

# Piccolo-II

## Integrating Averaging Sound Level Meter

User Guide – 2024-06-03



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## 1 Introduction

Congratulations for purchasing the Piccolo-II Integrating Sound Level Meter. This instrument provides an innovative and cost effective solution for professional grade acoustical measurement.

### 1.1 Features

- Precision Integrating Sound Level Meter;
- A, C and Z simultaneous frequency weightings;
- Leq, Lmax, Lmin, Lpeak, SEL,
- 10 Percentiles (L1%, L2%, L5%, L8%, L10%, L25%, L50%, L90%, L95% and L99%);
- Large dynamic range: 30 dBA to 130 dBZpk<sup>1</sup>;
- Slow or Fast SPL Time response;
- 1/1 Octave spectrum;
- 1/3 Octave spectrum<sup>2</sup>;
- 400 lines FFT spectrum;
- 16 MB memory for up to 198,948 records;
- Auxiliary input for external microphone;
- Large Li-Ion battery for up-to 48h operating time.

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<sup>1</sup> Using two ranges: Low : 30 dBA to 110 dBZpk, High 46 dBA to 130 dBZpk, at nominal sensitivity

<sup>2</sup> 1/3 octave spectrum available using Spectrum Analyzer software (Section 8.5)

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## 2 First Use

### 2.1 Unpacking



### 2.2 Instrument Components

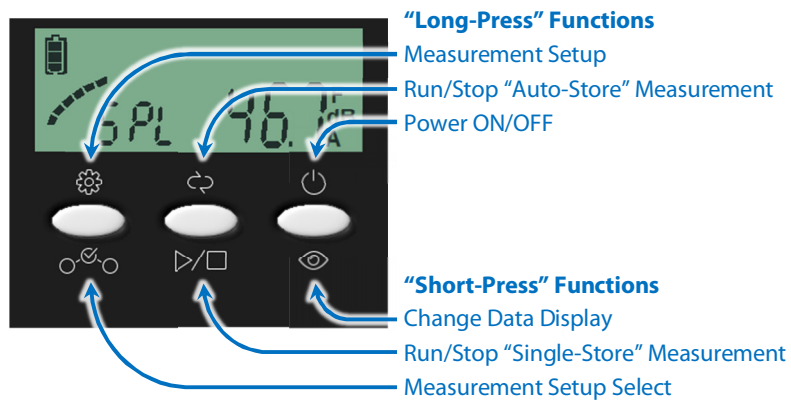


## 2.3 Dimensions

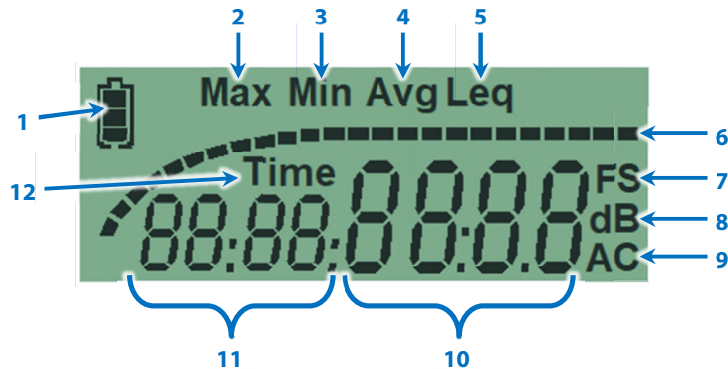


## 2.4 Buttons

There are 3 buttons on the Piccolo-II to control the instrument. Icons displayed above each button indicate the functions associated with a long-press and icons under the buttons indicate the functions associated with a short-press.



## 2.5 Display Screen



- 1) Battery Level (contour blinking when charging)
- 2) Maximum Sound Pressure Level (SPL) Label
- 3) Minimum SPL Label
- 4) Average in progress (blinking)
- 5) Equivalent Level Label (Leq)
- 6) Live SPL Bar Graph (Right-most segment blinking on Under-Range, Left-most segment blinking on Over-Load)
- 7) SPL Time-Weight Label (Fast or Slow)
- 8) dB Unit Label
- 9) Frequency Weighting Label (A, C or Z)
- 10) Sound Level (Leq, Live SPL, Lmax, Lmin, SEL, Lpeak);  
Record Number;  
Elapsed Time (mm:ss);  
Overload (- or 1);  
Battery %.
- 11) Additional Label: SPL, SEL, PEA (Lpeak), rEC (Record number), bAtt (Battery);  
Under-Range (- or 1);
- 12) Time Label: visible when displaying Elapsed Time.

## 2.6 Overload Indication

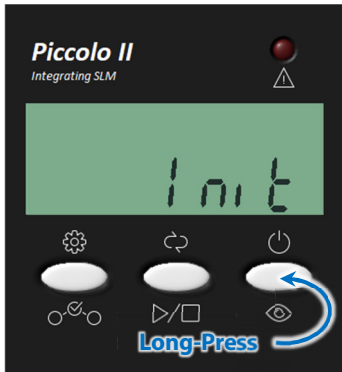


The overload LED will blink for 1s when an overload occurs. If the overload occurs during a measurement, the right-most segment of the SPL Bar Graph will blink. This segment will keep blinking until another measurement is performed.

The overload threshold is set 1 dB below the upper limit of the dynamic range.

## 2.7 Power-Up

To power ON the instrument, press and hold the right-most button. At power-up, the display screen displays the live SPL.



To power-up the instrument, perform a long-press on the right-most button. This will power-up the instrument and display "Init" on the display during the warm-up process (~1s).

## 2.8 Shut-Down

To shut-down the instrument, press and hold the right-most button until the display turns off.

When no measurement is in progress, the instrument will shut-down after 10 minutes of inactivity.



### 3 Running a Measurement

There are two measurement modes available on the Piccolo-II: "Single-Store" and "Auto-Store".

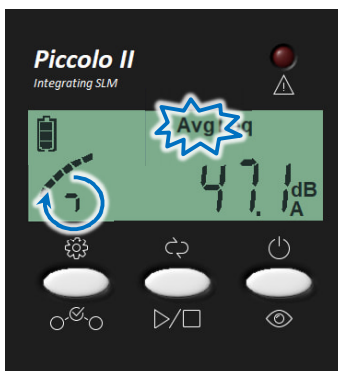
The Single-Store runs a single average period and stops after the specified duration or when the user stops the measurement.

The Auto-Store runs a series of average periods one after the other until the user stops the measurement or until the memory is full.

#### 3.1 Single-Store



To start a Single-Store measurement, perform a short-press on the center button. This will display "run SGL" on the display for 1s and start the measurement.



Once the measurement is started, the display automatically shows the Leq. While the measurement is running, the "Avg" indicator will blink and the left-most segments will rotate indicating a measurement in progress.

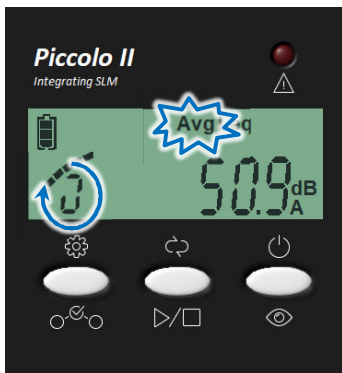


To stop the measurement, press the center button or simply wait for the measurement duration to be elapsed. When the measurement is over, the record number will be displayed for 1s and the display will return to the Leq.

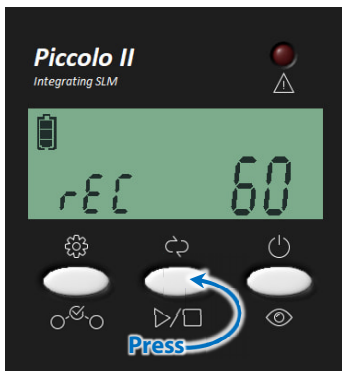
## 3.2 Auto-Store



To start an Auto-Store measurement, perform a long-press on the center button. This will display "run AUTO" on the display for 1s and start the measurement.



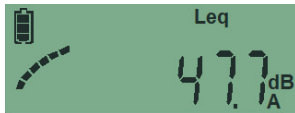
Once the measurement is started, the display automatically shows the Leq. While the measurement is running, the "Avg" indicator will blink and the left-most segments will rotate indicating a measurement in progress. Note that the left-most segments rotate to form an "O" shape in Auto-Store mode whereas it forms a small "o" shape in Single-Store mode.



To stop the measurement, press the center button. When the measurement is over, the record number will be displayed for 1s and the display will return to the Leq.

## 4 Data Display

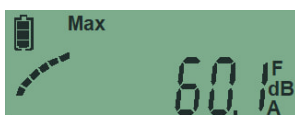
Each Data Display is accessible by performing a short-press on the right-most button. This will flip through the following displays:



**Leq** : Equivalent sound level of the last record



**Live SPL** : Live sound pressure level



**Lmax** : Maximum SPL of the last record



**Lmin** : Minimum SPL of the last record



**SEL** : Sound Exposure Level of the last record



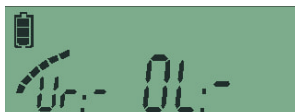
**Lpeak** : Peak sound level of the last record



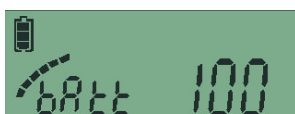
**Record** : Number of the last record



**Time** : Duration of the last record



**Dynamic Info** : Overload and Under-Range indicators of the last record



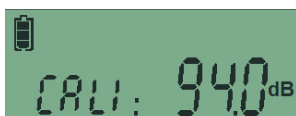
**Battery** : Battery percent

## 5 Measurement Setup

The measurement setup is accessible by performing a long-press on the left-most button. Another long-press on the button changes the setup menu and a short-press on the button changes the parameter value. To exit the menu, click on any of the two other buttons or wait 10s.



**Record Duration** : Flips through 1s, 10s, 1m, 5m, 15m and 60m. Note that these durations can be changed using the software.



**Calibration** : Flips through 94 dB or 114 dB calibrator selection. A long-press on the center button starts the calibration process. Refer to section XX for more information.



**Input Range** : Flips through "Low" and "High". Refer to technical specifications for more information on the input range.



**Frequency Weighting** : Flips through "A", "C" and "Z" frequency weighting to display. Note that "A", "C" and "Z" global levels are always recorded regardless of this parameter. The only exception are percentiles (LN%) which are only recorded for the selected frequency weighting.



**SPL Time Response** : Flips through "Fast" and "Slow" time response for sound pressure level exponential response.



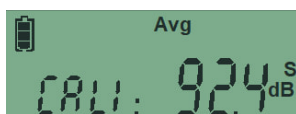
**FFT Mode** : Flips through "OFF", "Full", "8000", "4000", "2000", "1000", and "500". The FFT is 400 lines and spans a full bandwidth of 17.2kHz. The bandwidth can be reduced using the "8000" to "500" modes to achieve higher frequency resolution.

## 6 Calibrating

- 1) Insert the microphone in the calibration chamber of a microphone calibrator<sup>1</sup>
- 2) Perform a long press on the Setup button to enter the setup;
- 3) Perform another long-press on the setup button to get to the calibration menu;
- 4) Perform a short-click on the setup button to select the calibration level (94dB or 114 dB) matching the calibrator reference level;



- 5) Turn the calibrator ON;
- 6) Perform a long-press on the RUN/STOP button to initiate the calibration process;
- 7) The calibration process takes 5s. During this period the display shows the measured SPL and the "Avg" label blinks;



- 8) When the process is done, the display shows "done" indicating a success or "err" indicating an error.



An error can occur if the calibration value is out of range. This can occur when the calibrator is not in function or when the level selection (94-114) does not match the calibrator reference level.

Note that when an external signal source is connected on the auxiliary jack, the auxiliary input will be calibrated. This will not affect the calibration value of the main microphone.

The calibration process can also be performed using the software. Refer to section 8.3.2 for more information.

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<sup>1</sup> The microphone calibrator should be compliant to IEC 60942.

## 7 Locking and Unlocking

To lock and unlock the Piccolo-II, press and hold all 3 buttons at the same time. When the instrument gets locked or unlocked, it will display the following:



**Locked**



**Unlocked**

## 8 Software

### 8.1 Download and Install

To download the software installer, use the following link:

[www.softdb.com/software.php?piccolo-2](http://www.softdb.com/software.php?piccolo-2)

#### Computer Requirements

Item	Minimum Requirements
Operating System	Windows 7 or more
CPU	Dual-Core at 1.2 GHz
Memory	2 GB RAM
Hard drive	300 MB free hard disk space
Port	USB 2.0
Display resolution	800 x 600

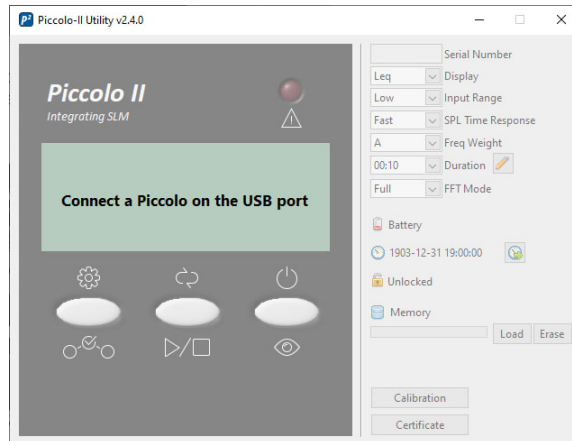
### 8.2 Software Modules

The software modules included in the Piccolo-II software installer and accessible in the Start Menu are the following:

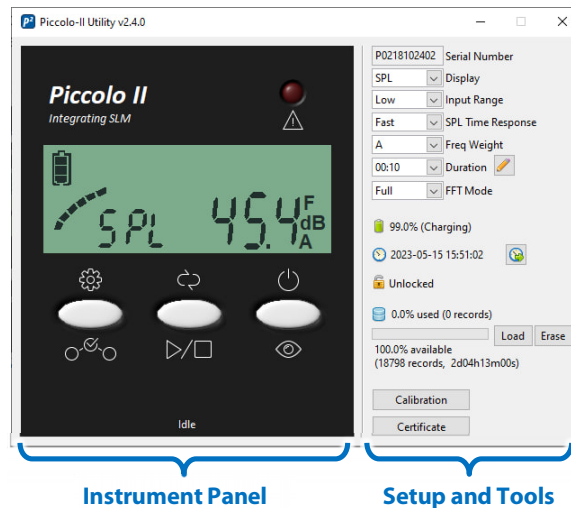
- Utility: Configure the Piccolo-II and import records (Section 8.3)
- Data Manager: Post-process measurement records (Section 8.4)
- Spectrum Analyzer: Measure and analyze spectrum files (Section 8.5)
- Audio Recorder: Record audio files using the Piccolo-II as a sound card (Section 8.6)

### 8.3 Utility Software

- 1) To open the software, click on “Piccolo-II Utility” from the Start Menu.



- 2) Connect a Piccolo-II instrument to the computer using the provided USB cable. Once connected, the software should automatically detect it.



The left side of the interface shows the Instrument Panel and the right side shows the Setup and Tools.

The Instrument Panel shows exactly what’s happening on the instrument itself. You can use the 3 software buttons as you would with the physical buttons. The display screen shows the same information as on the physical instrument as well as the Overload LED.

The Setup and Tools shows the setup parameters of the instrument as well as additional tools

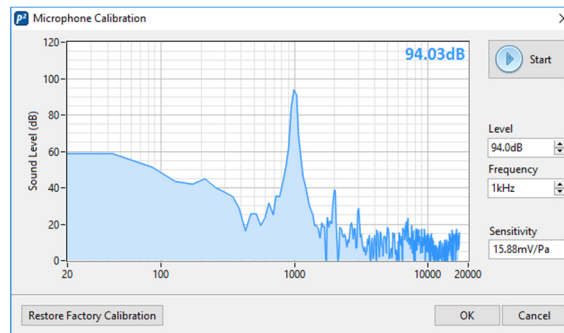


### 8.3.1 Memory Download

- 1) Click on the “Load” button to load the records in memory;
- 2) Once the download is completed, a file save prompt will show to save the \*.pic2 file on the computer.
- 3) Once the file is saved, the Data Manager software (Section 8.4) is launched to view the data.

### 8.3.2 Calibration

- 1) Click on the “Calibration” button to launch the microphone calibration interface;
- 2) Insert the microphone in the calibration chamber of a microphone calibrator<sup>1</sup>;
- 3) Enter the calibrator reference Sound Pressure Level and Frequency;
- 4) Turn the calibrator ON;
- 5) Click on the “Start” button to start the calibration process;
- 6) After 5s the measurement stops and the sensitivity value is updated.



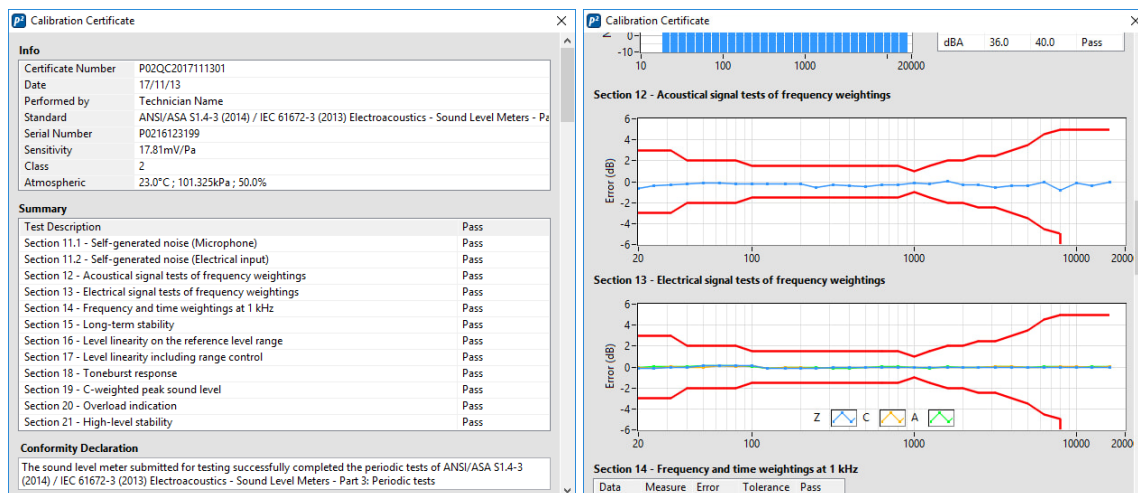
Note: If an external source is used with the auxiliary jack connector, the auxiliary jack will be calibrated.

### 8.3.3 Calibration Certificate

Click on the “Certificate” button to view the factory calibration certificate of the Piccolo-II:

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<sup>1</sup> The microphone calibrator should be compliant to IEC 60942.




Each Piccolo-II instrument is calibrated and tested at the factory following the procedures from IEC 61672-3 (2013) / ANSI/ASA S1.4-3 (2014) Electroacoustics – Sound Level Meters – Part 3: Periodic Tests.

A paper copy of the calibration certificate is delivered with each instrument and the certification data is stored in the instrument internal memory for software display. The Piccolo-II instruments can be sent back to the factory for periodic testing. Contact [info@softdb.com](mailto:info@softdb.com) for more information.

Refer to section 12 for a specimen calibration certificate.

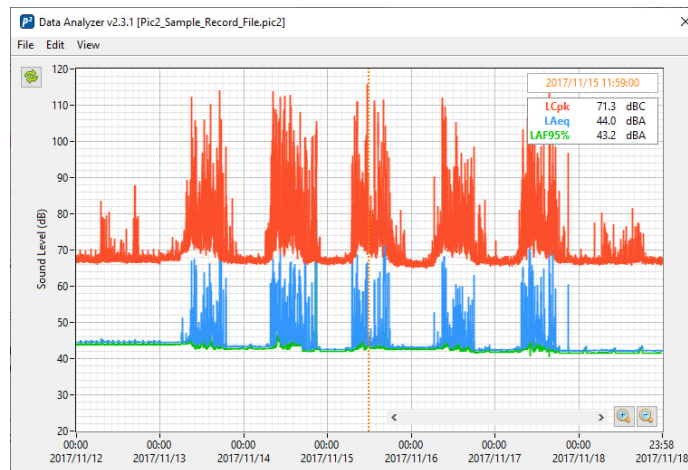
## 8.3.4 Clock Synchronisation

Click on the  button to synchronize the clock with the computer clock.

When the Piccolo-II clock indicates an offset of more than 10s compared to the computer clock, this  icon will be displayed next to the clock in the software interface.

## 8.4 Data Analyzer Software

The “Data Analyzer” software module allows viewing recorded measurements data, save it to a file and export it to a text file.



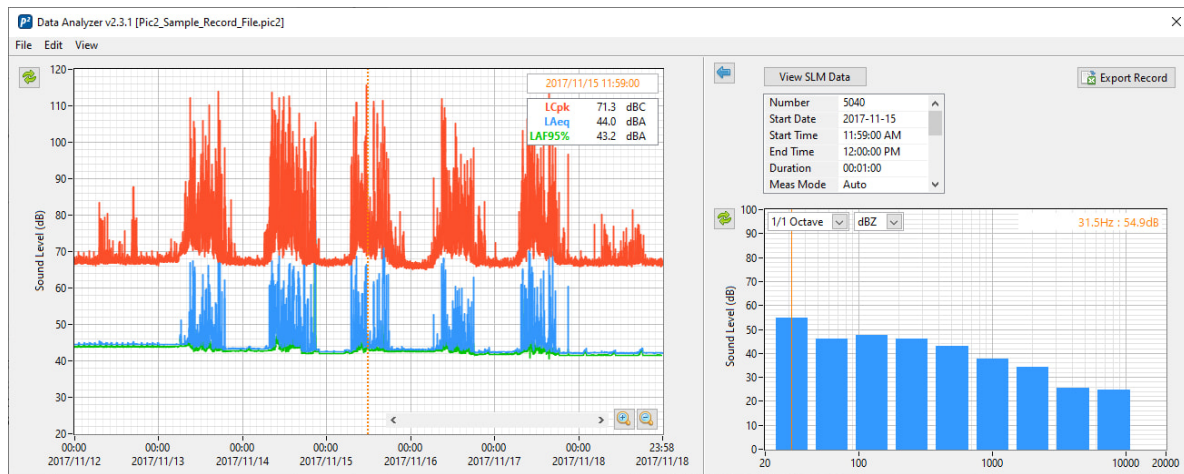
The main interface shows a time history graph of all recorded measurements. You can add a data plot by clicking on “Add Data” from the “Edit” menu.

Drag the cursor on the graph to update the legend values.

You can zoom in/out on the graph using the magnifier buttons or using the mouse wheel or the up/down keys. You can also manually edit the axis minimum and maximum labels to set the range to a specific value.

You can move the time range by moving the scrollbar at the bottom, or by dragging the cursor on the graph limits or by using the left/right keys.

Click on “Show Details” from the “View” menu to open the record details panel. This panel shows the details of the record indicated by the cursor. Moving the cursor on the time history graph updates the displayed information.



Click on "Records Table" from the "View" menu to show the recorded measurements as a table. When displaying the list, click on "History Chart" to go back to the time history graph. Note that displayed data curves on the time history graph will appear as data columns in the list view. The selected row in the list is linked to the cursor on the time history graph

The screenshot shows the 'Data Analyzer v2.3.1 [Pic2\_Sample\_Record\_File.pic2]' window with the 'Records Table' view. The table has columns: Number, Start Date, Start Time, End Time, Duration, LCpk, LAeq, and LAF95%. The table contains 23 rows of data.

Number	Start Date	Start Time	End Time	Duration	LCpk	LAeq	LAF95%
1	2017-11-12	12:00:00 AM	12:01:00 AM	00:01:00	67.0	44.6	43.9
2	2017-11-12	12:01:00 AM	12:02:00 AM	00:01:00	67.0	44.6	43.9
3	2017-11-12	12:02:00 AM	12:03:00 AM	00:01:00	68.4	44.5	43.9
4	2017-11-12	12:03:00 AM	12:04:00 AM	00:01:00	67.2	44.5	43.9
5	2017-11-12	12:04:00 AM	12:05:00 AM	00:01:00	67.1	44.6	43.9
6	2017-11-12	12:05:00 AM	12:06:00 AM	00:01:00	67.4	44.6	43.9
7	2017-11-12	12:06:00 AM	12:07:00 AM	00:01:00	67.1	44.6	43.9
8	2017-11-12	12:07:00 AM	12:08:00 AM	00:01:00	66.6	44.6	43.8
9	2017-11-12	12:08:00 AM	12:09:00 AM	00:01:00	67.1	44.6	43.9
10	2017-11-12	12:09:00 AM	12:10:00 AM	00:01:00	67.3	44.6	43.9
11	2017-11-12	12:10:00 AM	12:11:00 AM	00:01:00	66.9	44.5	43.8
12	2017-11-12	12:11:00 AM	12:12:00 AM	00:01:00	67.4	44.5	43.8
13	2017-11-12	12:12:00 AM	12:13:00 AM	00:01:00	67.8	44.6	43.9
14	2017-11-12	12:13:00 AM	12:14:00 AM	00:01:00	67.9	44.5	43.8
15	2017-11-12	12:14:00 AM	12:15:00 AM	00:01:00	67.8	44.5	43.8
16	2017-11-12	12:15:00 AM	12:16:00 AM	00:01:00	67.2	44.5	43.8
17	2017-11-12	12:16:00 AM	12:17:00 AM	00:01:00	67.4	44.6	43.9
18	2017-11-12	12:17:00 AM	12:18:00 AM	00:01:00	67.2	44.5	43.9
19	2017-11-12	12:18:00 AM	12:19:00 AM	00:01:00	67.2	44.5	43.9
20	2017-11-12	12:19:00 AM	12:20:00 AM	00:01:00	67.2	44.6	43.9
21	2017-11-12	12:20:00 AM	12:21:00 AM	00:01:00	67.7	44.5	43.8
22	2017-11-12	12:21:00 AM	12:22:00 AM	00:01:00	67.8	44.6	43.9
23	2017-11-12	12:22:00 AM	12:23:00 AM	00:01:00	67.6	44.5	43.8

Click on "Save" or "Save As" from the "File" menu to save the records in a \*.pic2 file.

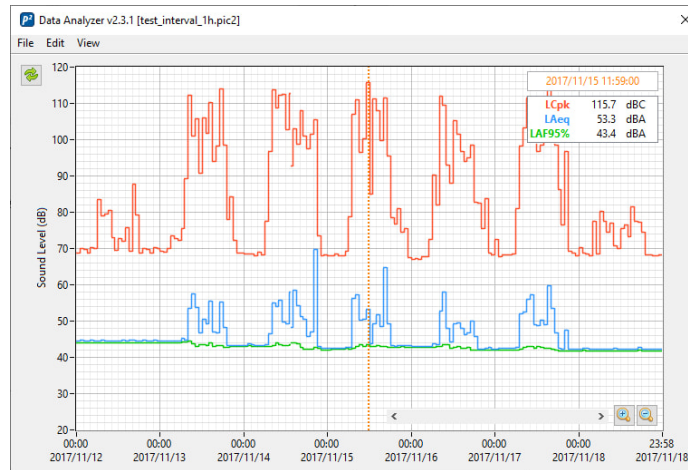
Click on "Export" from the "File" menu to export the data in a tab delimited file.

## 8.4.1 Trim Records

Click on "Trim to Time Range" from the "Edit" menu to keep only visible recordings from the History chart. Be sure to save this new dataset as a new file.

## 8.4.2 Compute Longer Intervals

You can recompute longer intervals by clicking on the "Calculate Longer Intervals" from the "Edit" menu. Note that only contiguous records will be considered; any discontinuity will remain.



Note that intervals are aligned on hours.

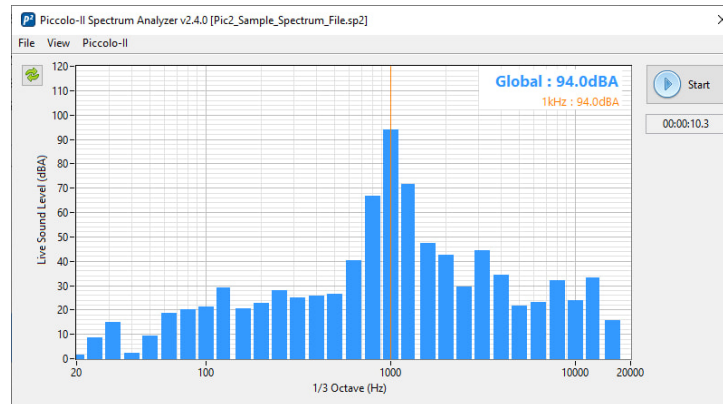
## 8.4.3 Noise Dose Calculation

Click on "Calculate Noise Dose" from the "Edit" menu to calculate a noise dose according to ANSI S1.25 or ISO 1999.

## 8.5 Spectrum Analyzer Software

The Spectrum Analyzer software allows recording 1/1 octave, 1/3 octave and FFT records simultaneously. All spectra definitions are recorded simultaneously.

- 1) Click on the “Start” button to start a measurement;
- 2) Click on the “Stop” button to stop the measurement.



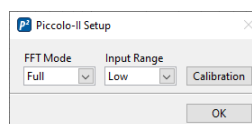
The “File” menu allows:

- Opening a \*.sp2 file;
- Saving a \*.sp2 file;
- Exporting a spectrum as a text file.

The “View” menu allows viewing the current spectrum as:

- “Live” or “Averaged”;
- “1/1 Octave”, “1/3 Octave” or “FFT”;
- “A”, “C” or “Z” frequency weighting.

The “Piccolo-II” menu allows to configure the relevant parameters for spectral measurements.

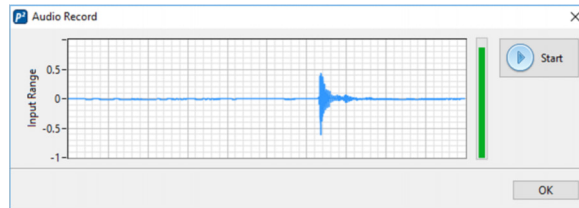


Note: The FFT resolution and bandwidth follows the Piccolo-II FFT mode. Refer to section 5 for more information.

## 8.6 Audio Recorder Software

The Audio Recorder software allows using the Piccolo-II as a sound card to record \*.wav files.

- 1) Click on the "Start" button to start a recording;
- 2) Click on the "Stop" button to stop the recording;
- 3) Upon stopping the recording, the software prompts to save the recorded file.



On the audio recording interface, the graph shows the time signal and the vertical fill-bar shows the dynamic range.

If an external source is used with the auxiliary jack connector, the auxiliary jack will be used as the signal source to be recorded.

## 9 Technical Specifications

Sound Level Meter	
Standards	IEC 61672-1 (2013) Class 2, Group X; ANSI S1.4-1 (2014) Class 2, Group X; ANSI S1.43 (2007) Type 2; IEC 60651 (1979), Amd.1(1993-02), Amd.2(2000-10) Type 2, Group X
Averaging	Exponential and Linear
Time Weightings	Slow or Fast
Frequency Weightings	A, C and Z
Input Ranges	Low or High
Sampling Rate	44.1 kHz
Measured Metrics	Leq, Lmax, Lmin, Lpeak, SEL, LN% (1%, 2%, 5%, 8%, 10%, 25%, 50%, 90%, 95%, 99%)
Peak Maximum Level	Low Range: 110 dBZpk, High Range: 130 dBZpk
Under-Range Level	Low Range: 30 dBA, High Range: 46 dBA
Electrical Noise Level	Low Range: 24 dBA, High Range: 40 dBA
Total Noise Level	Low Range: 30 dBA, High Range: 40 dBA
Resolution	0.1 dB
Microphone Nominal Sensitivity	-35dB $\pm$ 3 dB, ref 1V/Pa (17.78 mV/Pa)
Spectrum Analyzer	
Standards	IEC 61260-1 (2014) Class 2, Group X (1/1 Octave), Group Z (1/3 Octave); ANSI S1.11-1 (2014) Class 2, Group X (1/1 Octave);
Averaging	Linear (Leq)
1/1 Octave Spectrum	31.5 Hz to 8 kHz
1/3 Octave Spectrum (PC software only)	20 Hz to 16 kHz
FFT Spectrum	400 lines, 6 bandwidths
FFT Bandwidth	Full: 17.2kHz (43.1Hz) 8000: 8.62kHz (21.5Hz) 4000: 4.31kHz (10.8Hz) 2000: 2.15kHz (5.39Hz) 1000: 1.08kHz (2.69Hz) 500: 539Hz (1.35Hz)
Timing	
Display Refresh Rate	0.1s
Record Duration Resolution	1s
Record Duration Pre-sets	1s, 10s, 1m, 5m, 15m, 60m (can be redefined from 1s to 1h)
Real-Time Clock Resolution	1s
Recording	
Recording Modes	Single-Store or Auto-Store
Align on Real-Time Clock	Single-Store: No, Auto-Store: Yes
Recording Data	All Global Metrics (A, C and Z), LN% (A, C or Z), 1/1 Octave, FFT (optional)
Memory Capacity	Without FFT: 198 948 records, With FFT: 18 798 records



Auxiliary Input	
Connector	Phone Jack 1/8" (Female, Mono)
Voltage Range	Low Range: $\pm 0.16\text{Vpk}$ , High Range: $\pm 1.6\text{Vpk}$
Routing	Automatic upon jack plug connection
Sensitivity	Independent value for microphone and auxiliary input
Environmental	
Operating Temperature	0°C to 40°C
Storage Temperature	-10°C to 50°C
Power	
Power	70 mW (Running), 0.3 mW (Sleeping)
Battery Life	48 h (Running), > 6 months (Sleeping)
Battery Charge	5V (USB-powered)
Physical	
Dimensions	144mm x 59mm x 18.5mm (5 5/8" x 2 5/16" x 3/4")
Weight	115g (4 Oz.)
Accessories	
Windscreen	35mm x 25mm (12mm hole)
USB Cable	0.9m (3') A to Micro-B
Carrying Case	213 mm x 183 mm x 62 mm (8.4" x 7.2" x 2.45")
Calibration Certificate	Tested in accordance with procedures from IEC 61672-3 (2013)

## 10 Measuring to IEC 61672-3

### 10.1 Reference Sound Pressure Level

The reference sound pressure and frequency are 94.0 dB at 1 kHz.

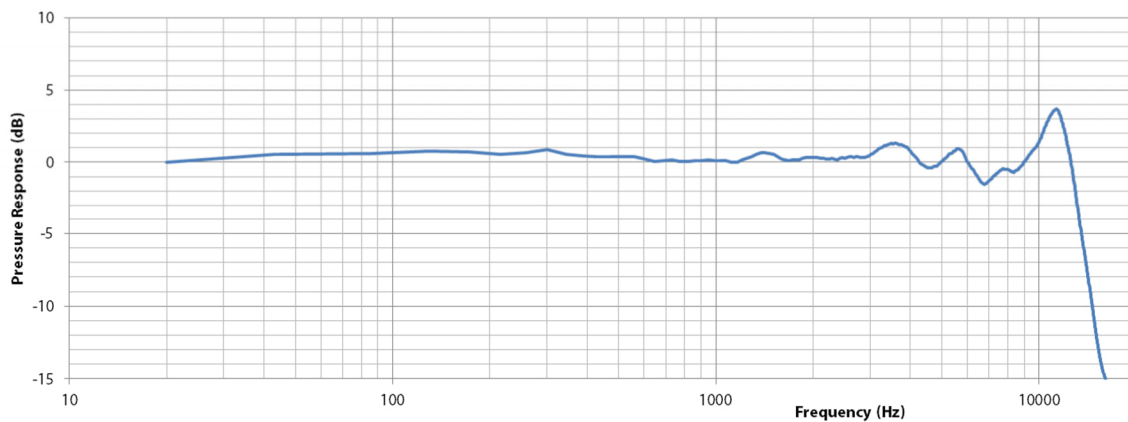
### 10.2 Reference Level Range

The reference level range is “Low”.

### 10.3 Corrections for Acoustic Tests

#### 10.3.1 Free-Field and Pressure Response

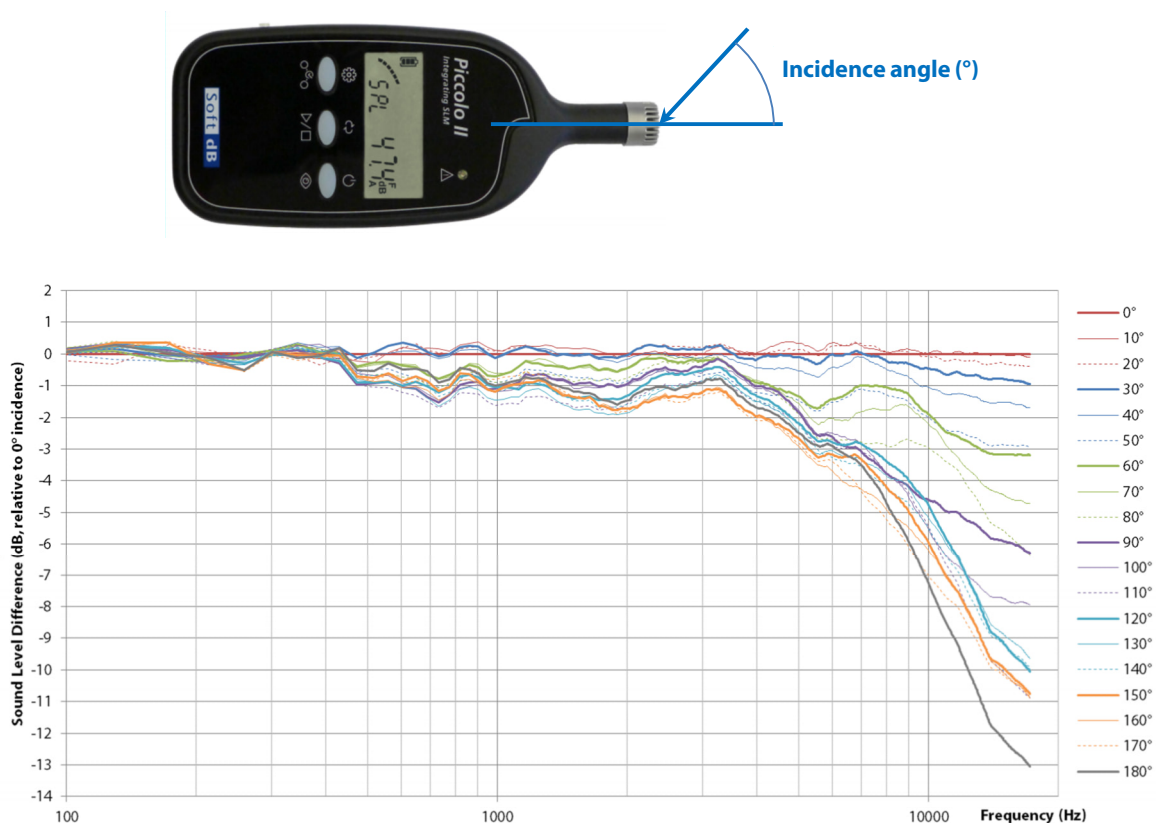
The Piccolo-II is designed to have a flat response ( $\pm 0$  dB) in a  $0^\circ$  free-field sound field. When in a pressure field such as in the calibration chamber of a calibrator, the following pressure response must be taken into account. The pressure response and correction data are given for calibrator model 4226 from B&K.



Freq. (Hz)	0° Free-Field Response (dB)	0° Free-Field Corrections (dB)	Pressure Response in Calibrator Chamber (dB)	0° Free-Field Corrections in Calibrator Chamber (dB)	Uncertainty (dB)
31.5	0.0	0.0	0.3	-0.3	0.3
63	0.0	0.0	0.6	-0.6	0.3
125	0.0	0.0	0.7	-0.7	0.3
250	0.0	0.0	0.6	-0.6	0.3
500	0.0	0.0	0.4	-0.4	0.3
1000	0.0	0.0	0.0	0.0	0.3
2000	0.0	0.0	0.3	-0.3	0.3
4000	0.0	0.0	0.8	-0.8	0.5
8000	0.0	0.0	-0.5	0.5	0.5
16000	0.0	0.0	-14.9	14.9	1.0

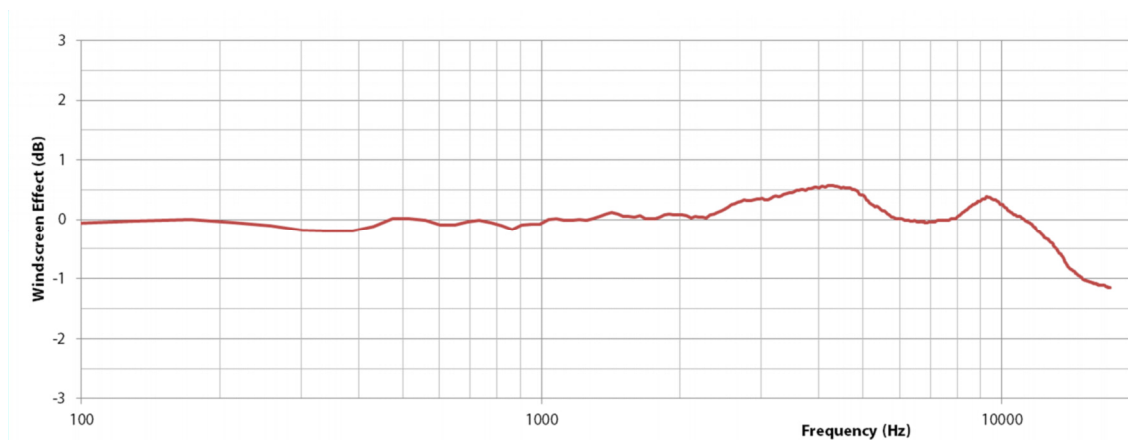
## 10.3.2 Directivity Response

The figure below shows the directional response of the Piccolo-II with respect to the sound incidence angle.



## 10.3.3 Effect of Windscreen

The figure below shows the effect of the supplied windscreen (35mm x 25mm, 12mm hole).



## 10.4 Upper and Lower Boundaries of Linear Operating Ranges

### 10.4.1 Upper Boundary of Linear Operating Range for the “Low” range setting

Frequency Weighting	Frequency (Hz)	Upper Boundary (dB[A,C,Z], rms)	Upper Boundary (dB[A,C,Z], peak)
A	31.5	67.6	70.6
A	500	103.8	106.8
A	1000	107.0	110.0
A	4000	108.0	111.0
A	8000	105.9	108.9
C	31.5	104.0	107.0
C	500	107.0	110.0
C	1000	107.0	110.0
C	4000	106.2	109.2
C	8000	104.0	107.0
Z	31.5	107.0	110.0
Z	500	107.0	110.0
Z	1000	107.0	110.0
Z	4000	107.0	110.0
Z	8000	107.0	110.0

#### 10.4.2 Upper Boundary of Linear Operating Range for the “High” range setting

Frequency Weighting	Frequency (Hz)	Upper Boundary (dB[A,C,Z], rms)	Upper Boundary (dB[A,C,Z], peak)
A	31.5	87.6	90.6
A	500	123.8	126.8
A	1000	127.0	130.0
A	4000	128.0	131.0
A	8000	125.9	128.9
C	31.5	124.0	127.0
C	500	127.0	130.0
C	1000	127.0	130.0
C	4000	126.2	129.2
C	8000	124.0	127.0
Z	31.5	127.0	130.0
Z	500	127.0	130.0
Z	1000	127.0	130.0
Z	4000	127.0	130.0
Z	8000	127.0	130.0

#### 10.4.3 Lower Boundary of Linear Operating Range for the “Low” range setting

Frequency Weighting	Frequency (Hz)	Linearity Lower Limit (dBA, rms)
A	31.5	30.0
A	1000	30.0
A	8000	30.0

#### 10.4.4 Lower Boundary of Linear Operating Range for the “High” range setting

Frequency Weighting	Frequency (Hz)	Linearity Lower Limit (dBA, rms)
A	31.5	46.0
A	1000	46.0
A	8000	46.0

#### 10.4.5 Starting Point for Testing Boundaries of Linear Operating Ranges

The starting point at which to begin tests of level linearity deviation is 94 dB (1Pa, rms) at 1kHz. This starting point is used for both “Low” and “High” dynamic range settings.

Frequency Weighting	Frequency (Hz)	Freq. Weight (dB)	Reference Starting Point (dBA)
A	31.5	-39.4	54.6
A	1000	0.0	94.0
A	8000	-1.1	92.9

## 10.5 Performing Electrical Tests

### 10.5.1 Inserting Electrical Signals

Inserting electrical signals into the Piccolo-II is performed by the means of the auxiliary input. The auxiliary input requires a 1/8" phone plug and must be a mono type (no stereo). The signal should be applied on the tip and the ground should be on the sleeve.

Note that when using an electrical input it is recommended to use the Piccolo-II in stand-alone configuration (without USB connection to a PC) to avoid ground loop noise. If the instrument is tested using a USB connectivity to a PC, make sure to use appropriate ground isolation.

### 10.5.2 Specifications Adjustment

The technical specifications are set for a nominal microphone sensitivity of -35dB (ref 1V/Pa). The variation in sensitivity from one instrument to another is  $\pm 3.0$  dB. If the sensitivity of the instrument under test differs from the nominal sensitivity, an adjustment should be applied to the specifications of the instrument corresponding to the sensitivity offset.

$$\text{Adjustment (dB)} = -35(\text{dB}) - \text{Microphone Sensitivity (dB)}$$

### 10.5.3 Calibration

Calibrate the microphone using an IEC 60942 Class 1 sound pressure calibrator at the reference sound pressure and frequency of 94.0 dB at 1 kHz.

The microphone calibration procedure can be performed on the instrument (see section 6) or using the equivalent software interface (see section 8.3.2).

The nominal microphone sensitivity is -35 dB (ref 1V/Pa) and the tolerance from one instrument to another is  $\pm 3.0$  dB.

### 10.5.4 Adjusting Sensitivity for the Auxiliary Input

There are two sensitivity settings for the Piccolo-II, one for the microphone and the other for the auxiliary input. The auxiliary input is used mainly for inserting electric signals during calibration and certification tests. For convenience, a separate sensitivity is provided for the auxiliary input for specific applications such as using an external microphone (not covered by this user guide). Since the instrument knows if a jack is inserted, it can select the appropriate sensitivity. When measuring to IEC-61672-3, one must set the same sensitivity for the microphone and auxiliary input using the following procedure:

- 1) Calibrate the microphone (see section 10.5.3);
- 2) Using the software, click on the "Calibrate" button to open the calibration interface;
- 3) On the calibration interface, make sure the window title is "Microphone Calibration";
- 4) Identify the sensitivity field in mV/Pa and write it down;
- 5) Insert the 1/8" phone plug in the auxiliary input to force the input change;

- 6) On the calibration interface, make sure the window title is "Auxiliary Input Calibration";
- 7) Identify the sensitivity field in mV/Pa and write the same sensitivity as for the microphone.
- 8) Click OK.

## 10.6 Self-Generated Noise

Self-generated noise is measured using Leq,30s.

### 10.6.1 Total Self-Generated Noise (Acoustical and Electrical)

Frequency Weighting	Low Range	High Range
A	30	40
C	39	42
Z	42	47

### 10.6.2 Electrical Self-Generated Noise

Frequency Weighting	Low Range	High Range
A	24	40
C	24	41
Z	28	45

## 11 Glossary

### Time-Weighted Sound Pressure Level (SPL)

Expressed in dB, the SPL represents the sound level of the running time-weighted average of a sound pressure signal observed at a specific time.

$$LW(t) = 10lg \left[ \frac{1}{\tau_w} \cdot \frac{\int_{-\infty}^t p^2(t) e^{-t/\tau_w} dt}{p_0^2} \right]$$

- W is the time-weight indication, F for Fast and S for Slow
- $\tau_w$  is the time constant for the time-weight 0.125s for Fast and 1s for Slow
- $p(t)$  is the sound pressure signal;
- $p_0$  is the reference sound pressure ( $2 \times 10^{-5}$  Pa.)

### Equivalent Continuous Sound Level (Leq)

Expressed in dB, the  $Leq,T$  represents the equivalent continuous sound level of a sound pressure signal observed for a specific time interval.

$$Leq,T = 10lg \left[ \frac{1}{T} \cdot \frac{\int_{t-T}^t p^2(t) dt}{p_0^2} \right]$$

- T is the averaging time interval;
- $p(t)$  is the sound pressure signal;
- $p_0$  is the reference sound pressure ( $2 \times 10^{-5}$  Pa.)

### Peak Sound Level (Lpk)

Expressed in dB, the Lpk represents the sound level of the maximum of a squared sound pressure signal observed for a specific time interval.

$$Lpk = 10lg \left[ \frac{\max(p^2(t), T)}{p_0^2} \right]$$

- T is the observation time interval;
- $p(t)$  is the sound pressure signal;
- $p_0$  is the reference sound pressure ( $2 \times 10^{-5}$  Pa.)

### Maximum and Minimum Sound Pressure Level (Lmax, Lmin)

Expressed in dB, the Lmax and Lmin represent the maximum and minimum time-weighted sound pressure level observed for a specific time interval.



## Percentiles (LN%)

Expressed in dB, the Percentiles represent the time-weighted sound pressure level which is exceeded N% of a specific time interval. Typical percentiles are L1%, L5%, L10%, L50%, L90%, L95% and L99%.

## Sound Exposure Level (SEL or LE)

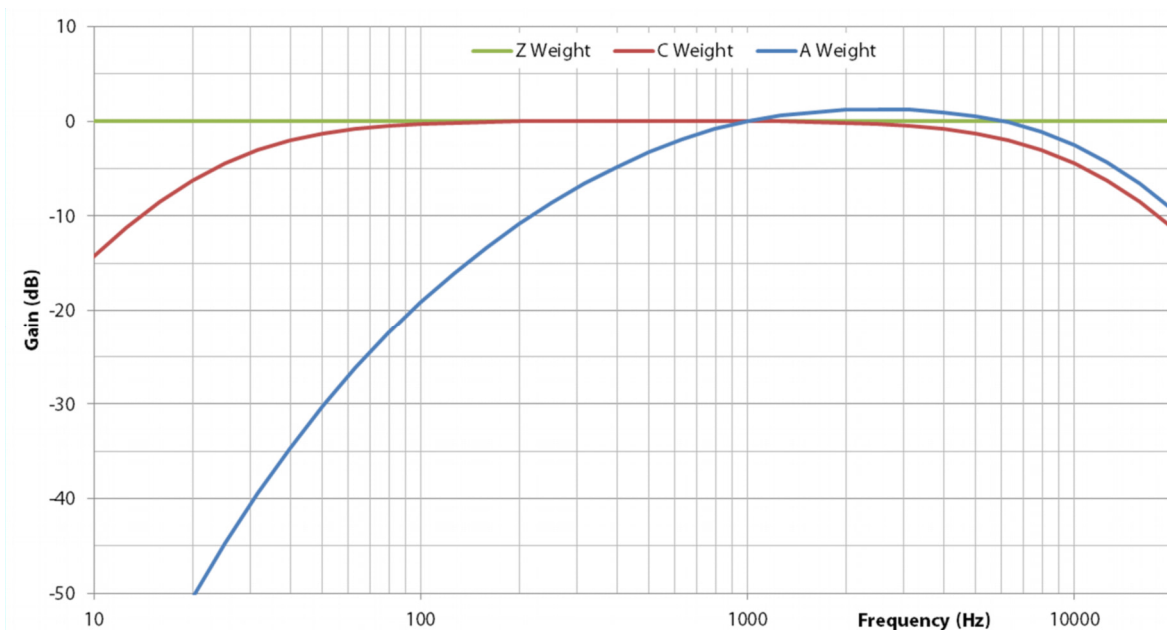
Expressed in dB, the SEL (or LE) represents the total energy level of a sound pressure signal observed for a specific time interval.

$$LE, T = 10 \lg \left[ \frac{\int_{t-T}^t p^2(t) dt}{p_0^2} \right]$$

- T is the averaging time interval;
- p(t) is the sound pressure signal;
- p<sub>0</sub> is the reference sound pressure (2x10<sup>-5</sup> Pa.)

## Frequency Weighting (A, C, Z)

The A, C and Z frequency weightings refer to signal filters applied to the sound pressure signal. The figure below shows the frequency response of each filter.



Note that all sound level metrics (SPL, Leq, SEL, Lpk, Lmax, Lmin, and LN%) can be expressed with a specific frequency weighting. For example, the LAeq represents the A-weighted Equivalent Continuous Sound Level.

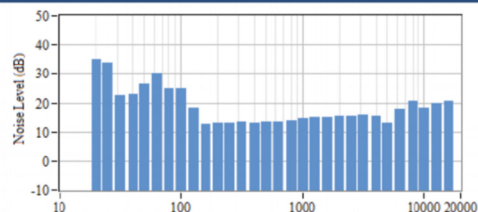
## 12 Specimen Calibration Certificate

		1040, Avenue Belvedere, Suite 215 Quebec, Qc, Canada, G1S 3G3 1 (418) 686-0993 Email: <a href="mailto:info@softdb.com">info@softdb.com</a> <a href="http://www.softdb.com">www.softdb.com</a>	
<b>Calibration Certificate No. P02QC2017111301</b> 17/11/13			
<b>Instrument</b> Type: Integrating Averaging Sound Level Meter Model: Piccolo-II SN: P0216123199 Class: 2 Mic Sensitivity: 17.81mV/Pa (0.0 dB from nominal)			
<b>Standards</b> Tested in accordance with procedures from ANSI/ASA S1.4-3 (2014) / IEC 61672-3 (2013) Electroacoustics - Sound Level Meters - Part 3: Periodic tests			
<b>Calibration Instruments</b>			
Description	Manufacturer	Model	Serial Number
Function Generator	Stanford Research Systems	DS360	33623
Multi-function Calibrator	Brüel & Kjær	4226	1551588
<b>Environmental Conditions</b>			
Temperature	Barometric Pressure	Humidity	
23.0 C	101.3kPa	50%	
<b>Personnel</b>			
Calibrated by: _____		Date : 17/11/13	
Technician Name			
<b>Summary</b>			
Description	PASS / FAIL		
Section 11.1 – Self-generated noise (Microphone)	Pass		
Section 11.2 – Self-generated noise (Electrical input)	Pass		
Section 12 – Acoustical signal tests of frequency weightings	Pass		
Section 13 – Electrical signal tests of frequency weightings	Pass		
Section 14 – Frequency and time weightings at 1 kHz	Pass		
Section 15 – Long-term stability	Pass		
Section 16 – Level linearity on the reference level range	Pass		
Section 17 – Level linearity including range control	Pass		
Section 18 – Toneburst response	Pass		
Section 19 – C-weighted peak sound level	Pass		
Section 20 – Overload indication	Pass		
Section 21 – High-level stability	Pass		
<b>Declaration of Conformity</b> The sound level meter submitted for testing has successfully completed the Class 2 tests of ANSI/ASA S1.4-3 (2014) / IEC 61672-3 (2013) (limited to sections 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21), for the environment conditions under which the tests were performed.			
Certificate No. : P02QC2017111301		17/11/13	
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## IEC 61672-3 – Section 11.1 – Self-generated noise (Microphone)

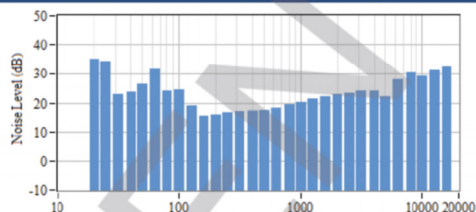
### Low Range

Value	Measure	Limit	PASS / FAIL
dBZ	42.0	---	---
dB(C)	36.7	---	---
dB(A)	27.9	30.0	Pass



### High Range

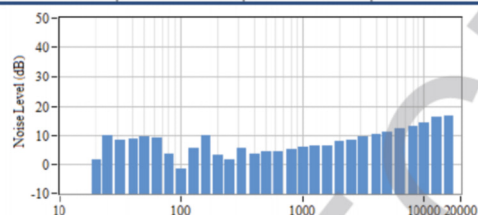
Value	Measure	Limit	PASS / FAIL
dBZ	43.9	---	---
dB(C)	39.1	---	---
dB(A)	36.8	40.0	Pass



## IEC 61672-3 – Section 11.2 – Self-generated noise (Electric)

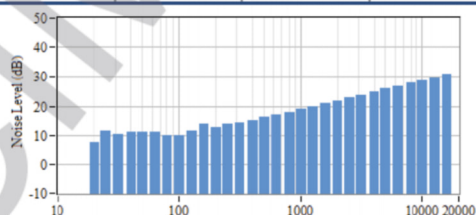
### Low Range

Value	Measure	Limit	PASS / FAIL
dBZ	25.1	---	---
dB(C)	21.9	---	---
dB(A)	21.8	24.0	Pass

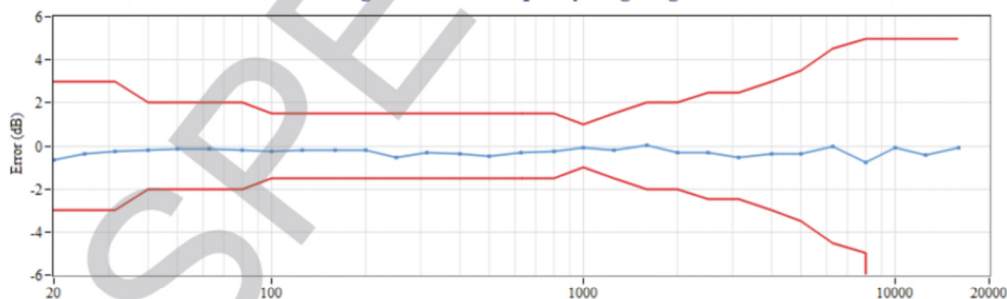


### High Range

Value	Measure	Limit	PASS / FAIL
dBZ	40.6	---	---
dB(C)	34.7	---	---
dB(A)	36.0	40.0	Pass



## IEC 61672-3 – Section 12 – Acoustical signal tests of a frequency weighting



Conformity to IEC 61672-3 – Section 12, Class 2: Pass

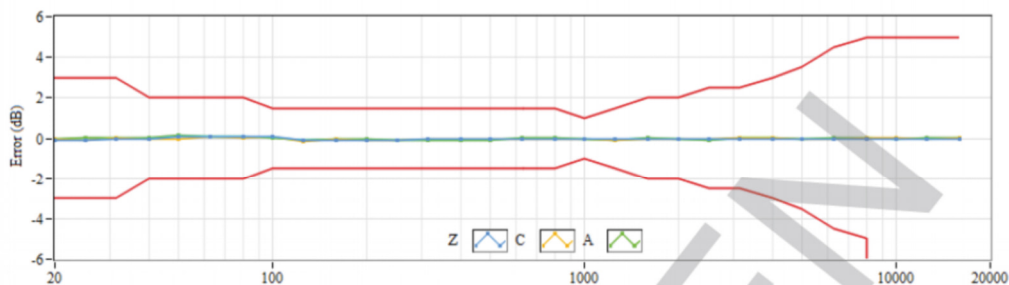
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## IEC 61672-3 – Section 13 – Electrical signal tests of frequency weightings



Conformity to IEC 61672-3 – Section 12, Class 2: Pass

## IEC 61672-3 – Section 14 – Frequency and time weightings at 1 kHz

Data	Measure	Error	Tolerance	PASS / FAIL
LAF	94.0	---	---	---
LCF	94.0	0.0	$\pm 0.1$	Pass
LZF	94.0	0.0	$\pm 0.1$	Pass
LAS	94.0	0.0	$\pm 0.2$	Pass
LCS	94.0	0.0	$\pm 0.1$	Pass
LZS	94.0	0.0	$\pm 0.1$	Pass
LAeq	94.0	0.0	$\pm 0.2$	Pass
LCeq	93.9	0.1	$\pm 0.1$	Pass
LZeq	93.9	0.1	$\pm 0.1$	Pass

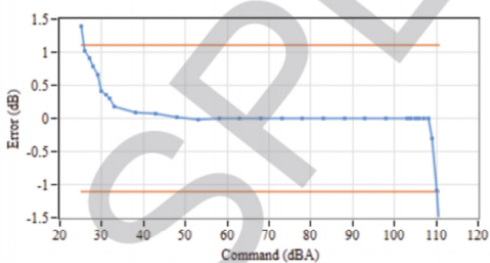
## IEC 61672-3 – Section 15 – Long-term Stability

Initial	Final	Error	Tolerance	PASS / FAIL
94.0	94.0	0.0	0.3	Pass

## IEC 61672-3 – Section 16 – Level Linearity (at 4 kHz)

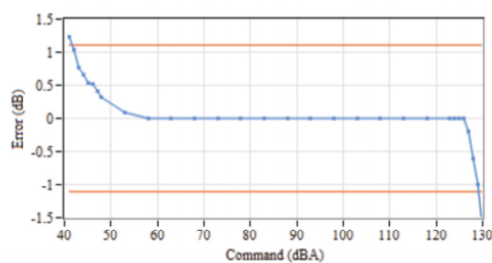
Low Range

Boundary	Measure (dBA)	Limit (dBA)	PASS / FAIL
Upper	110.0	105.8	Pass
Lower	26.0	30.0	Pass



High Range

Boundary	Measure (dBA)	Limit (dBA)	PASS / FAIL
Upper	129.0	125.8	Pass
Lower	42.0	46.0	Pass



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## IEC 61672-3 – Section 17 – Level Linearity including Range Control

Range	Level	Applied	Measure	Error	Tolerance	PASS / FAIL
Low	Ref.	94.0	94.0	---	---	---
Low	UR+5dB	37.0	37.1	0.1	1.1	Pass
High	Ref.	94.0	94.0	0.0	1.1	Pass
High	UR+5dB	53.0	53.1	0.1	1.1	Pass

## IEC 61672-3 – Section 18 – ToneBurst Response

Tb(ms)	Data	Applied	Measure	Meas. Diff.	Target Diff.	Error	Tolerance	PASS / FAIL
200	LASmax	104.9	97.5	-7.4	-7.4	0.0	±1.0	Pass
2	LASmax	104.9	77.9	-27.0	-27.0	0.0	1.0; -5.0	Pass
200	LAFmax	104.9	103.9	-1.0	-1.0	0.0	±1.0	Pass
2	LAFmax	104.9	86.2	-18.7	-18.0	-0.7	1.0; -2.5	Pass
0.25	LAFmax	104.9	77.7	-27.2	-27.0	-0.2	1.5; -5.0	Pass
200	LAE	104.9	98.0	-6.9	-7.0	0.1	±1.0	Pass
2	LAE	104.9	78.0	-26.9	-27.0	0.1	1.0; -2.5	Pass
0.25	LAE	104.9	68.9	-36.0	-36.0	0.0	1.5; -5.0	Pass

## IEC 61672-3 – Section 19 – C-Weighted Peak Sound Level

Freq.	Cycle	Applied	Meas.	Meas. Diff.	Target Diff.	Error	Tolerance	PASS / FAIL
31.5Hz	1 (Full)	119.9	123.1	3.2	2.5	0.7	±3.0	Pass
500Hz	1 (Full)	123.0	126.6	3.6	3.5	0.1	±2.0	Pass
8kHz	1 (Full)	119.9	123.1	3.2	3.4	-0.2	±3.0	Pass
500Hz	½ (Pos.)	123.0	124.8	1.8	2.4	-0.6	±2.0	Pass
500Hz	½ (Neg.)	123.0	124.8	1.8	2.4	-0.6	±2.0	Pass

## IEC 61672-3 – Section 20 – Overload Indication

### Low Range

Data	Freq.	Overload (+)	Overload (-)	Error	Tolerance	PASS / FAIL
LZE	4kHz	68.1	68.3	0.2	±1.5	Pass
LCE	4kHz	67.5	67.7	0.2	±1.5	Pass
LAE	4kHz	68.4	68.5	0.1	±1.5	Pass
LZpk	4kHz	110.0	110.0	0.0	±1.5	Pass
LCpk	4kHz	109.1	109.1	0.0	±1.5	Pass

### High Range

Data	Freq.	Overload (+)	Overload (-)	Error	Tolerance	PASS / FAIL
LZE	4kHz	88.4	88.2	0.2	±1.5	Pass
LCE	4kHz	87.8	87.6	0.2	±1.5	Pass
LAE	4kHz	88.6	88.4	0.2	±1.5	Pass
LZpk	4kHz	130.0	130.0	0.0	±1.5	Pass
LCpk	4kHz	129.2	129.2	0.0	±1.5	Pass

## IEC 61672-3 – Section 21 – High-level Stability

Initial	Final	Error	Tolerance	PASS / FAIL
126.0	126.0	0.0	0.3	Pass

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## 13 FAQ

### Can I power the Piccolo-II from an external battery?

Yes, the Piccolo-II can be powered from an external battery but it's important to mention that not every USB battery will work.

The "smart" USB batteries widely available on the Internet are meant to charge a cellphone battery and disconnect itself once the battery is fully charged. Since the Piccolo-II is already full when it's connected to such a battery, the battery disconnect itself and does not provide any power.

Thus, the recommended battery is a simple battery pack with battery voltage directly on the USB power pins such as this one:



Using 4x AA batteries (4x 3200 mAh) should provide 3-4 days of extended battery life before the internal battery starts being used.

Important: The maximum voltage on the USB connector is 7V.

Note: No technical support will be provided on the use of an external battery. The warranty does not cover any damages caused by the use of an external battery.

### Is the Piccolo-II weatherproof?

No, the Piccolo-II is not weatherproof. Exposing the Piccolo-II to water can damage the microphone and its internal electronics. Water damages are not covered by the warranty.

## **14 Warranty**

Soft dB warrants this instrument to be free of defects in parts and workmanship for one year from date of shipment (a six-month limited warranty applies on sensors and cables). Please contact us at [info@softdb.com](mailto:info@softdb.com) should it become necessary to return the instrument for service during or beyond the warranty period. A return authorization (RMA) must be issued before any product is returned to Soft dB. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from actions of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modifications. Soft dB specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. Soft dB's total liability is limited to repair or replacement of the product. The warranty set forth is inclusive and no other warranty, whether written or oral, is expressed or implied.