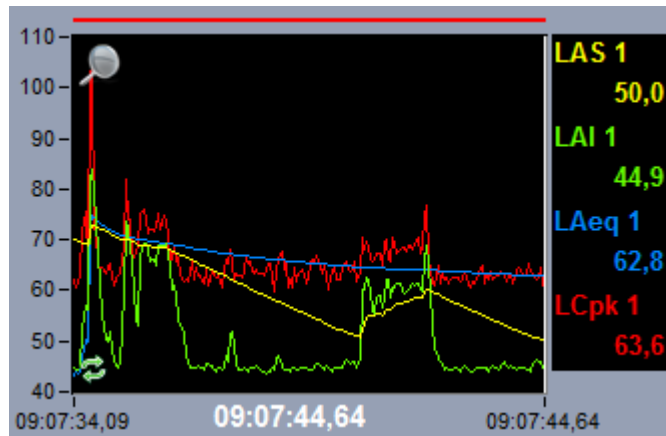
1, 2 or 4 graphs can be displayed at the same time. Click one of the icons in the upper part of the **Display Setup** to select the desired number of graphs for display.

## 7.2 Graph Type

For each graph, the **Graph Type** list box allows the user to select the graph type.

✓ <b>Historic</b>	← Time History Graph of global levels (see section 7.2.1)
<b>Spect 1/3Oct</b>	← 1/3 Octave Spectrum Graph (see section 7.2.2)
<b>Spect FFT</b>	← FFT Spectrum Graph (see section 7.2.3)
<b>Numeric data</b>	← Numeric indicator of global levels (see section 7.2.4)
<b>Statistics</b>	← Statistics Graph of SPL global levels (see section 7.2.5)
<b>Camera</b>	← Camera Display (see section 7.2.6)

## 7.2.1 Time History Graph



### Available data


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

### 7.2.1.1 Particularities

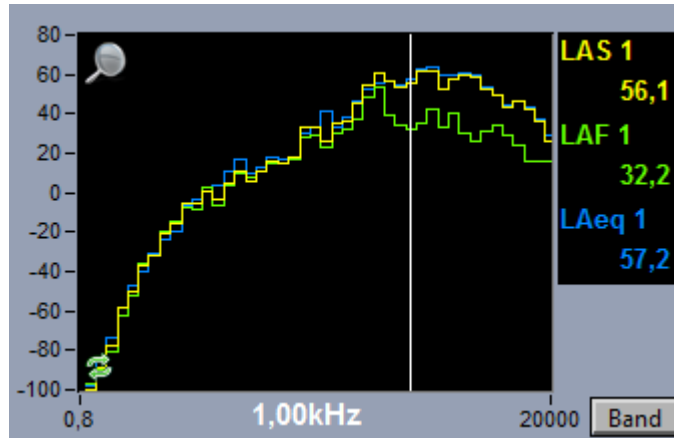
#### Length of the historic graph

The Time History displays the last 1000 measured sample. All samples are available once the measurement has stopped. To display the past samples, drag the graph cursor so that it is positioned before the start of the graph (see section 5.5.3.1, p. 14).

#### Audio recording indicator

If a audio record was recorded during the measurement, a red line will be displayed on the top of the Time History Graph. To listen to the recorded file, click on the  icon to access the magnified view of the Time History Graph and its audio record controls (see section 5.5.4, p. 15).

## 7.2.2 1/3 Octave Spectrum Graph



### Available data

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

### 7.2.2.1 Particularities

#### Legend Values

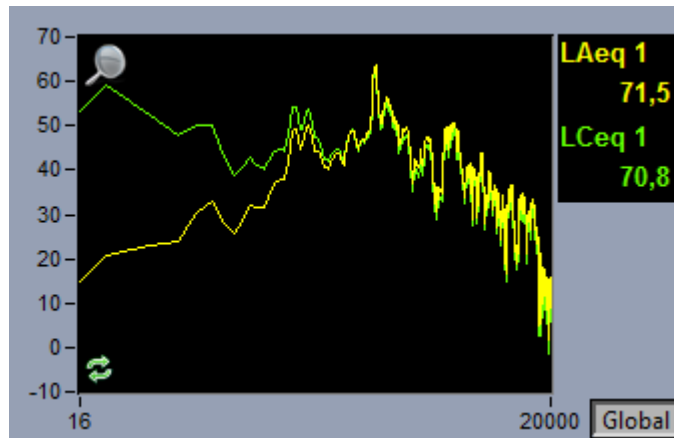
Selecting  versus  on a **1/3 Octave Band Spectrum** graph displays either the **Global** value or the **Band** value (associated to the cursor) on the **Legend** (see section 5.5.3.1, p. 14).

#### Effect of Input Enabling on Frequency Span

The number of enabled inputs has an effect on the 1/3 Octave Spectrum Frequency Span (see section 6.1, p.19):

Number of Enabled Inputs	1/3 Octave Spectrum Frequency Span
1 to 2	6.3 Hz to 20 kHz
3 to 4	20 Hz to 20 kHz

## 7.2.3 FFT Spectrum Graph



### Available data

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

### 7.2.3.1 Particularities

#### 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. 14).

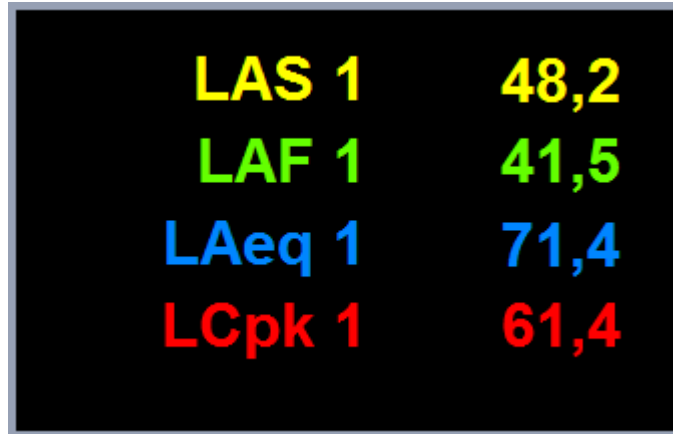
#### FFT High Pass Filter

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 if 1 or 2 inputs are enabled and 20 Hz to 20 kHz if 3 or 4 inputs are enabled (see section 6.6, p.21).

#### Averaging Period

The FFT spectrum being a Leq FFT, its averaging time is the same as the **Leq Averaging Time** (see section 5.3, p. 10).

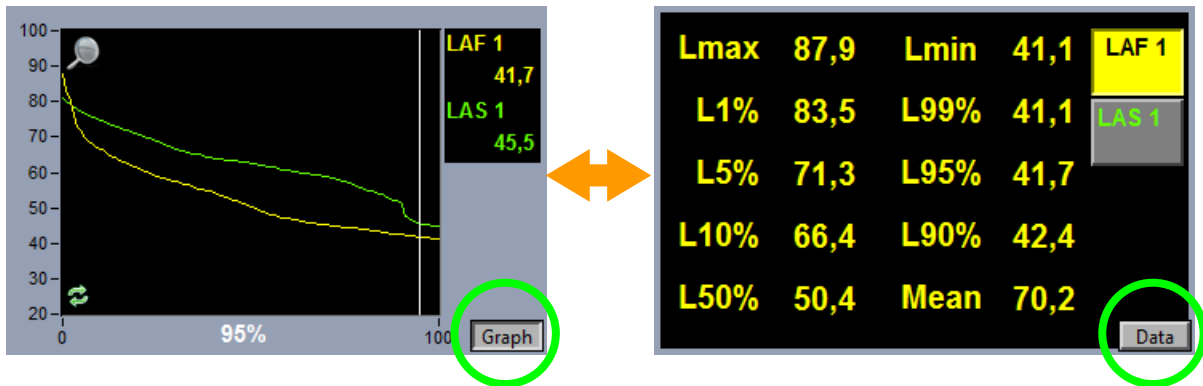
## 7.2.4 Numeric Indicators



### Available data

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

## 7.2.5 Statistic Graph



### Available data

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

### 7.2.5.1 Particularities

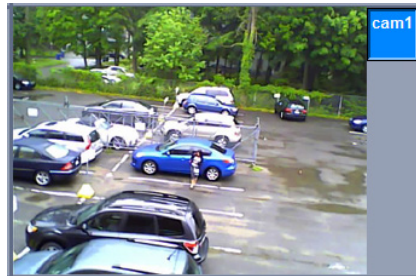
#### Graph / Data Display

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 5.3, p. 10).

## 7.2.6 Camera display



The camera display can be used to display the live video captured by a webcam. The camera settings can be adjusted from the Photo Setup within the Record Setup interface (section 0, p.49). 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 realtime acquisition.

### Camera buttons

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



## 7.3 Data Selection

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

A : SLM - Historic


Display Element	Input				Parameters (Time weighting)					Freq. weighting A/C/Z	Inst./ Max/Min	Average Period	
<input checked="" type="checkbox"/> ON LAS 1	<input checked="" type="button" value="1"/>	<input type="button" value="2"/>	<input type="button" value="3"/>	<input type="button" value="4"/>	<input checked="" type="button" value="Slow"/>	<input type="button" value="Fast"/>	<input type="button" value="Imp."/>	<input type="button" value="Peak"/>	<input type="button" value="Leq"/>	<input type="button" value="SEL"/>	<input checked="" type="button" value="A"/>	<input checked="" type="button" value="Inst."/>	
<input checked="" type="checkbox"/> ON LCF 1	<input checked="" type="button" value="1"/>	<input type="button" value="2"/>	<input type="button" value="3"/>	<input type="button" value="4"/>	<input type="button" value="Slow"/>	<input checked="" type="button" value="Fast"/>	<input type="button" value="Imp."/>	<input type="button" value="Peak"/>	<input type="button" value="Leq"/>	<input type="button" value="SEL"/>	<input checked="" type="button" value="C"/>	<input checked="" type="button" value="Inst."/>	
<input checked="" type="checkbox"/> ON LZpk 1	<input checked="" type="button" value="1"/>	<input type="button" value="2"/>	<input type="button" value="3"/>	<input type="button" value="4"/>	<input type="button" value="Slow"/>	<input type="button" value="Fast"/>	<input type="button" value="Imp."/>	<input checked="" type="button" value="Peak"/>	<input type="button" value="Leq"/>	<input type="button" value="SEL"/>	<input checked="" type="button" value="Z"/>	<input checked="" type="button" value="Inst."/>	
<input checked="" type="checkbox"/> ON LZeq 1	<input checked="" type="button" value="1"/>	<input type="button" value="2"/>	<input type="button" value="3"/>	<input type="button" value="4"/>	<input type="button" value="Slow"/>	<input type="button" value="Fast"/>	<input type="button" value="Imp."/>	<input type="button" value="Peak"/>	<input checked="" type="button" value="Leq"/>	<input type="button" value="SEL"/>	<input checked="" type="button" value="Z"/>		<input checked="" type="button" value="Avg Time"/>

<b>Display Element</b>	Click <input checked="" type="checkbox"/> ON / <input type="checkbox"/> OFF to enable or disable the element. Each display zone can display up to four elements.
<b>Input Selection</b>	Select the <b>Input Channel</b> from which the data will be acquired. Only enabled inputs will be accessible (see section 6.1, p.19)
<b>Parameters</b>	Select the <b>Parameter</b> for each element. The selection may be restricted depending on the graph type (see section 7.2).
<b>Frequency Weighting</b>	Select the desired <b>Frequency Weighting (A, C or Z)</b>
<b>Inst./Min/Max</b>	The user can choose to display the <b>Maximum</b> or <b>Minimum</b> value of the <b>Averaging Period</b> or the current value. The selection may be restricted depending on the graph type (see section 7.2).
<b>Average Period</b>	When the selected elements depend on the averaging period, the reference period has to be selected. <b>Avg Time:</b> The value resets at each new leq period <b>DataSet:</b> The value resets at each new DataSet.

## 7.4 X Axis Properties

The X axis range is automatically adjusted 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.

## 7.5 Y Axis Range

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. 13). However, the default Y axis range can be set by modifying the associated field in the **Display Setup** Interface (see section 7, p. 22).

## 8 Record Setup

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

- Record Destination (see section 8.1, p. 33)
- Dataset ID (see section 8.2, p. 38)
- Auto-Store Setup (see section 8.3, p. 40)
- Data Selection (see section 8.4, p. 41)
- Audio Setup (see section 8.5, p. 46)
- Photo Setup (see section 8.6, p. 49)
- Generator Setup (see section 8.7, p. 51)

**Record Destination**  
 Web: ftp.softdb.com/wwwroot/nv\_monitor/00000002/Default [Edit] [Test]  
 Local: \\OpusRoot\SLM 4ch

**DataSet ID**  
 ID Format: YYYYMMDD\_hhmmss | ID increment: Every Day | 00:00:00

**Data Selection**  
 All Data / Average Mode / AveragePeriod = 30 sec  
 RecSize: 505 KB/hour or 4,21 KB/Leq or 11,8 MB/DataSet  
 Max RecTime: >365 days (no wave) >365 days (continuous wave) [Edit]

**Audio Setup**  
 Format: MP3 | Gain=20dB

Trig	Input	Rec Enable	Trig Data	Trig Value	Trig Delay	Duration
#1		On Trig	LZS 1	80,0dB	-2,0sec	00m30s

**AutoStore Setup**  
 OFF  
 Single Mode  
 Multiple Mode  
 Stop Mode: User Stop

**Photo Setup**  
 1 camera enabled.  
 Record On Any New Audio Rec [Edit]

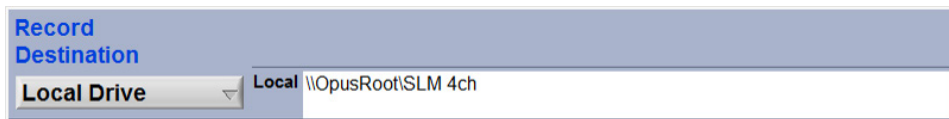
**Generator Setup**  
 Disabled [Edit]


[Cancel] [OK]

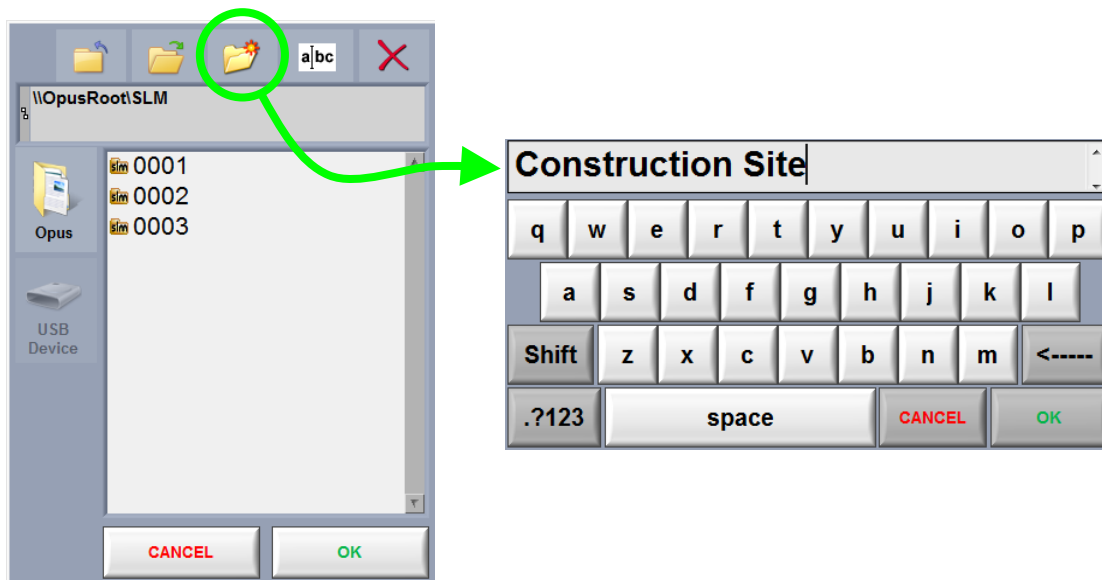
## 8.1 Record Destination

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 (see section 10, p. 56).

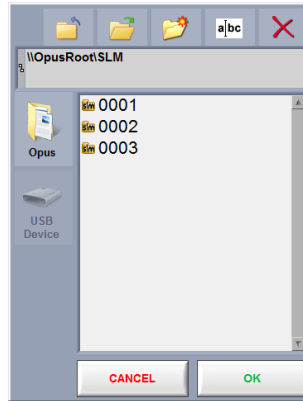


#### 8.1.1.1 Data Format on the local drive

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  0001 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

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).

Base Path	Unit Serial Number	Station Name
/wwwroot/nv_monitor	00000002	Default

<b>FTP server address (IP or URL)</b> 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)
<b>Username</b> user	Login user name
<b>Password</b> *****	Login password
(Port Number: 21)	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.

<p><b>Remote path</b></p> <p>Base Path /wwwroot/nv_monitor</p> <p>Unit Serial Number 00000002</p> <p>Station Name Default</p>	<p>The combination of the <b>Base Path</b>, <b>Unit Serial Number</b> and <b>Station Name</b> form the record path on the FTP server. The <b>Unit Serial Number</b> is related to the hardware used. Therefore, it cannot be changed by the user.</p>								
<p><b>Leq Average Time</b></p> <table border="1"> <tr><td>Main</td><td>30 sec</td></tr> <tr><td>2nd</td><td>5 min</td></tr> <tr><td>3th</td><td>1 h</td></tr> <tr><td>4th</td><td>24 h</td></tr> </table>	Main	30 sec	2nd	5 min	3th	1 h	4th	24 h	<p>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.</p>
Main	30 sec								
2nd	5 min								
3th	1 h								
4th	24 h								
<p><b>File Selection</b></p> <p><input type="radio"/> Data</p> <p><input checked="" type="radio"/> Audio files (if any)</p> <p><input type="radio"/> Photo files (if any)</p>	<p>The <b>File Selection</b> 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.</p>								
<p><b>Network Status</b></p> <p>Operational</p>	<p>This indicators shows the network status (operational or not operational)</p>								
<p><b>Test FTP Tranfer</b></p>	<p>Use this test button to validate the whole FTP transfer process used in the Web mode.</p>								

### 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)

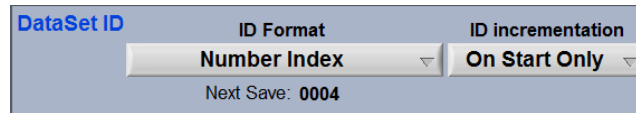
#### 8.1.2.2 Limitations with the Web mode

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

<p>Number Index YYYYMMDD_hhmmss (date) MMDD_hhmmss (date) DD_hhmmss (date)</p>	<p>The ID Format allows the user to choose the name format of dataset files to be recorded.</p> <ul style="list-style-type: none"> <li>• Four-digit increment of the <b>DataSet</b> in the <b>Record Directory</b></li> <li>• DataSet start time in format YYYYMMDD_hhmmss</li> <li>• DataSet start time in format MMDD_hhmmss</li> <li>• DataSet start time in format DD_hhmmss</li> </ul>
<p>On Start Only Every 'X' Leq Every Hour Every Day Every Week</p>	<p>The <b>ID increment</b> allows the user to choose when to switch to a new measurement file. This control is enabled only when <b>AutoStore</b> is in <b>Multiple Mode</b> (see section 8.3, p. 40).</p> <ul style="list-style-type: none"> <li>• All the data in a single file (unless maximum size is reached)</li> <li>• New file after a specified quantity of 'X' Leq average periods</li> <li>• New file once an hour (according to the specified alignment)</li> <li>• New file once a day (according to the specified alignment)</li> <li>• New file once a week (according to the specified alignment)</li> </ul> <p>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.</p>
	<p>The <b>Align Leq Period on Clock Time</b> control allows the user to force the Alignment of the Leq Period to match the time on the clock.</p> <p>This control is only visible with <b>ID increment</b> set to <b>On Start Only</b> or <b>Every 'X' Leq</b>. The alignment with clock is always forced when <b>Every Hour/Day/Week</b> modes are selected.</p>

### 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 allow 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 then go 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 then be created and would normally include 24 one-hour Leq spanning from 6:30 AM to 6:30 AM the next day.

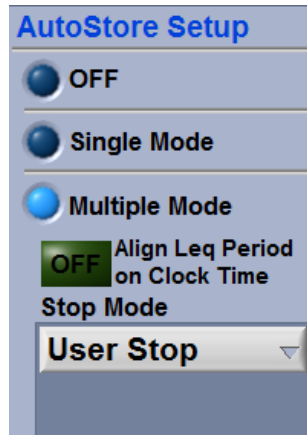
In order to achieve the Leq alignment to the clock it is necessary for the **Leq Average Period** to be a common multiple of the **DataSet** period. With the **Every Hour/Day/Week** modes, the **Leq Average period** will be forced to the nearest common multiple. With the **On Start Only** and the **Every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

<input type="radio"/> OFF	The measurement will stop after the <b>Leq Average Time</b> elapses. The resulting <b>DataSet</b> must be stored manually by pressing the SAVE button.
<input type="radio"/> Single Mode	The measurement will stop after the <b>Leq Average Time</b> elapses. The resulting <b>DataSet</b> is stored automatically.
<input checked="" type="radio"/> Multiple Mode	The measurement continues after the <b>Leq Average Time</b> elapses, averaging is reset and each period data is stored automatically.

### Multiple Mode Setup

<input type="checkbox"/> Align Leq Period on Clock Time	The <b>Align Leq Period on Clock Time</b> forces the alignment of the Leq periods to match the time on the clock. This control is only visible with <b>ID increment</b> set to <b>On Start Only</b> or <b>Every 'X' Leq</b> . The alignment with clock is always forced when <b>Every Hour/Day/Week</b> modes are selected.	
Stop Mode	<input type="text" value="User Stop"/> Stop Mode User Stop	The measurement will stop when it is stopped manually by the user.
	<input type="text" value="10.6 h"/> Stop Mode Fixed Duration	The measurement will stop automatically when the <b>fixed duration</b> has elapsed. It can also be stopped manually by clicking the STOP button.
	<input type="text" value="10:34:50 2012-09-06"/> Stop Mode Stop Time	The measurement will stop automatically when the <b>stop time</b> is reached. It can also be stopped by clicking the STOP button.

## 8.4 Data Selection

**Data Selection** All Data / Average Mode / AveragePeriod = 30 sec  
 RecSize: 505 KB/hour or 4,21 KB/Leq or 11,8 MB/DataSet  
 Max RecTime: >365 days (no wave) >365 days (continuous wave)

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. 41)
- Data Record Rate (see section 8.4.2, p. 43)
- Values to Record (see section 8.4.3, p. 44)

The screenshot shows the 'Record Data Selection' dialog box. At the top, there are tabs for 'Record', 'Instant', 'Average', 'Same as Display', 'All Data', and 'Custom'. Below these, there are fields for 'Instant rate: 0,025 sec' and 'FFT rate: 0,256 s'. The main area contains a grid of buttons for selecting recording modes, organized into four numbered rows (1-4). Row 1 includes 'Instant Leq' (LAeq, LCeq, LZeq, 1/3 Leq) and 'FFT Leq'. Row 2 includes 'Instant SPL' (LAS, LCS, LZS, 1/3 Slow). Row 3 includes (LAF, LCF, LZf, 1/3 Fast). Row 4 includes (LAI, LCI, LZI, 1/3 Imp.), (LApk, LCpk, LZpk). At the bottom right are 'Cancel' and 'OK' buttons. Annotations with green boxes and arrows point to: 'Sampling Rate' (pointing to the instant rate field), 'Instantaneous / Average Record Mode' (pointing to the Instant/Average switch), 'Data Selection Options' (pointing to the top tabs), and 'Data Selections' (pointing to the grid of mode buttons).

### 8.4.1 Instantaneous / Average Record Mode

The    Average switch defines the record mode.

## 8.4.1.1 Instantaneous Record Mode

The **Instantaneous Record Mode** records instantaneous values at a rate defined by the **Instant Rate**. This record mode allows for more flexibility in post-processing, but creates much larger files.

Use this record mode is recommended for taking short measurements that require high temporal resolution like impulsive events.

### Available Data

Data Type	Measure Type	Record Type	Freq Weighting
Global	SPL Slow	Instantaneous	A, C or Z
	SPL Fast		
	SPL Impulse		
	SPL Peak		
	Leq and SEL		
1/3 Octave Spectrum	SPL Slow	Instantaneous	A, C and Z
	SPL Fast		
	SPL Impulse		
	Leq and SEL		
FFT Spectrum	Leq and SEL	Instantaneous	A, C and Z

Note: Only Z weighting is recorded for spectrums as frequency weighting can be applied in post-processing.

### 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

## 8.4.1.2 Average Record Mode

The **Average Record Mode** records averaged values at a rate defined by the **Leq Average Time**. This record creates smaller files, but allows for less flexibility in post-processing.

This record mode is recommended for taking long measurements that do not require high temporal resolution such as environmental noise measurements.

### Available data

Data Type	Measure Type	Record Type	Freq Weighting
-----------	--------------	-------------	----------------

<b>Global</b>	SPL Slow	Statistics	A, C or Z
	SPL Fast		
	SPL Impulse		
	SPL Peak		
	Leq and SEL	Average	
<b>1/3 Octave Spectrum</b>	SPL Slow	Statistics	A, C and Z
	SPL Fast		
	SPL Impulse		
	Leq and SEL		
<b>FFT Spectrum</b>	Leq and SEL	Average	A, C and Z

Note: Only Z weighting is recorded for spectrums as frequency weighting can be applied in post-processing.

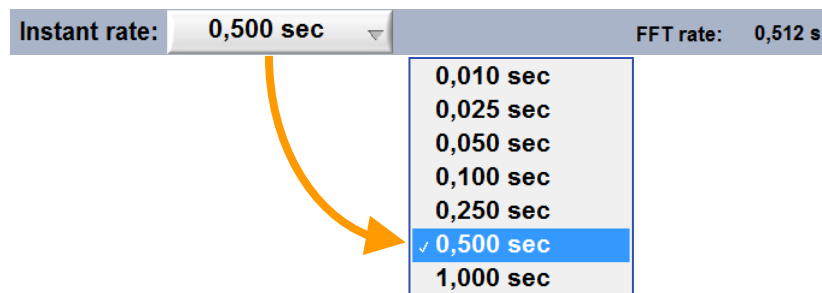
## [Post-Processing Options](#)

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

## 8.4.2 Sampling Rate

### 8.4.2.1 Instantaneous Record Mode



In Instantaneous Record Mode, the data rate can go from 10 ms to 1 s.

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 Average Record Mode

Leq Average time: 20 sec

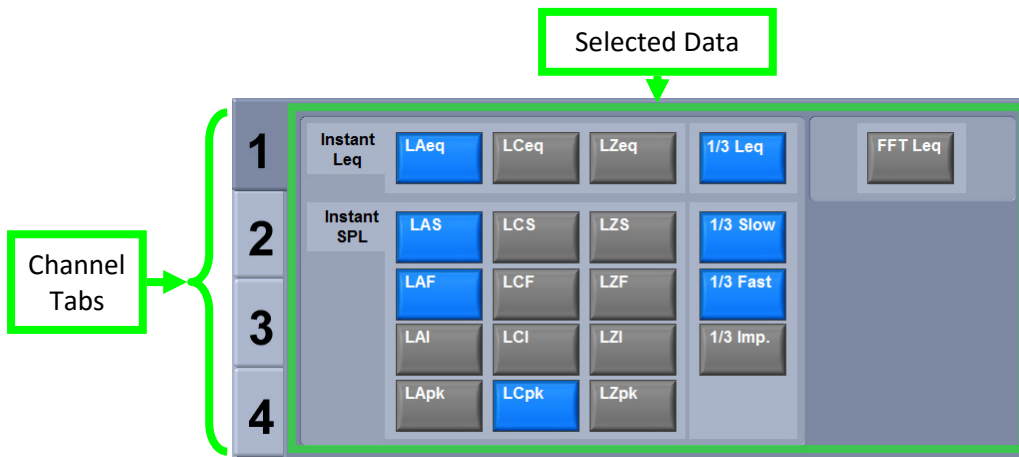
In Average Record Mode, the record rate can be set between 1 s to 24 hrs. Simply click on the field to modify this value. This value can also be modified on the **Leq Averaging Time** indicator on the main interface (see section 5.3, p. 10).

## 8.4.3 Data Selections

The Data Selection area includes four pages that display the data to record on each channel. The number of enabled pages corresponds on the number of enabled inputs (see section 6.1, p. 19). Values to record are coloured in blue.

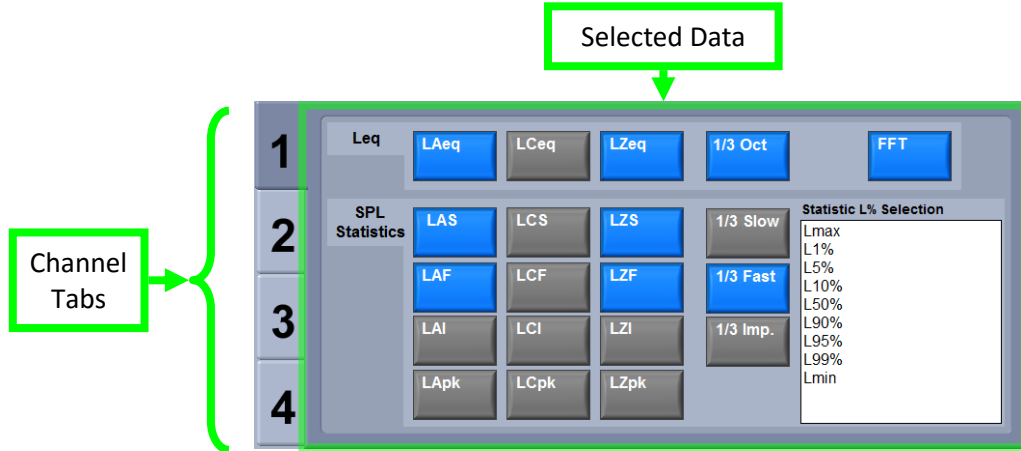
### 8.4.3.1 Instantaneous Record Mode

The **Instantaneous Record Mode** records instantaneous values at a rate defined by the **Sampling Rate**. This record mode allows for more flexibility in post-processing, but creates much larger files (see section 8.4.1, p. 41).



### 8.4.3.2 Average Record Mode

The **Average Record Mode** records averaged values at a rate defined by the **Sampling Rate**. This record creates smaller files, but allows for less flexibility in post-processing (see section 8.4.1, p. 41).



The **Statistic L% Selection** control let the user decide what statistics data will be saved. This control applies to all statistic data (both global levels and 1/3 octave spectrums).

#### 8.4.4 Data Selection Options

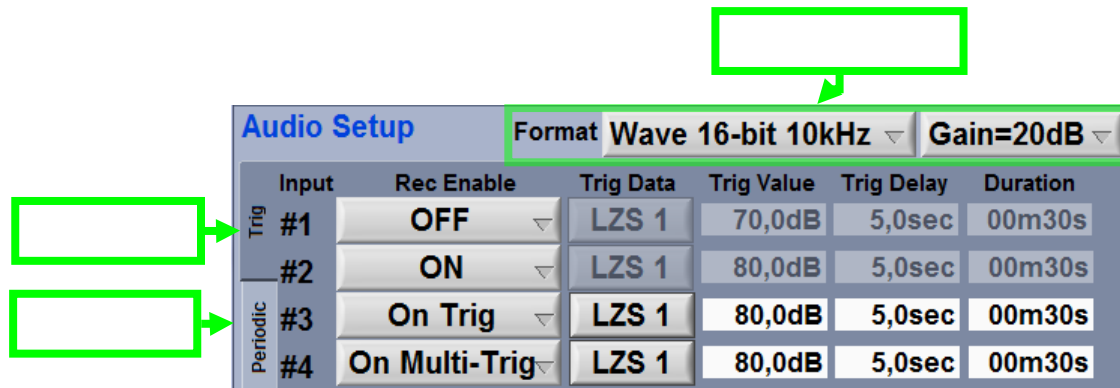


The **Data Selection Presets** automatically selects the data to be recorded. The table below summarizes these options, as well as their advantages and drawbacks.

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



## 8.5 Audio Setup



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.

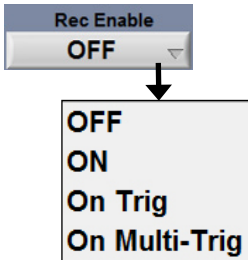
### Audio Format

<p>Wave 10kHz</p> <p>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)</p>	<p>The file format of the audio recordings.</p> <ul style="list-style-type: none"> <li>.mp3 file, 16-bit &amp; 24 kHz sampling rate compressed to 32 kbps</li> <li>.wav file, 16-bit, 24 kHz sampling rate (10 kHz usable bandwidth)</li> <li>.wav file, 16-bit, 48 kHz sampling rate (20 kHz usable bandwidth)</li> <li>.wav file, 32-bit, 24 kHz sampling rate (10 kHz usable bandwidth)</li> <li>.wav file, 32-bit, 48 kHz sampling rate (20 kHz usable bandwidth)</li> </ul> <p>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.</p> <p>When using MP3 compression, the maximum file duration is 30 sec. Also the Record Enable mode ON and On Multi-Trig are disabled.</p>
<p>Gain=20dB</p> <p>Gain=0dB (levels&gt;90dB) Gain=20dB (level around 70dB) Gain=40dB (level around 50dB)</p>	<p>The gain is applied on the audio signal before recording to the file.</p> <ul style="list-style-type: none"> <li>No gain: for very high level or to avoid numeric saturation</li> <li>- 20 dB gain: for better listening of mid-range levels (around 70 dB)</li> <li>- 40 dB gain: for better listening of low levels (lower than 70 dB)</li> </ul> <p>This option is useful to facilitate the listening of files that the levels are low. Such files are otherwise almost impossible to heard in</p>

common audio players.

Applying a gain exposes the audio signal to numerical saturations.

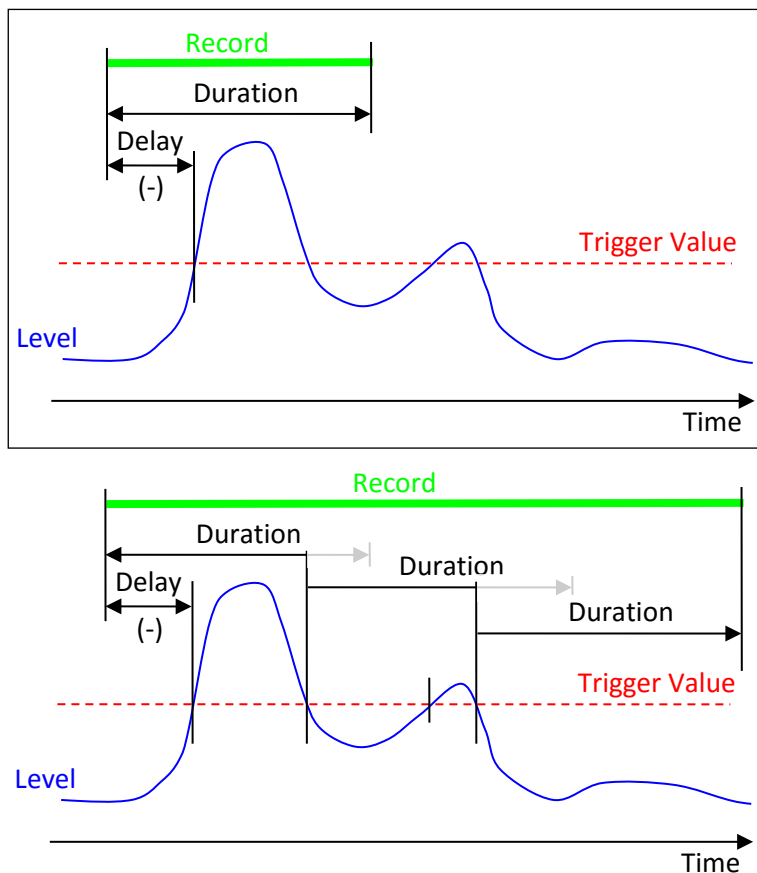
## Trig Tab



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:

<b>OFF</b>	No audio recording is performed.
<b>ON</b>	Continuous audio recording is performed from the start to the end of a measurement.
<b>On Trig</b>	Recording is triggered by a noise event and stops after the user-specified duration.
<b>On Multi-Trig</b>	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.

**Wave Recording** Bandwidth: 10 kHz

Input Rec Enable Trig Data Trig Value (dB) Trig Delay (sec) Duration (mm:ss)

#1	OFF	LZS 1	80,0	-5,0	00:10
#2	ON	LZS 1	80,0	-5,0	60:00
#3	On Trig	LAF 3	80,0	-5,0	00:30
#4	On Multi-Trig	LCI 4	80,0	-5,0	00:30

**Global Level**

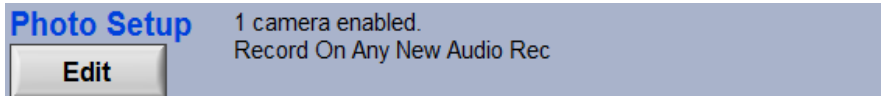
SPL	Time Weigthing	Global Level		
		A	C	Z
Peak	Slow	LAS	LCS	LZS
	Fast	LAF	LCF	LZF
	Impulse	LAI	LCI	LZI

## 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 $\leq$ 25 ms
3 or 4 enabled inputs	Sampling rate $\leq$ 50 ms

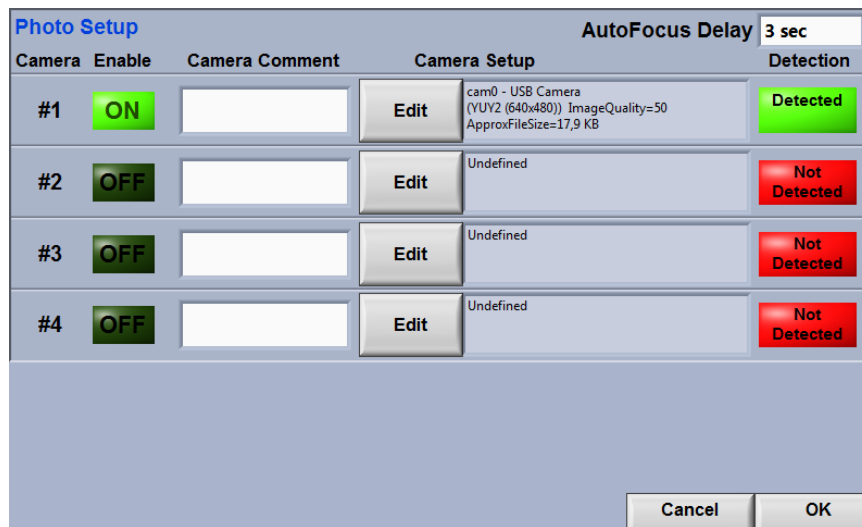
## 8.6 Photo Setup



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

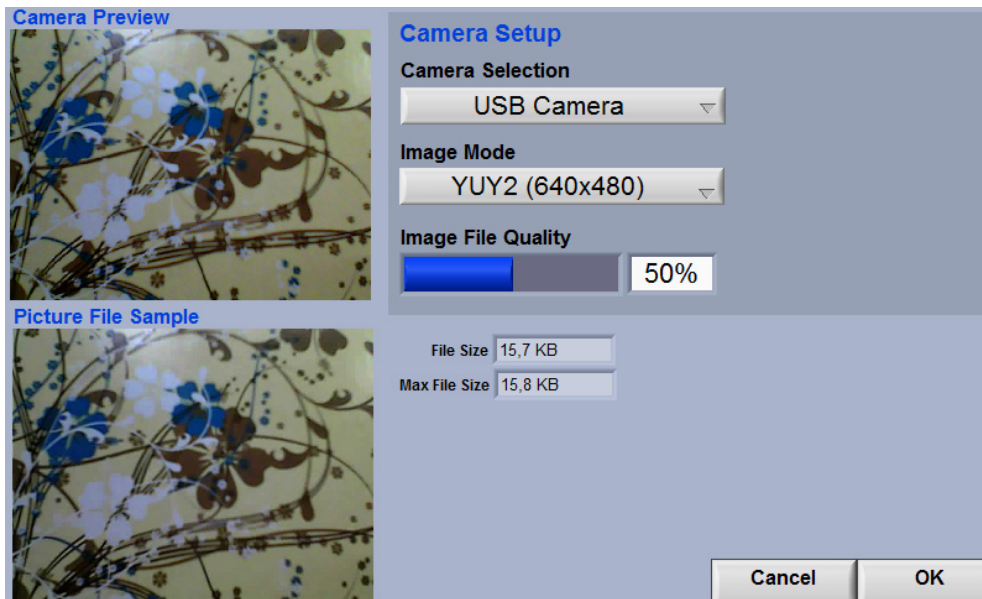


### Photo Setup Interface



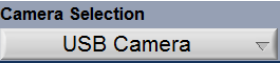
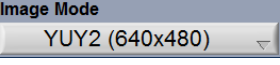
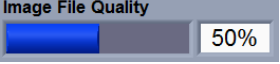

	The Autofocus Delay should be adjusted to the time the camera takes to properly set its focus once it is powered. This parameter is important if several cameras are used during a measurement.
	This button enables or disables the related camera. Using several cameras on a Concerto platform is not recommended.
	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

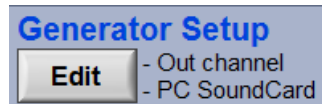
The **Camera Setup** interface is available from the **Photo Setup** interface.



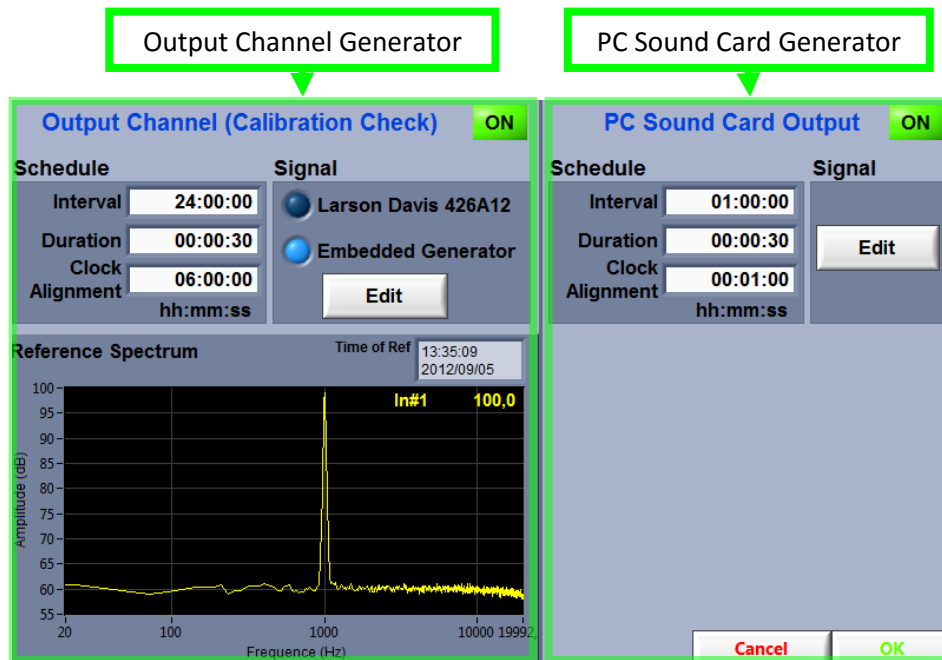
### Camera Setup Interface

	<p>The Camera Preview is the video streaming that outputs the camera.</p>
	<p>The Picture File Sample is a sample of the file that is recorded with the current camera setup.</p>
	<p>Select a camera from the Camera Selection menu.</p>
	<p>Select the image definition from the Image Mode menu.</p>
	<p>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.</p>
	<p>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.</p>

## 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 (see section 8.7.2, p. 52). 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.52) 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.

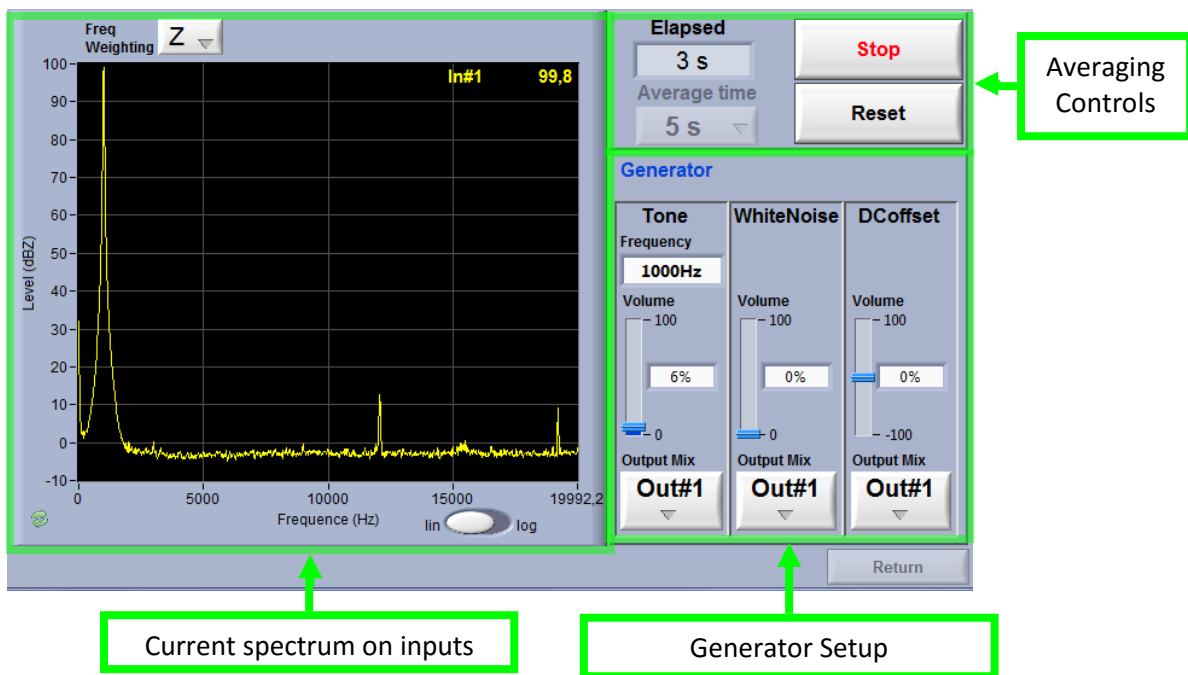
## 8.7.1 Calibration Check

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.


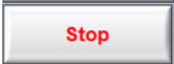


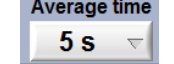
The generated signal should be loud enough to be way over the normal signal being measured. Ideally, the generated signal should be a few dB below the maximum range of the input. For example, the Larson Davis 426A12 actuator typically generates 91 to 97 dB at the input.

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





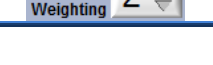
## 8.7.2 Reference Spectrum Interface



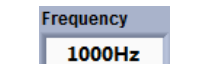
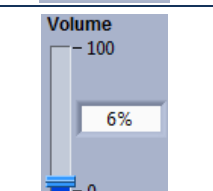
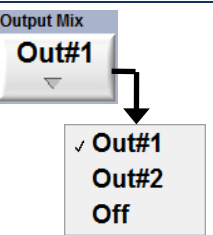
## Averaging Controls

 	Starts and stops the average of the averaging of the spectrum. Once the <b>Average Time</b> 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

	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).

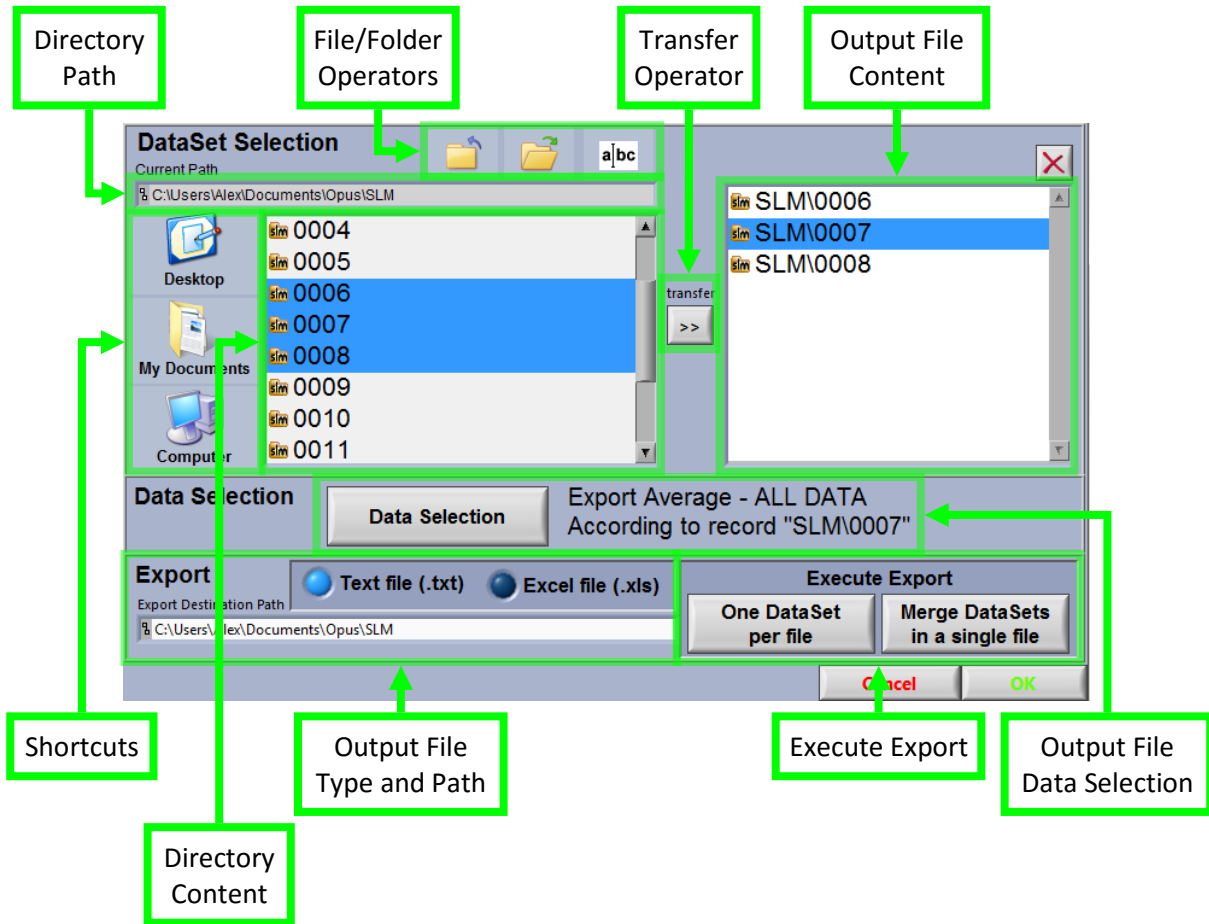
## Generator Setup

	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.



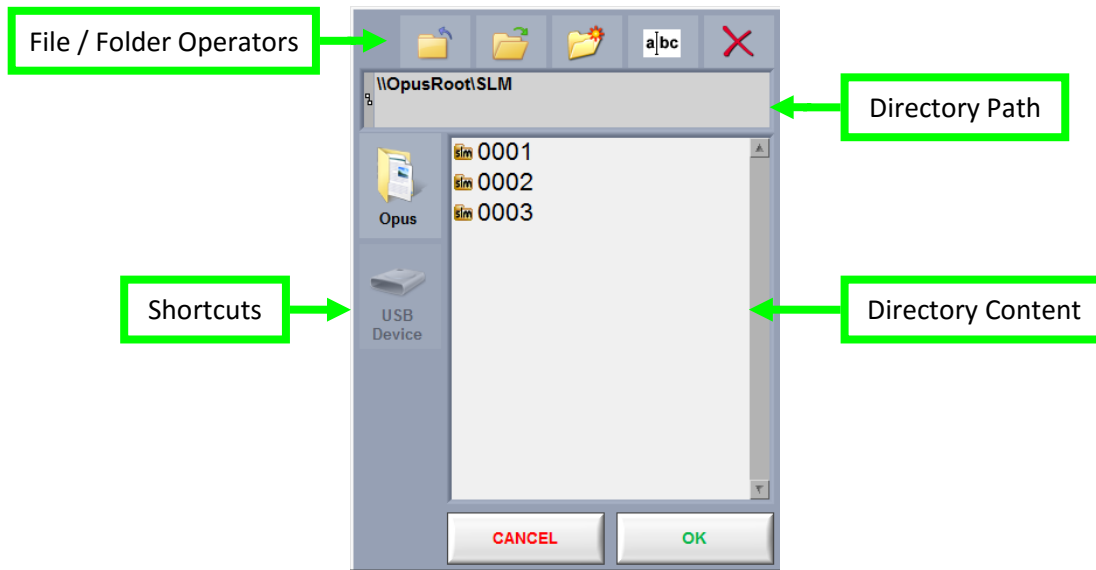
## 9 Data Exporter

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



<b>Directory Path</b>	Displays the path of the active directory.
<b>File/Folder Operators</b>	Can be used to: <ul style="list-style-type: none"> <li>• Go to parent directory</li> <li>• Open directory</li> <li>• Rename folder or file</li> </ul>
<b>Transfer Operator</b>	Transfers the <b>Dataset</b> content to the output data file.
<b>Export File Content</b>	Displays the content of the output file. To add data, drag <b>DataSets</b> from the <b>Directory Content</b> to the <b>Output File Content</b> or click on the <b>Transfer Operator</b> to transfer selected <b>DataSets</b> .
<b>Shortcuts</b>	Allows easy access to common directories. When the <b>Data Exporter</b> is used on a stand-alone computer, these shortcuts are linked to: <ul style="list-style-type: none"> <li>• Desktop</li> <li>• My Documents</li> <li>• Computer</li> </ul> When the <b>Data Exporter</b> is used on a <b>Concerto</b> , the shortcuts are linked to: <ul style="list-style-type: none"> <li>• Opus Root</li> <li>• USB Device.</li> </ul>
<b>Directory Content</b>	Displays the content of a directory and responds to common actions from the user: <ul style="list-style-type: none"> <li>• Single clicking on an element will select it</li> <li>• Double clicking on a directory will open it</li> <li>• Dragging an element from one side to the other will perform a transfer.</li> </ul>
<b>Export File Type and Path</b>	Allows the user to select the output file type (.txt or .xls) and select the output file directory.
<b>Execute Export</b>	Creates the output file: <ul style="list-style-type: none"> <li>• <b>One Dataset Per File</b> creates different files for each datasets in the <b>Output File Content</b></li> <li>• <b>Merge Datasets in a Single File</b> creates a single file with each datasets on separate columns.</li> </ul>
<b>Output File Data Selection</b>	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 <b>Output File Content</b> .

## 10 Explorer Dialog



### Explorer Window Controls and Indicators

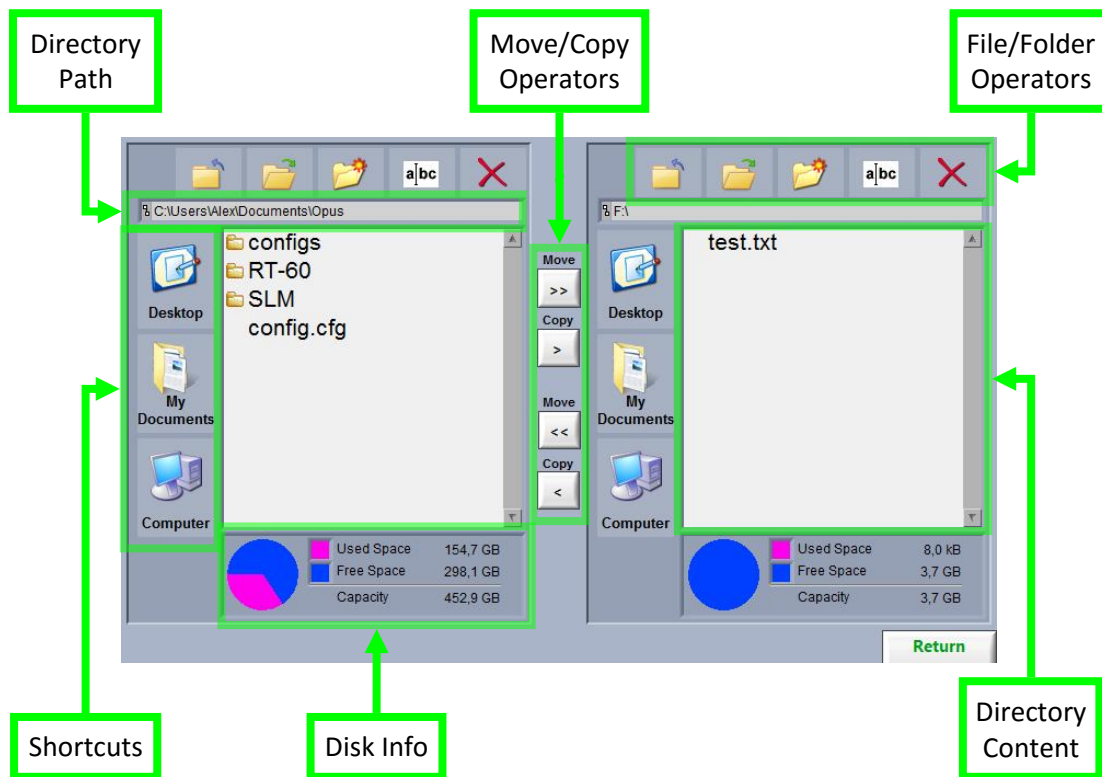
<b>File/Folder Operators</b>	<ul style="list-style-type: none"> <li>• Go to parent directory</li> <li>• Open directory</li> <li>• Create new folder</li> <li>• Rename folder or file</li> <li>• Delete folder or file</li> </ul>
<b>Directory Path</b>	Displays the path of the active directory.
<b>Shortcuts</b>	<p>Accesses to <b>common directories</b>.</p> <p>When used on a stand-alone computer, those shortcuts are linked to:</p> <ul style="list-style-type: none"> <li>• Desktop</li> <li>• My Documents</li> <li>• Computer</li> </ul> <p>When used on a <b>Concerto</b>, the shortcuts are linked to:</p> <ul style="list-style-type: none"> <li>• Opus Root</li> <li>• USB Device.</li> </ul>
<b>Directory Content</b>	<p>Displays the content of a directory and responds to common actions:</p> <ul style="list-style-type: none"> <li>• Single clicking on an element selects it.</li> <li>• Double clicking on a directory opens it.</li> </ul>

## 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.



<b>Directory Path</b>	Displays the path of the active directory.
<b>Shortcuts</b>	<p>Allows easy access to common directories. When the <b>File Manager</b> is used on a stand-alone computer, these shortcuts are linked to:</p> <ul style="list-style-type: none"> <li>• Desktop</li> <li>• My Documents</li> <li>• Computer</li> </ul> <p>When the <b>File Manager</b> is used on a <i>Concerto</i>, the shortcuts are linked to:</p> <ul style="list-style-type: none"> <li>• Opus Root</li> <li>• USB Device.</li> </ul>
<b>Move/Copy Operators</b>	Copies or moves a file or folder from a source to its destination.
<b>File/Folder Operators</b>	<p>Allows user to:</p> <ul style="list-style-type: none"> <li>• Go to parent directory</li> <li>• Open directory</li> <li>• Create new folder</li> <li>• Rename folder or file</li> <li>• Delete folder or file</li> </ul>
<b>Directory Content</b>	<p>Displays the content of a directory and responds to common actions from the user:</p> <ul style="list-style-type: none"> <li>• Single clicking on an element will select it</li> <li>• Double clicking on a directory will open it</li> <li>• Dragging an element from one side to the other will copy it.</li> </ul>
<b>Disk info</b>	Displays the disk information of the associated hardware.

## Appendix 1: Concerto Hardware

### Connections



## Power on/off



<p><b>Turn On</b></p>	<p>Press the trigger button located at the back of the unit This key has two (2) functions:</p> <ol style="list-style-type: none"> <li>1. To turn the unit ON.</li> <li>2. Start a measurement once the SLM Module is loaded</li> </ol> <p>After a few seconds, the <b>Opus Environment Interface</b> will appear.</p>
<p><b>Stand-by</b></p>	<p>The <b>stand-by</b> mode allows fast load time.</p> <ul style="list-style-type: none"> <li>• To put the unit on <b>stand-by</b>, click the <b>Turn Off</b> button.</li> </ul> <p>Note: The unit can be in stand-by for more than three days without recharging, provided batteries are fully charged prior to storage.</p>
<p><b>Shutdown</b></p>	<p>To <b>Shut down</b> the unit, click and <b>hold</b> the <b>Turn Off</b> button for five seconds.</p>

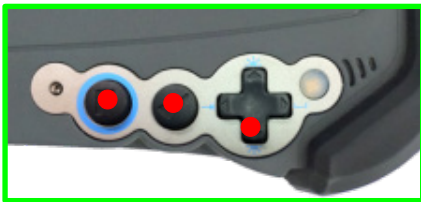
## Power Reset

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

Power-on

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

## *Physical (DAP Tech 8900 Tablet PC)*

Operating system	AMD® Geode™ LX800 Processor, 500MHz
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, 2600 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

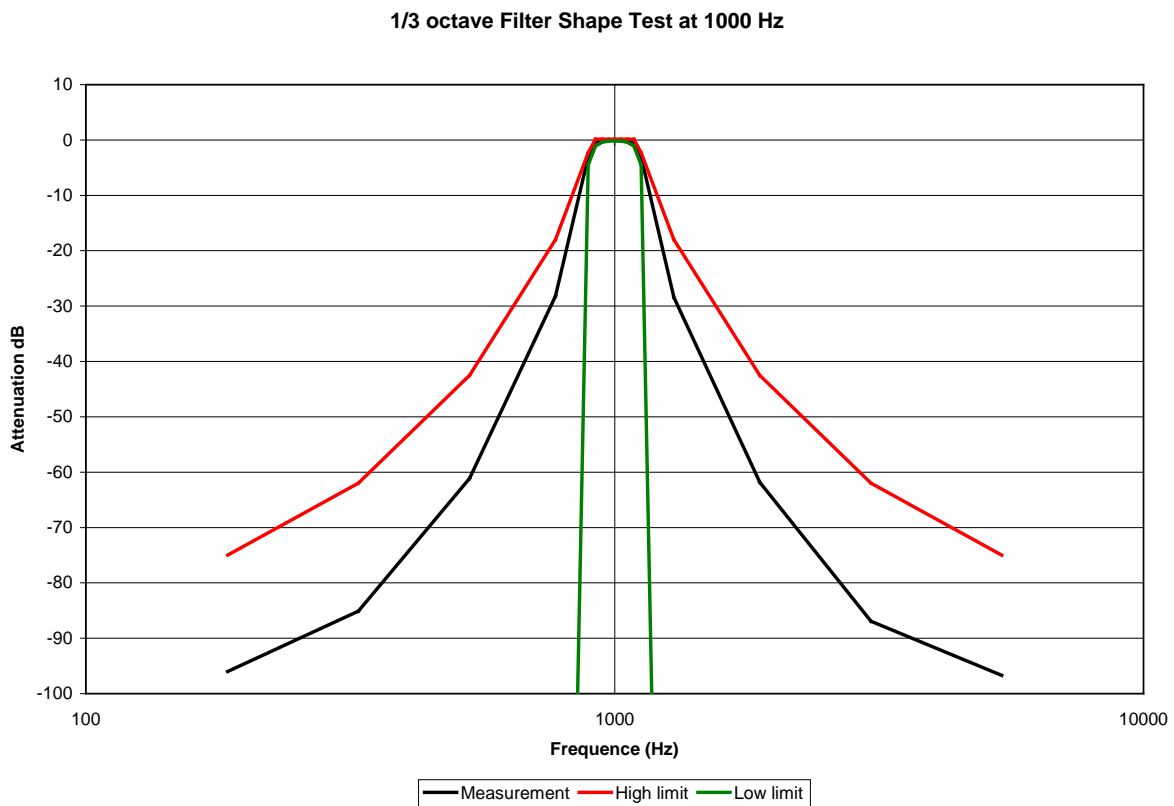
The 1/3 octave filters are computed at low-level in real time (at 48 kHz) on the digital signal processor (DSP) of the Concerto system. The filters comply with all requirements of IEC 61260 for Class 1.

### 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:

<b>Frequency (Hz)</b>	<b>Low limit (dB)</b>	<b>Measurement (dB)</b>	<b>High limit (dB)</b>
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

# Soft dB

Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
10000	120.5	26.3	94.2	16.9
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)

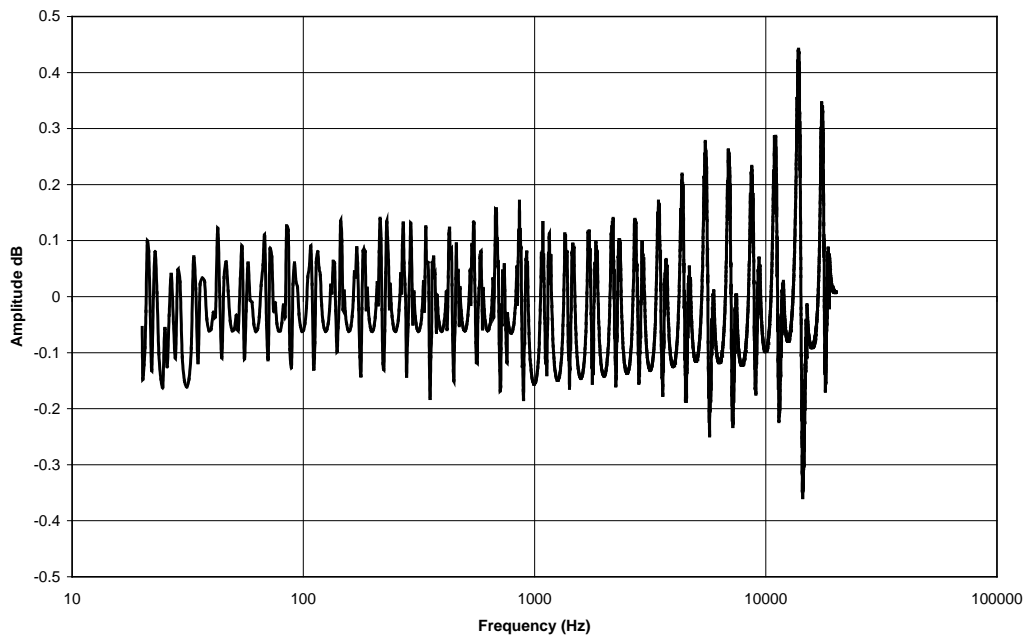
Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
20	132.5	51.5	81.0	7.3
25	132.5	49.2	83.3	5.3
31.5	132.5	47.1	85.4	2.0
40	132.5	44.2	88.3	7.9
50	132.5	41.8	90.7	9.3
63	132.5	39.1	93.4	9.1
80	132.5	37.1	95.4	10.6
100	132.5	32.6	99.9	10.6
125	132.5	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

Frequency (Hz)	Saturation Level (dB)	Minimum Linear Level (dB)	Linear Dynamic Range (dB)	Noise Floor (dB)
8000	132.5	32.7	99.8	22.4
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 (Low Range Case)



Summation Test (High Range Case)

