NTi AUDIO


08:56:45
TA
Sound Level Meter
96%
123
70 dB
60
50
40
30
20
20Hz
100
630
3.15k
20k
A Z
LZF
--
--.- dB
A
125 Hz
LZF
live
58.5 dB
1/3 Oct
LOGGING
00:40:56
NTi AUDIO
XL3
ESC
OK
START
STOP

# XL3 Instruction Manual

Version: V 1.54 Rev. 2026-05-07

Firmware: V 1.54

Table of Contents

# 1 Overview / Interfaces

Thank you for purchasing the XL3 Acoustic Analyzer. The XL3 is a very powerful class 1 acoustics analyzer with network access. It bases on the latest developments of processors, converters and display technologies ensuring easy and comfortable operation of the system.

The broad set of functionality is optimized for the following applications:

- Sound level measurements & unattended noise monitoring:
  - Environmental noise analysis;
  - Workplace noise measurements;
  - Car and traffic noise.
- Room & Building acoustics:
  - Reverberation time;
  - Airborne noise isolation;
  - Structure-borne noise isolation;
  - Facade isolation.

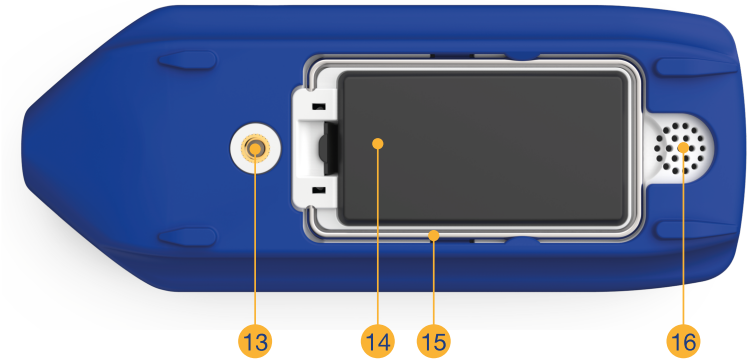
## 1.1 Interfaces

These here are the interfaces and controls of the XL3.

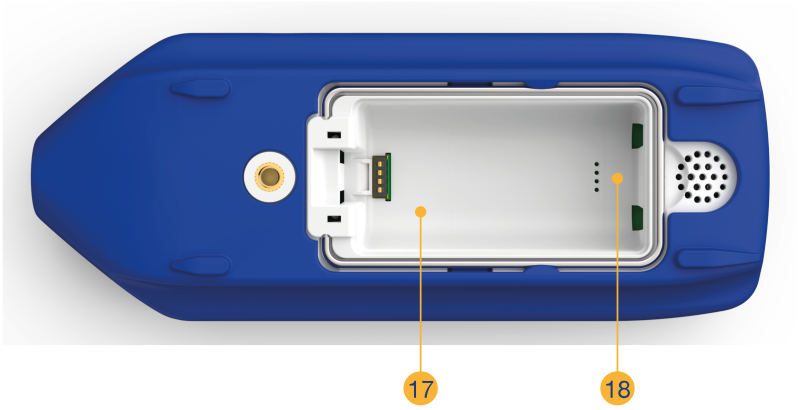

| | |
|---|---|
| 1 | Balanced XLR microphone or audio input. The XLR input has an automatic sensor detection ASD, i.e. as soon as an NTi Audio microphone is connected, the XL3 automatically switches on the 48 V Phantom power and reads the calibration data of the measurement microphone. |
| 2 | Programmable digital input/output interface for controlling external devices (e.g Input Keypad XL3 or a weather station) or detecting external input signals (e.g. via the complainant key, etc.). |
| 3 | Connection for the supplied XL3 power supply. For specifications, see chapter Power supply. |

| | |
|---|---|
| 4 | Indicates the battery charge status by means of an LED:<br>● No charger / power supply unit is connected;<br>● The charger is connected and the battery is fully charged;<br>● The power supply unit supplies the device with power and charges the battery;<br>● (flashing) power supply not sufficient. |
| 5 | USB-C socket for connecting external devices such as 600 000 535 USB-C to LAN Adapter, as well as for charging the device. |
| 6 | Device for attaching the wrist strap and mounting an anti-theft device (Kensington Lock). |


| | |
|---|---|
| 7 | Internal voice microphone for recording comments. |
| 8 | Micro SD-card for saving measurement results, or display graphics, WAV files. |
| 9 | USB-A socket for connection of external devices. |
| 10 | Keypad for operating the XL3. |
| 11 | High-resolution,color touchscreen for the device control and for displaying measurement results, etc. |
| 12 | Headphone output to listen to the input signal. |




| | |
|---|---|
| 13 | ¼" thread for mechanical mounting of the XL3 (e.g. on a photo-tripod). |
| 14 | Replaceable Li-Ion battery. |
| 15 | Fold-out stand for convenient operation on a table. |
| 16 | Built-in speaker to listen to the input signal or recorded comments. The internal speaker is automatically disabled when headphones are connected. |




| | |
|---|---|
| 17 | The nameplate can be found underneath the battery and contains all information about the hardware version, serial number and device configuration. |
| 18 | This push-button contact is used to reboot the device from the inserted SD-card.<br>ⓘ Do NOT press this button unless instructed by the NTi Audio support. |


| | |
|---|---|
| 19 | The built-in light sensor will allow the XL3 to automatically adjust the brightness of the display and LEDs to the ambient conditions if desired (planned). |
| 20 | ● (dark) no network connection;<br>● (yellow) Network detected, but no connection to internet;<br>○ (white) Connection to the internet established;<br>● (blue) connected to connect.nti-audio.com. |
| 21 | This LED indicates, whether the instrument is in TA-mode (Type Approval): Whenever this LED is lit, only the certified modules of the sound level meter are active, i.e. the measurement results can be used in court. |

## 1.2 Onboarding

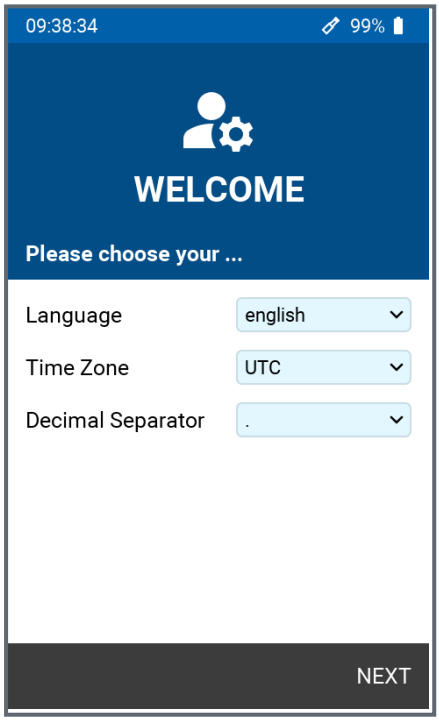
The XL3 will automatically guide you through the onboarding procedure:

a. When you switch the instrument ON the for the first time;

b. After a factory reset (switch the XL3 OFF, then press ESC + ⏻ simultaneously).


### Step 1

This is the welcome screen of the onboarding procedure – please wait.



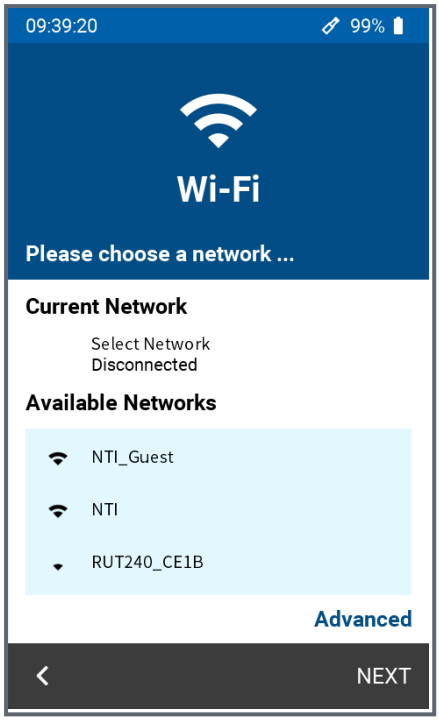

### Step 2

Tap on the corresponding dropdown menu to select the preferred

- Language (e.g. Deutsch / English / Français / ...)
- Time Zone (UTC = Coordinated Universal Time)
- Decimal Separator ("." or ",").

> You may also edit any of these settings at a later time (see General).

Tap on "**NEXT**" to proceed.




### Step 3

Select the preferred Wi-Fi network from the list and enter the applicable password.

Tap on "**Advanced**" if you want to add a network that is actually not shown in the list, or to delete all passwords that have been saved so far on the XL3.


Alternatively, you may also connect the XL3 to a wired LAN network by plugging an Ethernet cable via adapter to the USB-C connector.

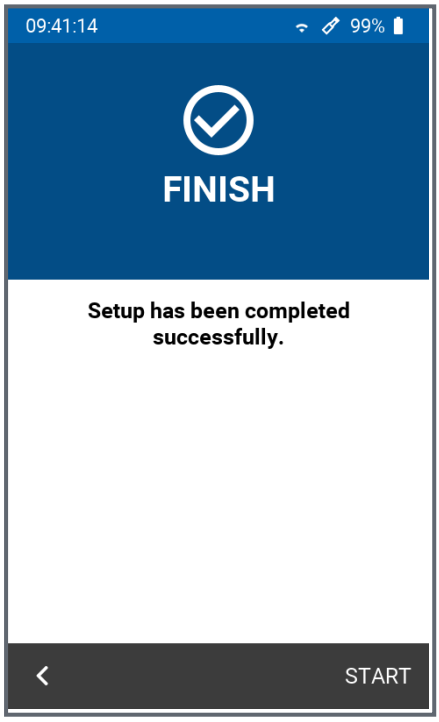
Tap on "**<**" to return to the previous step or on "**NEXT**" to proceed.


### Step 4

Optionally enter a password and an individual Device Name for your XL3.

> The web server functionality becomes available only when you enter a password (see Data transfer).

Tap on "**<**" to return to the previous step or on "**NEXT**" to proceed.




### Step 5

The onboarding procedure is now finished.

Tap on "**<**" to return to the previous step or on "**START**" to proceed to the Sound Level Meter mode.

# 2 Operation

The XL3 offers the latest technologies with a large color touchscreen and an additional keypad for safe and intuitive operation. In addition, you can also control the entire XL3 remotely via a web browser.

## 2.1 Operation via the keypad

With the keypad you control the basic functions of the instrument, such as starting or stopping a measurement, switching between different displays or pages, or moving the cursor within a chart view (e.g sound level spectrum).

Keypad of the XL3


The device keys

| | |
|---|---|
|  | Switches between the result views. Press and hold the button to lock the touchscreen.<br>Press the On/Off key for approx. 2 seconds to switch ON the XL3.<br>During operation, press the On/Off key briefly to switch the display ON or OFF (but not the meter).<br>When the display is switched OFF, the key shows the state of the instrument: |
|  | • Pulsing slowly – XL3 is ON;<br>• Flashing – Measurement is running;<br>• Panic blinking – User interaction required. |
| | To switch OFF or to restart the XL3, press the On/Off key for approx. 3 seconds. |

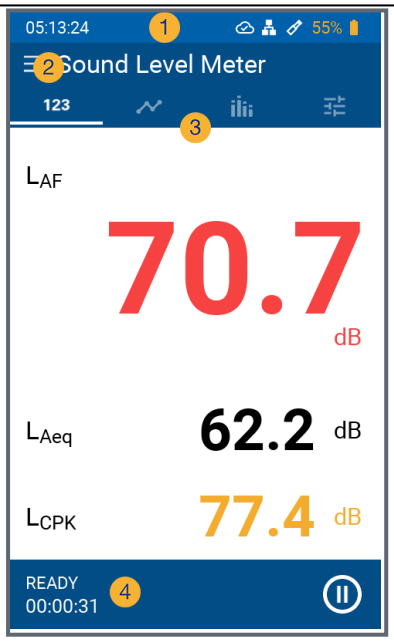
| | |
|---|---|
| ← | Moves the cursor horizontally (left / right) within a chart view (e.g spectral display). |
| → | |
| ESC | The ESC key terminates any selection and closes the open window. The cursor returns to the main menu. |
| OK | By pressing the OK button you confirm the current cursor selection, as for instance the measurement function or the parameters. |
| START | Starts a measurement. |
| STOP | Stops the current measurement. |

## 2.2 Operation via the display

You can operate the XL3 easily and silently via the touchscreen. In addition to simple inputs, the touchscreen also supports swipe gestures to change the displayed page.

A long press on the key locks (or unlocks) the touchscreen to prevent accidental operation.

The display of the XL3 is divided into the following function segments:




| | |
|---|---|
| 1 | The status bar displays general information such as the time of day, network status, microphone connection and battery status. Swipe down to expand this area. |
| 2 | Tap on the Main Menu to select the required measurement function (available measurement functions depend on the installed options). |
| 3 | Display area of the measurement results. The preferred display can be selected by swiping left/right on the touchscreen, or via the key. |
| 4 | Current status (e.g. "**READY**", "**LOGGING**" or "**PAUSE**"), together with elapsed time of the ongoing measurement. |

### 2.2.1 The status bar


Always shows the current time of the device on the left. The time is automatically synchronized with the internet via the NTP protocol when there is a network connection.

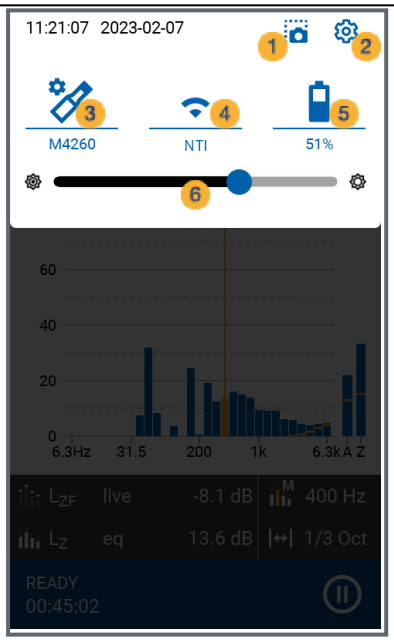
| | |
|---|---|
|  | The microphone symbol indicates that an ASD-compatible NTi Audio microphone is connected, and the calibration data has been read. |
|  |  Valid Wi-Fi connection; the number of segments represents the signal strength.<br>  Network connection created via 600 000 535 USB-C to LAN Adapter. |
|  |  The File Push service is active and the XL3 is uploading the files from its internal memory to the cloud drive.<br>  The XL3 has pushed (i.e uploaded) all the files from its internal memory to the cloud drive.<br>  An error has occurred during the uploading process, or the service is incorrectly configured; check the log file for more information. |

| | Icon | Appearance | Meaning |
|---|---|---|---|
| |  | Red exclamation mark, blinking | Battery temperature invalid<br>Battery Management defective Battery USB charging defective Battery Charging Circuit defective Battery Pack Error (1)<br>Battery Pack Error (2)<br>Battery pack not supported.<br>Update XL3 firmware! |
| |  | White question mark, static | No Battery inserted |
| |  | Red charge level, blinking | Temperature too high for battery discharging<br>Temperature too low for battery discharging<br>Temperature too high for battery charging<br>Temperature too low for battery charging |
| |  | White charge level, slow charge animation (1s) | Charging |
| |  | White charge level, slow charge animation (1s) | Pre charging |
| |  | White charge level, fast charge animation (0.5s) | Fast Charging |
| |  | Yellow charge level, slow charge animation (1s) | Insufficient charging power |
| |  | Yellow charge level, static | Low battery charge |
| |  | Yellow charge level, blinking | Critical battery charge |
| |  | White charge level, static | Regular battery operation |
| |  | A Weather station is connected to the XL3. | |
| |  | The connection to the weather station has been interrupted. | |
| |  | A GPS Mouse is connected and working. | |
| |  | The signal is too weak to get the GPS location. | |

| | |
|---|---|
|  |  The XL3 is connected to the NTi Connect service at connect.nti-audio.com.<br>  The XL3 is connected to multiple instances of connect.nti-audio.com. |
|  | During a measurement, the icon appears blinking, indicating progress. |
|  | The watchdog icon alternates with the network icon in the status bar when a measurement is running under MeasurEye or NoiseScout. |
|  | During an event, the icon appears blinking, indicating progress. |
|  | No storage warning symbol is shown in the status bar with a blinking icon. |

## 2.3 Quick settings

Swipe down across the display to get access to the quick settings.

| | |
|---|---|
|  | |
| 1 | Record screenshot – tap this icon to record a PNG picture of the current screen; alternatively, you may also press the two arrow keys ← + → simultaneously. The recorded picture will be saved on the SD-card. |
| 2 | System settings |
| 3 | Calibration screen |
| 4 | Connections |
| 5 | Rechargeable battery |
| 6 | Display brightness – move the slide controller to the left (darker) or right (brighter) to adjust the brightness of the LCD. |

## 2.4 Data access and remote control via web browser

For detailed instructions on how to set up and use the web browser for data access, please refer to chapter Data transfer.

# 3 Commissioning

## 3.1 Power supply

You can power the XL3 in several ways:

- Replaceable, rechargeable Li-Ion battery (supplied with the XL3);
- Mains voltage adapter (supplied with the instrument);
- USB-C cable.

The battery is approximately half charged when delivered and should be fully charged before using the XL3 for the first time.

### 3.1.1 Li-Ion battery

The protected and certified Lithium-Ion battery must only be used in the XL3. No other use is permitted. To insert the battery into the instrument, insert it into the battery compartment with the plastic tab first and let it snap into place.

In order to minimize the battery charging time it is recommended to leave the XL3 switched OFF during charging.

Safety information when handling the Li-Ion battery pack:

- In order to avoid electrostatic discharges, switch OFF the XL3 before removing the battery pack;
- Never short-circuit the contacts of the battery;
- The permissible operating temperature of the battery is between 0 to +45 °C (+32 to +113 °F);
- Never heat the battery above +60 °C;
- Do not solder on the battery;
- The battery must not be opened;
- Dispose of the used battery properly according to the instructions in this manual.

### 3.1.2 Operation with mains adapter

The supplied power supply is able to completely power the XL3 in all functions. In this configuration, you may leave the battery in the instrument. The power manager of the XL3 prevents from overcharging the battery. When switched off, the charging time for full charge is app. 3 hours. It prolongs when the XL3 is in use during charging.

Switched power supply with 9 VDC / 2 A with international adapters for EU, UK, US, AU.

CAUTION: Non-original mains voltage adapters may affect the measurement results. Damages caused by the use of a non-original power supply is excluded from warranty.

External DC power supply

Voltage: 5.8 – 17.0 VDC

Power: minimum 6 W

Connection: 2.1 x 5.5 x 9.5 mm

Polarity: Positive pole on inner contact

### 3.1.3 Supply via USB cable

Fundamentally, a USB connection supplies sufficient power to operate the XL3. Should the battery charged in parallel during operation, it is recommend to use an USB-C connection with 3 A rating, allowing to fully charge the battery in less than 3 hours. When using a USB-C 1.5 A rated supply, the charging time is extended to about 6 hours, while with a USB-2 connection with a rated power of 500 mA, the battery is only charged slowly when the device is turned off – no charging is possible during operation of the instrument in this configuration.

## 3.2 Attach hand strap / Kensington lock

A hand strap is included to secure it during work. This puts the XL3 firmly in your hand.

- Pull the thin cord of the hand strap through the opening;
- Slip the end of the thin string over the loop;
- Tighten the hand strap.

## 3.3 Fold-out stand

The practical device stand is located on the back of the XL3. Unfold the wire stand to place the meter in a convenient reading position on a table.

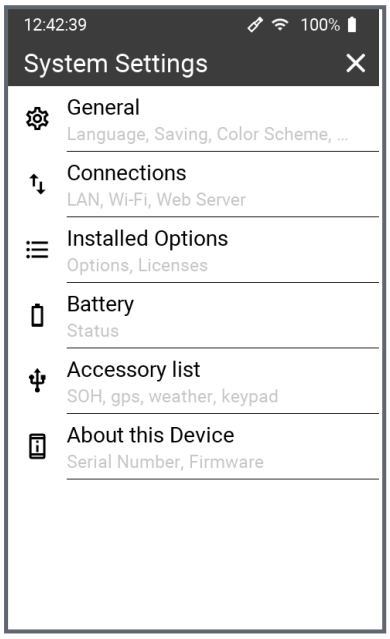
## 3.4 Acoustic measurements

For acoustic measurements, connect an NTi Audio measuring microphone to the XLR input socket 1 in Overview / Interfaces. The microphone is connected directly with the XLR connector, or via an XLR ASD cable to the XL3.

## 3.5 On / Off

Press the key for approx. 2 seconds to switch on the device; after start-up, the XL3 is ready for operation. Pressing the On/Off key again briefly during operation switches the display ON or OFF, respectively. To switch OFF the XL3, you must press and hold the On/Off key for approx. 3 seconds.

## 3.6 System settings




You can open the system settings in two ways:

a. Swipe the touchscreen from top to bottom ...

b. Or tap the menu icon in the upper left corner ...

... and then select the settings icon .

This opens the **System Settings**, which includes all global settings such as storage method, network connections, color scheme, language, time, options and device-specific information. Tap on the respective menu item to open the corresponding setting.

### 3.6.1 General

#### 3.6.1.1 Language

Select your preferred language in this sub menu. The language setting changes all menus (if available – otherwise English appears).

#### 3.6.1.2 Time zone

The date and time of the XL3 are synchronized – as soon as available – with the internet time via the NTP protocol. Therefore, there is no possibility to change the date or time manually.

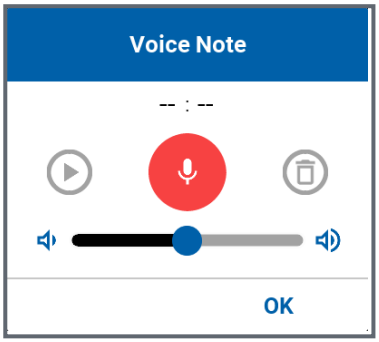
However, you can select the time zone (e.g. Europe/Berlin) so that the device time matches your local time.

#### 3.6.1.3 Decimal separator

For numerical display and storage, make the selection between "." (period) or "," (comma).

#### 3.6.1.4 Save

After completing a measurement, you can save the obtained results in three different ways on the XL3.

<table>
<tr><td>manually</td><td>Here, the user is responsible for saving the recorded measurement results. As soon as the measurement has been finished, the Save Result dialog will open. After that, tap on CANCEL to abandon or on OK to save a report.<br><br>• The Comment function can also be used via a voice note. To do this, simply click on the symbol, then press the symbol to complete the recording.<br>  <br>• After recording, you can delete the recorded voice message on , or play it back on . After recording the message, simply click OK to continue.<br><br>Manual saving is useful, for example, if you are performing trial measurements and do not always want to save all the results.<br><br>Measured values that are not saved yet, are retained even when the XL3 is switched OFF. You can still save them by tapping on ?</td></tr>
<tr><td>prompt</td><td>In this mode, after the measurement is finished, the Save Result dialog appears with the Folder (save location) and the file Name. Before you confirm with "OK", you can add a note (Comment) or cancel the saving with CANCEL.<br><br>Select this mode if you want to decide situational, whether the measurement results should be saved or if you want to add a comment to your measurement data in each case.</td></tr>
<tr><td>automatic</td><td>In this mode, the measurement results are written automatically – i.e. without user interaction – to the SD-card in the predefined project Folder. The file Name has the format yyyy-mm-dd_SLM_nnn, where nnn is a sequential number that increases automatically with each subsequent save operation.<br><br>Select this mode if you want to be sure that all measurement data are always stored.</td></tr>
</table>

### 3.6.1.5 Color scheme

Select the color scheme that suits you:

1. "dark" – white font on dark gray background;
2. "blue" – white writing on blue background;
3. "light" – black font on white background.

#### 3.6.1.6 Display timeout

Select the duration after which the display automatically switches OFF when not in use. Six time-limited increments are available from 5" (five seconds) to 60' (one hour) and "never" (no timeout).

As soon as you touch the switched-off display, it becomes active again.

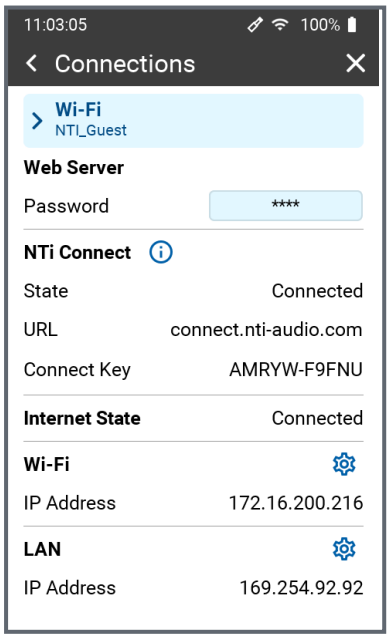
### 3.6.2 Connections

You can connect the XL3 to the internet in three ways:

a. Directly via the built-in Wi-Fi transmitter / receiver;
b. Via a LAN network using a USB Ethernet adapter or a PC;
c. Via a mobile data connection; for this, the XL3 requires an external gateway connected to the USB connector and connected using the NDIS protocol.

Regardless of the type of connection, the network LED provides information about the status of the connection.

| | |
|---|---|
| ● | (dark) No network connection |
| ● | (yellow) Network detected, but no connection to internet |
| ○ | (white) Connection to the internet established |
| ● | (blue) Connected to connect.nti-audio.com |

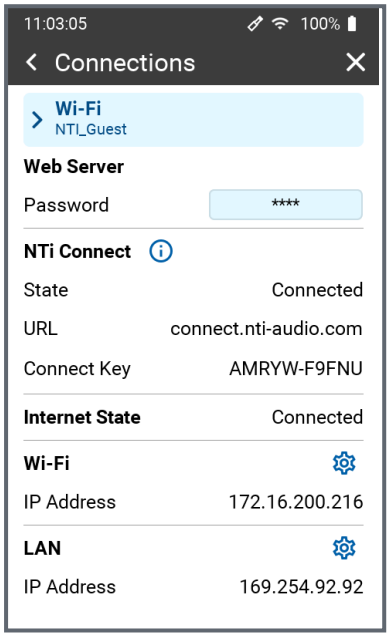



This setup shows the current status of the Wi-Fi connection and the assigned IP address of the device. The IP address is important for the connection with the web server. Under NTi Connect you may see the URL of the connection server and the unique connection key of your XL3. This key and the to be defined password are the required elements for a connection to the instrument via NTi Connect.

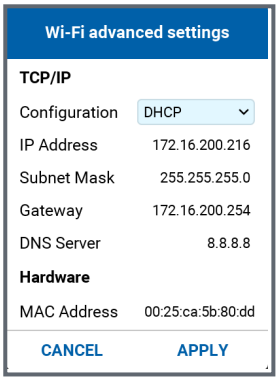
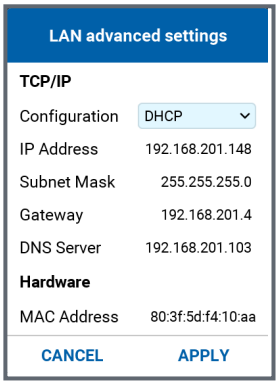
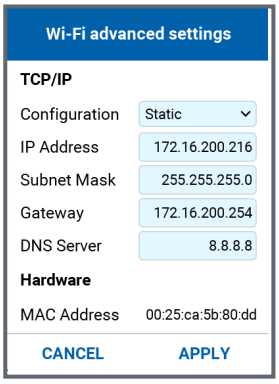
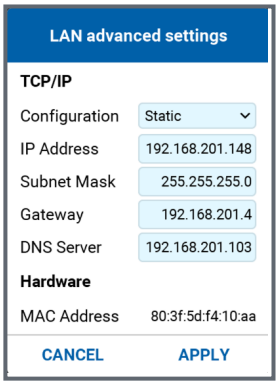
In an internal LAN you may also use the IP address to connect instead.

Shows how much data was used on the NTi connect server for the current month. The monthly data rate is limited to 2GB, unless a valid “NTi Connect Open Data 365” option is installed. See Data transfer for further details.

| | |
|---|---|
| Web Server | In this menu you can define the password. The web server is automatically enabled when a password is defined – otherwise, it is disabled |
| LAN | As soon as an Ethernet connection has been established via LAN on the USB port, the network icon in the top line of the display changes to and the IPv4 address is displayed. This address must be known in order to be able to address the XL3 via the web server. |




- To configure the Wi-Fi or LAN properties, tap on the settings symbol . This also reveals the MAC adress of the network adapter.

| | Wi-Fi advanced settings | LAN advanced settings |
|---|---|---|
| **DHCP** |  |  |
| **Static** |  |  |



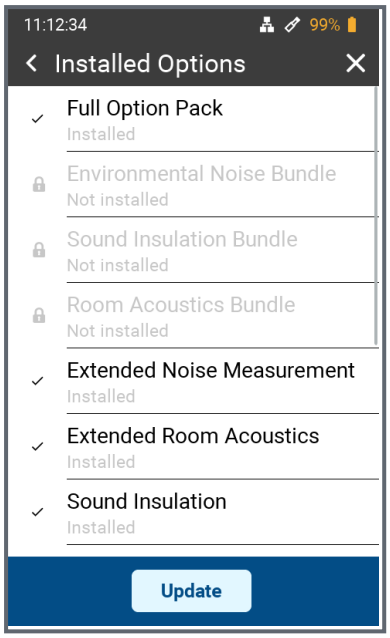






To set between **DHCP** and **Static**, tap for configuration.

### 3.6.3 Installed options



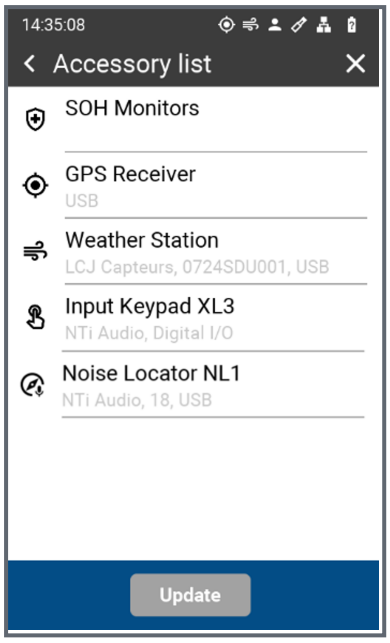

You can see here a list of all options that are installed & enabled in this XL3. Active options are displayed in black font – grayed out options are not active.

All available options for the XL3 can be installed on your device via the my.nti-audio.com portal on-line or through your NTi Audio distributor.

### 3.6.4 Rechargeable battery

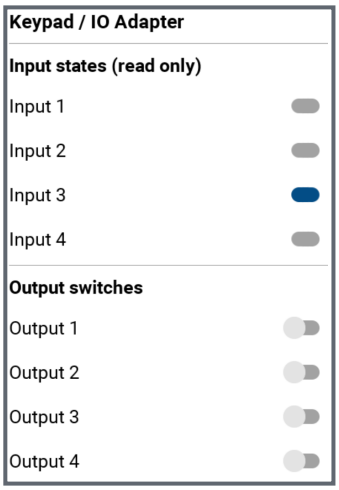
This menu shows you the current battery status and – if connected – the type of the external power supply (USB or Power Adapter). In case of a Battery failure, the related error message is shown as well.

### 3.6.5 Accessory list

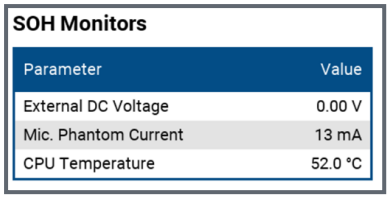



Update interval on screen:

- SOH: 20 sec
- Weather:
  - Measurement is running:
    - Logging interval
  - Measurement is not running:
    - Weather Station Sonic Anemo+Rain: 1 sec
    - Vaisala: 1 sec.
- GPS: 20 sec
- Keypad / IO Adapter: 1 sec
  - Inputs: Reads inputs 1 to 4;
  - Outputs: Sets/Resets outputs 1 to 4.




- NL1 Noise Locator:
  - The XL3 records NL1 Noise Locator data whenever the NL1 Noise Locator is connected, a measurement is running, and a logging interval (100 ms or 1 s) is selected. A log file with the suffix _NoiseLoc_ Log.txt is then created.



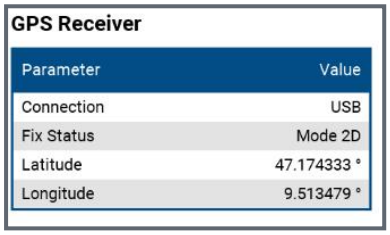
**SOH Monitors**

| Parameter | Value |
|---|---|
| External DC Voltage | 0.00 V |
| Mic. Phantom Current | 13 mA |
| CPU Temperature | 52.0 °C |

SOH Monitors:

- External DC Voltage;
- Microphone Phantom Current;
- CPU Temperature.

> The XL3 automatically shuts down when the CPU temperature reaches 98°C to prevent damage from overheating. The XL3 will automatically restart after a period of 30 minutes.

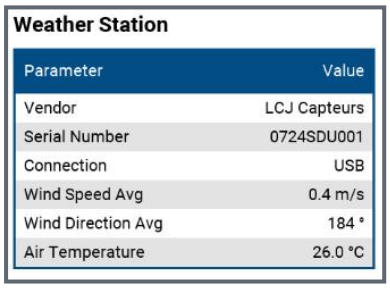


**GPS Receiver**

| Parameter | Value |
|---|---|
| Connection | USB |
| Fix Status | Mode 2D |
| Latitude | 47.174333 ° |
| Longitude | 9.513479 ° |

GPS Receiver:

- Connection;
- Fix Status;
- Latitude;
- Longitude.



**Weather Station**

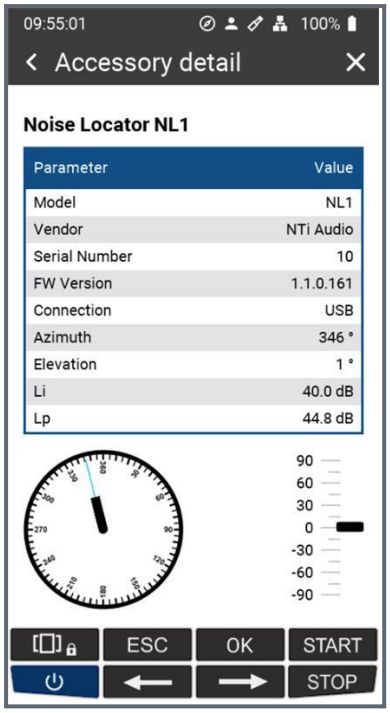
| Parameter | Value |
|---|---|
| Vendor | LCJ Capteurs |
| Serial Number | 0724SDU001 |
| Connection | USB |
| Wind Speed Avg | 0.4 m/s |
| Wind Direction Avg | 184 ° |
| Air Temperature | 26.0 °C |

Weather Station:

- Vendor;
- Serial Number;
- Connection;
- Wind Speed Avg;
- Wind Direction Avg;
- Air Temperature

Weather Data on Screen:

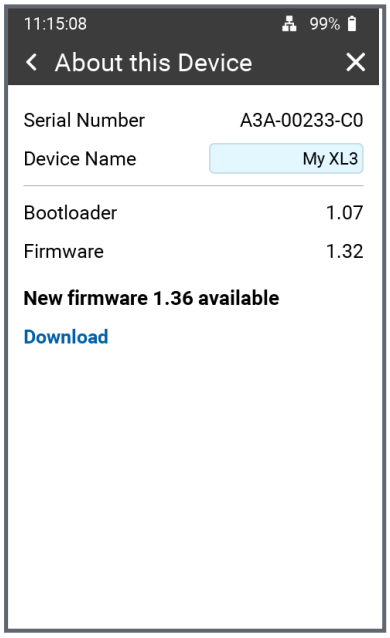
- Accessory Menu Integration – Weather stations now appear in the XL3's accessory list;
- Detailed View – A dedicated page shows live sensor values (wind speed, wind direction, temperature, humidity, etc.);
- Status Updates – Readings refresh automatically while a measurement is running;
- Convenience – No need to check logs or external tools; weather data is accessible directly on the instrument's screen.




NL1 Noise Locator:

- The XL3 provides an overview of the NL1 Noise Locator parameters under System Settings -> Accessory List -> NL1 Noise Locator;
- The NL1 Noise Locator parameters are available through the Streaming API interface and are synchronized with the SPL log data.

### 3.6.6 About this device

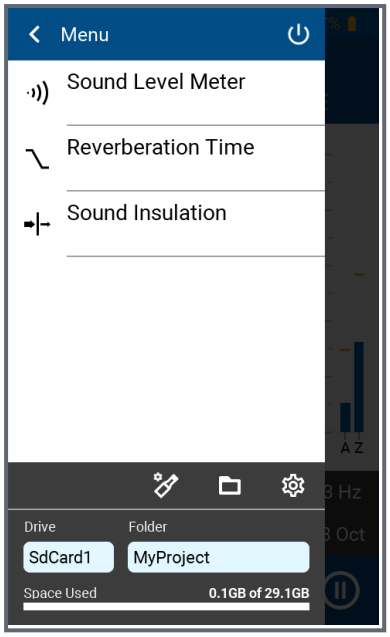



Under this menu item you will find:

- The serial number of the device;
- The selectable device name (factory setting: "My XL3");
- The Bootloader version of the device;
- The installed firmware version and the indication if this version is up-to-date, or if a newer version is available for download (XL3 must be online).

## 3.7 Selection of the measurement function

Tap the selection menu at the top left of the display.




You will then see a list of all available measurement functions. Tap on the desired function so that it is loaded. Detailed descriptions of the respective measuring functions can be found in the corresponding chapters.

Measurement functions depend on the installed options.

For a general functional check and for ensuring best possible measurement accuracy, we are recommending to check the sound level meter together with the microphone, using a sound calibrator before executing measurements. Instructions for this can be found under Calibration.

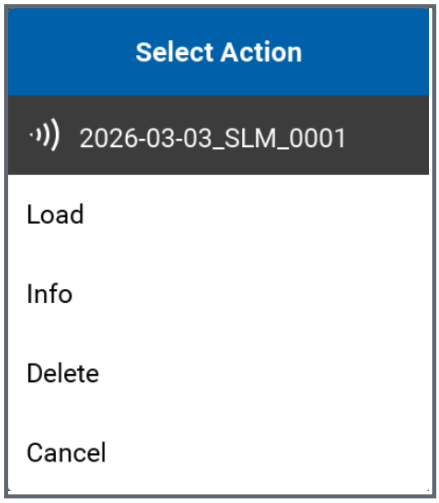
## 3.8 Selection of the measurement explorer

Tap the selection menu at the top left of the display and after tap the measurement folder menu.

You will then see a list of all the measurement recorded files in you project. Tap on the three dots at the right of the display to see the select action menu for the respective measurement file with the following options:

**Info:**

- Displays the additional information of the measurement folder, such as: creation date, number of files and total size




**Delete:**

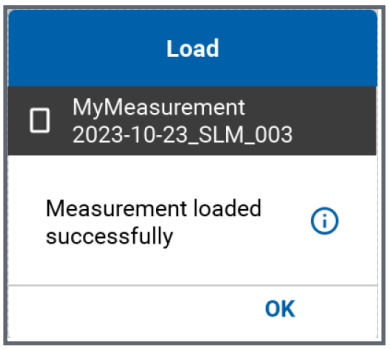
- Deletes the measurement folder and all of its content.

**Cancel:**

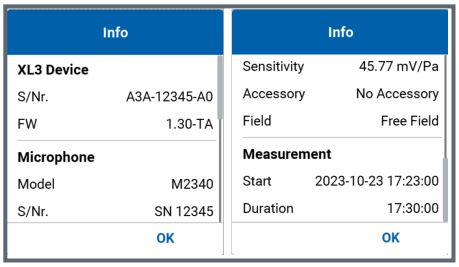
- Leaves the selection list without any action.

**Load:**

- Loads the measurement configuration and displays a window with the confirmation




- Press the "**Info**" symbol to display additional information on the loaded measurement.




- Press "**OK**" to display the aggregated results of the measurement saved in the encrypted system file with the extension *.xl3. If the *.xl3 file was subsequently changed, this is acknowledged with an error message and no level data is displayed.

# 4 Measurement Functions

## 4.1 Sound level meter

The XL3 together with the measuring microphone forms a precise sound level meter for ambient noise, room & building acoustics, and workplace & industrial noise.

With the M2230 or M2340 measuring microphone and the ASD cable, the XL3 forms a class 1 sound level meter that can be calibrated in accordance with the standards DIN EN 61672-1, DIN 45657:2005 and DIN EN 61260 (see Options and accessories).

To activate the sound level meter mode, tap the menu icon  in the upper left corner and then tap "**Sound Level Meter**".

The XL3 continuously displays the current sound level (i.e. even without a measurement having been started). All averaged levels (e.g. LAeq) refer either to the current measurement period or – if no measurement is currently running – to the previous measurement period. If there is no current or previous data, "--.-" appear.

Numerical measured values are updated every 500 ms, regardless of the measurement duration or the selected logging interval. The maximum time span between an averaging and the display is therefore 500 ms. Spectra are updated every 50 ms.

During a sound level measurement with the XL3, all results are available simultaneously, such as the current sound level, Lmin, Lmax, Leq with the frequency weightings A, C, Z and the time weightings F and S. The device stores the determined measurement results including all real-time information on the removable SD card. In addition to broadband levels, the XL3 also measures the real-time spectrum in third-octave or octave band resolution according to IEC 61260 Class 1.

For complete documentation of the measured sound levels, you may also record a WAV file in parallel. This helps, for example, to acoustically verify sound events with high level values afterwards, or - if recorded uncompressed - to perform further calculations and analysis.

For live events, the XL3 determines the correction values between the loudest location and the measurement location, and automatically takes these into account for the level measurement .

By activating the Extended Noise Measurement option, the following additional functions are available in the sound level meter:

- Sound exposure level LAE;
- Time weighting pulse (I);
- Differential level LAIeq – LAeq;
- Percentile level Lxy (x = A, C or Z / y = F, S or EQ1"): 0.1 – 99.9%;
- Fast data recording in 100 ms intervals for broadband as well as spectral levels;
- Audio recording with 24-bit or 32-bit resolution and a sampling frequency of 12, 24, 48 or 96 kHz;

- Backward delete function (planned);
- Pre-trigger (planned).

The sound level measurement function offers a numerical display, a level-time graph and a spectral display, which you can select via the keypad as well as the touchscreen.

### 4.1.1 Page selection by means of page key

Press the page key  to toggle between the numerical and spectral display. This change is possible without restriction even during a running measurement.

### 4.1.2 Page selection via the display

You can also select the desired display with a swiping motion, or by tapping the corresponding icons.



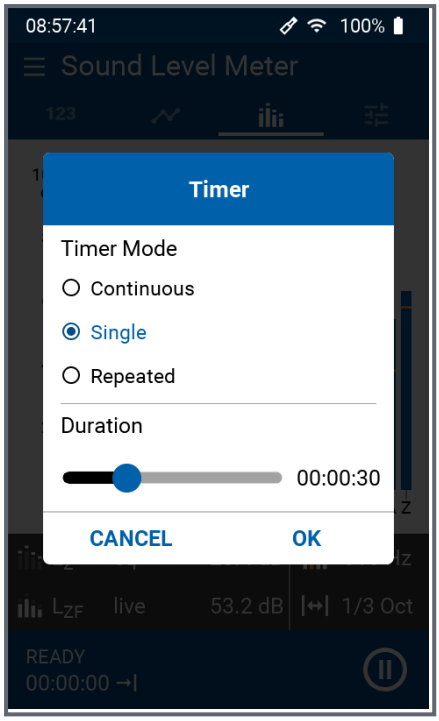
The Numerical level display shows the selected broadband values. You can change the font size of the displayed measured values under Display layout to display either one, three or five measured values simultaneously. For each of the displayed measured values you can individually select the frequency and time weighting, the current live value, maximum, minimum as well as correction values.

The Level-Time graph.

Switches to the spectral display of the measured values and displays the third-octave or octave band spectrum with the selected frequency weighting. The frequency scale is selectable. In addition to the spectral values, the A- and Z-weighted broadband levels are displayed as a bar graph on the right.

In this menu the sound level meter is configured and the layout of the numerical display can be adjusted. These settings are detailed under Settings .

To access Timer mode, before starting a measurement, you must tap the “READY” icon.

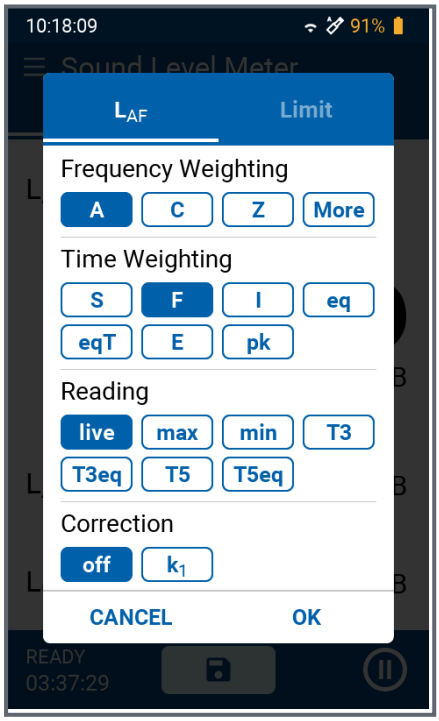



In Timer mode, you can choose from three options: Continuous, Single and Repeated.

- **Continuous**: The timer runs continuously without stopping;
- **Single**: You can set the timer for one specific duration. You can choose a time between 00:00:01 (1 second) and 24:00:00 (24 hours);
- **Repeated**: The timer will run for a set duration and then restart automatically. You can set this duration between 00:00:05 (5 seconds) and 01:00:00 (1 hour). In Repeated mode, the timer will restart at the next full interval, such as every 5 seconds, 10 seconds, full minute, or full hour.

### 4.1.3 Numerical level display

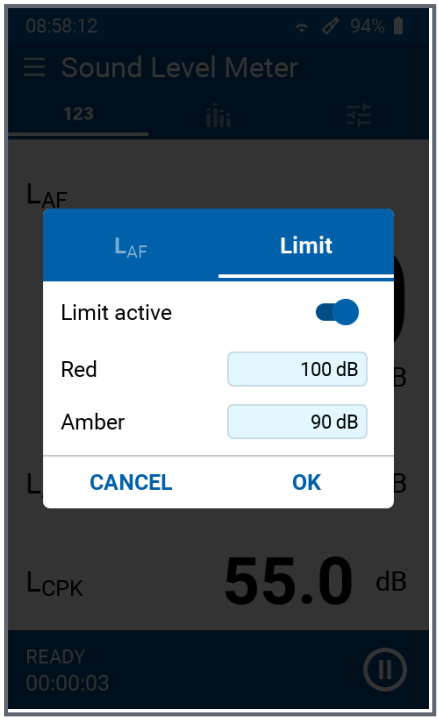
This page shows a freely configurable selection of sound levels. You can adjust the page layout under Display layout.



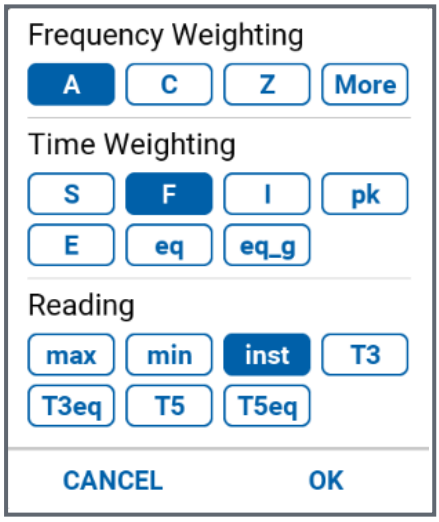

To display or change a specific level, tap on this level designation. This opens a menu where you can select the frequency weighting, the time weighting and any offset values for this level.

Spectral values as well as percentile values can be found at **More.**

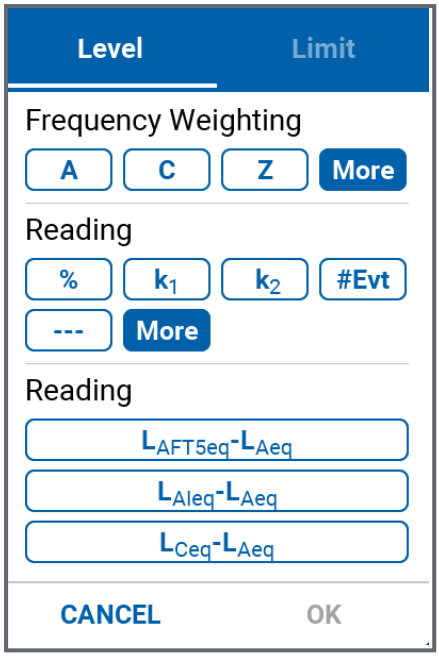
> If only "--.-" is displayed for a measured value, this is due to the fact that an averaged result is behind it, which is calculated and displayed only after the **START** of the measurement.




Under "**Limit**" you can activate and define a maximum limit ("Red") and an alert limit ("Amber") for each individual level. As soon as the sound level exceeds the maximum limit value, the display of the measured value changes to red. If the sound level is between the alert limit and the maximum limit, the display changes to amber (warning). Lower levels are displayed in normal black. Confirm the level input with "**OK**" on the on-screen keyboard.

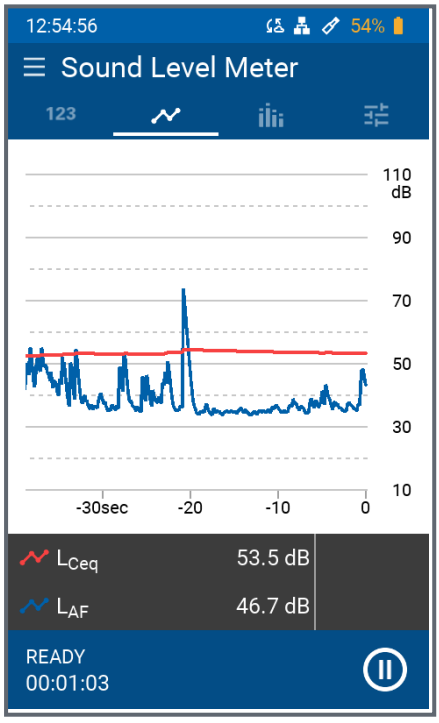



Logging of LxFinst, x = A/C/Z (requires Extended Noise Measurement Option).




When you select **More** at **"Frequency Weighting"**, the screen displays the Reading options and when you select **More** at **"Reading"** a selection of level differences becomes available for your choice.

### 4.1.4 Level-time history



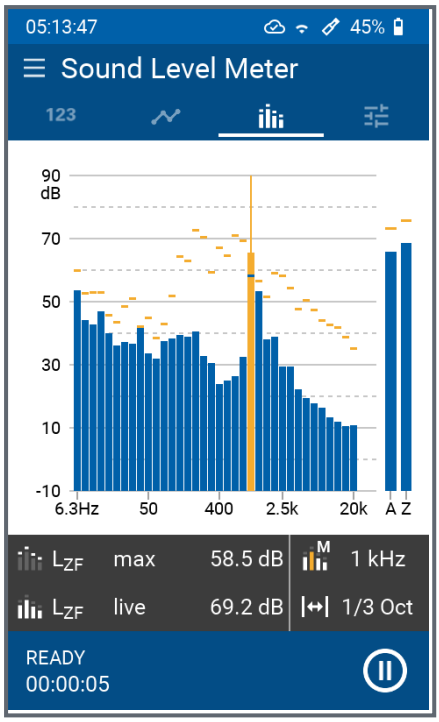

In level-time history display, two selectable level values are plotted over time, while the measurement is running. Tap on the red (or blue) curve icon to open the pop-up panel where you can select the corresponding levels. If you amend a level during a measurement, the corresponding curve will re-start at this point.

The level-time graph shows 390 data points, whereby the Logging interval is defined under Settings .

- Tapping on the X-axis scaling toggles between the full data point view, and two zoom ranges (refer to the table below);
- Tap on the Y-axis scaling to adjust its range (zoom) and position (scroll).

| Logging Interval | History duration | Zoom 1 | Zoom 2 |
|---|---|---|---|
| 1 sec | 06 min 30 sec | 03 min 15 sec | 01 min 05 sec |
| 100 ms | 39 sec | 19.5 sec | 6.5 sec |

### 4.1.5 Spectral display



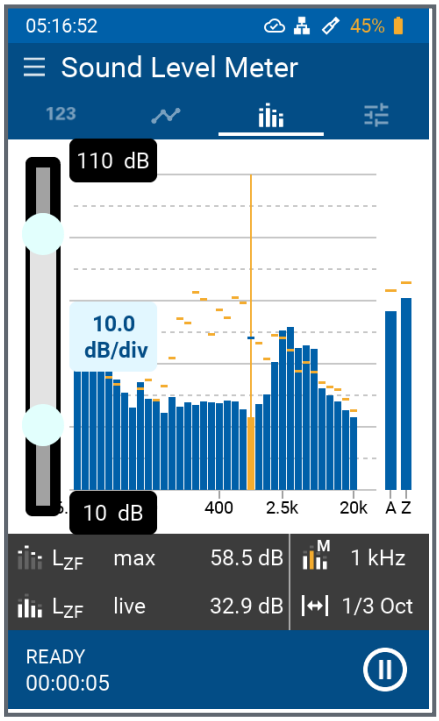

In the spectral display up to 2 spectra as well as the A- and Z-weighted broadband levels are displayed simultaneously.

In the dark area below the spectrum, you can switch the spectral resolution between 1/3rd-Octave and octave resolution on the right and the cursor mode between Manual and Automatic. In "**automatic**" mode, the frequency band that has the highest level is highlighted in orange, while in "manual" mode you can select and highlight a frequency band yourself using the ← and → arrow keys.

If you tap on either of the two level-icons to the left or , you will get access to the Frequency and Time Weighting of the spectral display, as well as:

- the Reading of the dashed curve;
- the Reading of the bar graph.

#### 4.1.5.1 Zoom and scroll of the axes



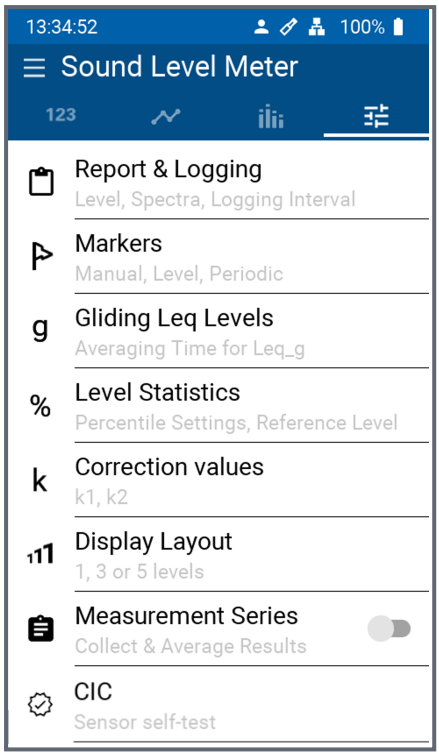

By long tapping on the X or Y axis, you can change the corresponding scale.

For the Y-axis, use the slider on the left to move the scale up or down, and tap the corresponding box to select the sensitivity in dB/div. To finish, tap in the middle of the display next to these fields.

You select the area of the X-axis to be displayed using the two end points of the slider. To finish, tap the center of the display again.

> The set sensitivities of both axes have no influence on the measurement or the data recording.

### 4.1.6 Settings




This page provides access to the following settings:

- **Report & Logging**: Selection of sound levels and measurement parameters to be recorded;
- **Markers**: Configuration of Manual (Markers, Source, Mode), Level (Threshold, Hysteresis), and Periodic (Interval, Duration) settings;
- **Gliding Leq Levels**: Averaging duration (length of time windows) of the moving Leq levels;
- **Level Statistics**: The parameters of the percentile statistics;
- **Correction values**: Input of correction values for offset level measurements;
- **Display Layout**: The layout of the numeric display;
- **Measurement Series**: (De)activation of measurement series.
- **CIC:** Charge Injection Check (CIC) workflow for self-verification of microphones.

#### 4.1.6.1 Report & Logging

At the end of the measurement, the XL3 then automatically generates the measurement report as a TXT file, if active. In the process, individual sound level measurement values previously selected by the customer or all sound level measurement values are stored.

##### 4.1.6.1.1 Spectra

| | |
|---|---|
| off | There is no recording of spectral data. |
| eq | The mean values of the spectrum are recorded. |
| eq, max, min | Average values, minimum and maximum levels are recorded. |
| all | The XL3 records all spectra. |

##### 4.1.6.1.2 Logging interval

| | |
|---|---|
| off | The selected measurements are saved only when the measurement is finished, i.e. as final results. |
| 1 s | The XL3 saves the current measurement data every second. |
| 100 ms | The XL3 saves the measurement data every 100 ms (i.e. 10 times per second). |

##### 4.1.6.1.3 Audio recording

| | |
|---|---|
| off | The audio recording is switched off. |

| | |
|---|---|
| on | Parallel to the ongoing sound level measurement, the XL3 records an audio file in WAV format. This file is available after the end of the measurement for analysis, documentation or further calculations. When audio recording is enabled, the Audio format and Sampling rate (sampling frequency) parameters can be configured. |
| markers only | When this option is selected, audio will only be recorded based on the settings defined in Markers . This allows for targeted audio capture aligned with specific marker events. |

#### 4.1.6.1.4 Audio format

The device can record the audio data as uncompressed or compressed WAV files.

Uncompressed (linear PCM), recordings are suitable for making further measurements or calculations later. Be aware that they are occupying a lot of memory.

The compressed ADPCM format, on the other hand, uses only 4-bit per sample, and is therefore very memory efficient. Compressed audio data can be listened to without restriction, e.g. to identify specific events. However, they are not suitable for downstream calculations.

All WAV files recorded by XL3 can be played back with a common media player. However, it is important to note that the uncompressed recording formats cover a wide dynamic range, and the content on a media player can therefore only be very quiet / barely audible.

| | |
|---|---|
| 32-bit | Uncompressed audio recording is done with a resolution of 32-bit (floating point), resulting in a dynamic range of 1'528 dB. The maximum level of the WAV file is fixed to 200 dB. |
| 24-bit | Uncompressed audio with a resolution of 24-bit, a dynamic range of 144 dB is available. The maximum level of the WAV file depends on the sensitivity of the microphone and is calculated as: 117.5 dB – 20*log10 (mic_sensitivity_in_V/Pa). The maximum level in dB is also encoded in the file name. |
| compressed | This format compresses the audio content with the ADPCM algorithm in 4-bit in such a way that the memory consumption is minimized with good audibility.<br>Furthermore, the level range can be set:<br>• Automatic Gain Control (AGC): the level of the wav file is automatically controlled and optimized for good audibility.<br>• Fixed ranges in LZpk:<br>  • 70-140 dB;<br>  • 60-130 dB;<br>  • 50-120 dB;<br>  • 40-110 dB;<br>  • 30-100 dB. |

**Broadcast Wave Format BWF**

The XL3 stores scaling factor, serial number, date, time and time zone within the wav-file (according to EBU TECH 3285). This information is available through professional audio/video tools typically used in broadcast.

#### 4.1.6.1.5 Sampling rate

Audio recording can be done with different sampling frequencies. The higher the sampling frequency, the higher maximum frequencies can be recorded. The highest recordable frequency corresponds to half of the sampling frequency.

| | |
|---|---|
| 96 kHz | Ultrasonic signals up to 48 kHz can be recorded, provided that the cut-off frequency of the measuring microphone supports this. |
| 48 kHz | This sampling rate covers the entire audible audio range up to 24 kHz. |
| 24 kHz | A memory-saving format to record audio signals up to max. 12 kHz. |
| 12 kHz | A memory-saving format to record audio signals up to max. 6 kHz. |

#### 4.1.6.1.6 Memory consumption of WAV files

The following table shows the memory consumption of all possible combinations.

| fs | 32-bit | 24-bit | Compressed |
|---|---|---|---|
| 96 kHz | 31 GB/day – 1.3 GB/h | 23 GB/day – 1 GB/h | – |
| 48 kHz | 15 GB/day – 0.64 GB/h | 12 GB/day – 0.5 GB/h | – |
| 24 kHz | 8 GB/day – 0.32 GB/h | 6 GB/day – 0.25 GB/h | 989 MB/day – 41 MB/h |
| 12 kHz | 4 GB/day – 0.16 GB/h | 3 GB/day – 0.12 GB/h | 494 MB/day – 21 MB/h |

#### 4.1.6.1.7 New Daily Measurement

The New Daily Measurement function allows you to configure the timing for when a measurement file should be completed and a new one initiated. This feature ensures that you have a new measurement file for each 24 hours, enhancing organization and data management.

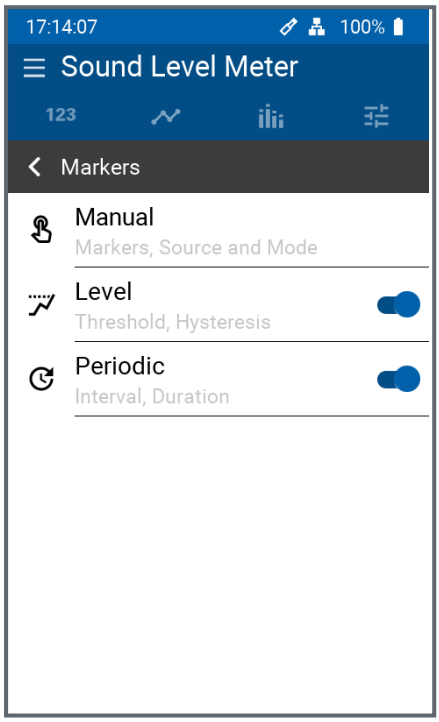
You can configure from the following options to set the daily measurement schedule:

- **00:00:00**: default and disabled;
- **24 Hours After Start**: Select this option to create a new measurement file exactly 24 hours after the initial file was started.
- **At full hours**: you can configure to start a new measurement file at specific hours throughout the day:
  - at 00:00;
  - at 01:00;
  - at 02:00;
  - ...
  - at 23:00.

#### 4.1.6.1.8 Levels to be recorded

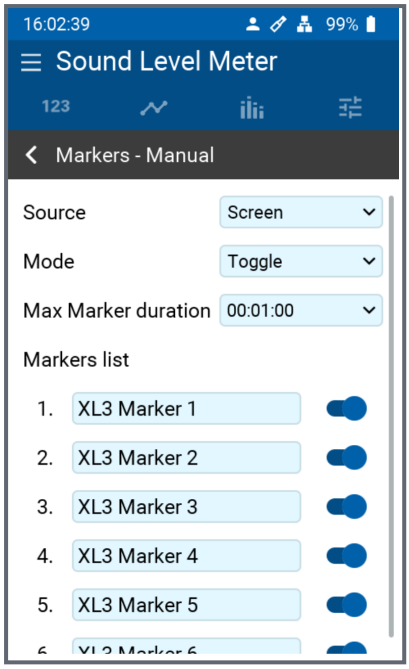
Here you can choose between **All** and **Selected**. With **All,** all levels calculated in the sound level meter are recorded and are then available for post-processing. In the **Selected** list you can enter up to 10 freely selectable levels that will end up in the log file. The level selection is analog to the level selection in the sound level meter.

### 4.1.6.2 Markers



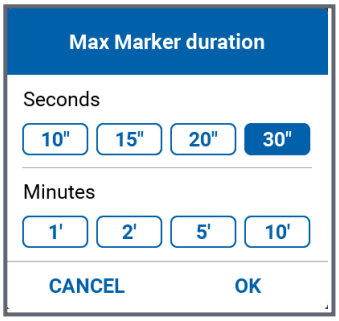

This page provides you access to the events settings:

- **Manual** : Configuration of Markers, Source, and Mode;
- **Level** : Setting of Threshold and Hysteresis values;
- **Periodic** : Definition of Interval and Duration for periodic events.

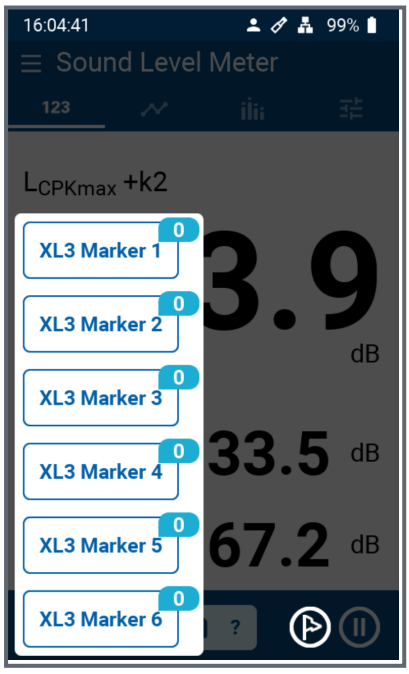



The Markers - Manual page allows you to configure:

- **Source**: Screen and Keypad;
- **Mode**: Toggle and Hold;
  - In Hold mode, the Max Marker Duration function is disabled.
  - Long-pressing the marker key now creates a marker hold, useful for highlighting extended events during measurements.
- **All keys = Marker 1**: enable and disable Markers equal to 1;
- **Max Marker Duration:**

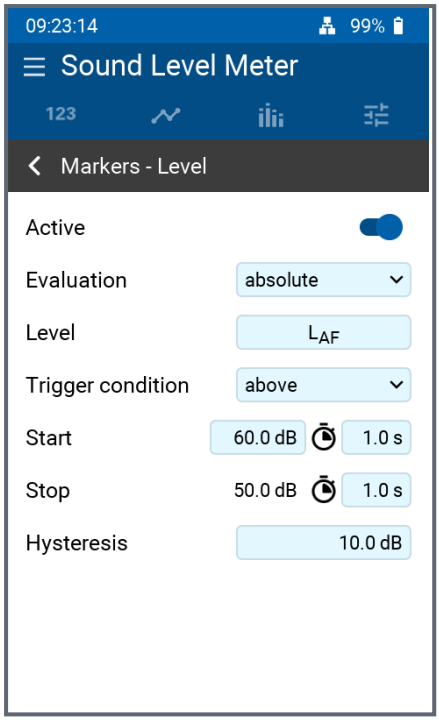



  - Seconds: 10, 15, 20 or 30 (default) s;
  - Minutes: 1, 2, 5, 10, 15, 20, 30 or 60.



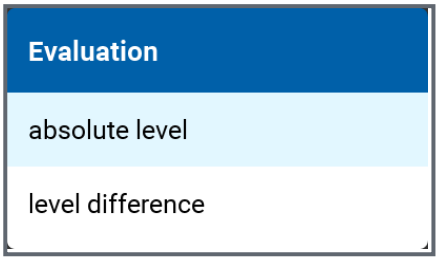

- **Markers list:**
  - Defines how many markers, from 1 to 6, can be activated.
  - During the measurement process, you can verify the placement of your markers by referring to the markers icon .

During a measurement, the marker button provides a flashing visual indication when activated, allowing users to confirm the event marking.

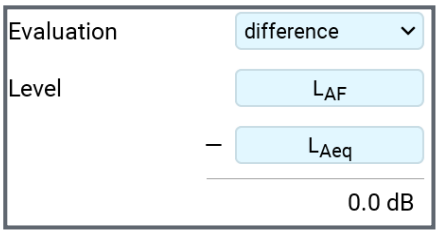



When Markers - Level is activated, you are enabled to configure the following settings:

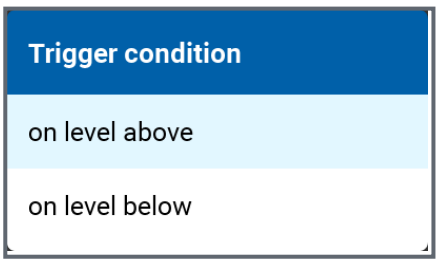
- **Evaluation**: Selection between absolute level and level difference;




> When the level difference is selected, you can configure the levels and visualize the resulting difference.

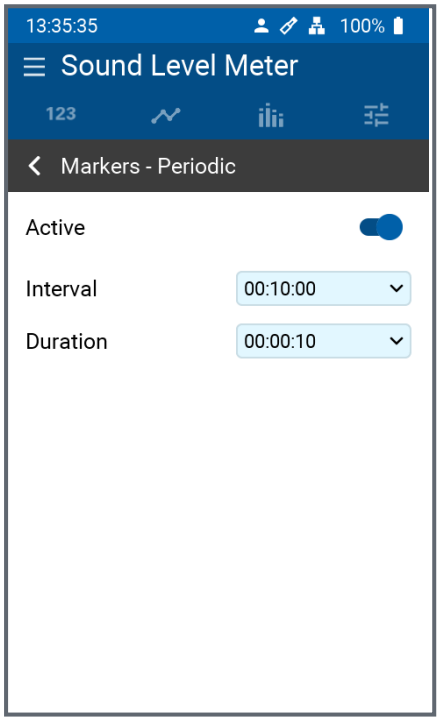



- **Level**: The specific threshold level to trigger the marker; it is possible to define the Frequency Weighting, Time Weighting, Reading, and Correction. For more information see Numerical level display.
- **Trigger Condition**: Conditions under the markers are activated;



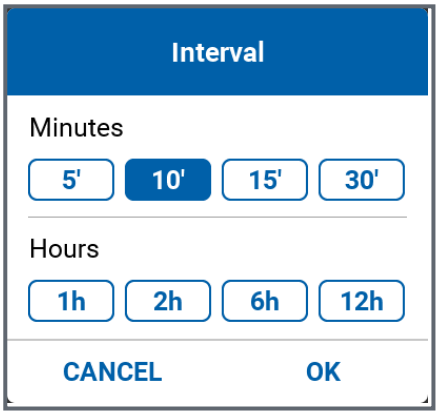

- **Start**: Define the Level in dB where the trigger starts and the pre-trigger duration in seconds;
- **Stop**: Define the Level in dB where the trigger stops and the post-trigger duration in seconds;

- **Hysteresis**: A single value in dB that creates a buffer around the trigger level. It prevents rapid toggling by ensuring the marker remains active until the signal drops below the trigger level minus the hysteresis value, enhancing stability and reducing false triggers.

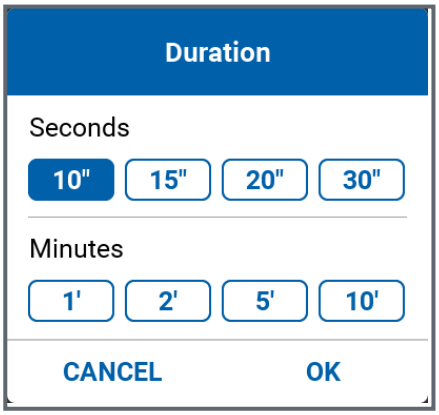


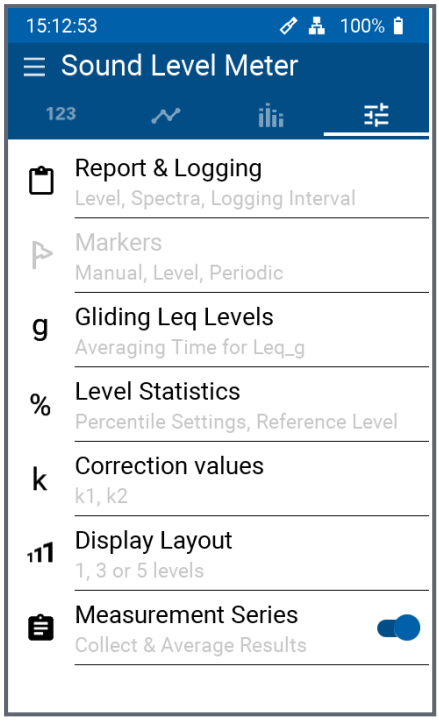

When Markers - Periodic is activated, it is possible to configure the following settings:

- **Interval**: Set the interval for periodic measurements in minutes or hours;




- **Duration**: Define the duration of each measurement in seconds or minutes.

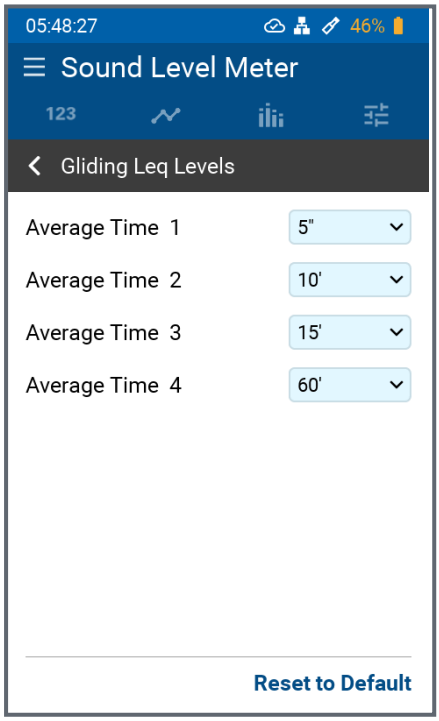





When the **"Measurement Series"** is activated, marker mode is automatically disabled.

When the **"Logging Interval"** at the **Report & Logging** is off, marker mode is automatically disabled.

### 4.1.6.3 Gliding Leq level




In addition to the mean value (Leq), which represents the entire measurement period from **START** to the observation time **STOP**, there are also gliding averages Leq_g, which calculate the mean value for a defined measurement period up to the observation time. The XL3 can calculate up to four averages in parallel.

Example:

10:00:00 Start of measurement

10:00: 05 Leq5" = Leq of this 5 seconds

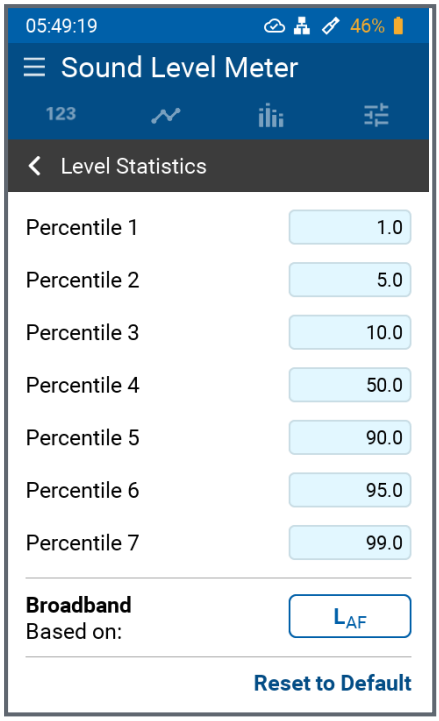
10:00:06 Leq5" = Leq of the time window from 10:00:01 to 10:00:06

10:00:07 Leq5" = Leq of the time window from 10:00:02 to 10:00:07

Applications:

- Measurement of the averaged LAeq over 5 seconds according to DIN15905;
- Measurement of the gliding LAeq over 60 minutes according to V-NISSG;

### 4.1.6.4 Level statistics

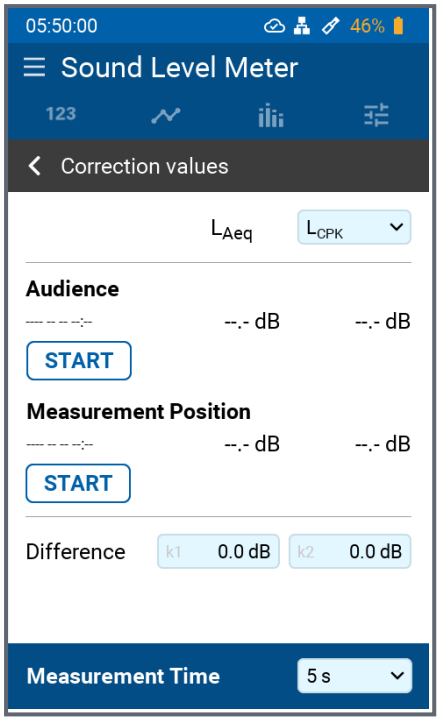



The instrument calculates up to 7 different percentile levels for broadband and spectral measurements. These data represent the statistical sound level distribution, and are typically used for environmental noise measurements. Here, for example, LAFxx% corresponds to a noise level exceeded during xx% of the measurement period. The 10 percentile sound levels are flexibly adjustable from 0.1% to 99.9%.

Specifications:

- Broadband and spectral measurements;
- Fast/slow weighted levels are sampled every 1.3 ms;
- Broadband resolution: in 0.1 dB class width;
- Octave and 1/3$^{rd}$ Octave spectral resolution: in 1 dB class width.

### 4.1.6.5 Define K-values

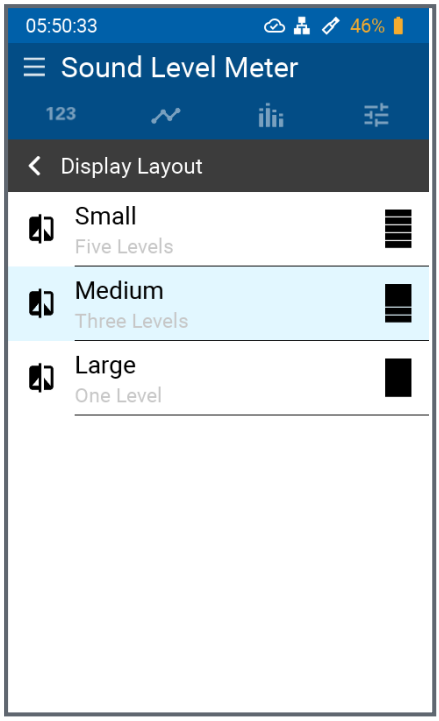



At live concerts, you often cannot place the meter directly at the loudest measurement location (**Audience**), but must place it at an alternate location (**Measurement Position**). This leads to differences between the A- and C-weighted levels measured at the substitute location and those prevailing at the measurement location. You can determine or correct these differences by a simple measurement with the XL3.

Procedure:

- Temporarily place the instrument at the loudest measurement point, provide a constant sound level (e.g. pink noise) and perform a measurement with "**Audience**" –> **START**;
- Then place the instrument at the replacement measuring location and perform a measurement again with "**Measurement Position**" –> **START** (while the sound level remains constant);
- The level differences of the A level are calculated as k1 value and the difference of the C level as k2 value.

### 4.1.6.6 Display layout

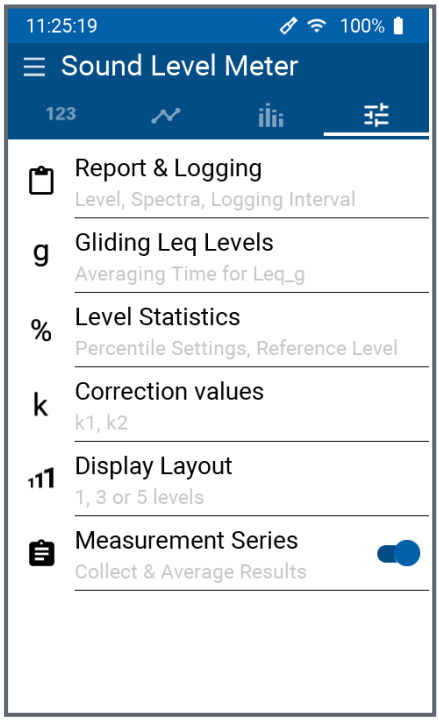



Three layout templates are available for the numeric level display:

- "**Small**" displays 5 levels of the same size next to each other.
- "**Medium**" displays one level in large font, and two other levels slightly smaller.
- "**Large**" focuses on a single level that is displayed large.

> The selection of displayed levels follows the order of the levels from the "**Small**" layout. That means, layout "**Small**" shows all 5 levels, while layout "**Medium**" shows only the top three levels of layout "**Small**". Finally, Layout "**Large**" shows only the top level of Layout "**Small**".

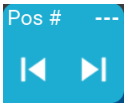
### 4.1.6.7 Measurement Series




With the Measurement Series selected, it is possible to collect and average the results. When the Measurement Series is selected, the Initial Series icon START Series will be available on the screen, either in Numerical Level View and Level-Time Graph, Spectral View.

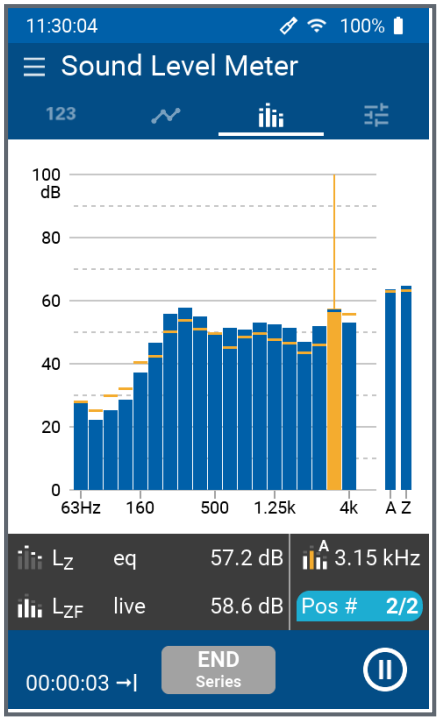
> Level-Time Graph shows only the current measurement.

In the Numerical Level View and Spectral View displays, you will see the Positioning icon Pos # ---. When you touch it, the icon extends to:




After each measurement in the series, it is necessary to **SAVE** or **CANCEL** it. **SAVE** increases the number of positions.

To finish a Mesurement Series you just need to touch in the display END Series and select between **OK** or **CANCEL**.

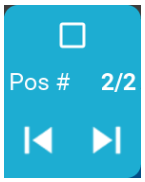


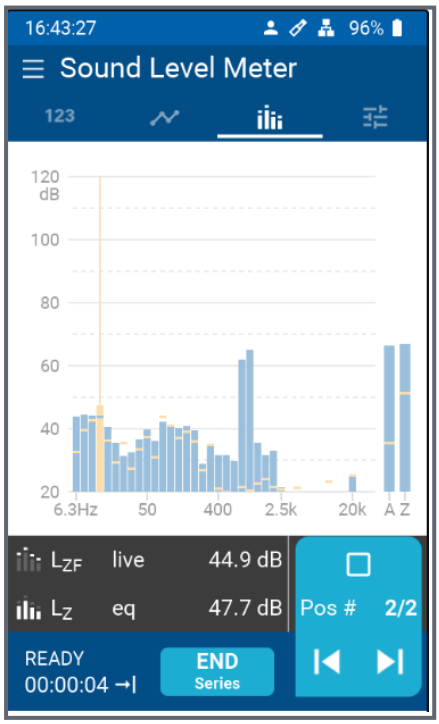

When a Measurement is being performed in the Series, you will see the reference of the measurement. The extended icon is also displayed at a touch, according to:

| Position reference | Position reference extended |
|---|---|
| Pos # 1/1 | Pos # 1/1 |
| Pos # 1/2 | Pos # 1/2 |
| Pos # 2/2 | Pos # 2/2 |
| av | av |

The dashed yellow line shows the average of the previous measurements realized in the current Measurement Series.

If you want to disable one measurement for the average, please deactivate the corresponding box.



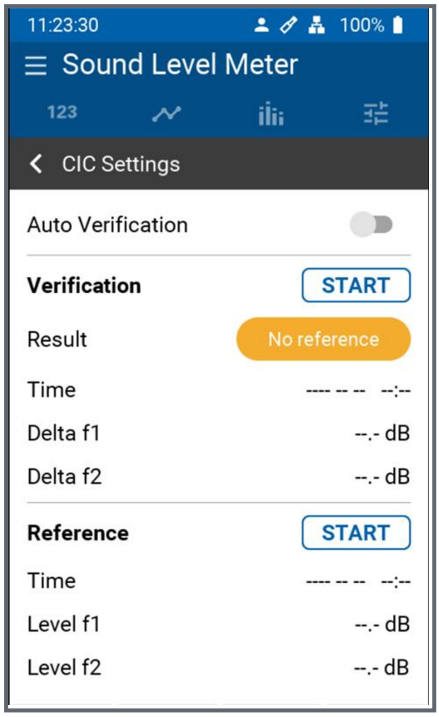




Disabled Positions are marked with Used = 0 in the XL3 Spectrum Report and XL3 Broadband Report.

It is not possible to complete a series while a measurement is being performed. The icon END Series will appear in gray, and if you attempt to select it, the following message will be shown.

Ongoing measurement

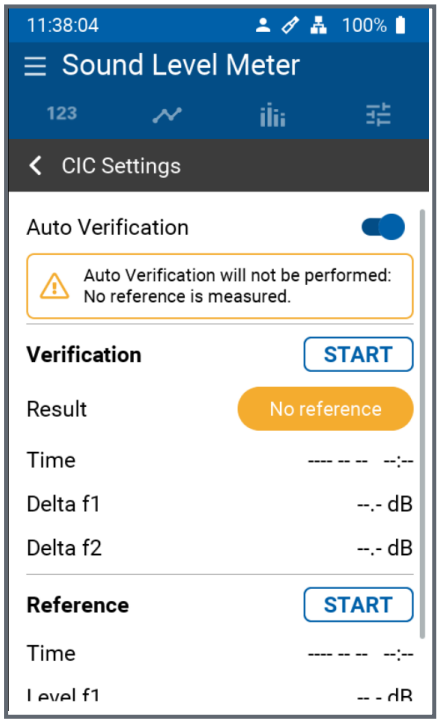
### 4.1.6.8 Charge Injection Check (CIC)




The XL3 supports a complete Charge Injection Check (CIC) workflow for self-verification of microphones. The reference data is stored in the microphone for portability.

When you enter the CIC Settings menu, you will have access to the Verification and Reference menu.

- By default no Verification or Reference measurement are applied.



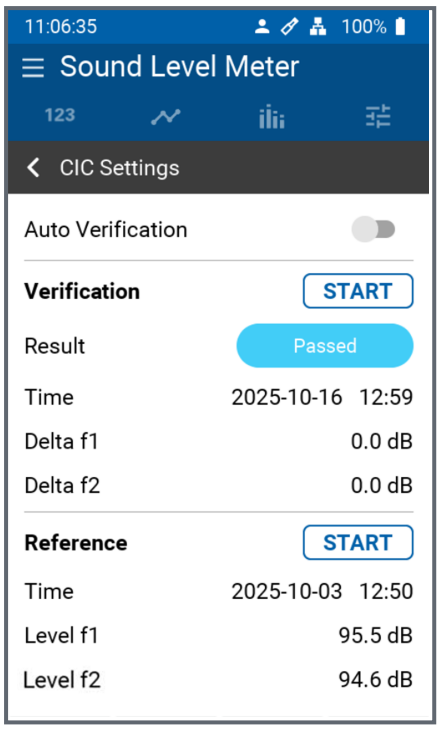

With a suitable sensor, you can activate auto verification, but if you do not yet have any verification and reference stored, you will see the following warning message:

> Auto Verification will not be performed:
> No reference is measured.

When no sensor is connected or the sensor does not support CIC, another warning message will be displayed.

To perform a new verification and reference, simply select **START** and follow the procedure.

> Perform the reference measurement under conditions that correspond as closely as possible to your application, avoiding loud environments.




With the verification and reference measurements already performed, you are now able to activate **Auto Verification**.

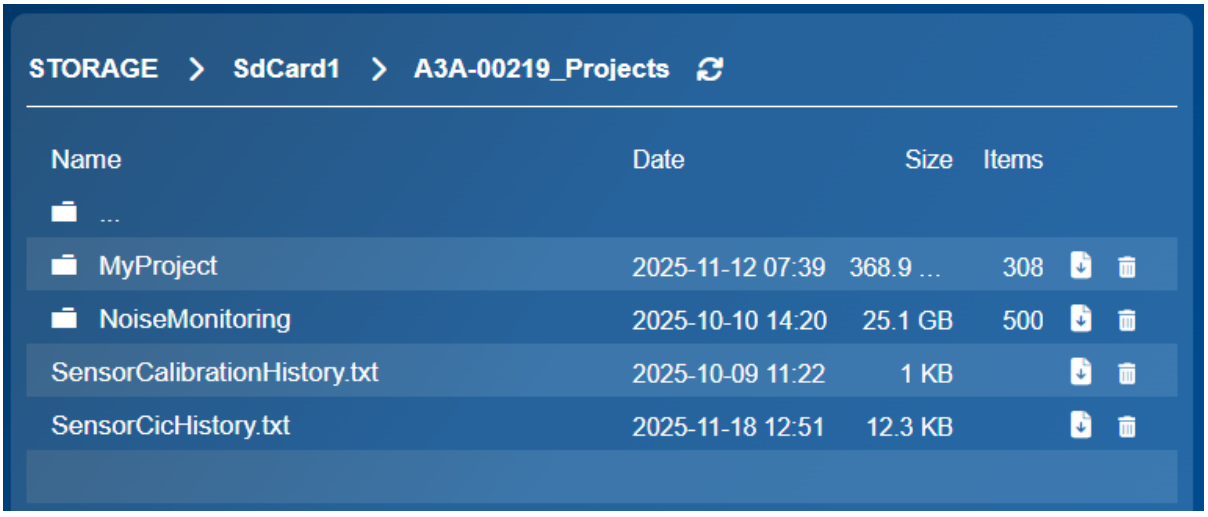
#### 4.1.6.8.1 Auto CIC – Conditions for Execution

Auto CIC runs at the end of an SLM measurement:

- When user stops via front-panel “Stop” or via control API;
- On automatic stop (single timer elapsed, daily scheduler stop, auto_on changed by loading a new configuration);
- On a daily measurement split (CIC occurs at the “New Daily Measurement” time even if split < 24 h);
- Also performed if the user sends *RST to stop an SLM measurement via control API.

#### 4.1.6.8.2 CIC Verification Storage & History

A CIC history file is created and stored for the last verification of each microphone.



XL3 Sensor CIC Logging:

# Hardware Configuration

Device Info: XL3, SNo. A3A-00219-C0, FW1.52, My XL3

# CicLogs

| Date | Time | Time Zone | Model | Serial | Action | Dev_f1 | Dev_f2 | Ref_f1 | Ref_f2 | RefDate | RefTime | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2025-11-18 | 12:51 | UTC +01:00 | M2340 | 1667 | Verification | -0.00 | 0.00 | 103.07 | 102.63 | 2025-11-18 | 12:50 | Passed |
| 2025-11-18 | 12:51 | UTC +01:00 | M2340 | 1667 | Verification | -0.00 | 0.00 | 103.07 | 102.63 | 2025-11-18 | 12:50 | Passed |
| 2025-11-18 | 12:50 | UTC +01:00 | M2340 | 1667 | Reference | | | 103.07 | 102.63 | 2025-11-18 | 12:50 | Done |
| 2025-11-11 | 11:16 | UTC +01:00 | M2340 | 1667 | Verification | 0.03 | 0.02 | 103.07 | 102.64 | 2025-11-10 | 15:11 | Passed |
| 2025-11-10 | 23:59 | UTC +01:00 | M2340 | 1667 | Verification | 0.03 | 0.03 | 103.07 | 102.64 | 2025-11-10 | 15:11 | Passed |
| 2025-11-10 | 16:00 | UTC +01:00 | M2340 | 1667 | Verification | 0.02 | 0.01 | 103.07 | 102.64 | 2025-11-10 | 15:11 | Passed |
| 2025-11-10 | 15:58 | UTC +01:00 | M2340 | 1667 | Verification | 0.02 | 0.01 | 103.07 | 102.64 | 2025-11-10 | 15:11 | Passed |
| 2025-11-10 | 15:11 | UTC +01:00 | M2340 | 1667 | Verification | 0.00 | 0.00 | 103.07 | 102.64 | 2025-11-10 | 15:11 | Passed |
| 2025-11-10 | 15:11 | UTC +01:00 | M2340 | 1667 | Reference | | | 103.07 | 102.64 | 2025-11-10 | 15:11 | Done |

#CheckSum

mz14xpB8Av+5BhxhqSy+vTXT+lnCohKI/1EaNdoF7Xim+ass63XB9LZJ9HVCHU5JmGKT2OUWiU/gSF7shHGEJ/nZWY6FCMxF1aUlQH/FMyAjBbDNXbt7UUFVoC9aBjXwMJ8YRNmxd+qOoEkPKlR2Pi3wW6IGgH6L(

### 4.1.7 Carrying out a sound level measurement

#### 4.1.7.1 Test preparations

The XL3 reads the electronic data sheet of a connected NTi Audio measuring microphone and automatically activates the 48 V Phantom power for the measuring microphone.

- Connect the measurement microphone to the XLR input;
- Switch on the XL3 with the On/Off key ⏻;

> The 48 V Phantom power display in the upper menu bar changes to ASD. The instrument is now ready for acoustic measurements.

- Position the measuring instrument at the measurement location, e.g. mounted on a microphone stand;
- Select the **Sound Level Meter** measurement function and press the side key to switch between the sound level and spectral display;
- Select the display of numerical levels select the levels you are interested in;
- Define which levels you want to have recorded here: Report & Logging .

> The displayed levels behave independently from the recorded levels.

#### 4.1.7.2 Start measurement

> A measurement cannot be started, unless a storage device (SD-card or USB drive) is inserted.

When the XL3 is ready to measure the defined sound levels, press the START button.

- The measurement status display switches first to **STARTING**, then to **LOGGING** (if logging is switched on, otherwise **RUNNING** is displayed);
- Above the timer, the flashing status indicates the measurement in progress.

The measurement can be paused at any time using the Pause function on the screen. Logging continues in the background, but the recorded levels are marked as invalid and excluded from the averages. As long as **PAUSE** is active, the icon flashes. Another tap on will continue the measurement.

The measurement runs continuously until it is stopped. After 24 hours, a new measurement file is opened automatically, which follows the previous day's file without any gaps.

#### 4.1.7.3 Stop measurement

Press the STOP button. The measurement status display switches first to **STOPPING**, then **SAVING** and finally **READY**.

Depending on how the global SAVE configuration is set, the XL3 saves all levels that are defined in the measurement, either automatically to the SD card, or with queries (for more details, refer to chapter Save).

### 4.1.8 XL3 Measurable Indicators

#### 4.1.8.1 Level (L)

All indicators begin with the letter L, which stands for Level, specifically the Sound Pressure Level being measured.

#### 4.1.8.2 Frequency Weightings

These define how the analyzer filters different frequencies:

- A: A-weighting, simulates human hearing and is the most common standard;
- C: C-weighting, used for peak measurements and identifying low-frequency noise;
- Z: Z-weighting (Zero-weighting), a flat frequency response with no filtering.

#### 4.1.8.3 Time Weightings

These define the averaging time used for the measurement:

- F (Fast): A 125 ms time constant for rapid fluctuations;
- S (Slow): A 1000 ms time constant for steady signals;
- I (Impulse): A very fast time constant (35 ms rise, 1500 ms fall) for measuring impulsive noise like hammering; this requires the Extended Noise Measurement option.

#### 4.1.8.4 Reading Types

These define which specific value or calculation is applied to the data:

- eq: Equivalent continuous sound level, the average sound energy over the measurement period;
- inst: The instantaneous current sound level, updated every 500 ms;
- max / min: The maximum or minimum sound level reached during the measurement;

- pk: Peak level, the maximum instantaneous value of the sound pressure wave;
- E: Sound exposure level, the total sound energy normalized to a one-second duration;
- g (Gliding): A moving average Leq calculated over a specific window leading up to the current moment;
- T3 / T5 (TaktMax): The maximum Fast-weighted level recorded within a 3-second or 5-second interval (per DIN 45645-1);

#### 4.1.8.5 Level Statistics (Percentiles%)

These indicate the sound level that was exceeded for n% of the measurement time.

- 1.0% to 10.0%: Usually represents intrusive, short-term noise events;
- 50.0%: The median sound level;
- 90.0% to 99.0%: Typically used to identify the constant background noise level.

#### 4.1.8.6 Calculated Parameters

These indicators compare two measurements to identify specific noise characteristics:

- LAFT5eq - LAeq: Known as TaktMax, this assesses the "impulsiveness" of sound by comparing the 5-second maximum-weighted average to the standard average;
- LAIeq - LAeq: The difference between the impulse-weighted average and the standard average, used to quantify impulsive noise;
- LCeq - LAeq: The difference between C-weighting and A-weighting, which identifies the amount of low-frequency energy in the signal.

### 4.1.9 Measurement File and Reporting tool

#### 4.1.9.1 Measurement File

The measurement file contains the results of measurements, formatted in .txt for easy import into MS Excel. Additionally, it can also be exported as an XL3 file, which is compatible with NTi Audio Data Explorer for further analysis. This PC software has a powerful data processor for easy and fast analysis of sound level measurement data, interpreting the markers automatically.

#### 4.1.9.2 Analysis tool

The Data Explorer software is a PC application that provides professional reports with customized titles and comments, automatically adding relevant header data such as the measurement date, calibration information, and instrument setup, while allowing you to easily include your own company logo.

## 4.2 Reverberation time

To activate the reverberation time measurement, tap the menu icon at the top left  and select "Reverberation time".

In its basic version, the XL3 measures the reverberation time in octave bands from 63 Hz to 8 kHz. You can use an omnidirectional loudspeaker with gated pink noise or an impulse sound source as the sound source. In this case, the broadband level LApk must be greater than 80 dB to trigger the measurement and to avoid false measurements. The results are determined either from a drop of 20 dB (T20) or 30 dB (T30).

The **Advanced Room Acoustics** option extends the range of functions for measuring the reverberation time by:

- 1/3rd Octave band measurements from 50 Hz to 10 kHz,
- Simultaneous measurement of T30, T20, T15 and EDT;
- Adjustable trigger level;
- Parallel audio recording of the decay spectrum;
- Calculation of the room mean value from a series of measurements;
- Individual display and optimization of spectral decay curves (planned).

### 4.2.1 Page selection by means of page key

Use the page key  to toggle between the spectral display, the reverberation time curve and the tabular values. This switching of the display can also be done during a running measurement.

### 4.2.2 Page selection via the display

Alternatively, you may slect the desired display (except settings) also with a horizontal swipe on the touch screen or by typing to the respective icon.

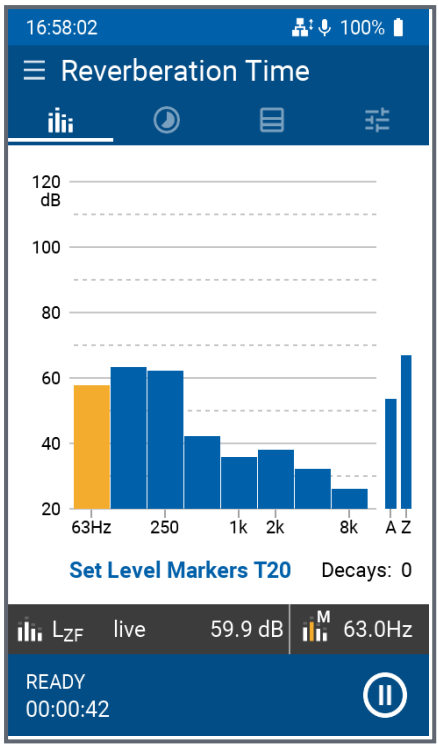
Displays the current spectrum in octave or third octave band resolution. Below the spectrum you will find the information about the measurement mode and the number of recorded measurement cycles.

Shows the averaged reverberation time spectrum of all measurements of the current measurement series.

Here you will find the tabular values of the current or the last measurement performed.

Tapping this icon takes you to the parameter page (not integrated in the page scroll list). Here you can set all settings of the reverberation time measurement and activate a measurement series if required.

### 4.2.2.1 Spectral display

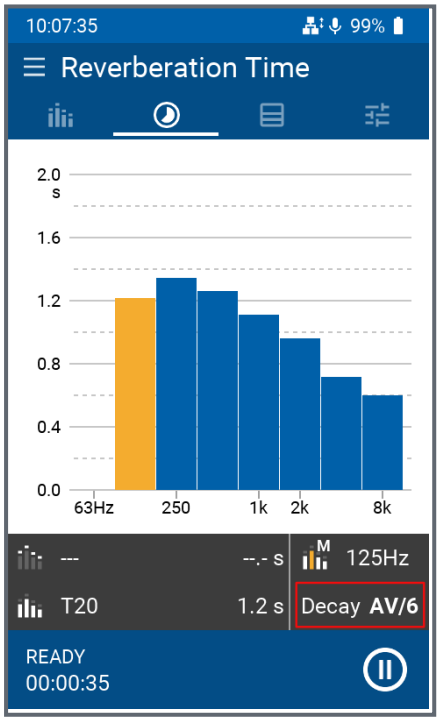



Here the spectrum of the current level is displayed in the selected resolution (octave or third octave bands).

In the dark bar below the spectrum, the current, unweighted level of the yellow colored band appears, which you can select using the arrow keys ← and →.

The blue field at the very bottom shows the measurement status. By tapping the ⏸ icon, you can pause the measurement in progress (Pause); in this state, the icon flashes. By tapping again, the XL3 is ready for the next measurement.

### 4.2.2.2 Reverberation time graph

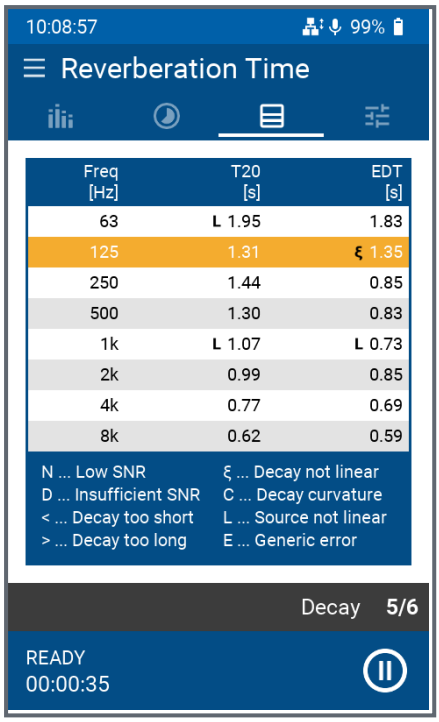



As soon as an initial measurement of the reverberation time has been performed, the device displays the spectral mean values. The single result of the yellow marked band appears below - you can select it with the arrow keys.

By tapping the DECAY field, another arrow menu opens, with which the individual measurements can be visualized.
Bands with measurement errors are marked with an **X** above the bar in the respective measurements.

> ⓘ In this FW version it is not yet possible to delete single measurements.

### 4.2.2.3 Reverberation time table




In this table, those measurement results appear which you have selected during configuration.

By tapping on "Decay" you can call up the values individually (e.g. 5/6) or averaged (AV).

If an error or impairment has occurred during a measurement, a warning message appears before the corresponding measurement result. The respective explanation of these abbreviations can be found below the measurement table.

| Error indicator | Error | Error condition |
|---|---|---|
| N | Low SNR | The signal level at the end of the relevant decay is less than 10 dB above the noise floor. The relevant decay depends on the RT measurement:<br>• EDT: 15 dB below level at start of decay;<br>• T15: 20 dB below level at start of decay;<br>• T20: 25 dB below level at start of decay;<br>• T30: 35 dB below level at start of decay. |
| D | Insufficient SNR | The signal level never reached the required threshold, which depends on the RT measurement:<br>• EDT: 25 dB above noise floor;<br>• T15: 30 dB above noise floor;<br>• T20: 35 dB above noise floor;<br>• T30: 45 dB above noise floor. |

| Error indicator | Error | Error condition |
|---|---|---|
| < | Decay too short | The measured decay is unreliable because the RTA filter roll-off could have influenced it, so the device is measuring the filter roll-off and not the actual decay.<br>The limit value is different for each band, and depends on the band width:<br>• RT60 * BW must be < 16. |
| > | Decay too long | The calculated RT60 is more than 72 seconds.<br>This limit is given by the length of the decay buffer where decay data is stored for RT measurements. |
| ξ | Decay not linear | The regression shows a correlation coefficient (r) below threshold (1-r^2 < 0.7). |
| C | Decay curvature | The ratio T30/ T20 is more than 1.1, showing that the decay curve tends to flatten at the end. |
| L | Source not linear | Only for sound insulation measurements: the excitation signal level shows more than 6 or 8 dB difference between adjacent bands (depends on the SI standard used). |
| E | Generic error | The results seem inconsistent with expectations. |

### 4.2.3 Perform reverberation time measurement

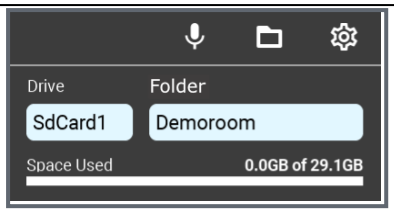
Place the XL3 in the room according to the standards and install the source for the sound signal (e.g. DS3 dodecahedron loudspeaker). The measuring device must not be in the near field of the source, otherwise measurement errors will occur. Also note that measuring reverberation time at low frequencies can be problematic because it is difficult to get enough energy into the room in the lower bands. In addition, the decay spectra are subject to statistical fluctuations, which is why several measurements should always be recorded and averaged.

In larger rooms, the standards require that both the signal source and the measuring device be placed successively in several locations in the room. Again, it is recommended to perform several measurements at each location and to average the results, which are then again included in the averaging of several measurement positions. The XL3 supports this procedure with the "Measurement series" function. See Configure reverberation time measurement.

At the end of the measurement, the XL3 then automatically generates the measurement report as a TXT file. All individual or all sound level measured values are stored.

#### 4.2.3.1 Select project folder

Select the project folder in which all measurements of this room will be saved under the main menu with .



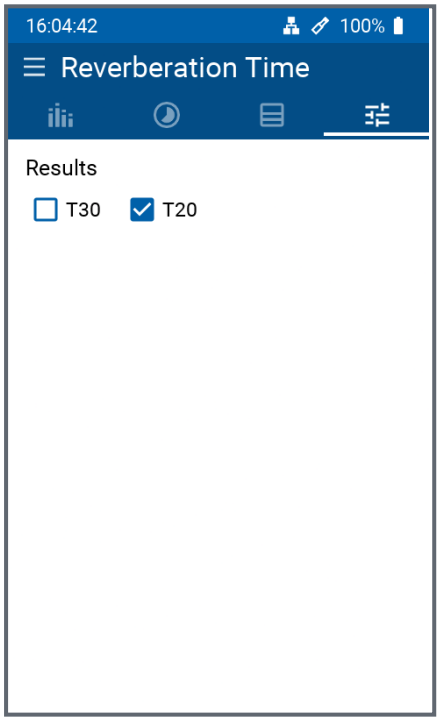

Tap at the bottom left under Drive to select the desired storage and then define the folder where you want to store the results.

In the bar graph below you can see the occupied space of the selected media.

### 4.2.3.2 Configure reverberation time measurement

Here you can set or adjust various parameters and settings for your reverberation time measurement.

If necessary, stop the current measurement to change the parameter(s).

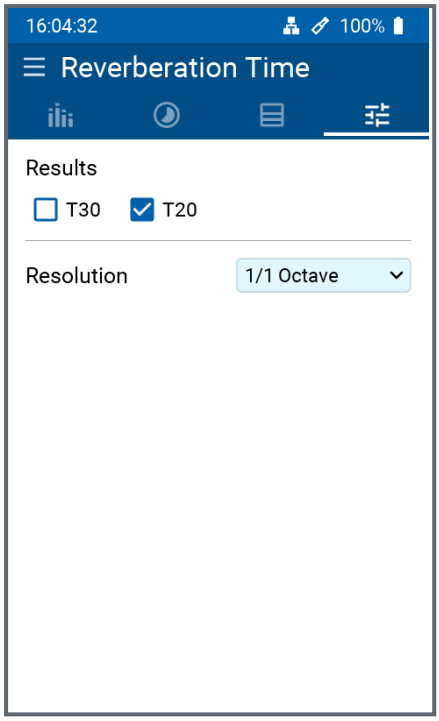



Selectable parameters (base version):

- Calculation basis: T30 or T20 (i.e. the reverberation time T is derived from the 30 dB or 20 dB values).

Fixed settings:

- 1/1 Octave spectral resolution;
- 80 dB trigger level (i.e. the minimum level required to enable triggering).

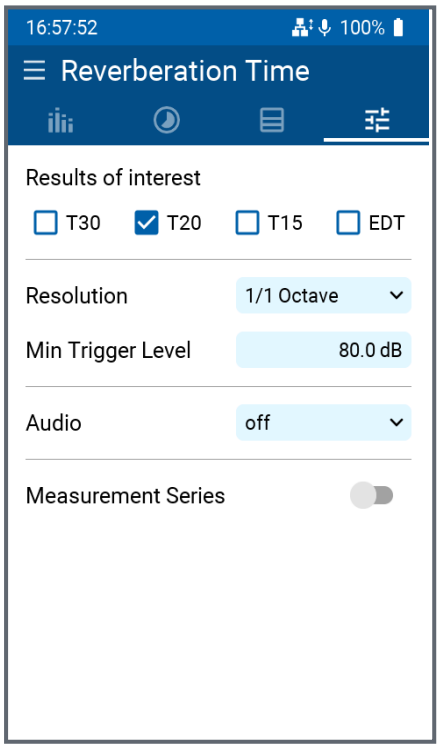



Selectable parameters, available with the **Sound Insulation** option:

- Calculation basis: T30 or T20 (i.e. the reverberation time T is derived from the 30 dB or 20 dB values);
- Spectral resolution: 1/1 Octave or 1/3rd Octave.

Fixed setting:

- 80 dB trigger level (i.e. the minimum level required to enable triggering).




Selectable parameters, available with the **Advanced Room Acoustics** option:

- Calculation basis: T30, T20, T15 and/or EDT;
- Spectral resolution: 1/1 Octave or 1/3rd Octave;
- Minimum Trigger Level: defines the minimum broadband signal level required to trigger a reverberation time measurement. The trigger is based on LZeq evaluated over 10 ms intervals. It activates as soon as the signal level rises above the defined threshold, provided it has previously remained below 50% of that threshold for at least 100 ms. The threshold is adjustable from 50 to 100 dB.
- Parallel audio recording (of the sound drop): off or on;
- Recording of a measurement series*: off or on.

*Please note that in a room you can measure the reverberation time in two ways:

a. In a Single measurement, both the sound source and the measuring device are each at a defined position in the room and are not moved during the measurement - which

typically comprises several measurement cycles;

b. A Measurement series links the results of several individual measurements together. Between every two individual measurements, the sound source and/or the measuring device are moved to a new position. The XL3 stores the respective results of the individual measurements performed and shows these results individually or as a total average value on the display at the end.

#### 4.2.3.3 Perform reverberation time measurement

Place the sound signal source (e.g. DS3 dodecahedron loudspeaker) and the XL3 in the room in accordance with the standards. Make sure that the measuring device is not in the near field of the sound source, otherwise measurement errors will occur. Also note that you usually need to record and average several measurement cycles per measurement position, since decay spectra are subject to statistical fluctuations, especially at low frequencies.

For larger rooms, the standards require that both the sound source and the measuring device be placed sequentially at different locations. Again, it is recommended to record several measurement cycles at each location. From the averaged results of these measurement positions, the overall result of the reverberation time of the room is finally obtained. The XL3 supports this procedure with the "Measurement series" function (see Configure reverberation time measurement).

At the end of a single measurement or a series of measurements, the XL3 automatically generates a measurement report as a TXT file with all individual or the total measured value.

#### 4.2.3.4 Single measurement

Start a single measurement by pressing the START key - the instrument is now ready for the first measurement cycle. Next, activate the noise source or actuate the impulse sound source so that the generated sound level is above the trigger threshold.

As soon as the sound source is muted, the XL3 automatically detects the decay of the sound level and measures the decay curves in each frequency band. The XL3 indicates those frequency bands, in which a valid measurement has been completed, with a tick in the spectrum display.

Each further switching on/off of the noise source or triggering of the pulse source automatically triggers another measurement cycle, the results of which are averaged with the previous ones.

You can switch between the different displays at any time during the measurement without affecting the measurement itself.

Press STOP last to complete the single measurement and save the averaged results in an ASCII text file on the device.

#### 4.2.3.5 Measurement series

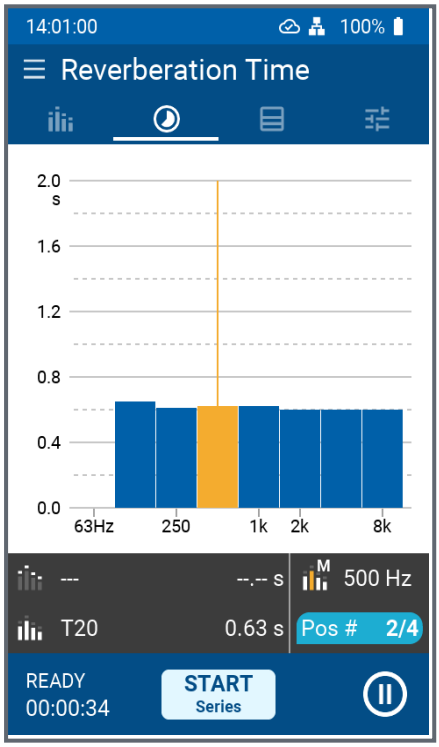
The term "Measurement series" refers to a series of individual measurements at different points in space that are combined to produce a common result. Thus, several individual

measurements are made at different locations in the room and their results are averaged to produce an overall reverberation time result.

The measurement series must be activated in the Configure reverberation time measurement. After that, the START Series icon appears in the measurement displays.


By tapping the START Series button, you start the measurement series and select the storage location.

Next, press the START button to begin the first individual measurement. Once you are done, press the STOP button and confirm saving the results. Now, move the sound source or the analyzer, respectively, to the next position in the room and press the START button to start the second measurement, or end it by pressing on STOP.

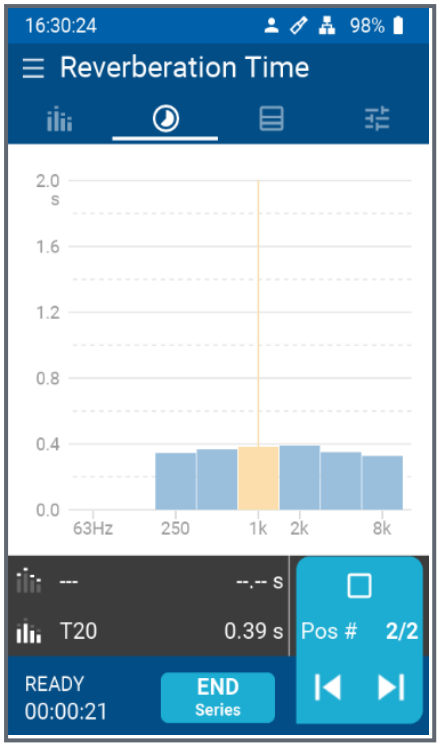



Continue in this manner until you have made the respective individual measurements at all sound source / meter locations.

After completing the last individual measurement, tap the END Series button to end the measurement series and save the averaged overall result of the recorded individual measurements.

At any time you can select and view the results of the individual measurements (e.g. Pos # 2/4) as well as the averaged total value (see figure below) by tapping on Pos # ---,


.

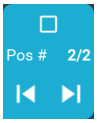



To disable one of the measurements taken in your Measurement Series:

- tap on the position correspondent to the measurement (e.g Pos # 2/2), to extend the position,


;

- deactivate the following button,




.

You will see the graph corresponding to the deactivated measurement.

> Disabled Positions are marked with "Used = 0" in the XL3 RT Report.

### 4.2.4 Measurement File and Reporting tool

#### 4.2.4.1 Measurement file

The measurement file contains the results of reverberation time measurements, formatted in .txt for easy import into MS Excel. Additionally, it can also be exported as an XL3 file, which is compatible with NTi Audio Room Acoustics Reporter for further analysis. This PC software then calculates the required results for room acoustics applications in accordance with the selected standards.

#### 4.2.4.2 Analysis tool

The Room Acoustics Reporter is PC software that automatically creates reports on reverberation time measurements and analyzes frequency response spectra. It helps acousticians and experts visualize and evaluate measurement data from the Sound Level Meter.

- IEC 61260, GB 50371, ANSI/ASA S12.2-2008, ANSI/ASA S12.2-2008, DIN 15996:2008, ISO R 1996-1971, ASR A3.7:2018, DIN 18041: 2016, ISO 3382-1:2009, ISO 3382-2:2008, ÖNORM B 8115-3:2015, ASTM C423-17, ISO 354:2003

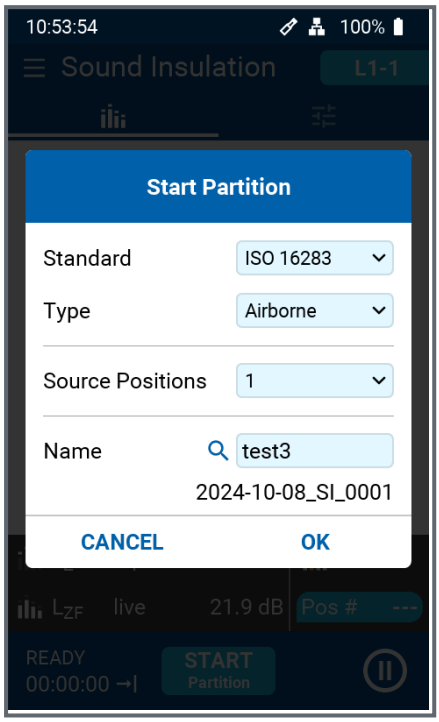
## 4.3 Sound insulation

Effective sound insulation is a crucial factor in building design, and the XL3 provides extensive support for measuring various procedures in the application of building acoustics. This includes:

- Airborne sound insulation;
- Impact sound insulation;
- Facade sound insulation.

Users can access the measurement function by tapping the menu icon in the upper left corner and selecting “Sound Insulation”. The XL3 allows for continuous recording and display of the individual measurements needed to assess the desired sound attenuation.

### 4.3.1 Start partition




Tap the button START Partition to start.

> Wear appropriate hearing protection before activating the sound source!

- Standard:
  - ISO 16283;
  - Document E;
  - ASTM.
- Type:
  - Airborne;
  - Impact;
  - Facade.
- Source Positions:
  - 1 to 4.

### 4.3.2 Page selection by means of page key

Press the page key to toggle between the numerical and spectral display. This change is possible without restriction even during a running measurement.

### 4.3.3 Page selection via the display

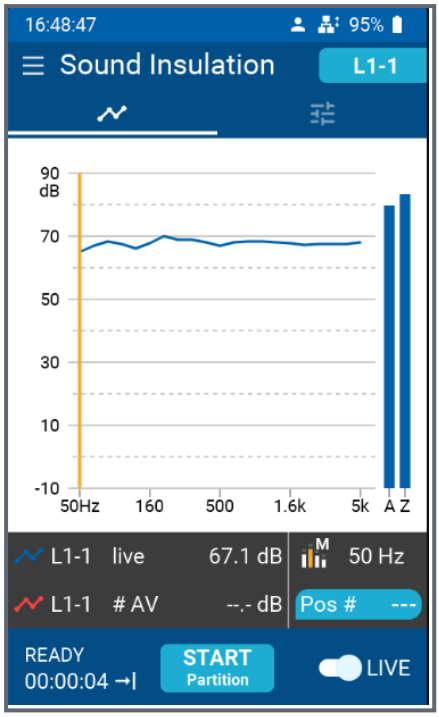
You can also select the desired display with a swiping motion, or by tapping the corresponding icons.


Shows the Sound Insulation measured values and displays the spectral results

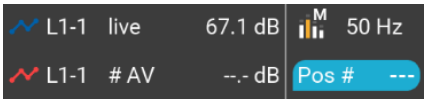
In this menu the sound level meter is configured and the layout of the numerical display can be adjusted. These settings are detailed under Settings display.

L1-1 The menu Sound insulation shows the measurements required for each of the available standards and for each partition. You can complete these measurements in any order, allowing you to import data from previous measurements. This feature helps to save time and optimize a series of measurements.

### 4.3.4 Spectral display



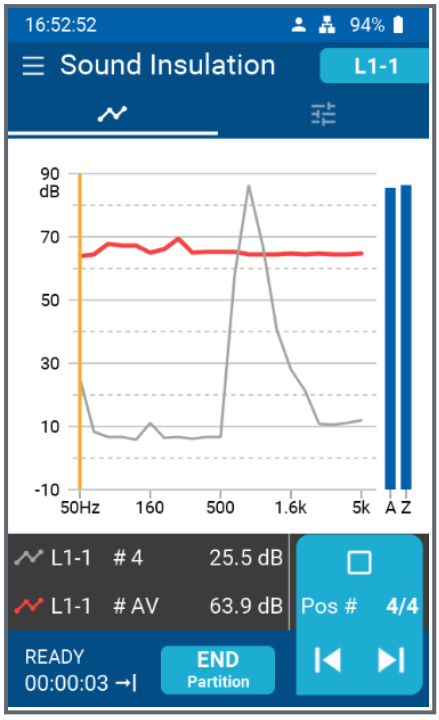

- If you tap on, for example, L1-1, the page displaying the current sound level spectrum in third octave band resolution will appear.
- The display allows to navigate through the single band values of Live and average results using the cursor, arrow keys ← and →;




- Moreover, at any time, you can tap the Pos # 0/0 button at the bottom right to view the measured results up to that point or their average value “AV”;
- Live data LIVE can be switched on and off manually, but no longer interferes when it is switched off.
- To start the measurement, tap the button START Partition .

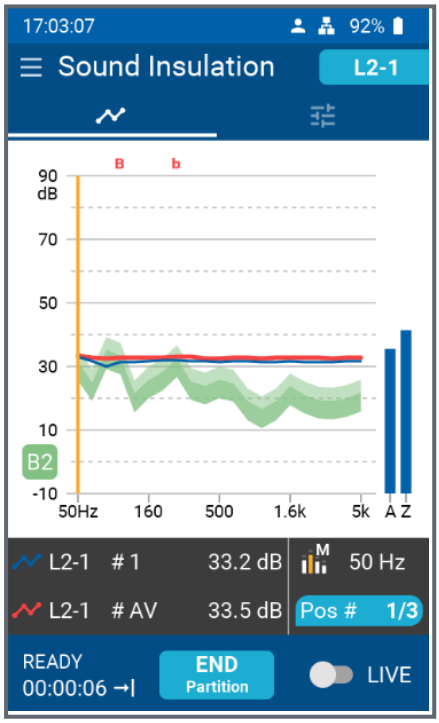

- The average of the active position is shown in red.

> ⚠ When displaying the sending room level, the maximum difference between neighboring bands of the sound soruce are checked acccording the the applied standard. Exceedings are marked with an A .




- When a position is disabled, the result is updated immediately.

> Disabled measurements are indicated as grey in the "Select Measurement" screen L1-1 .

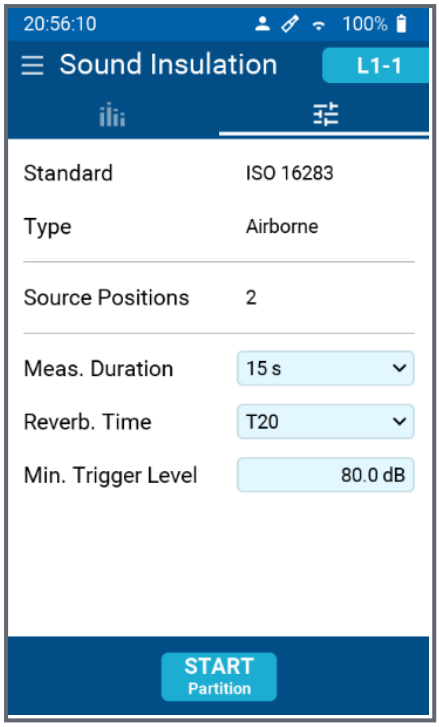



The background noise level B2 is shown in the L2 results screen to allow identifying potential conflicts.

> If an L2 band is less than 6 dB or 10 dB above the corresponding B2 band, it is labelled b or B respectively in the XL3 display.

### 4.3.5 Settings display

To select the desired page, tap the corresponding button at the top right of each page.

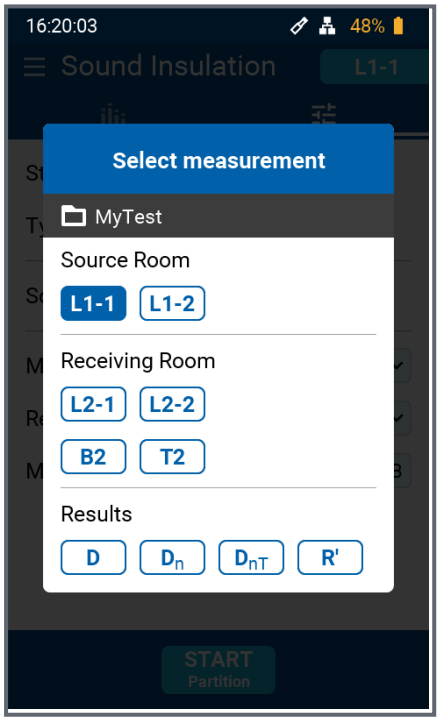



On the "**Settings**" page you can make the following settings:

- SLM measurement duration: 6, 15, 30 or 60 seconds;
- Reverb. Time: T20 or T30;
- Min. Trigger Level: 80 dB.

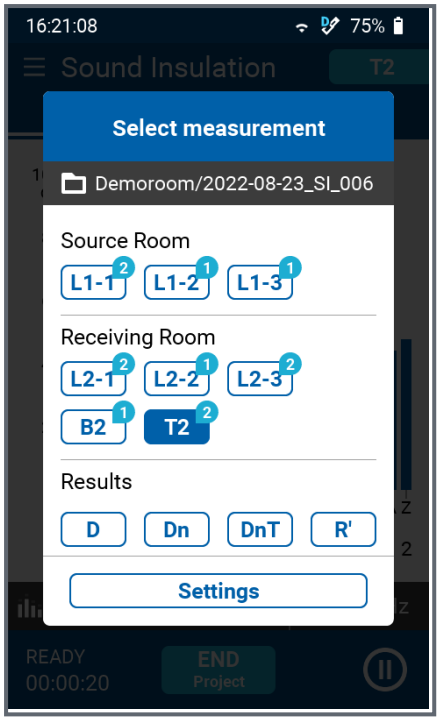
> Select the appropriate settings before starting measurements!

### 4.3.6 Select measurement display

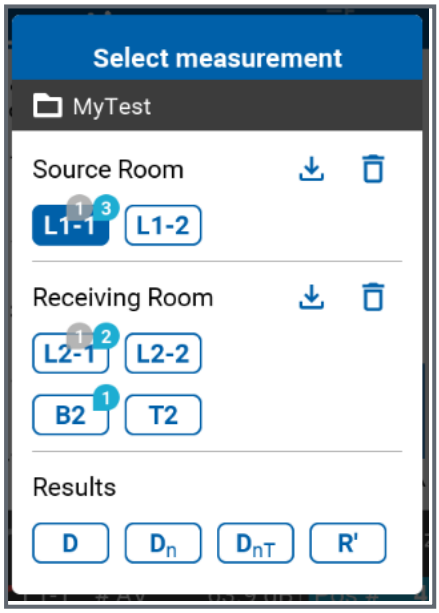



At the "**Select measurement**" page, you may choose the next measurement to be conducted, as well as view the results.

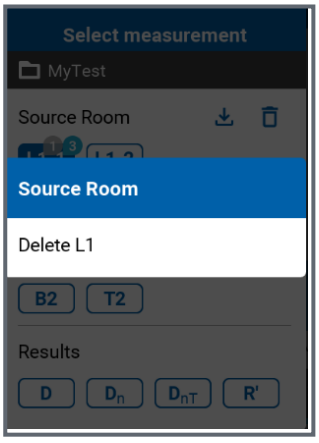
- Transmitting room: L1-x = position of noise source in the transmitting room (number of available positions depends on the afore-mentioned Setting off);
- Receiving Room:
  - L2-x = measuring position in the receiving room (number of available positions depends on the above-mentioned setting off);
  - B2 = Background sound level in the receiving room;
  - T2 = Reverberation time in the receiving room.
- Results: D, Dn, DnT or R';

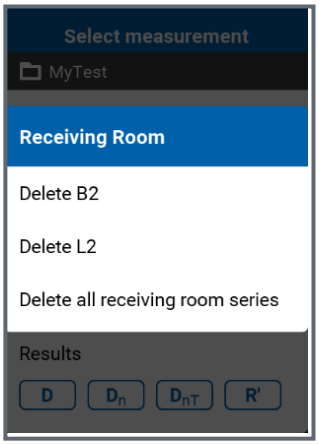



NOTE: During a measurement series, you can check the number of individual measurements taken in the transmitting or receiving room at different sound source positions on the "Select measurement" page.




It is possible to exclude individual measurements from the averaging process. This can be done either directly after a faulty measurement or in post-processing.



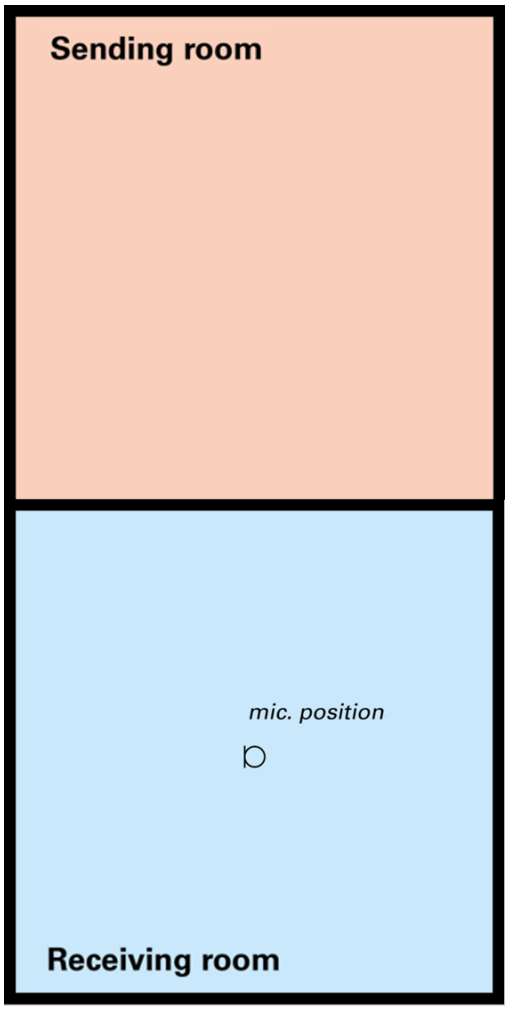

Active and excluded measurements are clearly indicated in the overview. This ensures that an overview is always maintained.

### 4.3.7 Perform sound insulation measurement

The measurement process involves placing the noise source in transmitting room and measuring parameters in both the transmitting and receiving rooms. For this purpose, the XL3 shows on the display, or the sound level spectrum in the transmitting or receiving room, i.e.:

- L1: Level in the sending room;
- L2: Level in the receiving room;
- B2: Background level in the receiving room;
- T2: Reverberation time in the reception room.

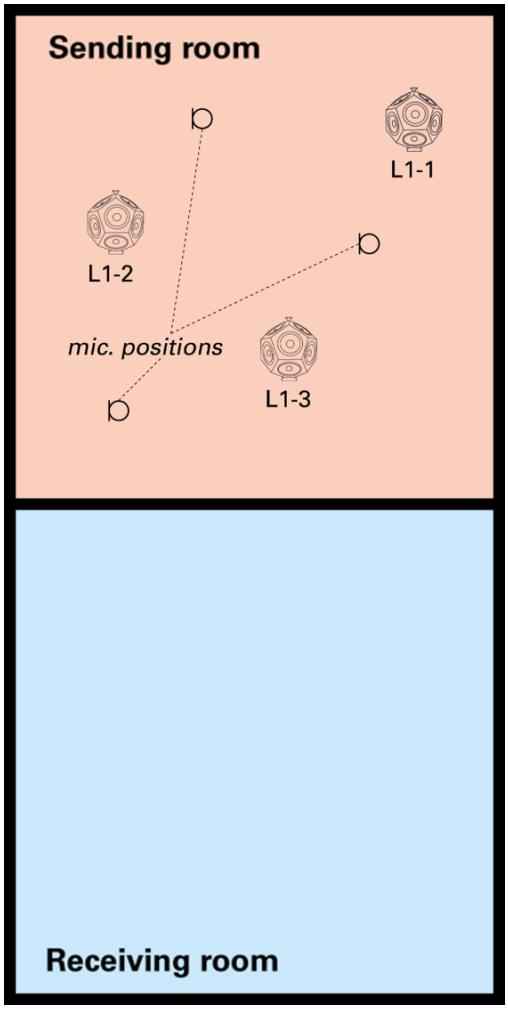
#### 4.3.7.1 Background Noise Measurement in the Receiving Room




All measurements can be carried out in the desired order without influencing the final result; however, it is recommended to start with the background level in the receiving room. This initial measurement helps the user understand the appropriate sound level at which the sound source should be set to ensure a good signal-to-noise ratio.

To measure the background sound level B2 in the receiving room (i.e., with the noise source turned off). To do this, select B2 on the "**Select measurement**" page and press the START button.

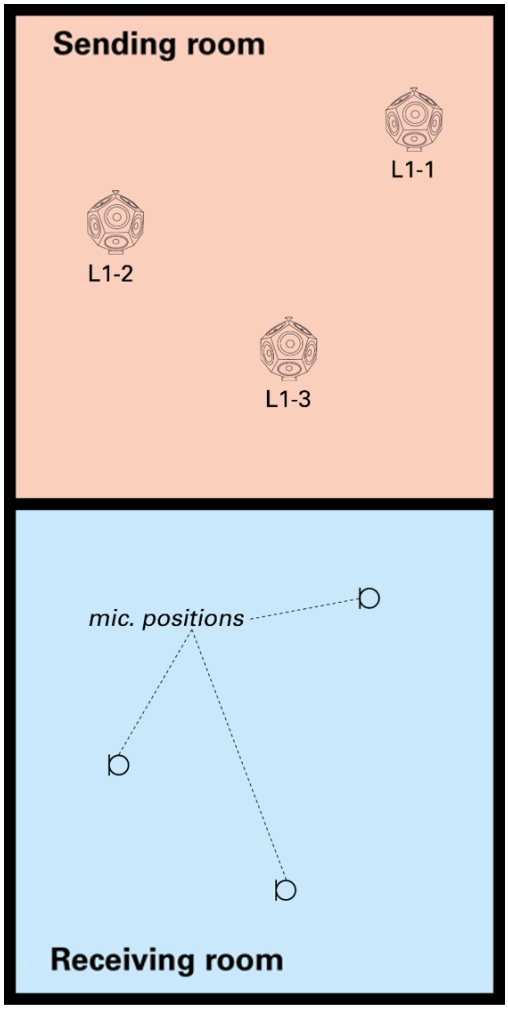
### 4.3.7.2 Sound Level Measurement in the Sending Room




Switch on the noise source (e.g. dodecahedron loudspeaker DS3) and move to the desired measurement position. Then, press the START key to initiate the first measurement and wait until it is completed. Move to the next measurement position and press the START key again to start the second (or third, etc.) sound level measurement in the receiving room.

Once you have taken enough individual measurements for L1-1, press the STOP key.

### 4.3.7.3 Sound Level Measurement in the Receiving Room



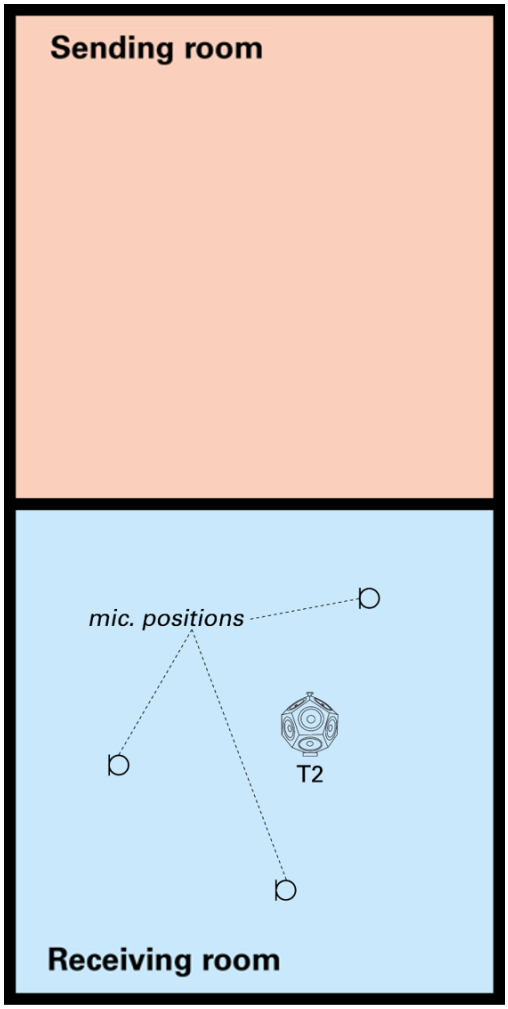

Proceed to the L2 receiving room and choose L2-1 located on the "**Select measurement**" page. Activate the sound source (which is still placed at position #1 in the transmitting room) and press the START button to initiate the initial sound level measurement in the receiving room.

Proceed with conducting the remaining measurements in the receiving room for the data set L2-1 and then press the STOP button.

Select L2-2 on the "**Select measurement**" page and position the noise source in the transmitter room at position #2.

Repeat the aforementioned measurements in both the transmit and receive rooms for noise source position #2. Repeat this process until all L1-x and L2-x measurements for different noise source positions in the transmitter room are completed.

#### 4.3.7.4 Reverberation Time Measurement in the Receiving Room




Now position the dodecahedron loudspeaker in the receiving room to determine the reverberation time T2. Choose T2 on the "**Select measurement**" page. Press the START button to commence the reverberation time measurement and toggle the speaker On and Off multiple times. Then press the STOP button.

Conclude the measurement series by first pressing the STOP button and then tapping END Partition. You can now review the measurement results D, Dn, DnT, or R' individually by pressing the corresponding button under "**Results**".

### 4.3.8 Measurement File and Reporting tool

#### 4.3.8.1 Measurement File

The measurement file contains the results of sound insulation measurements, formatted in .txt for easy import into MS Excel. Additionally, it can also be exported as an XL3 file, which is compatible with NTi Audio. Sound Insulation Reporter for further analysis. This PC software then calculates the required results for building acoustics applications in accordance with the selected standards.

#### 4.3.8.2 Analysis tool

The Sound Insulation Reporter software is a PC software that provides all the standard reports for Airborne, Impact and Facade sound insulation measurements, such as:

- ASTM E336, ASTM E413, ASTM E1007, ASTM E989, ASTM E966, ASTM E1332, BB93, DIN 4109, Document E, GB/T 19889, ISO 16283, ISO 140, ISO 717, ISO 10140, NEN 5077:2019, SIA 181:2006, SIA 181:2020

## 4.4 Speech Intelligibility STIPA

The STIPA analyzer option allows reliable measurement of the speech transmission index (STI). Besides the single value STI or CIS (= common intelligibility scale) test result, a detailed view of the modulation indices and individual band level results is provided. The STIPA analyzer meets the standard IEC 60268-16, edition 5 released in 2020. The XL3 also supports noise corrections, automated averaging of measurements and the older standard editions 2, 3 and 4.

The intelligibility of speech depends on:

- Signal-to-noise ratio;
- Sound pressure level;
- Ambient noise level;
- Reverberation time;
- Reflections;
- Frequency response;
- Distortion;

The speech intelligibility measurement function STIPA is an option for the XL3 Acoustic Analyzer. Ask your local representative for purchasing details.

### 4.4.1 Signal Source

Choose the applicable STIPA test signal source:

| | |
|---|---|
| NTi Audio TalkBox | The NTi Audio TalkBox simulates a person talking at a precise acoustic level, enabling the measurement of the complete signal chain including the microphone.<br>• Place the NTi Audio TalkBox in front of the microphone at the typical position of the talking persons head;<br>  • As a guideline, typically position the microphone at 1 - 1.2 meters above ground in sitting areas or 1.5 - 1.8 meters in standing areas. Also, directly in front of the speakers or very close to a wall are examples of positions that are not typical.<br>• Select Track 1 for the STIPA test signal;<br>• Select Output Mode to Speaker; you should hear the STIPA test signal. |
| Minirator MR-PRO | The Minirator MR-PRO is used for electrical signal injection into public address systems that commonly use alarm messages from a hard drive (systems without a microphone). |
| Other Audio Player | Register the XL3 and download the STIPA test signal at https://my.nti-audio.com/support/xl3 . The maximum tolerable deviation in test signal playback sample frequency is 0.1%. |

### 4.4.2 Page selection by means of page key

Press the page key  to toggle between the level, the modulation indices at octave bands, and the ambient noise correction. This change can be made without restriction, even during an ongoing measurement.

### 4.4.3 Page selection via the display

You can also select the desired display with a swiping motion, or by tapping the corresponding icons.



The STIPA display shows the STI index result, LAeq, LAS, and the Bargraph with an interpretation of the speech intelligibility measurement result.

The Table result display shows the Octave Bands, Sound Pressure Level Leq for the individual time-averaged octave band level Leq, and the STIPA Modulation Ratio mr1 and mr2.

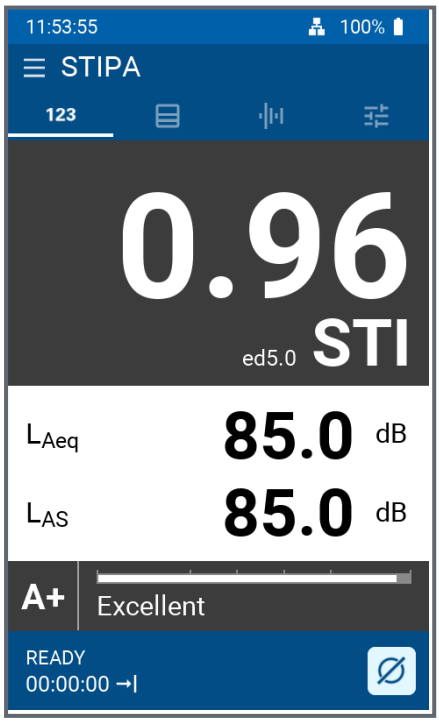
The Ambient noise correction display allows you to activate, or deactivate the ambient noise correction, which is composed of an octave band spectrum, LZeq for the Frequencies 125 Hz - 8 kHz in 1/1 octave band resolution.

The Settings display shows the standard editions: ed5.0, ed4.0, ed3.0, and ed2.0. It also indicates the units for measurement, such as STI and CIS, and includes a time selection for ambient noise.

### 4.4.4 STIPA display



Use only the original NTi Audio test signal for speech intelligibility measurements with the XL3. Other signals may not seamlessly loop, thus causing wrong measurement results!




This display shows the run status of the measurement.

- Measurement Result
  - Single value speech transmission index result.
- Sound Level LAeq
  - Shows the time-averaged sound level of the 15 seconds measurement cycle time.
- Sound Level LAS
  - Actual sound pressure level.

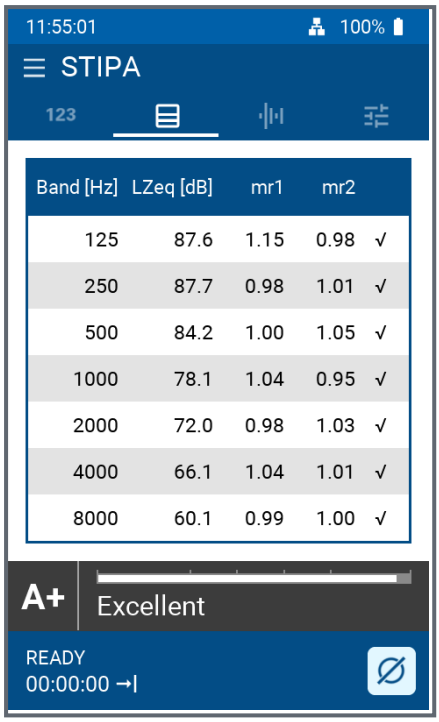
Bargraph display and interpretation of the speech intelligibility measurement result

- Excellent 0.75 - 1.00 STI
- Good 0.60 - 0.75 STI
- Fair 0.45 - 0.60 STI
- Poor 0.30 - 0.45 STI
- Bad 0.00 - 0.30 STI

The STI value is shown as a letter representing the qualification scale below. Listed are also examples of typical application environments.

| Band | STI Range | Examples of typical uses |
|---|---|---|
| A+ | > 0.76 | recording studios |
| A | 0.72 - 0.76 | theatres, speech auditoria, parliaments, courts |
| B | 0.68 - 0.72 | theatres, speech auditoria, parliaments, courts |
| C | 0.64 - 0.68 | teleconference, theatres |
| D | 0.60 - 0.64 | class rooms, concert halls |
| E | 0.56 - 0.60 | concert halls, modern churches |
| F | 0.52 - 0.56 | PA in shopping malls, public offices, cathedrals |
| G | 0.48 - 0.52 | PA in shopping malls, public offices |
| H | 0.44 - 0.48 | PA in difficult acoustic environments |
| I | 0.40 - 0.44 | PA in very difficult spaces |
| J | 0.36 - 0.40 | not suitable for PA systems |
| U | < 0.36 | not suitable for PA systems |

### 4.4.5 Table result display




Octave Bands:

- Frequencies 125 Hz - 8 kHz in 1/1 octave band resolution.

Sound Pressure Level Leq

- Individual time-averaged octave band level Leq.

STIPA Modulation Ratio mr1, mr2

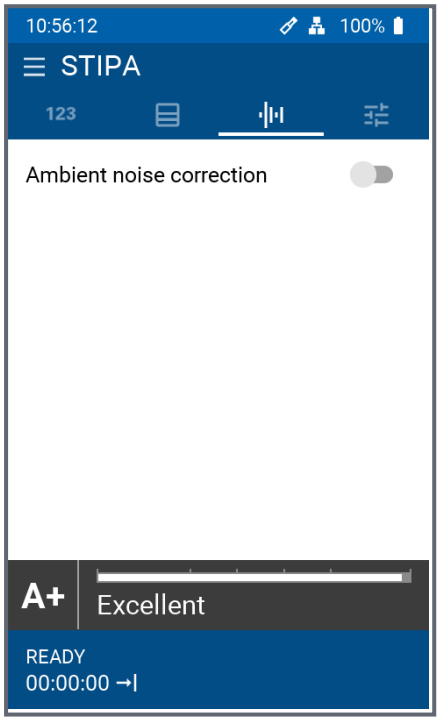
- For good speech intelligibility it is mandatory that the integrity of the transmitted voice signal modulations are preserved. Therefore, STIPA is based on measuring the MTF (Modulation Transfer Function). This function quantifies the degree to which the voice modulations are preserved in individual octave bands. The STIPA method determines the MTF by analyzing the seven frequency bands. Each band is modulated with two frequencies, resulting in the modulation ratio mr1 and mr2. All indexes together combined with psycho-acoustic models provide the single-value speech intelligibility result.

| Band | mr1 | mr2 |
|---|---|---|
| 125 Hz | 1.60 Hz | 8.00 Hz |
| 250 Hz | 1.00 Hz | 5.00 Hz |
| 500 Hz | 0.63 Hz | 3.15 Hz |
| 1 kHz | 2.00 Hz | 10.00 Hz |
| 2 kHz | 1.25 Hz | 6.30 Hz |
| 4 kHz | 0.80 Hz | 4.00 Hz |
| 8 kHz | 2.50 Hz | 12.50 Hz |

### 4.4.6 Ambient noise correction display

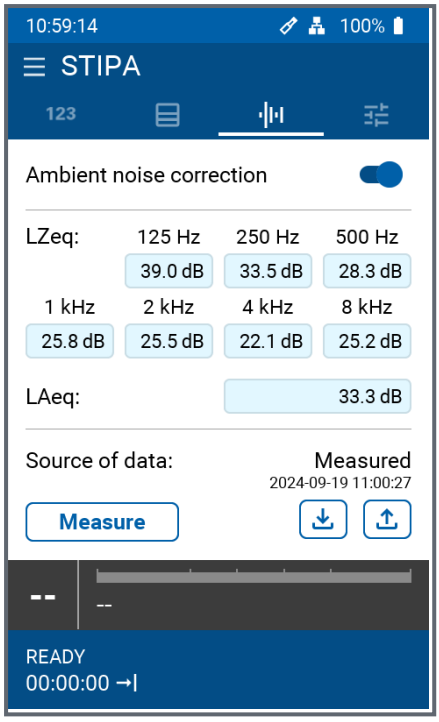
Measuring the speech intelligibility index under realistic environmental conditions is often not feasible; e.g., playing the test signal in a railway station at emergency levels during peak hours will irritate passengers. Additionally, at rush-hour the characteristics of ambient noise might be highly impulsive, while a pre-requisite for accurate speech intelligibility measurements is a negligible impulsivity in the ambient noise. Under such circumstances the speech intelligibility measurement should be shifted to a more suitable time of the day; e.g. night time.

- The ambient noise has to be sufficiently static during the measurement. A signal-noise ratio of 15 dB or higher is recommended to achieve best speech intelligibility. Impulsive ambient noise during the measurement, such as speech, causes severe measurement errors. The STIPA result is usually too high.
- Fluctuating noise is detected by measuring the direct STI in the absence of the test signal. Carry out these measurements at least at a representative set of locations. If the STI is too high (e.g. STI > 0,3), the measurement results are likely to be erroneous. In this case the speech intelligibility measurement should be carried out without the presence of noise.




Utilize the ambient noise correction for such instances.

- At locations with varying conditions (e.g., some public areas with few people and other areas with crowds) the worstcase speech intelligibility should be measured. Consult the local regulations (e.g. the NFPA code in the U.S.) for directives concerning measurement locations and number of required measurements under which circumstances.

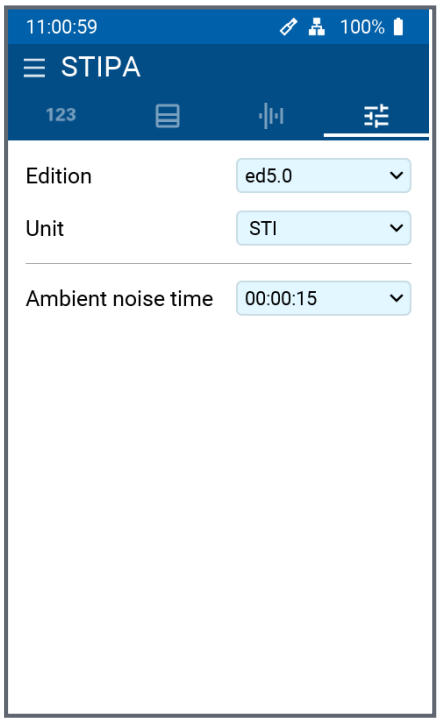



- Activate the “**Ambient noise correction**” option;
- LZeq shows the individual time-averaged with frequencies 125 Hz - 8 kHz in 1/1 octave band resolution;
- LAeq shows the weighted equivalent value in A.
- The START button activates the ambient noise measurement, loading a progress bar.
- The export button allows you to save documents in .txt format

> ⚠ If the file name already exists, you must decide whether to cancel or overwrite the old file.

- The import button allows you to import Ambient noise files in format .txt.

### 4.4.7 Settings display




**Edition:**

- ed5.0: actual edition released in 2020 with continuous level dependent auditory masking function;
- ed4.0: old edition released in 2011 with continuous level dependent auditory masking function;
- ed3.0: old edition released in 2003 with stepped level dependent auditory masking function;
- ed2.0: old edition released in 1998 with fixed masking function.

**Unit:**

- The speech intelligibility result is displayed in STI (Speech Transmission Index) or CIS (Common Intelligibility Scale), whereby CIS is calculated as CIS = 1 + log STI.

**Ambient noise time:**

- examples between 5 seconds and 10 minutes. Default 15 seconds.

### 4.4.8 Perform STIPA measurment

#### 4.4.8.1 Test Preparations

The XL3 reads the electronic data sheet of the connected NTi Audio measurement microphone and switches the 48 V Phantom power automatically on as follows:

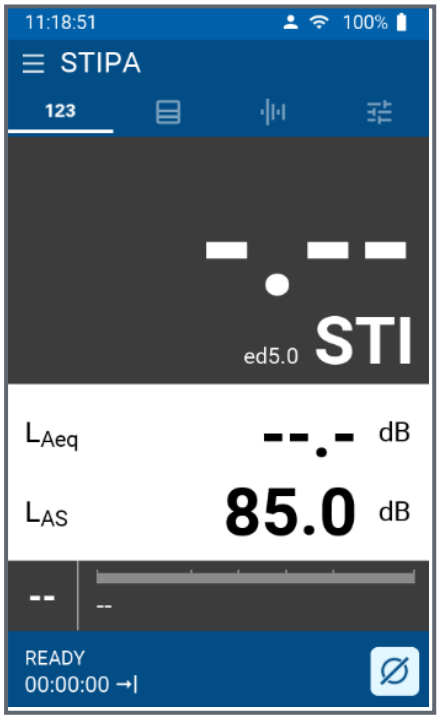
- Connect the measurement microphone to the XL3.
- Switch on the XL3.

> The 48 V Phantom power indication in the upper menu bar changes to ASD. The XL3 is ready for acoustic measurements.

- Position the XL3 at the measurement location using a microphone stand or tripod.
- Select the STIPA measurement function in the measurement menu.
- Prepare the environment for the measurement. For example mute all sound sources to establish silence.

> No impulsive noise shall occur during the speech intelligibility measurement as well no speaking or other noise sources should be allowed near the measurement microphone.

#### 4.4.8.2 Start STIPA Test Signal




Select the STIPA signal source according your application requirements.

- Switch on the STIPA test signal at the signal source.
- Set the acoustic sound pressure level of the PA system to simulate the typical announcement level; e.g. LAS = 85 dB.

#### 4.4.8.3 Start Measurement

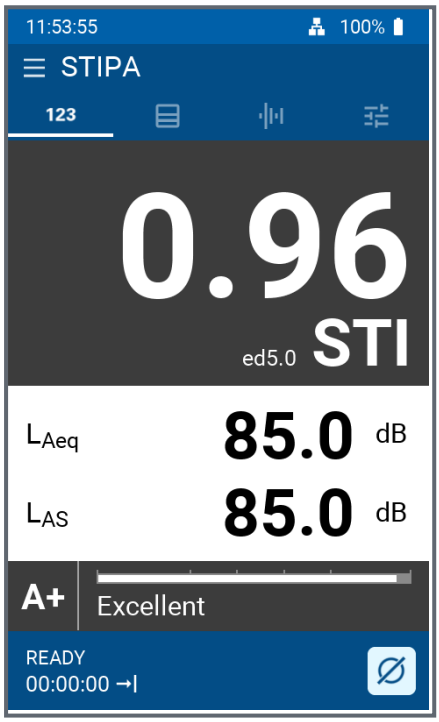
Select measurement positions as stipulated by local regulations. As a guideline, typically position the microphone at 1 - 1.2 meters above ground in sitting areas or 1.5 - 1.8 meters in

standing areas. Also, directly in front of the speakers or very close to a wall are examples of positions that are not typical.

The person taking the measurements should be out of the acoustic field, so as not to affect the measurement results. For this purpose, the measurement microphone can be mounted on a microphone stand and connected with the ASD Cable to the XL3.

Low speech intelligibility readings can be caused by

- Excessive sound reverberation, echoes or reflections;
- Poor speaker directivity or speaker coverage;
- Speaker level setting incorrect; e.g. low signal-to-noise ratio.




- When necessary, activate ambient noise correction.
- Press START;
- The progress bar switches to RUNNING.

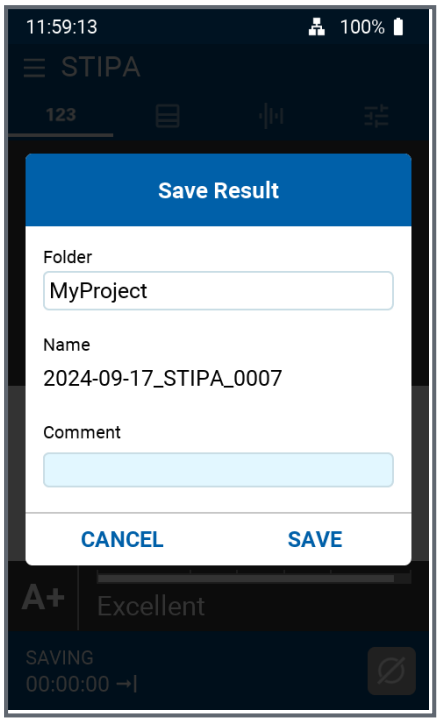
  The test result tendency is shown on the bargraph, marked with Bad, Poor, Fair, Good and Excellent.

### 4.4.8.4 German Standard VDE 0833-4 Requirements

| | |
|---|---|
| STI > 0.63 | One single measurement is sufficient.<br>ⓘ An STI > 0.63 implies that the speech intelligibility is higher than 0.5 with a confidence level of 95%. |
| STI < 0.63 | Perform three subsequent measurements at this measurement position.<br>• If the maximum result deviation of these three measurements is > 0.03 then a further three measurements shall be performed.<br>• If the maximum result deviation of these measurements is > 0.05 then the cause of this instability shall be evaluated and removed.<br>• The arithmetic average of the performed three or six measurements has to be reported. |

Utilize the STIPA Reporting Tool for the documentation of your measurements according the standard.

### 4.4.8.5 Stop Measurement and Data Saving




After the period of 15 seconds the speech intelligibility measurement finishes automatically. The progress bar indications switches to and the final test result is displayed. The measurement result is stored automatically.

- Switch off the STIPA test signal.
- Press **SAVE** to confirm. The measurement data is stored on the SD Card in ASCII format.

The measurement is completed.

### 4.4.8.6 Averaging display

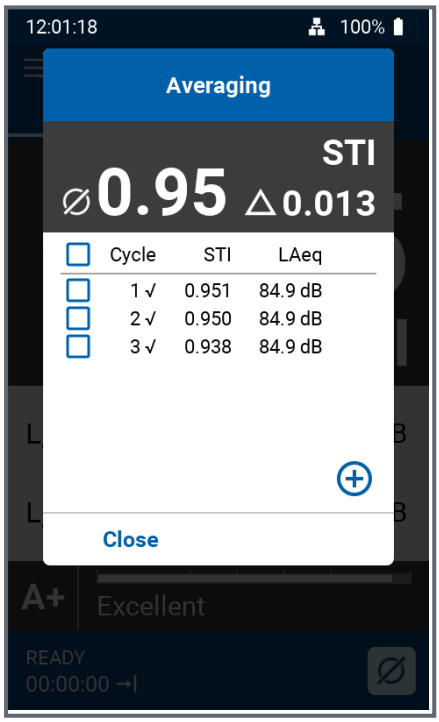
The standard IEC 60268-16 recommends averaging two or three subsequent results taken at the same measurement location.

The German Standard VDE 0833-4 requires performing minimum three subsequent measurements for one measurement position in case of STI < 0.63.

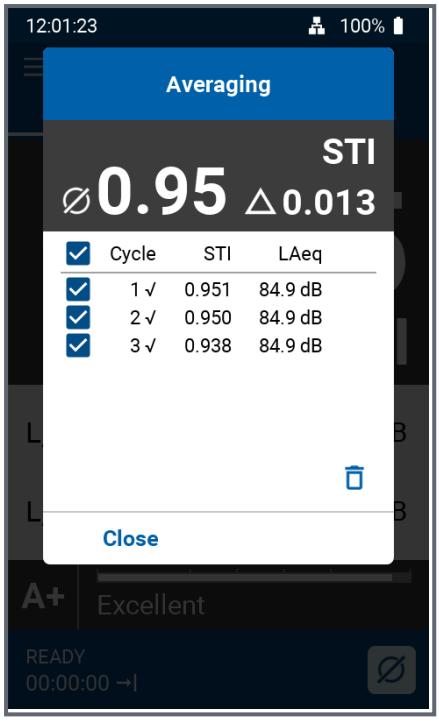
The XL3 Analyzer offers automated averaging of two up to eight speech intelligibility results based on these standard requirements.

### 4.4.8.7 Start Averaging

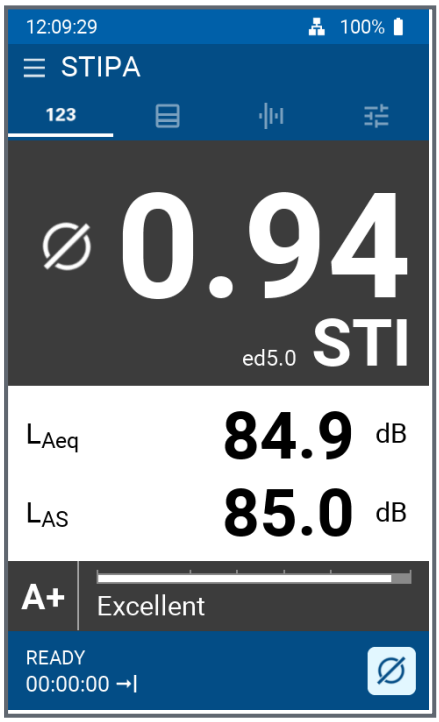

- Select the averaging page Ø
  - STI-Average Ø: Calculated average of the recorded cycle results
  - Difference △: Difference (Max – Min) of the of the recorded cycle results.
- Repeatability of measurement result: Since a dedicated noise test signal is used, the result may deviate by a of maximum 0.03 STI (=Max-Min) at the same measurement position.




- Tap ⊕ and the measurement starts automatically.




- Select measurement box to remove an unwanted measurement.




- The symbol ⌀ indicates that the averaged STI value is displayed.

### 4.4.9 Measurement File and Reporting tool

#### 4.4.9.1 Measurement File

The measurement file contains the results of STIPA measurements, formatted as a .txt file for easy import into MS Excel. It is also compatible with the NTi Audio STI Reporting Tool, allowing for further analysis. This tool combines speech intelligibility measurements taken in quiet conditions with real-time ambient noise data, simulating expected speech intelligibility in practical scenarios.

#### 4.4.9.2 STI Reporting Tool

The STIPA Reporting Tool generates measurement reports compliant with various standards, including AS 1670.4, CEN/TS 54-32:2015, and others. Users can directly import data, including ambient noise measurements, to display corresponding Speech Transmission Index (STI) or Common Intelligibility Scale (CIS) values.

The tool is available for free download from the NTi Audio Support website for registered users, with a note to enable macros upon opening the document.

For more details on the functionalities of the XL3 Acoustic Analyzer, please visit the NTi Audio website.

# 5 Web Server

Once you have activated the internal web server, you can connect your XL3 to the Internet and both remotely control the device and download measurement data during operation.

## 5.1 Activate the web server

Under System Settings and Connections (described under Commissioning), setting an individual password enables the web server.

> To access the XL3 via a network, there must be an active network connection ( ) and the web server must be active. The LED can be yellow, blue or white. After that, you can remotely control the XL3 from any HTML-enabled device.

## 5.2 Accessing the web server

This section explains how to access the XL3 web server, both within the same network and from an external network.

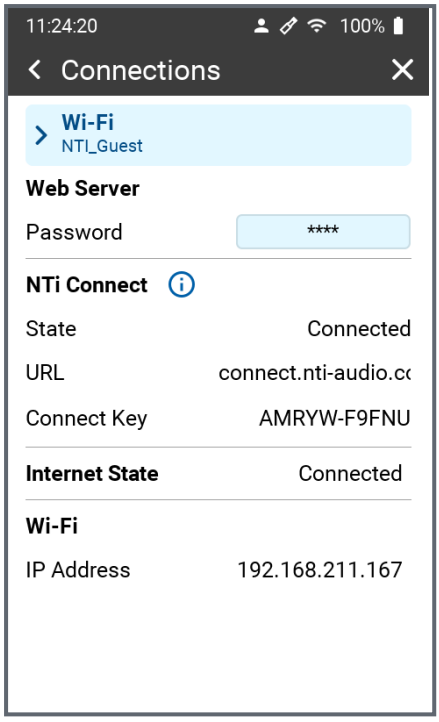
### 5.2.1 Within the same network

If the meter is connected to the same subnet as the computer making the query, you can access it using its internal IP address, as there are no firewalls between them.

- Open your preferred web browser (e.g., Chrome, Firefox, or Edge);
- Enter the IP address of the XL3 (e.g., 192.174.xxx.xx) in the address bar. You can find this IP address in the current network settings of theXL3.

### 5.2.2 From the internet

When the device is connected to the Internet, its internal IP address is typically not visible due to one or more intervening firewalls. In this case, you can establish a connection using the NTi Connect service at connect.nti-audio.com, which is free to use under fair use conditions.




Each XL3 has a unique key that can be used to address it from the Internet.

You will find this described under **System Settings** and **Connections** in the chapter Commissioning.

> The Connect Key is the unique key to access your XL3 in the cloud.

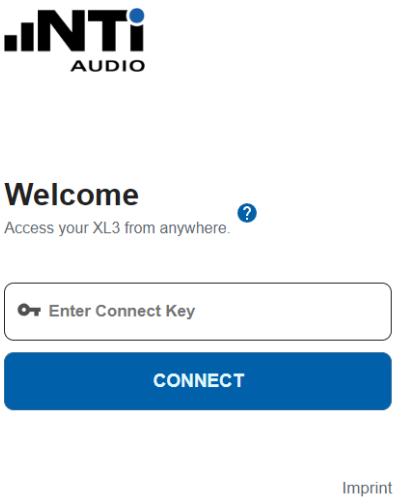
## 5.3 Web pages

The NTi Connect service (connect.nti-audio.com) provides secure worldwide access to XL3 data files and the API.

### 5.3.1 Login

To login, follow the instructions below:

- Open a browser and type connect.nti-audio.com.
- A web page opens





- Now type in your Connect Key and click connect.

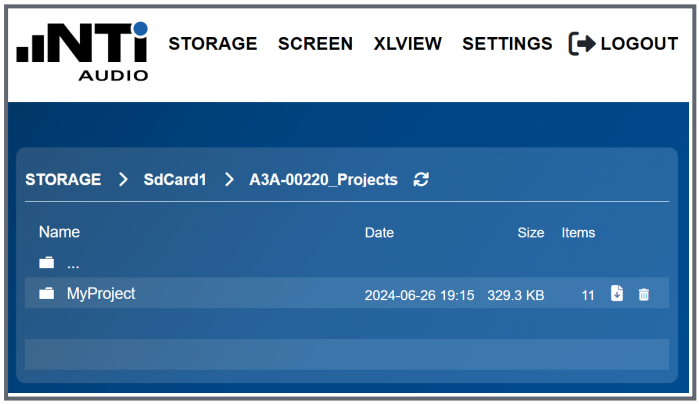
XL3 uses port 22 to communicate with the NTi Connect Server.

The NTi Connect Server now establishes the connection through the server and links your PC to the device. Subsequently, the XL3 will automatically display its web server page..


The web page will prompt you to enter the password previously defined in XL3. After that, the overview screen of the web server will open.

### 5.3.2 Storage

In the top menu, you can access the storage of the XL3 by selecting **STORAGE**.

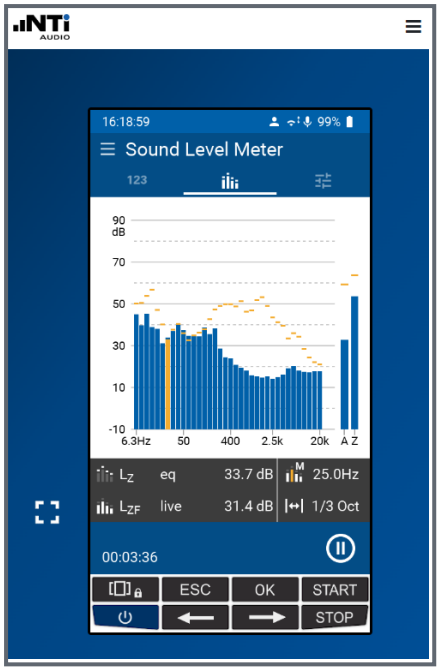



In the top menu, you can access your XL3 storage, which allows you direct access to all measurement data stored in XL3 and the ability to download each individual file.

To use the NTi Connect service, all data traffic to and fromXL3 must go through the server. NTi Connect allows free usage for data volumes up to 2 GB per month. If you exceed this limit, your download speed will be reduced. You can avoid this by subscribing to "NTi Connect Open Data 365," which ensures uninterrupted communication at full speed.

### 5.3.3 Screen

In the top menu, you can access the live screen of the XL3 by selecting **SCREEN**.

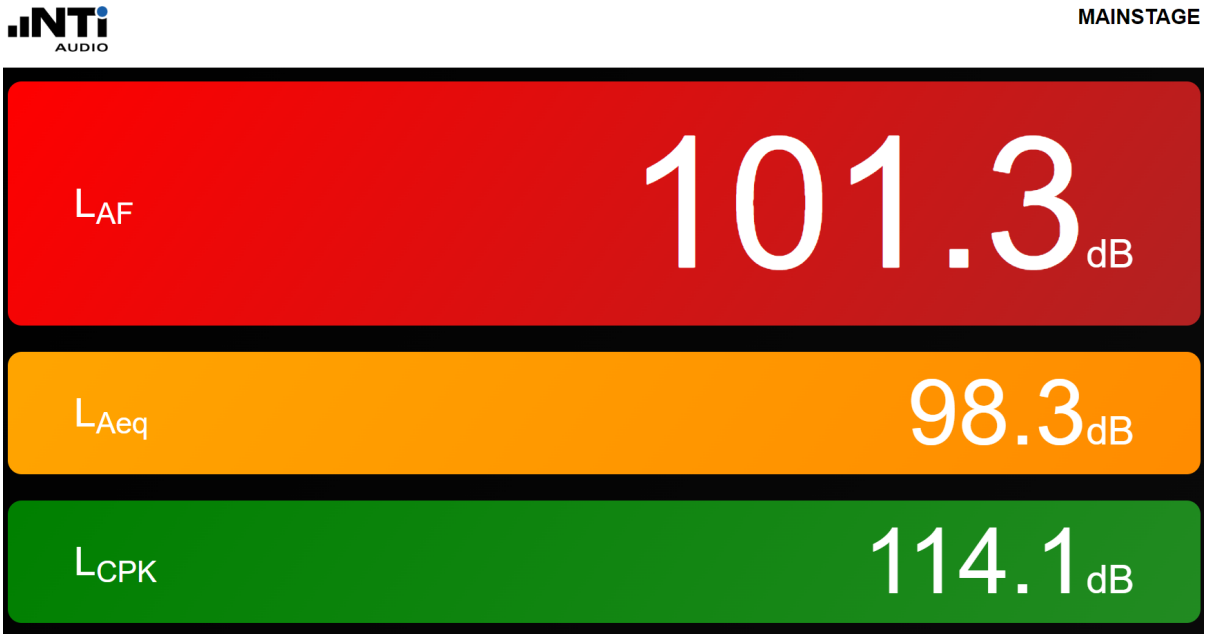



You can now control the device remotely with the mouse, just as if you were working directly on the device. If the web interface's screen is touch-sensitive, you can also use this touch screen to operate the device.

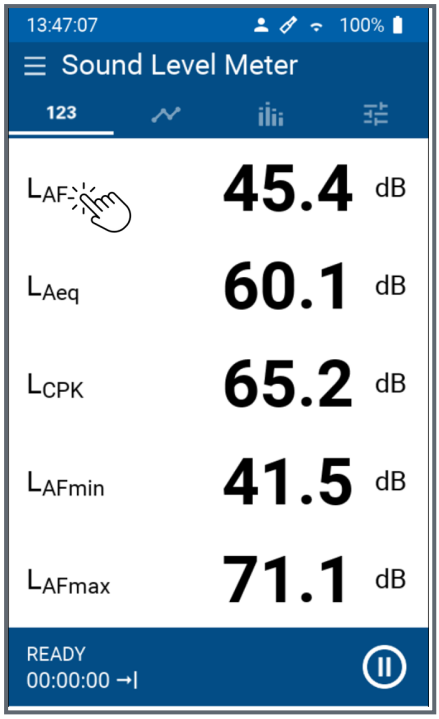
The website is responsive, meaning it can be scaled as desired. The icon enables full-screen mode, while the **ESC** key on the PC keyboard exits full-screen view.

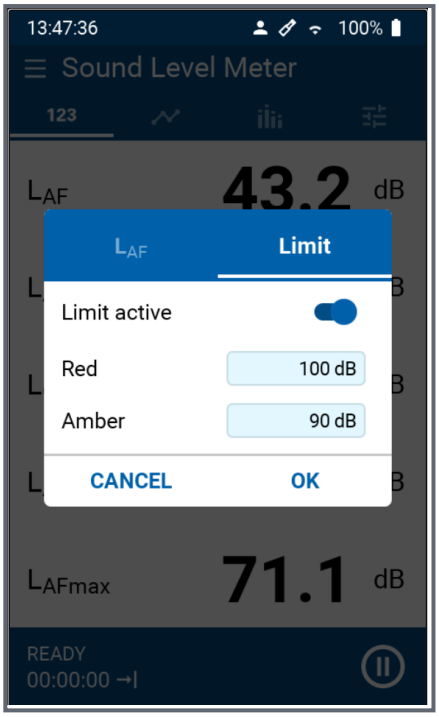
### 5.3.4 XLView

NTi Connect service (connect.nti-audio.com) allows you to instantly visualize sound levels on a large scale through the XLView feature, making it ideal for presentations or monitoring. Users can view the first three sound pressure levels set on the XL3. Exceeding levels are displayed with an amber warning color or a red alarm color.



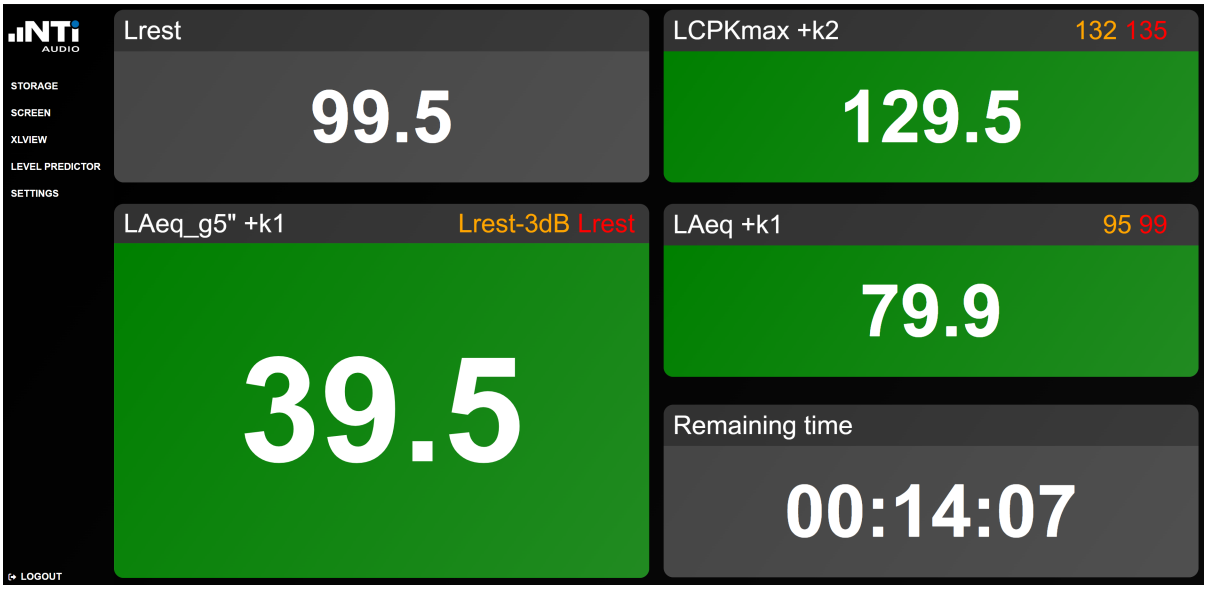

To set the sound level limits, tap on the desired parameter (e.g. LAF) and set the threshold for each case.




### 5.3.4.1 DIN 15905 Level Predictor tool

The Level Predictor, based on the DIN 15905 standard, visualizes the level of the current measurement interval and indicates the headroom for the upcoming period. Green indicators confirm that the sound level is well below the limits, while red indicators signal a need to reduce the sound level. This tool helps optimize dynamic passages for audience satisfaction while ensuring compliance with legal sound limits.

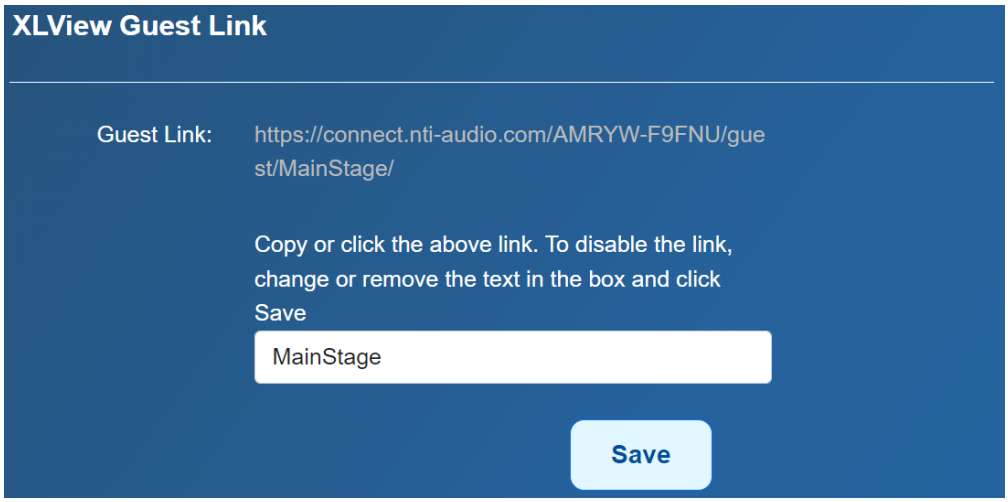



### 5.3.5 Settings

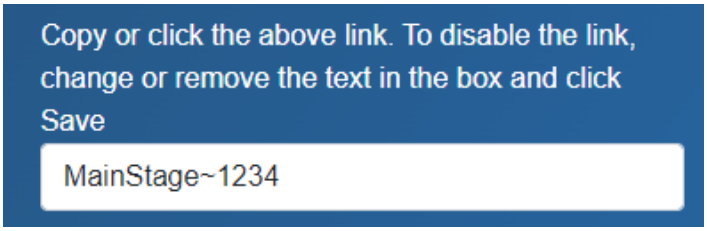
The **SETTINGS** tab displays the configuration options for XLView Guest Link and File Push Service.

### 5.3.5.1 XLView Guest Link

To create an XL View Guest Link and monitor real-time sound levels, simply name the location in the settings where the measurement is taken, such as "MainStage".




If you want to stop sharing the link, but do not want to change the name, you need to expand the link with a ~ character plus a name extension, see the example below.

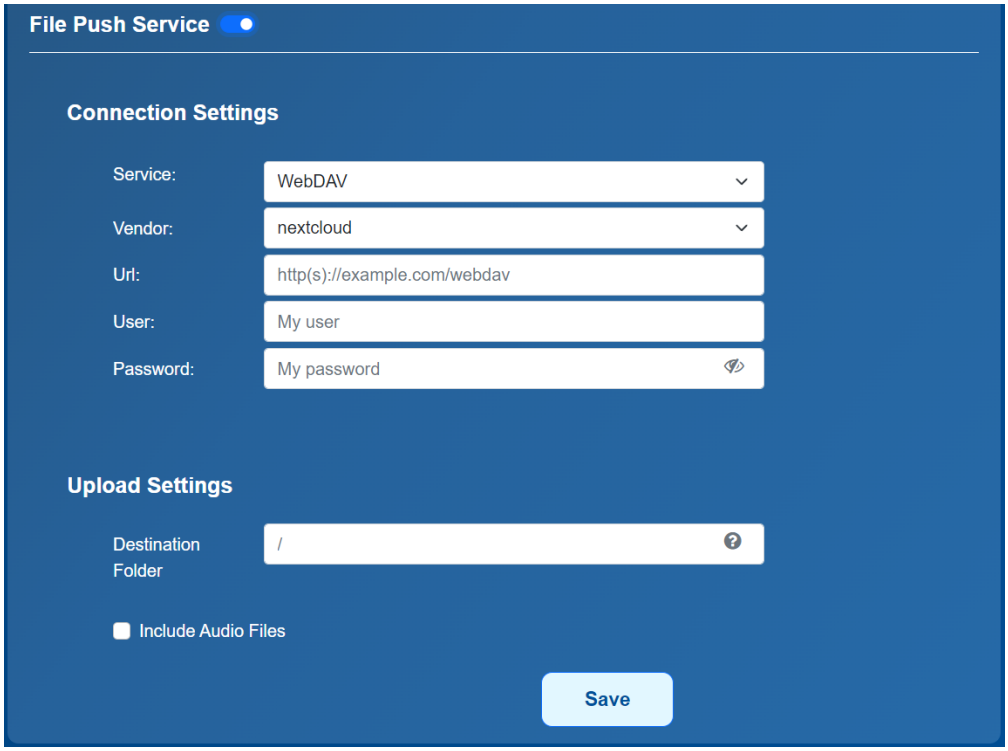



The previously shared link will then be no longer valid.

> The XLView Guest Link works with up to 20 clients (or 20 tabs) simultaneously.

### 5.3.5.2 File Push Service

The File Push Service allows users to upload files to various cloud storage solutions. Below are the settings required to configure the connection and upload options.




Connection Settings:

- Service: Select from the following options:
  - WebDav;
  - SFTP;
  - Google Drive;
  - Microsoft OneDrive.
- Vendor: Choose the appropriate vendor from the list:
  - nextcloud;
  - owncloud;
  - sharepoint;
  - sharepoint-ntlm;
  - other.
- URL: Enter the connection URL in the format:
  - http(s)://example.com/webdav.
- User: Provide your username.
- Password: Enter your password.
- Upload Settings:
  - Destination Folder: Specify the folder where files will be uploaded (e.g., /). Path levels must be separated by slashes (/). A leading or trailing slash is optional.
  - Additionally, you have the option to activate audio files during the upload process.

After pressing **SAVE**, the connection is automatically tested, and the result is displayed in a pop-up window.

The File Push Service creates a log file named "File_Push_Service.log" on the SD card. This file records all file push actions as well as any potential issues encountered during the process.

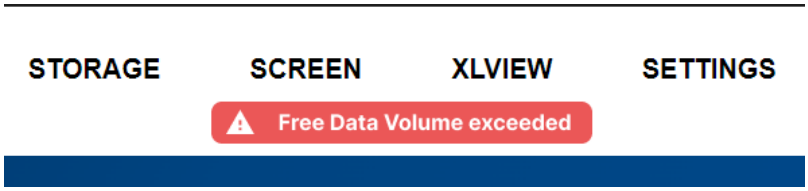
For more details please see File Push Service.

# 6 NTi Connect Service

The NTi Connect Service facilitates the remote control and data transfer for the XL3. Here is a clear breakdown of its features and functionalities.

## 6.1 How it works

Monthly, NTi Audio provides a free data volume of 2 GB to each XL3 device on the Connect Server (https://connect.nti-audio.com). Within this data volume, the typical data transfer rate is 1 to 4 MBytes/s as long as any mobile connection does not limit the rate. If they exceed the 2 GB limit, they will receive notifications, as shown below.




## 6.2 Fair Use Principle for NTi Connect

To ensure fair access to the NTi Connect service, we enforce a Fair User Principle. This principle aims to prevent excessive use that could negatively impact other users.

### 6.2.1 Throttling upon Exceeding

Once the 2 GB data limit is surpassed, the XL3's transmission rate is throttled to approximately 40 KBytes/s. This reduced speed will be reinstated to normal levels on the first day of each new month, allowing users to begin again with their data volume.

### 6.2.2 Effects of Throttling

Despite the throttling, users can still remotely control the XL3 using a web browser. However, during this period, downloading reports and short log files remain functional, albeit with certain limitations. Users may experience significantly longer waiting times or even timeouts when transferring large log files, audio recordings, or when utilizing the Streaming API.

### 6.2.3 Recommended Option

We recommend acquiring the “NTi Connect Open Data 365” option to circumvent the limitations imposed by throttling. This subscription removes the throttling of the transmission rate, ensuring a smoother user experience.

### 6.2.4 File Push Service

The File Push Service allows users to transfer files directly to the target server **without impacting their data usage on the NTi Connect service**. This feature is free from any throttling or speed limitations. To utilize the File Push Service, users must first activate it within the NTi Connect Settings, which involves configuring both the connection and upload settings to ensure proper file transfer.

### 6.2.5 Reserved Rights

NTi Audio reserves the right to further restrict the fair use of the Connect Server as necessary. This ensures that the service remains reliable and accessible for all users.

# 7 Data transfer

The XL3 Acoustic Analyzer provides multiple options for transferring the stored measurement data.

## 7.1 Ports and Protocols

The XL3 uses a variety of ports and protocols to facilitate data transfer and uninterrupted communication. These interfaces are essential for ensuring efficient operation, allowing users to interact with the device and manage measurement data effectively. The following table describes the main protocols and their respective ports, detailing the availability of each protocol for access to the Local Area Network (LAN) and Wide Area Network (WAN).

| Purpose | Protocol | Port | LAN (Internal Network) | WAN (Internet Access) | Description |
|---|---|---|---|---|---|
| Web interface | TCP | 80 | ✅ | ❌ | Access the XL3 via browser within the local network |
| NTi Connect remote access | TCP | 22 | ❌ | ✅ | Secure remote access via NTi Connect (SSH tunnel) |
| Time synchronization (NTP) | UDP | 123 | ✅ | ✅ | System time synchronization via NTP |
| DHCP (IP address assignment) | UDP | 67/68 | ✅ | ❌ | Automatic IP address configuration in local networks |
| Zeroconf / Bonjour / mDNS | UDP | 5353 | ✅ | ❌ | Local service discovery (e.g., xl3xxxxx.local) |
| UPNP / SSDP | UDP | 1900 | ✅ | ❌ | Multicast service for Windows discovery and SIR/DEX |

## 7.2 USB-C using MTP (Media Transfer Protocol)

Connect the XL3 to the computer via a USB cable. It then functions like a thumb drive, allowing direct access to folders and files through drag and drop.

Please note that the computer software cannot directly access the instrument data via the MTP protocol. Therefore, you should first copy the measurement data to your computer before accessing it with the software.

Additionally, please be aware that MTP is not supported by MacOS.

## 7.3 SD-Card

The XL3 stores all measurement data onto the SD card. To access the data, simply remove the SD card and insert it into a compatible card reader connected to your computer. Ensure the SD card is formatted as FAT32 to prevent compatibility issues, and for optimal performance, use a high-speed card with adequate storage capacity. This method provides a quick and convenient way to manage and transfer measurement data.

## 7.4 Remote access via XL3 website

Under Web Server , you can find detailed instructions on how to activate the web server and transfer the XL3 data in this mode to your PC.

## 7.5 SFTP access

Choose any of the available sFTP client software such as WinSCP, FileZilla, or WatchFTP for accessing the stored measurement data. The necessary parameters are:

| Parameter | Value |
|---|---|
| File Protocol | SFTP |
| Target address | IP address of the XL3 |
| Port | 22 |
| User | sftp |
| Password | Password of the WebServers |

If you are accessing the instrument via NTi Connect, the parameters are:

| Parameter | Value |
|---|---|
| File Protocol | SFTP |
| Target address | connect.nti-audio.com |
| Port | 22 |
| User | Connect key (XXXXX-XXXXX) |
| Password | Password of the WebServers |

# 8 How to connect a router or gateway

A router can be directly connected to any USB port of the XL3 if it supports the NDIS protocol. The Teltonika router TRB140, is suitable for this application.

Routers such as the Teltonika RUT240 that do not support the NDIS protocol should be connected via an Ethernet connection using a recommended USB to Ethernet adapter.

# 9 Options and accessories

There are a number of accessories for the XL3:

- USB-C to LAN adapter, NTi # 600 000 535;
- Ever-ready belt pouch, NTi # 600 000 735;
- System case, NTi # 600 000 701;
- Backpack, NTi # 600 000 706;
- Weather station (see below);
- GPS Mouse (see below), NTi # 600 000 358;
- Input Keypad XL3, NTi # 600 000 745;
- Heavy-Duty outdoor case, NTi # 600 000 704 (IP43) or # 600 000 705 (IP65);
- 4G/LTE Gateway (see below);
- ASD flat ribbon cable for passing closed windows or doors, NTi # 600 000 367;
- WP40-90 Weather Protection for 1/2" Mic (see below);
- NL1 Noise Locator (see below).

Specifications and descriptions can be found on the NTi Audio web site.

## 9.1 Weather station

Connect a weather station to your XL3 to simultaneously record the sound level and weather data. Depending on the weather station model used, wind speed and wind direction, rain, temperature, air pressure and humidity are documented every 60 s in the log file.

The XL3 supports the following weather stations:

- Vaisala WXT532 (wind speed, wind direction) (Legacy), NTi # 600 000 736;
- Vaisala WXT533 (wind speed, wind direction, rain fall) (Legacy), NTi # 600 000 737;
- Vaisala WXT 536 (wind speed, wind direction, rain fall, temperature, air pressure, humidity), NTi # 600 000 738;
- Weather Station Sonic Anemo+Rain (wind speed, wind direction, temperature and rain).

Connect the weather station to the XL3 USB-A or the programmable digital

input/output interface; it will be recognized & activated, and shown in The status bar,

a. After switching ON the XL3;
b. As soon as a sound level measurement with active logging has been started.

If the connection to the weather station is interrupted, the color of the icon in the status bar will turn to amber, and instead of the weather data, "-.--" will be written to the log file.

The number of connected weather stations is logged in the "StateOfHealth_Log.txt" file.

## 9.2 GPS Mouse

- Plug the GPS Mouse to the USB-A connector of the XL3;
- Make sure that the LED-side of the GPS Mouse is facing upwards (towards the sky);
- Check the GPS status on the XL3 display:
  -  GPS Mouse is connected and working;
  -  The GPS signal is too weak .

If the GPS Mouse is connected, the received latitude and longitude data is written to the "StateOfHealth_Log.txt" file.

## 9.3 4G/LTE Gateway

The XL3 can be connected to a 4G/LTE Gateway to enable remote monitoring and data transmission capabilities via cellular networks. Two gateway options are available:

- G160 4G/LTE Gateway - NTi # 600 076 017:
  - USB-C cable connection (no power supply or Ethernet cable required).
- 4G/LTE Gateway – Worldwide, excluding Americas, China, and Japan - NTi # 600 076 011 (Legacy).

When integrating the XL3 with a 4G/LTE Gateway via the M8 connection:

- The XL3 requires a 12V power supply for this configuration;
  - The standard 9V adapter included with the XL3 is not sufficient and should not be used in this setup;
- The 12V supply is included with the IP65 HD Outdoor Case (NTi # 600 000 705);
- For all other cases, you must order the 12V power supply separately (NTi # 620 000 013).

## 9.4 WP40-90 Weather Protection for 1/2" Mic

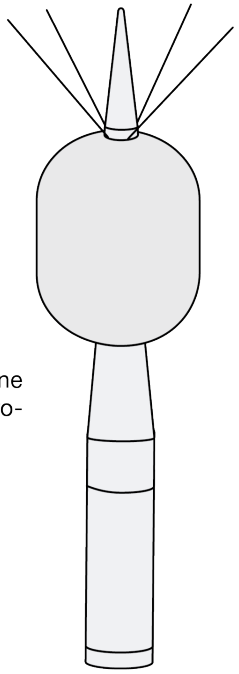
The Outdoor Measurement Microphones offer a weather-protected measurement solution for the NTi Audio 1/2" microphones allowing acquisition of environmental noise data in outdoor applications. The corrosion free polymer housing, windscreen with built-in water guard, water-repellent membrane and bird spike provide excellent protection from rain, wind, dust

and perching birds. WP40-90 Weather Protection for 1/2" Mic, for Measurement Microphones M2340, M2230 (with 90mm windscreen), NTi # 600 040 140.

1 year maintenance:
**WP40-90 / WP62-90**
**Windscreen replacement kit**
90 mm Windscreen with built in water protection grid.
# 600 040 142

2 years maintenance:
**WP40-90 / WP62-90**
**Full Service kit**
Cage with water repellant membrane and Windscreen with built in water protection grid.
WP40-90 # 600 040 141
WP62-90 # 600 040 151

WP ASD Cable 5 m: # 600 000 306
WP ASD Cable 10 m: # 600 000 307
WP ASD Cable 20 m: # 600 000 308



Outdoor Measurement Microphone Types:

- M2230-WP:

  M2230 + WP40 Weather Protection + WP ASD Cable;

- M2340-WP:

  M2340 + WP40 Weather Protection + WP ASD Cable.

For more information, check the Microphones Operation Manual: Measurement Microphones Manual.

- Install the Outdoor Measurement Microphones only in a vertical upright position. Installing them horizontally exposes the measurement microphone to raindrops and may cause damage.
- The snap mechanism works only at temperatures above –15°C / 5°F (as the ORing stiffens). In colder conditions we suggest you warm up the housing first, e.g. with your hands.

## 9.5 NL1 Noise Locator

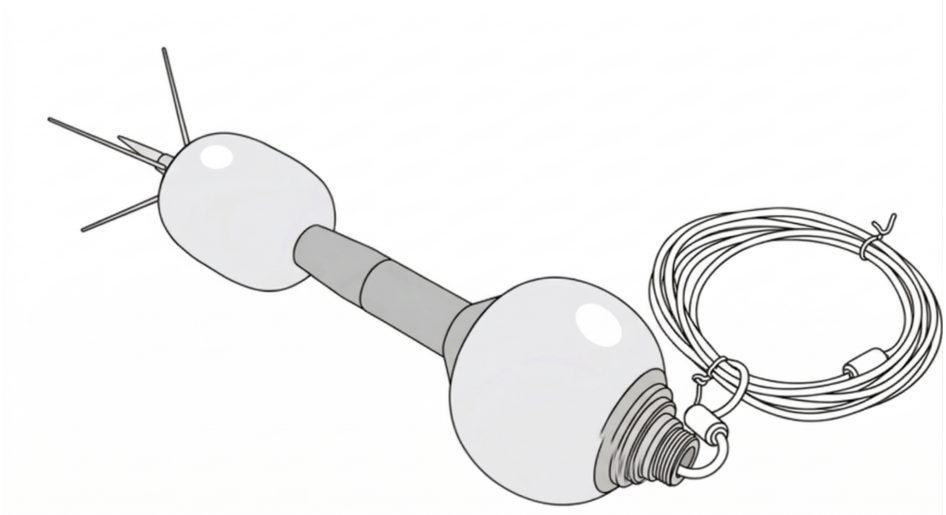
The NL1 Noise Locator, NTi # 600 041 000, is an all-weather sensor that identifies the direction of arrival of the predominant noise. It pairs with an outdoor microphone unit and compatible microphone (for example, WP40 + M2340) and connects via USB-A to the XL3 for power and real-time data logging.

NL1 Noise Locator requires XL3 and WP40-90 Weather Protection for 1/2" Mic. For more information, check the NL1 Noise Locator User Manual: NL1_User_Manual.pdf

The device performs octave analysis from 63 Hz to 4 kHz and also reports overall A-weighted

sound levels with selectable time resolution of 100 msec or 1 s. A built-in quality indicator

quantifies the validity of each measurement.



# 10 Calibration

The XL3 Acoustic Analyzer meets the specifications listed in the Technical Data XL3.

## 10.1 Calibration of the measuring device

To ensure that your measuring device meets the published specifications, we recommend an annual calibration of the XL3 together with the measuring microphone. During calibration, the specifications are checked, differences from the last calibration are pointed out, and the complete frequency response of the microphone is verified.

## 10.2 Microphone sensitivity calibration

The NTi Audio measurement microphones with ASD functionality include an electronic data sheet. This allows the XL3 to automatically detect the sensitivity and calibration data of the connected NTi Audio measurement microphone. The electronic data sheet is displayed in the function menu under **Calibration**.

## 10.3 Environmental conditions

Prior to calibration, the sound level meter and calibrator should be exposed to stable environmental conditions for the following typical acclimatization periods:

- 10 minutes after a temperature change of ±10 °C;
- 15 seconds after a 5 kPa change in ambient static air pressure;
- 10 minutes after a change of the relative humidity by 30% without condensation.

The calibration procedure and correction data apply within these environmental conditions:

- Temperature: –10 to +50 °C (14 to 122 °F);
- Static air pressure: 65 to 108 kPa;
- Humidity: 25 to 90 % r.h. without dew points from –10 to +39 °C (14 to 102 °F).

In case of deviating ambient conditions, observe the relative correction values specified in the certificate of the calibrator.

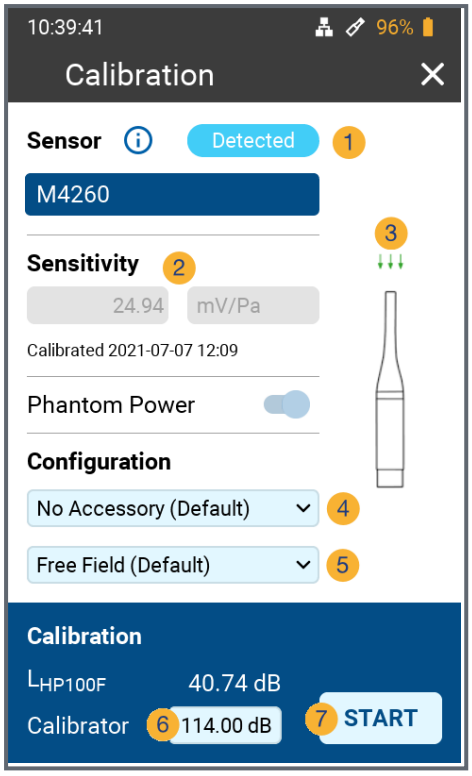
## 10.4 Community Noise

Make sure that during a calibration with a reference level of 94 dB (or 114.0 dB), the community noise level is less than 69 dB (or 89 dB, respectively).

## 10.5 Calibration screen

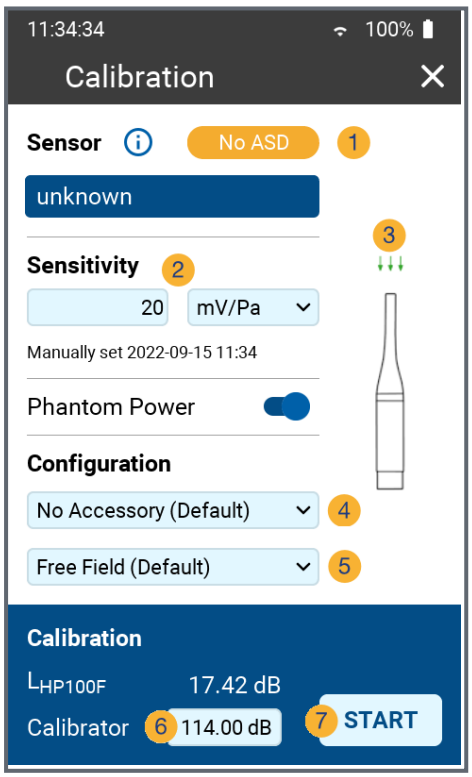
Swipe the touchscreen from top to bottom and tap the  icon to open the calibration screen.

### 10.5.1 Calibration menu with ASD measuring microphone connected

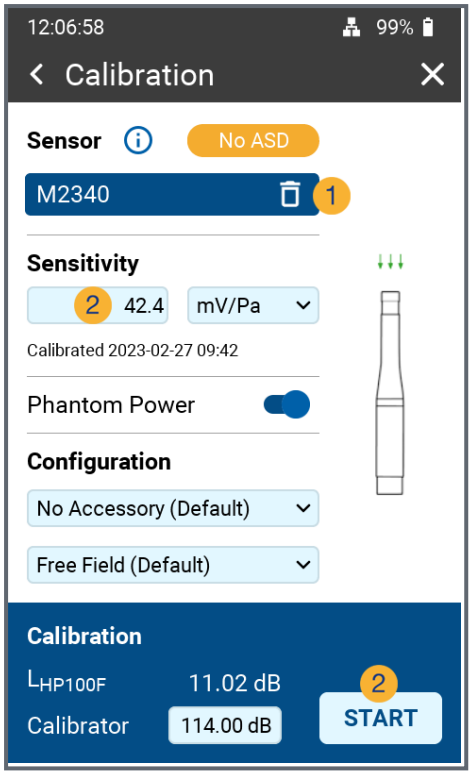



1. The blue status message "**Detected**" indicates that the connected microphone has been detected and its ASD data read.
2. The microphone sensitivity according to the ASD data sheet.
3. Visualizes the microphone configuration according to the settings 4 and 5.
4. The list allows the selection of any mounted accessories for this microphone.
5. Select here, whether you are planning for free-field or diffuse-field measurements. The XL3 then automatically selects the appropriate equalization curve.
6. Here you can set the nominal calibrator level (typ. 94.0 or 114.0 dB)
7. Tap on **START** to initiate the calibration process.

### 10.5.2 Calibration menu without sensor connected

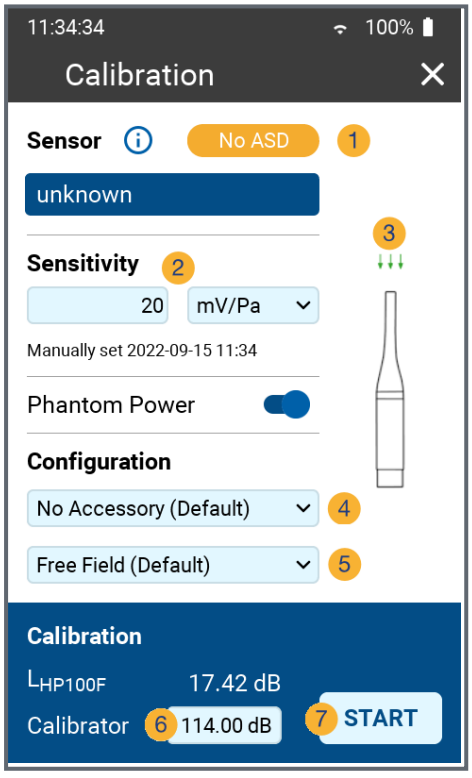



1. The yellow status message "**No ASD**" indicates that no ASD sensor has been detected.
2. The last saved microphone sensitivity.
3. The arrows indicate the sound incidence according to the settings 5.
4. Select any accessories that you may have installed for this microphone from the list.
5. Select here whether you are planning free-field or diffuse-field measurements. The XL3 then automatically selects the appropriate equalization curve.
6. With the calibrator plugged in, you can set the nominal calibrator level (94.0 or 114.0 dB) here
7. Press "**START**" to initiate the calibration process.




If a microphone without ASD is connected to the XL3, you may have to erase the ASD-information from the previously connected microphone first. To do so, connect the non-ASD microphone to the XL3, and

| | |
|---|---|
| 1 | Tap on the trash icon (thus, the display changes to "unknown" – see above). |
| 2 | You may now either a) Manually enter the Sensitivity of the connected microphone, or b) Start a calibration with a sound calibrator. |




Accessories for outdoor applications are available to select at 4. These are:

- No Accessory (Default);
- Wind Screen 90 mm;
- Wind Screen 50 mm;
- WP30 Community (Horizontal);
- WP30 Aircraft (Vertical);
- WP40 Community (Horizontal);
- WP40 Aircraft (Vertical);
- WP40+2ndWS1 Community (Horizontal).

## 10.6 Custom calibration

Follow these steps to calibrate the sensitivity of your NTi Audio measurement microphone or microphone amplifier or other microphone:

1. Enter the **Calibrator Level** 6 according to the instructions on your calibrator. Thereby, please observe the correction values for the calibrator used and your microphone type as described in chapter Free-field correction;
2. Plug the calibrator onto the microphone and switch on the calibrator;
3. Tap 7 **START** to start the calibration;
4. The Calibration: **Calibration running**... window appears and changes to Calibration: **Successfully finished** after the calibration has been successfully performed.

### 10.6.1 Customer calibration - Manual sensitivity adjustment

If no ASD microphone is connected and no calibrator is available, you can also set the sensitivity of the sensor used manually:

1. Tap the field under "Sensitivity" 1 and enter the microphone sensitivity;
2. Select the associated unit (V/Pa, mV/Pa or µV/Pa);
3. Tap OK.

As soon as you reconnect a measuring microphone with ASD functionality, the manually entered level is replaced by the sensitivity stored in the ASD chip.

**User Sensitivity**
After a manual calibration, the XL3 additionally writes the determined sensitivity to the ASD chip of the connected NTi Audio measuring microphone, microphone amplifier or ASD adapter. Thus, the newly determined sensitivity is automatically used from this point on.

However, if the measured sensitivity deviates from the factory calibration by ±1.5 dB for a Class 1 measurement microphone or by ±3.0 dB for a Class 2 measurement microphone, the XL3 will display the following message: **Measured sensitivity too far (xx dB) from factory settings. Check calibration level and microphone!**
Contact NTi Audio with the details for repair or calibration if needed.

**Calibration User Sensitivity Setting**
The CS011 sensor supports custom user sensitivity settings during calibration, providing enhanced flexibility for specialized test setups.

## 10.7 Free-field correction

All NTi Audio measurement microphones are free-field equalized measurement microphones. The irritation of the free-field level, due to the presence of the microphone body in the sound field, is already compensated for in the microphone.

As sound calibrators operate in the pressure field, the level at the microphone diaphragm differs for 1/2" measurement microphones at the reference ambient conditions.

For most accurate calibration of the microphone sensitivity, the following free-field correction shall be applied when using a class 1 sound calibrator. The table below shows the target

values for a microphone calibration with a sound level calibrator that is adjusted to 94.0 dB, and the correction values for different configurations.

| Sound calibrator | NTi CAL200 | B&K 4231 | Nor 1251 | Nor 1256 | Cirrus CIR:515 |
|---|---|---|---|---|---|
| **M2230 / M2340 Configuration** | 93.88 / -0.12 | 93.85 / -0.15 | 113.85 / -0.15 | 93.85 / -0.15 | 93.70 / -0.30 |

### 10.7.1 Application example

Configuration:

- XL3 + M2340 measurement microphone + WP40 vertically;
- NTi Audio CAL200 class 1 sound calibrator with 94.0 dB;

Setting for calibration:

- Open the Calibration screen;
- Adjust the **Calibrator** level to 93.88 dB (*refer to the table above*);
- Plug the sound calibrator onto the microphone and turn it ON;
- Tap on **START** and then on **OK**.

The calibration has been completed successfully.

## 10.8 Class 1 sound calibrator

The type-approved class 1 sound calibrator is used to check and maintain the correct display of the sound level meter when used under normal conditions in accordance with the type approval.

### 10.8.1 Technical details

- Type: Larson Davis CAL200, or another type-approved class 1 sound calibrator;
- Calibration frequency: 1 kHz (= reference frequency);
- Calibrator level: 94.0 dB or 114.0 dB (= reference sound pressure level).

Take the individual calibration value from the calibration certificate of the sonic calibrator.

#### 10.8.1.1 Calibration details

The calibration is to be carried out according to the chapter "Calibration" in this manual.

### 10.8.2 Accessories

#### 10.8.2.1 Complainant key

The input keypad has no effect on the sound level readings.

## 10.9 Free Field - Pressure Correction Factors to be used with multi-frequency calibrator B&K 4226

If a measurement microphone is located in a free-field environment, then the microphone capsule acts like a reflector at high frequencies, as the sound pressure increases in front of the membrane. M2230, M2340 are free-field equalized measurement microphones, they compensate for the increased pressure internally. The calibration of the measurement microphones M2230 and M2340 with the B&K 4226 requires the accessory Adapter Ring MXR01, NTi Audio # 600 040 105. Please note, never touch the diaphragm of the measurement microphone capsule.

The calibrator no longer offers free-field conditions. Therefore, the free-field equalization of the microphone must be compensated. This needs to be considered prior to the calibration. The correction value needs to be added to the pressure response of the microphone.

- During the calibration, the XL3 measures the sound level in the calibrator. If the B&K 4226 calibrator is used and is set to 8 kHz, then the XL3 + M2230 reads just 91.3 dBA.
- The free-field sound level is calculated by summing the XL3 measurement value and the correction value (91.3 dB + 2.7 dB = 94.0 dB).

| Nominal Frequency [Hz] | M2230, M2340 with MXR01 Adapter [dB] | Measurement Uncertainty U [dB] |
|---|---|---|
| 125 | -0.2 | 0.3 |
| 1000 | 0.0 | 0.3 |
| 8000 | 2.7 | 0.3 |

# 11 Technical data XL3

All specifications comply with the IEC61672 standard. Further standards – as far as they go beyond this standard – are listed with the respective items.

| Sound level measurement | |
|---|---|
| **Calibratable product configurations class 1** | • XL3 and the M2340 / M2230 measurement microphone builds an integrating sound level meter with type approval class 1 according to IEC 61672 and ANSI S1.4. |
| **Product configurations class 1** | • XL3 with M2340 / M2230 measuring microphone class 1 according to IEC 61672 and ANSI S1.4;<br>• XL3 with M2211 / M2215 measurement microphone class 1 frequency response according to IEC 61672 and ANSI S1.4.<br>The specifications given apply to operation with the microphone attached or detached. |
| **Product configurations class 2** | • XL3 with M4261 measurement microphone class 2 according to IEC 61672 and ANSI S1.4. |
| **Standards** | • IEC 61672:2014, IEC 61672:2003, IEC 61260:2014, IEC 61260:2003, IEC 60651, IEC 60804;<br>• China: GB/T 3785:2010, GB/T 3241, GB 3096-2008, GB 50526, GB/T 4959;<br>• Germany: DIN 15905-5, DIN 45657:2014, DIN 45657:2005, DIN 45645-2, optional: DIN 45645-1;<br>• Japan: JIS C1509-1:2005, JIS C 1513 class 1, JIS C 1514 class 0;<br>• Switzerland: V-NISSG, NAO;<br>• UK: BS 4142:2014, BS 5969, BS 6698;<br>• USA: ANSI S1.4-2014, ANSI S1.43, ANSI S1.11-2014;<br>• International IEC standards have been adapted as European standards and the letters IEC have been replaced by EN. XL3 is compliant with these EN standards. |
| **Weighting** | • Frequency weighting: A, C, Z (simultaneously);<br>• Time ratings: Fast, Slow, Impulse[1] (simultaneously). |
| **Level details** | • Measurement bandwidth (–3 dB): 4.4 Hz – 23.0 kHz;<br>• Level resolution: 0.1 dB;<br>• Intrinsic noise: 2.1 µV(Z). |

[1]Only available with Extended Noise Measurement Option

| Sound level measurement | |
|---|---|
| **Measuring range with different microphones** | • XL3 + M2340: 17.4 dB(A) – 138.3 dB @ 42 mV/Pa;<br>• XL3 + M2230: 17.1 dB(A) – 137.8 dB @ 42 mV/Pa;<br>• XL3 + M2215: 25 dB(A) – 153 dB @ 8 mV/Pa;<br>• XL3 + M2211: 21 dB(A) – 144 dB @ 20 mV/Pa;<br>• XL3 + M2914: 6.5 dB(A) – 103 dB @ 320 mV/Pa;<br>• XL3 + M4261: 27 dB(A) – 146 dB @ 16 mV/Pa. |
| **Linear measuring range according to IEC 61672 / ANSI S1.4** | • XL3 + M2340: 25 dB(A) – 138 dB \| 28 dB(C) – 138 dB @ 42 mV/Pa;<br>• XL3 + M2230: 24 dB(A) – 137 dB \| 27 dB(C) – 137 dB @ 42 mV/Pa;<br>• XL3 + M2215: 33 dB(A) – 153 dB @ 8 mV/Pa;<br>• XL3 + M2211: 29 dB(A) – 144 dB @ 20 mV/Pa;<br>• XL3 + M2914: 14 dB(A) – 103 dB @ 320 mV/Pa;<br>• XL3 + M4261: 33 dB(A) – 146 dB @ 16 mV/Pa. |
| **Stabilization time after activation of the phantom power** | • < 10 s. |
| **Integration times** | • Minimum: 1 second (default) or 100 ms (with Extended Noise Measurement option);<br>• Maximum: 24 hours. |
| **Intrinsic noise typical without measuring microphone @ S = 42 mV/Pa** | • Frequency weighting A: 5.1 dBA;<br>• Frequency weighting C: 4.1 dBC;<br>• Frequency weighting Z: 8.0 dBZ. |

| Sound level measurement | |
|---|---|
| **Standard functions** | • SPL actual, Leq, Lmin, Lmax, Lpeak, LE;<br>• Time weighting Fast, Slow;<br>• Broadband, 1/1 Octave and 1/3rd Octave spectral view;<br>• Gliding LAeq and LCeq with selectable time window from 1 second to 1 hour;<br>• TaktMax according to DIN 45645-1;<br>• All measurement results are simultaneously available;<br>• Logging of all or data or subsets in selectable intervals ≥ 1 second;<br>• Wizard for measuring the correction values for live events of the levels LAeq, LCeq and LCpeak;<br>• Individual limit values for each sound level displayed;<br>• Recording of compressed audio;<br>• Digital I/O interface for controlling accessories (e.g. Input Keypad XL3 or a weather station). |
| **Functions of Extended Noise Measurement option** | • Time weighting Impulse;<br>• Level difference LAIeq – LAeq;<br>• Sound exposure level LAE;<br>• Time-graph view;<br>• Percentiles / levels of the level frequency distribution for broadband and spectral measurements<br>Flexible setting from 0.1% to 99.9% with 7 values in parallel<br>Sampling rate for Fast/Slow weighted values: every 1.3 ms<br>Wideband: with 0.1 dB class bandwidth, based on Lxy sampling (x = A, C or Z, y = F, S or EQ1")<br>1/1 Octave band and 1/3rd Octave band spectrum: in 1.0 dB class width, based on Lxy (x = A, C or Z / y = F or S);<br>• 100 ms logging of all or data or subsets;<br>• Recording of uncompressed audio. |
| **Spectrum** | • Compliant with class 1 of IEC 61260:2014 and ANSI S1.11-2014 (filter base 10);<br>• Octave band display: 8 Hz – 16 kHz;<br>• 1/3rd Octave band display: 6.3 Hz – 20 kHz;<br>• Selectable frequency range is displayed together with A/Z wideband level;<br>• Logging of Leq, min, max every 100 ms[1] or 1 s;<br>• Spectrum Fast Logging: logs instantaneous Fast sound level (LAFinst) for each band every second. |

[1]Only available with Extended Noise Measurement Option

| Reverberation Time | |
|---|---|
| **Standard functions** | • Conforms with ISO 3382 and ASTM E2235 based on Schroeder's backwards integration;<br>• Octave bands results from 63 Hz - 8 kHz;<br>• Measurement parameters: T20, T30;<br>• Impulse and gated noise source;<br>• Automatic averaging for each position;<br>• Chart and table representation of results;<br>• Fixed minimum trigger level: 80 dB LAPK;<br>• Warning indicators according to ISO 3382;<br>• Range: 10 ms - 60 seconds;<br>• Minimum reverberation time (typical):<br>  ◦ < 100 Hz: 0.3 second;<br>  ◦ 100 - 200 Hz: 0.2 second;<br>  ◦ > 200 Hz: 0.1 second. |
| **With the "Extended Room Acoustics" Option** | • 1/3 octave band: 50 Hz - 10 kHz;<br>• T20, T30, T15, EDT simultaneously;<br>• Calculating spatial room average (Measurement Series) up to 99 positions;<br>• Audio recording (32-bit float);<br>• Adjustable minimum trigger level from 50 to 100 dB LAPK. |

| Sound Insulation | |
|---|---|
| **With the "Sound Insulation" Option** | Determination of airborne, impact and facade sound insulation on the instrument.<br>• Automated data averaging;<br>• Results as chart and table. |
| | Airborne Sound Insulation:<br>• Sound Sources: Speaker.<br>• Standards:<br>  • ISO16283-1:2014;<br>  • ASTM E336;<br>  • England/Wales: Approved Document E (2003).<br>• Results:<br>  • Dw \| Dn,w \| DnT,w \| R'w;<br>  • Spectrum adaption terms C, Ctr; |
| | Impact Sound Insulation:<br>• Sound Sources: Tapping Machine, Rubber Ball;<br>• Standards:<br>  • ISO16283-2:2018;<br>  • ASTM E336;<br>  • England/Wales: Approved Document E (2003).<br>• Results:<br>  • With Tapping Machine: L'n,w \| L'nT,w;<br>  • With Impact Ball: L'IA,Fmax \| L'iA, Fmax,V,T;<br>  • Spectrum adaption terms CI. |
| | Facade Sound Insulation:<br>• Sound Sources: Element Loudspeaker, Global Loudspeaker;<br>• Standards:<br>  • ISO16283-3:2016;<br>  • ASTM E336.<br>• Results:<br>  • With Element Loudspeaker: Dw \| R'45°,w;<br>  • With Global Loudspeaker: Dls,2m,w \| Dls,2m,n,w \| Dls,2m,nT,w;<br>  • Spectrum adaption terms C, Ctr—. |

| STIPA | |
|---|---|
| **STIPA**<br>**Speech Intelligibility (optional)** | • Measurement in accordance with the standards:<br>  • IEC 60268-16 (edition 2, 3, 4 or 5);<br>  • AS 1670.4;<br>  • BS 5839-8;<br>  • CEN/TS 54-32:2015;<br>  • DIN EN 50849:2017;<br>  • ISO 7240-16;<br>  • ISO 7240-19:2007;<br>  • DIN VDE 0833-4;<br>  • VDE V 0833-4-32:2016;<br>  • VDE 0828-1:2017-11;<br>  • NFPA 72;<br>  • UFC 4-021-01.<br>• Direct measurement method (IEC 60268-16);<br>• Frequency range: 125 Hz - 8 kHz in octave band;<br>• Modulation frequencies 0.63 Hz - 12.5 Hz in thirdoctave resolution;<br>• Single value STI and CIS test result;<br>• Ambient noise correction;<br>• Automated averaging of measurements;<br>• Modulation indices and individual band level results with error indicator;<br>• Test signal: NTi Audio STIPA signal generated by the MR-PRO, NTi Audio TalkBox or other audio players (download wav-file at my.nti-audio.com/support/xl3). |

| Calibration | |
|---|---|
| **Free-field correction** | • Class 1 sound calibrator 94 dB (NTi Audio #: 600 000 402):<br>  • M2215 / M2211: –0.12 dB.<br>• Class 1 sound calibrator 94 dB (NTi Audio #: 600 000 402) with 1/4" calibrator adapter NTi (Audio #: 600 000 404):<br>  • M4260 (Legacy): +0.10 dB;<br>  • M4261 (Legacy): +0.20 dB;<br>  • M4262: +0.10 dB. |

| Calibration | | | | | | |
|---|---|---|---|---|---|---|
| | **M2230 / M2340 Configuration** | **Sound Calibrator** | | | | |
| | | **NTi CAL200** | **B&K 4231** | **Nor 1251** | **Nor 1256** | **Cirrus CR:515** |
| **Windscreen correction @ 1 kHz** | No Accessory; Windscreen 90mm[1]; Windscreen 50mm[1]; WP40 Community[1] (horizontal); WP40 Aircraft[1](vertical). | 93.88 / -0.12 | 93.85 / -0.15 | 113.85 / -0.15 | 93.85 / -0.15 | 93.70 / -0.30 |
| | WP30 vertical (Legacy) | 93.69 / -0.31 | 93.66 / -0.34 | 93.66 / -0.34 | 93.66 / -0.34 | 93.51 / -0.49 |
| | WP30 horizontal (Legacy) | 93.69 / -0.31 | 93.66 / -0.34 | 93.66 / -0.34 | 93.66 / -0.34 | 93.51 / -0.49 |

| **Free Field Multi-frequency Pressure Correction Factors (calibrator B&K 4226)** | **Nominal Frequency [Hz]** | **Measurement Uncertainty U [dB]** | **Measurement Uncertainty U [dB]** |
|---|---|---|---|
| | 125 | -0.2 | 0.3 |
| | 1000 | 0.0 | 0.3 |
| | 8000 | 2.7 | 0.3 |

| | |
|---|---|
| **Calibration** | • Recommended calibration interval: 1 year;<br>• Microphone calibration with external sound calibrator possible;<br>• Calibration certificate for a new sound level meter is optionally available. |

| Input / output interfaces | |
|---|---|
| **Audio input** | • XLR balanced:<br>  • Input impedance 200 kΩ;<br>  • Phantom power: +48 V switchable; with maximum output current of 10 mA according to IEC 61938;<br>  • Automatic Sensor Detection (ASD) for NTi Audio measuring microphones and preamplifier MA230 / MA220;<br>• Internal speech microphone for recording voice memos. |
| **Audio output** | • Built-in speaker;<br>• Headphone socket 3.5 mm stereo; output reference: @ SPL Level 114.0 dBSPL (calibrated microphone) = –12 dBu. |
| **USB-A interface** | USB Host supporting the devices described below. |

[1]All required additional correction is handled by the instrument.

| Input / output interfaces | |
|---|---|
| **USB-C interface** | USB Device supporting MTP (file access from the PC) and Network (website access from the PC), as well as charging the Li-Ion battery. |
| **USB devices** | Supported devices:<br>• USB-C to LAN adapter, NTi # 600 000 535;<br>• 4G/LTE gateways with RNDIS protocol;<br>• Mass storage like USB stick, SSD;<br>• Vaisala or Sonic Anemo+Rain weather station (see below). |
| **Memory** | 32 GB micro-SDHC card (default), replaceable, for storing measurement data in ASCII format, as well as audio data (WAV) and screenshots (PNG)<br>Supported formats: FAT32 and NTFS |
| **Power supply** | • Rechargeable Li-Ion battery:<br>  • Typ. 3.6 V / 6'000 mAh;<br>  • Voltage range: 3.0 – 4.07 VDC (theXL3 limits the charging voltage to 4.05 VDC, and thus doubles the number of possible charging cycles);<br>  • Energy density = 339 Wh/l;<br>  • Typical battery life @ 25 °C (77 °F) with microphone M2340:<br>  with display active: >8 h;<br>  with display switched off: >12 h.<br>  • Operating temperature: –20 to +60 °C (–4 to +140 °F);<br>  • The XL3 switches OFF automatically as soon as either the battery charge level drops to 0%, or the temperature of the battery drops below –19 °C (–2.2 °F) or rises above +60 °C (+140 °F). Before an automatic self-shut-down, the XL3 stops the current measurement and saves the present results.<br>• Linear external power supply 9 VDC / 2 A:<br>  • Range: 7.0 – 17.0 VDC @ minimum 4 W;<br>  • Charges Li-Ion battery in operation; charging time from 10% to 80%: typ. 140 min;<br>  • Maximum charging power 15 W.<br>• USB-C supply with 5 VDC / 1.5 – 3 A / 5 W or 15 W according to USB-C specification release 1.2 is sufficient to operate the XL3 + charge the battery; USB BC1.2 is not supported;<br>• USB-A supply with 5 VDC / 0.5 A (e.g via a USB-A to USB-C adapter) does not provide sufficient power to supply the XL3. |

| Input / output interfaces | |
|---|---|
| **Automatic restart** | The XL3 automatically turns back ON and resumes the last active measurement:<br>a. after an automatic self-shutdown (due to too low charge level), or;<br>b. after unintentional removal of the battery (while the device was running);<br>c. as soon as it is is reconnected to a voltage source (e.g. power supply unit or charged battery). |

| Weather station | |
|---|---|
| **Vaisala** | • WXT532;<br>• WXT533;<br>• WXT536. |
| **LCJ Capteurs** | Weather Station Sonic Anemo+Rain |

| General | |
|---|---|
| **Clock** | • Real-time clock:<br>  • with lithium backup battery<br>  • Drift: < 100 ms (typ.), < 2.42s (max) per 24h<br>  • Time is corrected when NTP or PPS is available<br>• System time:<br>  • Synced to RTC on startup<br>  • No drift when NTP or PPS are available<br>  • Drift without NTP or PPS: < 300 ms (typ.), 2.16 s (max) per 24h<br>• Clock for data acquisition:<br>  • Synced to System time on measurement start/daily<br>  • Drift: < 1 ms (typ.), < 389 ms (max.) |
| **Mechanics** | • 1/4" tripod connection and fold-out stand on rear side<br>• Display: 480 x 800 pixels, 4.3" IPS<br>• Entry: 8 buttons, capacitive multitouch-display<br>• Dimensions L x W x H: 210 x 85 x 45 mm (8.3 x 3.4 x 1.8 ")<br>• Weight: 500 g (1.1 lb) including Li-Ion battery |
| **Temperature** | –10 to +50 °C (+14 to +122 °F) |
| **Humidity** | 5 to 90% RH, non-condensing |
| **Sensitivity to high frequency fields** | Classification group X |
| **Electromagnetic compatibility** | CE according to: EN 61326-1 class B, EN 55011 class B, EN 61000-4-2 to -6 and -11 |
| **Protection class** | IP51 |

# 12 Technical Data Measurement Microphones

## 12.1 Certified Class 1 Measuring Microphones

| | M2340 Class 1 certified with self-examination | M2230 class 1 certified |
|---|---|---|
| **Scope of delivery** | MA230 preamplifier + MC230A microphone capsule | MA220 preamplifier + MC230A microphone capsule |
| **Microphone type** | Omnidirectional, condenser free-field microphone with continuous polarization | |
| **Classification according to IEC 61672 and ANSI S1.4** | Class 1 certified | |
| **Microphone capsule** | ½" removable with thread 60UNS2 type WS2F according to IEC 61094-4 | |
| **Preamplifier type** | MA230 | MA220 |
| **Self-check** | Yes | No |
| **Frequency response tolerance typical** | ±1 dB @ 5 Hz – 20 Hz<br>±1 dB @ >20 Hz – 4 kHz<br>±1.5 dB @ >4 kHz – 10 kHz<br>±2 dB @ >10 kHz – 16 kHz<br>±3 dB @ >16 kHz – 20 kHz | |
| **Individual frequency response** | Freely available as Excel file: register the microphone on my.nti-audio.com and contact info@nti-audio.com | |
| **Frequency range** | 5 Hz – 20 kHz | |
| **Intrinsic noise typical** | 17 dB(A) | 16 dB(A) |
| **Maximum sound pressure level @ distortion factor 3%, 1 kHz** | 138 dBSPL | 137 dBSPL |
| **Sensitivity typical @ 1 kHz** | 27.5 dBV/Pa ±2 dB (42 mV/Pa) | |
| **Temperature coefficient** | < –0.015 dB / °C | |
| **Temperature range** | –10°C to +50°C (14°F to 122°F) | |
| **Influence of air pressure** | 0.005 dB / kPa | |
| **Influence of humidity (non-condensing)** | < ±0.05 dB | |
| **Humidity** | 5% to 90% RH, non-condensing | |

| | M2340 Class 1 certified with self-examination | M2230 class 1 certified |
|---|---|---|
| **Long-term stability** | > 250 years / dB | |
| **Power supply** | 48 VDC phantom power | |
| **Power consumption** | 0.76 mA typical | 2.3 mA typical |
| **Electronic data sheet** | NTi Audio ASD according to IEEE P1451.4 V1.0, Class 2, Template 27 | |
| **Output impedance** | 100 Ω symmetrical | |
| **Output connector** | balanced 3-pin XLR | |
| **Diameter** | 20.5 mm (0.8") | |
| **Length** | 154 mm (6.1") | |
| **Weight** | 100 g, 3.53 oz | |
| **Protection class** | IP51 | |
| **NTi Audio #** | 600 040 230 | 600 040 050 |

## 12.2 Measuring Microphones

| | M2211 frequency response class 1 | M2215 for high sound levels, frequency response class 1 | M4261 class 2 (Legacy) | M4262 class 2 |
|---|---|---|---|---|
| **Includes** | MA220 preamplifier + M2211 microphone capsule | MA220 preamplifier + M2215 microphone capsule | M4261 (Legacy) with fixed microphone capsule | M4262 with fixed microphone ECM capsule |
| **Microphone type** | Omnidirectional, condenser free-field microphone with continuous polarization | | Electret capsule | |
| **Classification according to IEC 61672 and ANSI S1.4** | Frequency response class 1 | | Class 2 | |
| **Microphone capsule** | 1/2" removable with thread 60UNS2 type WS2F according to IEC 61094-4 | | 1/4" fixed mounted | |
| **Preamplifier type** | MA220 | | - | |
| **Self-check** | No | | | |

| | M2211 frequency response class 1 | M2215 for high sound levels, frequency response class 1 | M4261 class 2 (Legacy) | M4262 class 2 |
|---|---|---|---|---|
| **Frequency response tolerance typical** | ±1 dB @ 5 Hz – 20 Hz<br>±1 dB @ >20 Hz – 4 kHz<br>±1.5 dB @ >4 kHz – 10 kHz<br>±2 dB @ >10 kHz – 16 kHz<br>±3 dB @ >16 kHz – 20 kHz | | +1/-4.5 dB @ 5 Hz – 20 Hz<br>±1.5 dB @ >20 Hz – 4 kHz<br>±3 dB @ >4 kHz – 10 kHz<br>±4.5 dB @ >10 kHz – 16 kHz<br>±5 dB @ >16 kHz – 20 kHz | +1/-5 dB @ 5 Hz – 20 Hz<br>±1.5 dB @ 20 Hz - 4 kHz<br>±3 dB @ 4 kHz – 20 kHz |
| **Individual frequency response freely available as Excel file** | Freely available as Excel file: register the microphone on my.nti-audio.com and contact info@nti-audio.com | | | |
| **Frequency range** | 5 Hz – 20 kHz | | | 10 Hz – 30 kHz |
| **Typical sensitivity @ 1 kHz** | - 34 dBV/Pa ±3 dB (20 mV/Pa) | - 42 dBV/Pa ±3 dB (8 mV/Pa) | - 36 dBV/Pa ±3 dB (16 mV/Pa) | -36 dBV/Pa ±3 dB (16 mV/Pa) |
| **Intrinsic noise typical** | 21 dB(A) SPL @ 20 mV/Pa | 25 dB(A) SPL @ 8 mV/Pa | 27 dB(A) SPL @ 16 mV/Pa | 32 dB(A) SPL @ 16 mV/Pa |
| **Maximum sound pressure level @ distortion factor 3%, 1 kHz** | 144 dBSPL | 153 dBSPL | 142 dBSPL | 140 dB SPL |
| **Temperature coefficient** | < ±0.015 dB / °C | | < ±0.02 dB / °C | < ±0.03 dB / °C |
| **Temperature range** | –10°C to +50°C (14°F to 122°F) | | 0°C to +40°C (32°F to 104°F) | |
| **Pressure coefficient** | 0.02 dB / kPa | | -0.04 dB / kPa | |
| **Influence of humidity (non-condensing)** | < ±0.05 dB | | < ±0.4 dB | |
| **Humidity** | 5% to 90% RH, non-condensing | | | |
| **Long-term stability** | > 250 years / dB | | - | |
| **Power supply** | 48 VDC phantom power | | | |
| **Power supply current** | 2.3 mA typical | | 1.7 mA typical | 1.4 mA idle, 5 mA @ clip level |
| **Electronic data sheet** | NTi Audio ASD according to IEEE P1451.4 V1.0, Class 2, Template 27 | | | |

| | M2211 frequency response class 1 | M2215 for high sound levels, frequency response class 1 | M4261 class 2 (Legacy) | M4262 class 2 |
|---|---|---|---|---|
| **Output impedance** | 100 Ω symmetrical | | | |
| **Output connector** | balanced 3-pin XLR | | | |
| **Diameter** | 20.5 mm (0.8") | | | Housing: 20.5 mm (0.8''), Neck: 7.8 mm (0.3''), Recess for calibrator: 7 mm |
| **Length** | 150 mm (5.9") | | | |
| **Weight** | 100 g, 3.53 oz | | 83 g, 2.93 oz | 83 g, 2.93 oz |
| **Protection class** | IP 51 | | | |
| **NTi Audio #** | 600 040 022 | 600 040 045 | 600 040 070 | 600 040 075 |

| | M2914 Low-Noise |
|---|---|
| **Microphone type** | Omnidirectional, pre-polarized condenser,free field microphone |
| **Capsule / transducer** | 1/2” detachable with 60UNS2 thread, type WS2F according IEC 61094-4 matched with preamplifier |
| **Preamplifier type** | MA214 |
| **Flatness tolerance bands typical** | ±2 dB @ 10 Hz – 16 kHz<br>±3 dB @ 5 Hz – 20 kHz |
| **Typical sensitivity @ 1 kHz** | 320 mV/Pa |
| **Residual noise floor typical** | 6.5 dB(A) |
| **Maximum SPL @ THD 3%, 1 kHz, S_typical** | Peak 103 dB / RMS 100 dB |
| **Temperature coefficient** | < ±0.01 dB / °C |
| **Temperature range** | –20°C to +60°C (–4°F to 140°F) |
| **Pressure coefficient** | –0.00001 dB/Pa |
| **Humidity** | < 90% R.H., non-condensing |
| **Power supply** | ICP |
| **Power supply current** | 4 – 20 mA typical |

| | M2914 Low-Noise |
|---|---|
| **Output impedance** | < 100 Ω |
| **Connector** | BNC |
| **Diameter** | 12.7 mm (0.5"), protection grid 13.2 mm (0.52") |
| **Length** | 135 mm (5.3”) |
| **Weight** | 250 g (8.8 oz) |
| **Windscreen diameter** | 50 mm (2") |
| **NTi Audio #** | 600 040 240 |

## 12.3 Technical Data Microphone Preamplifiers

| | MA230 | MA220 |
|---|---|---|
| **Microphone preamplifier** | Compatible with 1/2" microphone capsules type WS2F according to IEC61094-4 | |
| **Typical Frequency range** | 1.3 Hz – 50.0 kHz | 2.5 Hz – 50 kHz |
| **Frequency Response flatness** | ±0.2 dB, 10 Hz - 20 kHz | ±0.2 dB, 10 Hz - 20 kHz |
| **Phase linearity** | <±5° @ 20 Hz - 20 kHz | <±10° @ 20 Hz - 20 kHz |
| **Intrinsic noise typical** | 2.4 µV(A) @ $C_{in}$ 15 pF ≙9.1 dBA @ 42 mV/Pa | 1.6 µV(A) @ $C_{in}$ 18 pF ≙5.6 dBA @ 42 mV/Pa |
| **Maximum output voltage** | 22 Vpp ≙7.78 Vrms ≙139.3 dBSPL @ 42 mV/Pa | 21 Vpp ≙7.4 Vrms ≙138.9 dBSPL @ 42 mV/Pa |
| **Electronic data sheet** | • Contains calibration data<br>• Original NTi Audio sensitivity = 4.9 V/Pa<br>• Save and read data with XL3 Analyzer<br>• NTi Audio ASD according to IEEE P1451.4 V1.0, class 2, template 27 | |
| **Self-check** | Yes | No |
| **Humidity** | 5% to 90% RH, non-condensing | |
| **Power supply** | 48 VDC phantom power | |
| **Power supply current** | 0.76 mA typical | 2.3 mA typical |
| **Electronic data sheet** | NTi Audio ASD according to IEEE P1451.4 V1.0, class 2, template 27 | |
| **Output impedance** | 100 Ω symmetrical | |
| **Output connector** | balanced 3-pin XLR | |
| **Diameter** | 20.5 mm (0.8") | |

| | MA230 | MA220 |
|---|---|---|
| **Length** | 154 mm (6.1") | |
| **Weight** | 100 g, 3.53 oz | |
| **Protection class** | IP51 | |
| **NTi Audio #** | 600 040 200 | 600 040 050 |

## 12.4 Free-field correction

All NTi Audio measurement microphones are free-field equalized measurement microphones. The irritation of the free-field level, due to the presence of the microphone body in the sound field, is already compensated for in the microphone.

As sound calibrators operate in the pressure field, the level at the microphone diaphragm differs for 1/2" measurement microphones at the reference ambient conditions.

For most accurate calibration of the microphone sensitivity, the following free-field correction shall be applied when using a class 1 sound calibrator. The table below shows the target values for a microphone calibration with a sound level calibrator that is adjusted to 94.0 dB, and the correction values for different configurations.

| Sound calibrator | NTi CAL200 | B&K 4231 | Nor 1251 | Nor 1256 | Cirrus CIR:515 |
|---|---|---|---|---|---|
| **M2230 / M2340 Configuration** | 93.88 / -0.12 | 93.85 / -0.15 | 113.85 / -0.15 | 93.85 / -0.15 | 93.70 / -0.30 |

### 12.4.1 Application example

Configuration:

- XL3 + M2340 measurement microphone + WP40 vertically;
- NTi Audio CAL200 class 1 sound calibrator with 94.0 dB;

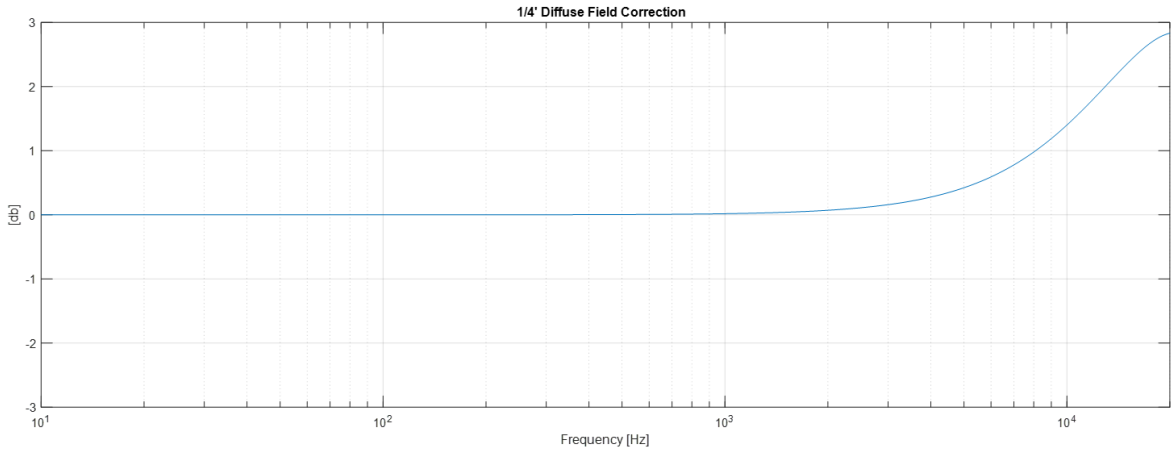
Setting for calibration:

- Open the Calibration screen;
- Adjust the **Calibrator** level to 93.88 dB (*refer to the table above*);
- Plug the sound calibrator onto the microphone and turn it ON;
- Tap on **START** and then on **OK**.

The calibration has been completed successfully.

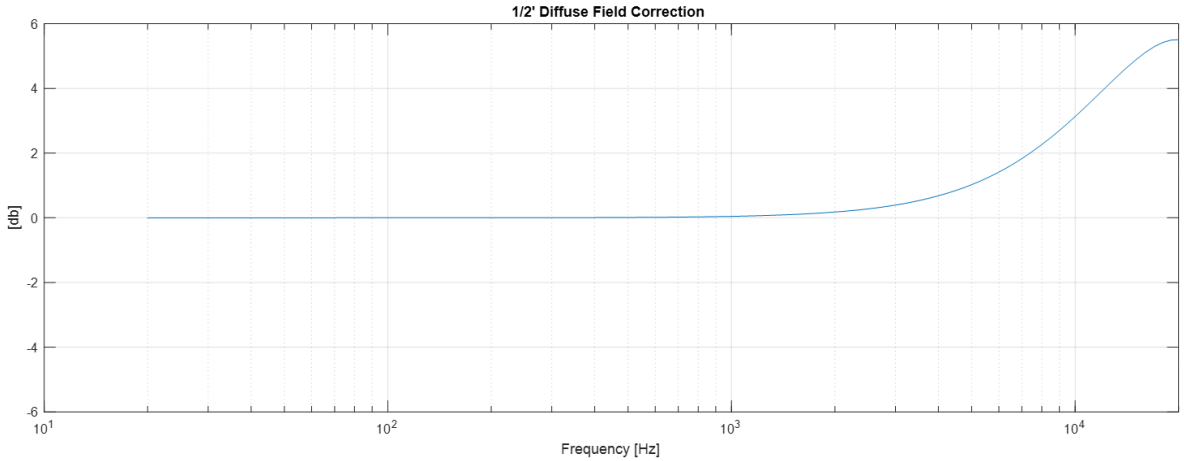
## 12.5 Diffuse field correction

### 12.5.1 M4261 1/4" microphone




| Frequency [Hz] | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 |
|---|---|---|---|---|---|---|---|---|
| Correction [dB] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 |
| Frequency [Hz] | 1060 | 1120 | 1180 | 1250 | 1320 | 1400 | 1500 | 1600 |
| Correction [dB] | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.05 |
| Frequency [Hz] | 1700 | 1800 | 1900 | 2000 | 2120 | 2240 | 2360 | 2500 |
| Correction [dB] | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.11 |
| Frequency [Hz] | 2650 | 2800 | 3000 | 3150 | 3350 | 3550 | 3750 | 4000 |
| Correction [dB] | 0.12 | 0.14 | 0.16 | 0.17 | 0.20 | 0.22 | 0.24 | 0.28 |
| Frequency [Hz] | 4250 | 4500 | 4750 | 5000 | 5300 | 5600 | 6000 | 6300 |
| Correction [dB] | 0.31 | 0.35 | 0.38 | 0.42 | 0.47 | 0.52 | 0.59 | 0.65 |
| Frequency [Hz] | 6700 | 7100 | 7500 | 8000 | 8500 | 9000 | 9500 | 10000 |
| Correction [dB] | 0.72 | 0.80 | 0.88 | 0.98 | 1.08 | 1.19 | 1.29 | 1.40 |
| Frequency [Hz] | 10600 | 11200 | 11800 | 12500 | 13200 | 14000 | 15000 | 16000 |
| Correction [dB] | 1.53 | 1.65 | 1.78 | 1.92 | 2.05 | 2.19 | 2.36 | 2.50 |
| Frequency [Hz] | 17000 | 18000 | 19000 | 20000 | | | | |
| Correction [dB] | 2.62 | 2.72 | 2.79 | 2.83 | | | | |

### 12.5.2 M2340 1/2" microphone

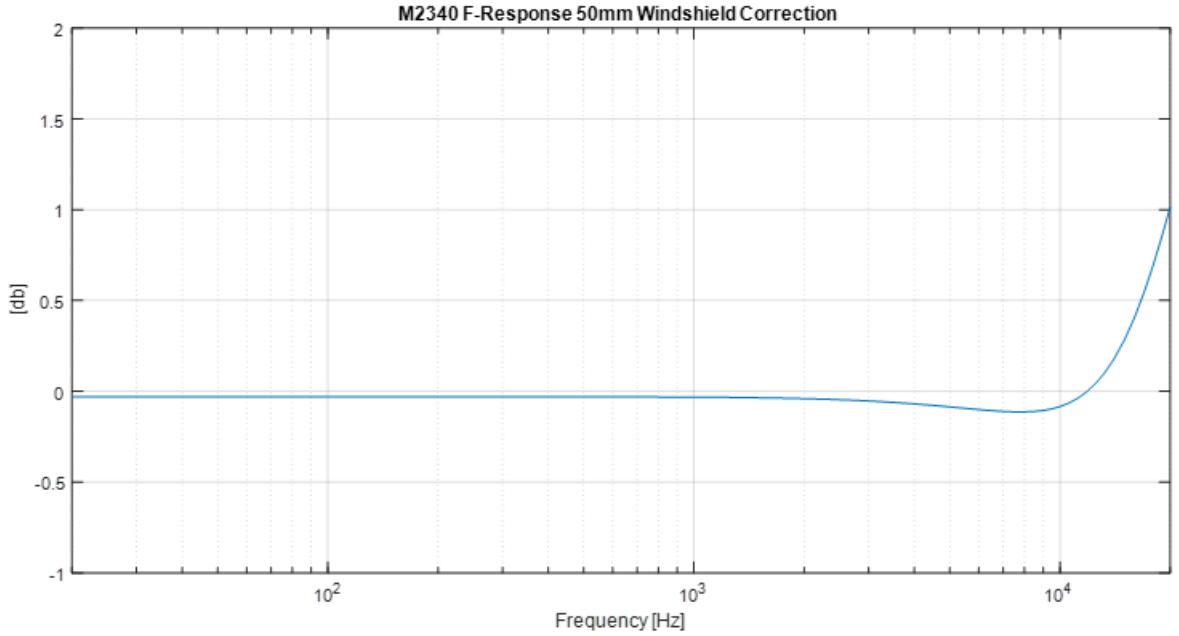



| Frequency [Hz] | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 |
|---|---|---|---|---|---|---|---|---|
| Correction [dB] | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.03 | 0.05 |
| Frequency [Hz] | 1060 | 1120 | 1180 | 1250 | 1320 | 1400 | 1500 | 1600 |
| Correction [dB] | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.12 |
| Frequency [Hz] | 1700 | 1800 | 1900 | 2000 | 2120 | 2240 | 2360 | 2500 |
| Correction [dB] | 0.13 | 0.15 | 0.16 | 0.18 | 0.20 | 0.22 | 0.25 | 0.28 |
| Frequency [Hz] | 2650 | 2800 | 3000 | 3150 | 3350 | 3550 | 3750 | 4000 |
| Correction [dB] | 0.31 | 0.35 | 0.39 | 0.43 | 0.49 | 0.54 | 0.60 | 0.68 |
| Frequency [Hz] | 4250 | 4500 | 4750 | 5000 | 5300 | 5600 | 6000 | 6300 |
| Correction [dB] | 0.76 | 0.85 | 0.93 | 1.02 | 1.14 | 1.25 | 1.41 | 1.54 |
| Frequency [Hz] | 6700 | 7100 | 7500 | 8000 | 8500 | 9000 | 9500 | 10000 |
| Correction [dB] | 1.70 | 1.87 | 2.05 | 2.26 | 2.48 | 2.70 | 2.92 | 3.13 |
| Frequency [Hz] | 10600 | 11200 | 11800 | 12500 | 13200 | 14000 | 15000 | 16000 |
| Correction [dB] | 3.38 | 3.62 | 2.86 | 4.11 | 4.35 | 4.60 | 4.88 | 5.11 |
| Frequency [Hz] | 17000 | 18000 | 19000 | 20000 | | | | |
| Correction [dB] | 5.29 | 5.42 | 5.49 | 5.51 | | | | |

- Measurement uncertainty 63 Hz – 4 kHz ±0.2 dB;
- Measurement uncertainty 4 kHz – 20 kHz ±0.3 dB.

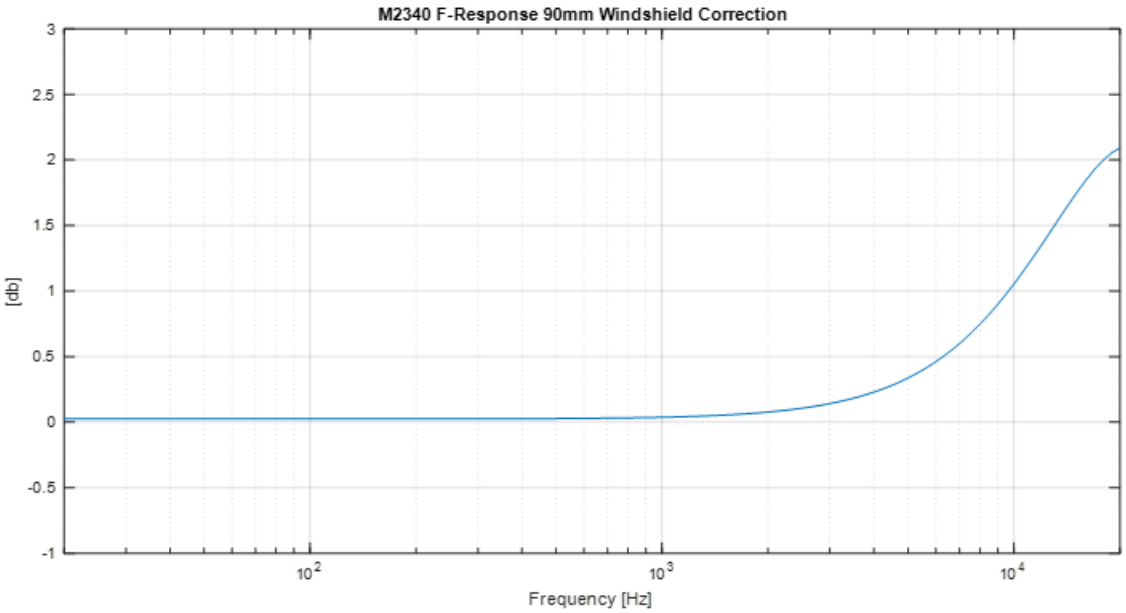
## 12.6 Windscreen corrections

### 12.6.1 Windscreen 50 mm correction (1/2")




| Frequency [Hz] | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 |
|---|---|---|---|---|---|---|---|---|
| Correction [dB] | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 |
| Frequency [Hz] | 1060 | 1120 | 1180 | 1250 | 1320 | 1400 | 1500 | 1600 |
| Correction [dB] | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.04 | -0.04 | -0.04 |
| Frequency [Hz] | 1700 | 1800 | 1900 | 2000 | 2120 | 2240 | 2360 | 2500 |
| Correction [dB] | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.05 |
| Frequency [Hz] | 2650 | 2800 | 3000 | 3150 | 3350 | 3550 | 3750 | 4000 |
| Correction [dB] | -0.05 | -0.05 | -0.05 | -0.06 | -0.06 | -0.06 | -0.07 | -0.07 |
| Frequency [Hz] | 4250 | 4500 | 4750 | 5000 | 5300 | 5600 | 6000 | 6300 |
| Correction [dB] | -0.07 | -0.08 | -0.08 | -0.09 | -0.09 | -0.10 | -0.10 | -0.10 |
| Frequency [Hz] | 6700 | 7100 | 7500 | 8000 | 8500 | 9000 | 9500 | 10000 |
| Correction [dB] | -0.11 | -0.11 | -0.11 | -0.11 | -0.11 | -0.11 | -0.10 | -0.08 |
| Frequency [Hz] | 10600 | 11200 | 11800 | 12500 | 13200 | 14000 | 15000 | 16000 |
| Correction [dB] | -0.06 | -0.04 | 0 | 0.04 | 0.10 | 0.17 | 0.28 | 0.41 |
| Frequency [Hz] | 17000 | 18000 | 19000 | 20000 | | | | |
| Correction [dB] | 0.55 | 0.70 | 0.86 | 1.01 | | | | |

### 12.6.2 Windscreen 90 mm (1/2")




| Frequency [Hz] | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 |
|---|---|---|---|---|---|---|---|---|
| Correction [dB] | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 |
| Frequency [Hz] | 1060 | 1120 | 1180 | 1250 | 1320 | 1400 | 1500 | 1600 |
| Correction [dB] | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.06 |
| Frequency [Hz] | 1700 | 1800 | 1900 | 2000 | 2120 | 2240 | 2360 | 2500 |
| Correction [dB] | 0.06 | 0.07 | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 | 0.11 |
| Frequency [Hz] | 2650 | 2800 | 3000 | 3150 | 3350 | 3550 | 3750 | 4000 |
| Correction [dB] | 0.12 | 0.13 | 0.14 | 0.15 | 0.17 | 0.19 | 0.21 | 0.23 |
| Frequency [Hz] | 4250 | 4500 | 4750 | 5000 | 5300 | 5600 | 6000 | 6300 |
| Correction [dB] | 0.25 | 0.28 | 0.31 | 0.34 | 0.37 | 0.41 | 0.46 | 0.5 |
| Frequency [Hz] | 6700 | 7100 | 7500 | 8000 | 8500 | 9000 | 9500 | 10000 |
| Correction [dB] | 0.56 | 0.61 | 0.67 | 0.75 | 0.82 | 0.9 | 0.98 | 1.05 |
| Frequency [Hz] | 10600 | 11200 | 11800 | 12500 | 13200 | 14000 | 15000 | 16000 |
| Correction [dB] | 1.15 | 1.24 | 1.33 | 1.43 | 1.52 | 1.63 | 1.74 | 1.85 |
| Frequency [Hz] | 17000 | 18000 | 19000 | 20000 | | | | |
| Correction [dB] | 1.93 | 2.00 | 2.06 | 2.09 | | | | |

- Measurement uncertainty 63 Hz – 4 kHz ±0.2 dB;
- Measurement uncertainty 4 kHz – 20 kHz ±0.3 dB.

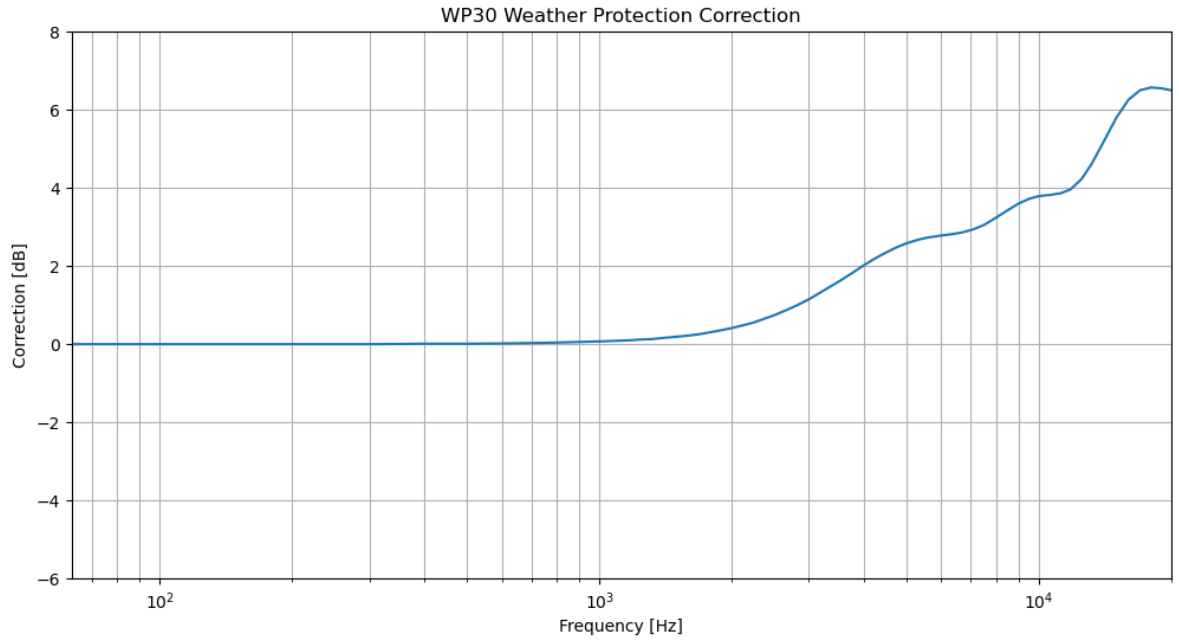
## 12.7 Correction weather protection WP30-90 and WP40-90

The following correction data apply for the WP30 and WP40 weather protection with either 90 mm windscreen.

### 12.7.1 WP30-90

The Horizontal sound incidence (community noise) and vertical sound incidence (e.g aicraft noise) corrections for the WP30-90 are presented below.

#### 12.7.1.1 Horizontal sound incidence (community noise)




The data is presented in table format in the Section WP30-90 horizontal sound incidence.

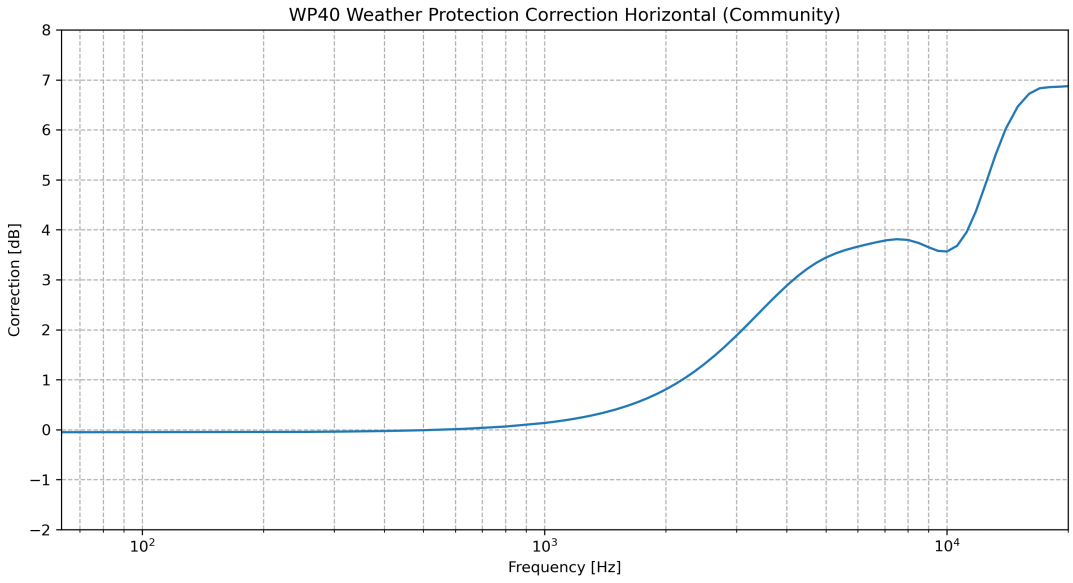
#### 12.7.1.2 Vertical sound incidence (e.g aircraft noise)

For 0° vertical sound incidences (e.g. aircraft noise during overflight) no correction is needed. Please see WP30-90 vertical sound incidence.

### 12.7.2 WP40-90

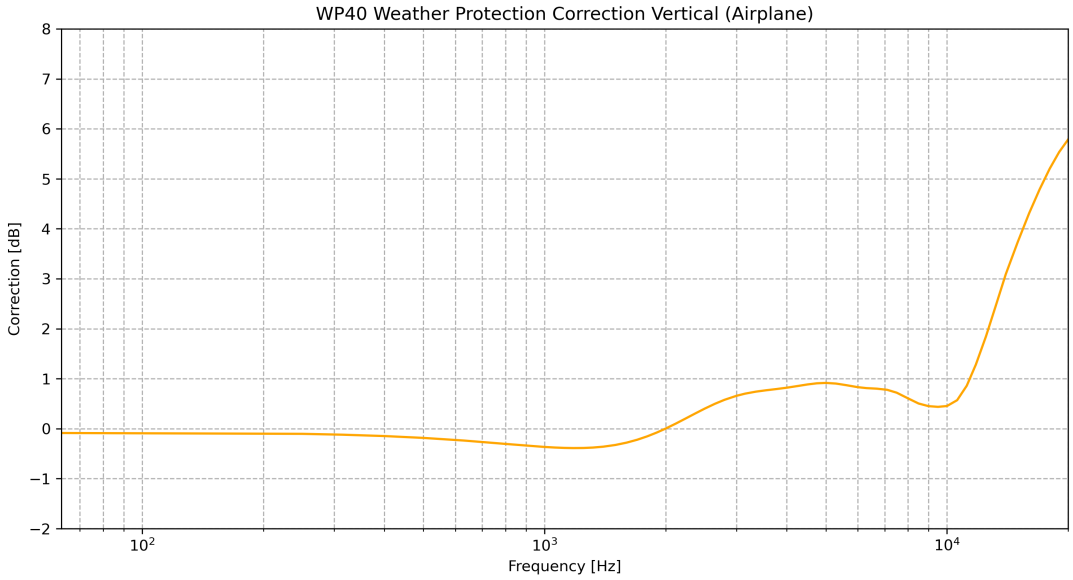
The Horizontal sound incidence (community noise) and vertical sound incidence (e.g aicraft noise) corrections for the WP40-90 are presented below.

#### 12.7.2.1 Horizontal sound incidence (community noise)



The data is presented in table format in the Section WP40-90 horizontal sound incidence.

#### 12.7.2.2 Vertical sound incidence (aircraft noise)




The data is presented in table format in the Section WP40-90 vertical sound incidence.

## 12.8 Frequency Response Corrections

### 12.8.1 90mm Windshield

The corrections for the 90 mm draft shield can be selected directly on the XL3-TA sound level meter. This allows the XL3-TA to correct the effect of the attached windscreen and precisely display the sound pressure level at the measuring point.

The specified measurement uncertainty applies to all measurement and correction values given here. The measurement uncertainty was calculated according to GUM with the coverage factor k = 2 and contains the uncertainty of the method as well as the uncertainty of the test specimen according to IEC 62585.

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of 90 mm Wind Screen | 0° Free-field Correction with 90 mm Wind Screen | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| Hz | Hz | dB | dB | dB | dB | dB | dB |
| 63 | 63.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 125 | 125.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 250 | 251.19 | 0.00 | 0.00 | 0.00 | -0.02 | 0.02 | 0.20 |
| 315 | 316.23 | 0.00 | 0.00 | 0.00 | -0.03 | 0.03 | 0.20 |
| 400 | 398.11 | 0.00 | 0.00 | 0.00 | -0.03 | 0.03 | 0.20 |
| 500 | 501.19 | 0.00 | 0.00 | 0.00 | -0.03 | 0.03 | 0.20 |
| 630 | 630.96 | 0.00 | 0.00 | 0.00 | -0.03 | 0.03 | 0.20 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of 90 mm Wind Screen | 0° Free-field Correction with 90 mm Wind Screen | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 800 | 794.33 | 0.00 | 0.00 | 0.00 | -0.03 | 0.03 | 0.20 |
| 1000 | 1000.00 | 0.00 | 0.00 | 0.00 | -0.04 | 0.04 | 0.20 |
| 1060 | 1059.25 | 0.00 | 0.00 | 0.00 | -0.04 | 0.04 | 0.20 |
| 1120 | 1122.02 | 0.00 | 0.00 | 0.00 | -0.04 | 0.04 | 0.20 |
| 1180 | 1188.50 | 0.00 | 0.00 | 0.00 | -0.04 | 0.04 | 0.20 |
| 1250 | 1258.93 | 0.00 | 0.00 | 0.00 | -0.04 | 0.04 | 0.20 |
| 1320 | 1333.52 | 0.00 | 0.00 | 0.00 | -0.05 | 0.05 | 0.20 |
| 1400 | 1412.54 | 0.00 | 0.00 | 0.00 | -0.05 | 0.05 | 0.20 |
| 1500 | 1496.24 | 0.00 | 0.00 | 0.00 | -0.05 | 0.05 | 0.20 |
| 1600 | 1584.89 | 0.00 | 0.00 | 0.00 | -0.06 | 0.06 | 0.20 |
| 1700 | 1678.80 | 0.00 | 0.00 | 0.00 | -0.06 | 0.06 | 0.20 |
| 1800 | 1778.28 | 0.00 | 0.00 | 0.00 | -0.07 | 0.07 | 0.20 |
| 1900 | 1883.65 | 0.00 | 0.00 | 0.00 | -0.07 | 0.07 | 0.20 |
| 2000 | 1995.26 | 0.00 | 0.00 | 0.00 | -0.08 | 0.08 | 0.20 |
| 2120 | 2113.19 | 0.00 | 0.00 | 0.00 | -0.08 | 0.08 | 0.20 |
| 2240 | 2238.72 | 0.00 | 0.00 | 0.00 | -0.09 | 0.09 | 0.20 |
| 2360 | 2371.37 | 0.00 | 0.00 | 0.00 | -0.10 | 0.10 | 0.20 |
| 2500 | 2511.89 | 0.00 | 0.00 | 0.00 | -0.11 | 0.11 | 0.20 |
| 2650 | 2660.73 | 0.00 | 0.00 | 0.00 | -0.12 | 0.12 | 0.20 |
| 2800 | 2818.38 | 0.00 | 0.00 | 0.00 | -0.13 | 0.13 | 0.20 |
| 3000 | 2985.38 | 0.00 | 0.00 | 0.00 | -0.14 | 0.14 | 0.20 |
| 3150 | 3162.28 | 0.00 | 0.00 | 0.00 | -0.15 | 0.15 | 0.20 |
| 3350 | 3349.65 | 0.00 | 0.00 | 0.00 | -0.17 | 0.17 | 0.20 |
| 3550 | 3548.13 | 0.00 | 0.00 | 0.00 | -0.19 | 0.19 | 0.20 |
| 3750 | 3758.37 | 0.00 | 0.00 | 0.00 | -0.21 | 0.21 | 0.20 |
| 4000 | 3981.07 | 0.00 | 0.00 | 0.00 | -0.23 | 0.23 | 0.20 |
| 4250 | 4216.97 | 0.00 | 0.00 | 0.00 | -0.25 | 0.25 | 0.30 |
| 4500 | 4466.84 | 0.00 | 0.00 | 0.00 | -0.28 | 0.28 | 0.30 |
| 4750 | 4731.51 | 0.00 | 0.00 | 0.00 | -0.31 | 0.31 | 0.30 |
| 5000 | 5011.87 | 0.00 | 0.00 | 0.00 | -0.34 | 0.34 | 0.30 |
| 5300 | 5308.84 | 0.00 | 0.00 | 0.00 | -0.37 | 0.37 | 0.30 |
| 5600 | 5623.41 | 0.00 | 0.00 | 0.00 | -0.41 | 0.41 | 0.30 |
| 6000 | 5956.62 | 0.00 | 0.00 | 0.00 | -0.46 | 0.46 | 0.30 |
| 6300 | 6309.57 | 0.00 | 0.00 | 0.00 | -0.50 | 0.50 | 0.30 |
| 6700 | 6683.44 | 0.00 | 0.00 | 0.00 | -0.56 | 0.56 | 0.30 |
| 7100 | 7079.46 | 0.00 | 0.00 | 0.00 | -0.61 | 0.61 | 0.30 |
| 7500 | 7498.94 | 0.00 | 0.00 | 0.00 | -0.67 | 0.67 | 0.30 |
| 8000 | 7943.28 | 0.00 | 0.00 | 0.00 | -0.75 | 0.75 | 0.30 |
| 8500 | 8413.95 | 0.00 | 0.00 | 0.00 | -0.82 | 0.82 | 0.30 |
| 9000 | 8912.51 | 0.00 | 0.00 | 0.00 | -0.90 | 0.90 | 0.30 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of 90 mm Wind Screen | 0° Free-field Correction with 90 mm Wind Screen | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 9500 | 9440.61 | 0.00 | 0.00 | 0.00 | -0.98 | 0.98 | 0.30 |
| 10000 | 10000.00 | 0.00 | 0.00 | 0.00 | -1.05 | 1.05 | 0.30 |
| 10600 | 10592.54 | 0.00 | 0.00 | 0.00 | -1.15 | 1.15 | 0.30 |
| 11200 | 11220.18 | 0.00 | 0.00 | 0.00 | -1.24 | 1.24 | 0.30 |
| 11800 | 11885.02 | 0.00 | 0.00 | 0.00 | -1.33 | 1.33 | 0.30 |
| 12500 | 12589.25 | 0.00 | 0.00 | 0.00 | -1.43 | 1.43 | 0.30 |
| 13200 | 13335.21 | 0.00 | 0.00 | 0.00 | -1.52 | 1.52 | 0.30 |
| 14000 | 14125.38 | 0.00 | 0.00 | 0.00 | -1.63 | 1.63 | 0.30 |
| 15000 | 14962.36 | 0.00 | 0.00 | 0.00 | -1.74 | 1.74 | 0.30 |
| 16000 | 15848.93 | 0.00 | 0.00 | 0.00 | -1.85 | 1.85 | 0.30 |
| 17000 | 16788.04 | 0.00 | 0.00 | 0.00 | -1.93 | 1.93 | 0.30 |
| 18000 | 17782.79 | 0.00 | 0.00 | 0.00 | -2.00 | 2.00 | 0.30 |
| 19000 | 18836.49 | 0.00 | 0.00 | 0.00 | -2.06 | 2.06 | 0.30 |
| 20000 | 19952.62 | 0.00 | 0.00 | 0.00 | -2.09 | 2.09 | 0.30 |

### 12.8.2 WP30-90 horizontal sound incidence

The following table shows the correction data that apply to the WP30 weather protection with horizontal sound incidence with a 90 mm windscreen.

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP30 Horizontal sound incidence (community noise) | Free field correction with WP30 Horizontal sound incidence (community noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| Hz | Hz | dB | dB | dB | dB | dB | dB |
| 63 | 63.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 125 | 125.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 250 | 251.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 315 | 316.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 400 | 398.11 | 0.00 | 0.00 | 0.00 | - 0.01 | 0.01 | 0.20 |
| 500 | 501.19 | 0.00 | 0.00 | 0.00 | - 0.01 | 0.01 | 0.20 |
| 630 | 630.96 | 0.00 | 0.00 | 0.00 | - 0.02 | 0.02 | 0.20 |
| 800 | 794.33 | 0.00 | 0.00 | 0.00 | - 0.04 | 0.04 | 0.20 |
| 1000 | 1000.00 | 0.00 | 0.00 | 0.00 | - 0.07 | 0.07 | 0.20 |
| 1060 | 1059.25 | 0.00 | 0.00 | 0.00 | - 0.08 | 0.08 | 0.20 |
| 1120 | 1122.02 | 0.00 | 0.00 | 0.00 | - 0.09 | 0.09 | 0.20 |
| 1180 | 1188.50 | 0.00 | 0.00 | 0.00 | - 0.10 | 0.10 | 0.20 |
| 1250 | 1258.93 | 0.00 | 0.00 | 0.00 | - 0.12 | 0.12 | 0.20 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP30 Horizontal sound incidence (community noise) | Free field correction with WP30 Horizontal sound incidence (community noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 1320 | 1333.52 | 0.00 | 0.00 | 0.00 | - 0.13 | 0.13 | 0.20 |
| 1400 | 1412.54 | 0.00 | 0.00 | 0.00 | - 0.16 | 0.16 | 0.20 |
| 1500 | 1496.24 | 0.00 | 0.00 | 0.00 | - 0.19 | 0.19 | 0.20 |
| 1600 | 1584.89 | 0.00 | 0.00 | 0.00 | - 0.22 | 0.22 | 0.20 |
| 1700 | 1678.80 | 0.00 | 0.00 | 0.00 | - 0.26 | 0.26 | 0.20 |
| 1800 | 1778.28 | 0.00 | 0.00 | 0.00 | - 0.31 | 0.31 | 0.20 |
| 1900 | 1883.65 | 0.00 | 0.00 | 0.00 | - 0.36 | 0.36 | 0.20 |
| 2000 | 1995.26 | 0.00 | 0.00 | 0.00 | - 0.41 | 0.41 | 0.20 |
| 2120 | 2113.19 | 0.00 | 0.00 | 0.00 | - 0.48 | 0.48 | 0.20 |
| 2240 | 2238.72 | 0.00 | 0.00 | 0.00 | - 0.55 | 0.55 | 0.20 |
| 2360 | 2371.37 | 0.00 | 0.00 | 0.00 | - 0.64 | 0.64 | 0.20 |
| 2500 | 2511.89 | 0.00 | 0.00 | 0.00 | - 0.74 | 0.74 | 0.20 |
| 2650 | 2660.73 | 0.00 | 0.00 | 0.00 | - 0.86 | 0.86 | 0.20 |
| 2800 | 2818.38 | 0.00 | 0.00 | 0.00 | - 0.98 | 0.98 | 0.20 |
| 3000 | 2985.38 | 0.00 | 0.00 | 0.00 | - 1.15 | 1.15 | 0.20 |
| 3150 | 3162.28 | 0.00 | 0.00 | 0.00 | - 1.29 | 1.29 | 0.20 |
| 3350 | 3349.65 | 0.00 | 0.00 | 0.00 | - 1.47 | 1.47 | 0.20 |
| 3550 | 3548.13 | 0.00 | 0.00 | 0.00 | - 1.64 | 1.64 | 0.20 |
| 3750 | 3758.37 | 0.00 | 0.00 | 0.00 | - 1.81 | 1.81 | 0.20 |
| 4000 | 3981.07 | 0.00 | 0.00 | 0.00 | - 2.02 | 2.02 | 0.20 |
| 4250 | 4216.97 | 0.00 | 0.00 | 0.00 | - 2.20 | 2.20 | 0.30 |
| 4500 | 4466.84 | 0.00 | 0.00 | 0.00 | - 2.35 | 2.35 | 0.30 |
| 4750 | 4731.51 | 0.00 | 0.00 | 0.00 | - 2.48 | 2.48 | 0.30 |
| 5000 | 5011.87 | 0.00 | 0.00 | 0.00 | - 2.58 | 2.58 | 0.30 |
| 5300 | 5308.84 | 0.00 | 0.00 | 0.00 | - 2.67 | 2.67 | 0.30 |
| 5600 | 5623.41 | 0.00 | 0.00 | 0.00 | - 2.73 | 2.73 | 0.30 |
| 6000 | 5956.62 | 0.00 | 0.00 | 0.00 | - 2.78 | 2.78 | 0.30 |
| 6300 | 6309.57 | 0.00 | 0.00 | 0.00 | - 2.81 | 2.81 | 0.30 |
| 6700 | 6683.44 | 0.00 | 0.00 | 0.00 | - 2.86 | 2.86 | 0.30 |
| 7100 | 7079.46 | 0.00 | 0.00 | 0.00 | - 2.94 | 2.94 | 0.30 |
| 7500 | 7498.94 | 0.00 | 0.00 | 0.00 | - 3.05 | 3.05 | 0.30 |
| 8000 | 7943.28 | 0.00 | 0.00 | 0.00 | - 3.24 | 3.24 | 0.30 |
| 8500 | 8413.95 | 0.00 | 0.00 | 0.00 | - 3.43 | 3.43 | 0.30 |
| 9000 | 8912.51 | 0.00 | 0.00 | 0.00 | - 3.60 | 3.60 | 0.30 |
| 9500 | 9440.61 | 0.00 | 0.00 | 0.00 | - 3.72 | 3.72 | 0.30 |
| 10000 | 10000.00 | 0.00 | 0.00 | 0.00 | - 3.79 | 3.79 | 0.30 |
| 10600 | 10592.54 | 0.00 | 0.00 | 0.00 | - 3.82 | 3.82 | 0.30 |
| 11200 | 11220.18 | 0.00 | 0.00 | 0.00 | - 3.86 | 3.86 | 0.30 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP30 Horizontal sound incidence (community noise) | Free field correction with WP30 Horizontal sound incidence (community noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 11800 | 11885.02 | 0.00 | 0.00 | 0.00 | - 3.96 | 3.96 | 0.30 |
| 12500 | 12589.25 | 0.00 | 0.00 | 0.00 | - 4.22 | 4.22 | 0.30 |
| 13200 | 13335.21 | 0.00 | 0.00 | 0.00 | - 4.62 | 4.62 | 0.30 |
| 14000 | 14125.38 | 0.00 | 0.00 | 0.00 | - 5.15 | 5.15 | 0.30 |
| 15000 | 14962.36 | 0.00 | 0.00 | 0.00 | - 5.79 | 5.79 | 0.30 |
| 16000 | 15848.93 | 0.00 | 0.00 | 0.00 | - 6.26 | 6.26 | 0.30 |
| 17000 | 16788.04 | 0.00 | 0.00 | 0.00 | - 6.50 | 6.50 | 0.30 |
| 18000 | 17782.79 | 0.00 | 0.00 | 0.00 | - 6.57 | 6.57 | 0.30 |
| 19000 | 18836.49 | 0.00 | 0.00 | 0.00 | - 6.55 | 6.55 | 0.30 |
| 20000 | 19952.62 | 0.00 | 0.00 | 0.00 | - 6.50 | 6.50 | 0.30 |

### 12.8.3 WP30-90 vertical sound incidence

The following table shows the correction data that applies to the WP30 weather protection with vertical sound incidence with a 90 mm windscreen.

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP30 Vertical sound incidence (Aircraft noise) | Free field correction with WP30 Vertical sound incidence (Aircraft noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| Hz | Hz | dB | dB | dB | dB | dB | dB |
| 63 | 63.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 125 | 125.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 250 | 251.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 315 | 316.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 400 | 398.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 500 | 501.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 630 | 630.96 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 800 | 794.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1000 | 1000.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1060 | 1059.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1120 | 1122.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1180 | 1188.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1250 | 1258.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1320 | 1333.52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1400 | 1412.54 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP30 Vertical sound incidence (Aircraft noise) | Free field correction with WP30 Vertical sound incidence (Aircraft noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 1500 | 1496.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1600 | 1584.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1700 | 1678.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1800 | 1778.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 1900 | 1883.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2000 | 1995.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2120 | 2113.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2240 | 2238.72 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2360 | 2371.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2500 | 2511.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2650 | 2660.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 2800 | 2818.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 3000 | 2985.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 3150 | 3162.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 3350 | 3349.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 3550 | 3548.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 3750 | 3758.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 4000 | 3981.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 4250 | 4216.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 4500 | 4466.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 4750 | 4731.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 5000 | 5011.87 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 5300 | 5308.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 5600 | 5623.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 6000 | 5956.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 6300 | 6309.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 6700 | 6683.44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 7100 | 7079.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 7500 | 7498.94 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 8000 | 7943.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 8500 | 8413.95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 9000 | 8912.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 9500 | 9440.61 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 10000 | 10000.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 10600 | 10592.54 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 11200 | 11220.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 11800 | 11885.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 12500 | 12589.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP30 Vertical sound incidence (Aircraft noise) | Free field correction with WP30 Vertical sound incidence (Aircraft noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 13200 | 13335.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 14000 | 14125.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 15000 | 14962.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 16000 | 15848.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 17000 | 16788.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 18000 | 17782.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 19000 | 18836.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| 20000 | 19952.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |

### 12.8.4 WP40-90 horizontal sound incidence

The following table shows the correction data that apply to the WP40 weather protection with horizontal sound incidence with a 90 mm windscreen.

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP40 Horizontal sound incidence (community noise) | Free field correction with WP40 Horizontal sound incidence (community noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| Hz | Hz | dB | dB | dB | dB | dB | dB |
| 63 | 63.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 125 | 125.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 250 | 251.19 | 0.00 | 0.00 | 0.00 | 0.04 | -0.04 | 0.20 |
| 315 | 316.23 | 0.00 | 0.00 | 0.00 | 0.04 | -0.04 | 0.20 |
| 400 | 398.11 | 0.00 | 0.00 | 0.00 | 0.03 | -0.03 | 0.20 |
| 500 | 501.19 | 0.00 | 0.00 | 0.00 | 0.01 | -0.01 | 0.20 |
| 630 | 630.96 | 0.00 | 0.00 | 0.00 | - 0.02 | 0.02 | 0.20 |
| 800 | 794.33 | 0.00 | 0.00 | 0.00 | - 0.06 | 0.06 | 0.20 |
| 1000 | 1000.00 | 0.00 | 0.00 | 0.00 | - 0.13 | 0.13 | 0.20 |
| 1060 | 1059.25 | 0.00 | 0.00 | 0.00 | - 0.16 | 0.16 | 0.20 |
| 1120 | 1122.02 | 0.00 | 0.00 | 0.00 | - 0.19 | 0.19 | 0.20 |
| 1180 | 1188.50 | 0.00 | 0.00 | 0.00 | - 0.22 | 0.22 | 0.20 |
| 1250 | 1258.93 | 0.00 | 0.00 | 0.00 | -0.25 | 0.25 | 0.20 |
| 1320 | 1333.52 | 0.00 | 0.00 | 0.00 | - 0.29 | 0.29 | 0.20 |
| 1400 | 1412.54 | 0.00 | 0.00 | 0.00 | - 0.34 | 0.34 | 0.20 |
| 1500 | 1496.24 | 0.00 | 0.00 | 0.00 | - 0.40 | 0.40 | 0.20 |
| 1600 | 1584.89 | 0.00 | 0.00 | 0.00 | - 0.47 | 0.47 | 0.20 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP40 Horizontal sound incidence (community noise) | Free field correction with WP40 Horizontal sound incidence (community noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 1700 | 1678.80 | 0.00 | 0.00 | 0.00 | - 0.55 | 0.55 | 0.20 |
| 1800 | 1778.28 | 0.00 | 0.00 | 0.00 | -0.63 | 0.63 | 0.20 |
| 1900 | 1883.65 | 0.00 | 0.00 | 0.00 | - 0.71 | 0.71 | 0.20 |
| 2000 | 1995.26 | 0.00 | 0.00 | 0.00 | - 0.80 | 0.80 | 0.20 |
| 2120 | 2113.19 | 0.00 | 0.00 | 0.00 | - 0.92 | 0.92 | 0.20 |
| 2240 | 2238.72 | 0.00 | 0.00 | 0.00 | - 1.04 | 1.04 | 0.20 |
| 2360 | 2371.37 | 0.00 | 0.00 | 0.00 | - 1.17 | 1.17 | 0.20 |
| 2500 | 2511.89 | 0.00 | 0.00 | 0.00 | - 1.32 | 1.32 | 0.20 |
| 2650 | 2660.73 | 0.00 | 0.00 | 0.00 | - 1.49 | 1.49 | 0.20 |
| 2800 | 2818.38 | 0.00 | 0.00 | 0.00 | - 1.66 | 1.66 | 0.20 |
| 3000 | 2985.38 | 0.00 | 0.00 | 0.00 | - 1.88 | 1.88 | 0.20 |
| 3150 | 3162.28 | 0.00 | 0.00 | 0.00 | - 2.05 | 2.05 | 0.20 |
| 3350 | 3349.65 | 0.00 | 0.00 | 0.00 | - 2.27 | 2.27 | 0.20 |
| 3550 | 3548.13 | 0.00 | 0.00 | 0.00 | - 2.48 | 2.48 | 0.20 |
| 3750 | 3758.37 | 0.00 | 0.00 | 0.00 | -2.67 | 2.67 | 0.20 |
| 4000 | 3981.07 | 0.00 | 0.00 | 0.00 | -2.88 | 2.88 | 0.20 |
| 4250 | 4216.97 | 0.00 | 0.00 | 0.00 | -3.07 | 3.07 | 0.30 |
| 4500 | 4466.84 | 0.00 | 0.00 | 0.00 | -3.22 | 3.22 | 0.30 |
| 4750 | 4731.51 | 0.00 | 0.00 | 0.00 | -3.35 | 3.35 | 0.30 |
| 5000 | 5011.87 | 0.00 | 0.00 | 0.00 | -3.44 | 3.44 | 0.30 |
| 5300 | 5308.84 | 0.00 | 0.00 | 0.00 | -3.53 | 3.53 | 0.30 |
| 5600 | 5623.41 | 0.00 | 0.00 | 0.00 | -3.60 | 3.60 | 0.30 |
| 6000 | 5956.62 | 0.00 | 0.00 | 0.00 | -3.66 | 3.66 | 0.30 |
| 6300 | 6309.57 | 0.00 | 0.00 | 0.00 | -3.70 | 3.70 | 0.30 |
| 6700 | 6683.44 | 0.00 | 0.00 | 0.00 | -3.75 | 3.75 | 0.30 |
| 7100 | 7079.46 | 0.00 | 0.00 | 0.00 | -3.79 | 3.79 | 0.30 |
| 7500 | 7498.94 | 0.00 | 0.00 | 0.00 | -3.81 | 3.81 | 0.30 |
| 8000 | 7943.28 | 0.00 | 0.00 | 0.00 | -3.80 | 3.80 | 0.30 |
| 8500 | 8413.95 | 0.00 | 0.00 | 0.00 | -3.74 | 3.74 | 0.30 |
| 9000 | 8912.51 | 0.00 | 0.00 | 0.00 | -3.65 | 3.65 | 0.30 |
| 9500 | 9440.61 | 0.00 | 0.00 | 0.00 | -3.58 | 3.58 | 0.30 |
| 10000 | 10000.00 | 0.00 | 0.00 | 0.00 | -3.57 | 3.57 | 0.30 |
| 10600 | 10592.54 | 0.00 | 0.00 | 0.00 | - 3.68 | 3.68 | 0.30 |
| 11200 | 11220.18 | 0.00 | 0.00 | 0.00 | -3.96 | 3.96 | 0.30 |
| 11800 | 11885.02 | 0.00 | 0.00 | 0.00 | -4.37 | 4.37 | 0.30 |
| 12500 | 12589.25 | 0.00 | 0.00 | 0.00 | -4.94 | 4.94 | 0.30 |
| 13200 | 13335.21 | 0.00 | 0.00 | 0.00 | -5.49 | 5.49 | 0.30 |
| 14000 | 14125.38 | 0.00 | 0.00 | 0.00 | -6.02 | 6.02 | 0.30 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP40 Horizontal sound incidence (community noise) | Free field correction with WP40 Horizontal sound incidence (community noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 15000 | 14962.36 | 0.00 | 0.00 | 0.00 | -6.47 | 6.47 | 0.30 |
| 16000 | 15848.93 | 0.00 | 0.00 | 0.00 | -6.72 | 6.72 | 0.30 |
| 17000 | 16788.04 | 0.00 | 0.00 | 0.00 | -6.83 | 6.83 | 0.30 |
| 18000 | 17782.79 | 0.00 | 0.00 | 0.00 | - 6.85 | 6.85 | 0.30 |
| 19000 | 18836.49 | 0.00 | 0.00 | 0.00 | - 6.86 | 6.86 | 0.30 |
| 20000 | 19952.62 | 0.00 | 0.00 | 0.00 | - 6.87 | 6.87 | 0.30 |

### 12.8.5 WP40-90 vertical sound incidence

The following table shows the correction data that applies to the WP40 weather protection with vertical sound incidence with a 90 mm windscreen.

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP40 Vertical sound incidence (Aircraft noise) | Free field correction with WP40 Vertical sound incidence (Aircraft noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| Hz | Hz | dB | dB | dB | dB | dB | dB |
| 63 | 63.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 125 | 125.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 |
| 250 | 251.19 | 0.00 | 0.00 | 0.00 | 0.10 | -0.10 | 0.20 |
| 315 | 316.23 | 0.00 | 0.00 | 0.00 | 0.12 | -0.12 | 0.20 |
| 400 | 398.11 | 0.00 | 0.00 | 0.00 | 0.15 | -0.15 | 0.20 |
| 500 | 501.19 | 0.00 | 0.00 | 0.00 | 0.18 | -0.18 | 0.20 |
| 630 | 630.96 | 0.00 | 0.00 | 0.00 | 0.24 | -0.24 | 0.20 |
| 800 | 794.33 | 0.00 | 0.00 | 0.00 | 0.31 | -0.31 | 0.20 |
| 1000 | 1000.00 | 0.00 | 0.00 | 0.00 | 0.37 | -0.37 | 0.20 |
| 1060 | 1059.25 | 0.00 | 0.00 | 0.00 | 0.38 | -0.38 | 0.20 |
| 1120 | 1122.02 | 0.00 | 0.00 | 0.00 | 0.39 | -0.39 | 0.20 |
| 1180 | 1188.50 | 0.00 | 0.00 | 0.00 | 0.39 | -0.39 | 0.20 |
| 1250 | 1258.93 | 0.00 | 0.00 | 0.00 | 0.39 | -0.39 | 0.20 |
| 1320 | 1333.52 | 0.00 | 0.00 | 0.00 | 0.38 | -0.38 | 0.20 |
| 1400 | 1412.54 | 0.00 | 0.00 | 0.00 | 0.36 | -0.36 | 0.20 |
| 1500 | 1496.24 | 0.00 | 0.00 | 0.00 | 0.33 | -0.33 | 0.20 |
| 1600 | 1584.89 | 0.00 | 0.00 | 0.00 | 0.28 | -0.28 | 0.20 |
| 1700 | 1678.80 | 0.00 | 0.00 | 0.00 | 0.22 | -0.22 | 0.20 |
| 1800 | 1778.28 | 0.00 | 0.00 | 0.00 | 0.15 | -0.15 | 0.20 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP40 Vertical sound incidence (Aircraft noise) | Free field correction with WP40 Vertical sound incidence (Aircraft noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 1900 | 1883.65 | 0.00 | 0.00 | 0.00 | 0.08 | -0.08 | 0.20 |
| 2000 | 1995.26 | 0.00 | 0.00 | 0.00 | - 0.00 | 0.00 | 0.20 |
| 2120 | 2113.19 | 0.00 | 0.00 | 0.00 | - 0.10 | 0.10 | 0.20 |
| 2240 | 2238.72 | 0.00 | 0.00 | 0.00 | - 0.20 | 0.20 | 0.20 |
| 2360 | 2371.37 | 0.00 | 0.00 | 0.00 | - 0.30 | 0.30 | 0.20 |
| 2500 | 2511.89 | 0.00 | 0.00 | 0.00 | - 0.40 | 0.40 | 0.20 |
| 2650 | 2660.73 | 0.00 | 0.00 | 0.00 | - 0.50 | 0.50 | 0.20 |
| 2800 | 2818.38 | 0.00 | 0.00 | 0.00 | - 0.58 | 0.58 | 0.20 |
| 3000 | 2985.38 | 0.00 | 0.00 | 0.00 | - 0.66 | 0.66 | 0.20 |
| 3150 | 3162.28 | 0.00 | 0.00 | 0.00 | - 0.70 | 0.70 | 0.20 |
| 3350 | 3349.65 | 0.00 | 0.00 | 0.00 | - 0.74 | 0.74 | 0.20 |
| 3550 | 3548.13 | 0.00 | 0.00 | 0.00 | - 0.77 | 0.77 | 0.20 |
| 3750 | 3758.37 | 0.00 | 0.00 | 0.00 | - 0.79 | 0.79 | 0.20 |
| 4000 | 3981.07 | 0.00 | 0.00 | 0.00 | - 0.82 | 0.82 | 0.20 |
| 4250 | 4216.97 | 0.00 | 0.00 | 0.00 | - 0.85 | 0.85 | 0.30 |
| 4500 | 4466.84 | 0.00 | 0.00 | 0.00 | - 0.88 | 0.88 | 0.30 |
| 4750 | 4731.51 | 0.00 | 0.00 | 0.00 | - 0.91 | 0.91 | 0.30 |
| 5000 | 5011.87 | 0.00 | 0.00 | 0.00 | - 0.92 | 0.92 | 0.30 |
| 5300 | 5308.84 | 0.00 | 0.00 | 0.00 | - 0.90 | 0.90 | 0.30 |
| 5600 | 5623.41 | 0.00 | 0.00 | 0.00 | - 0.87 | 0.87 | 0.30 |
| 6000 | 5956.62 | 0.00 | 0.00 | 0.00 | - 0.83 | 0.83 | 0.30 |
| 6300 | 6309.57 | 0.00 | 0.00 | 0.00 | - 0.81 | 0.81 | 0.30 |
| 6700 | 6683.44 | 0.00 | 0.00 | 0.00 | - 0.80 | 0.80 | 0.30 |
| 7100 | 7079.46 | 0.00 | 0.00 | 0.00 | - 0.78 | 0.78 | 0.30 |
| 7500 | 7498.94 | 0.00 | 0.00 | 0.00 | - 0.72 | 0.72 | 0.30 |
| 8000 | 7943.28 | 0.00 | 0.00 | 0.00 | - 0.61 | 0.61 | 0.30 |
| 8500 | 8413.95 | 0.00 | 0.00 | 0.00 | - 0.50 | 0.50 | 0.30 |
| 9000 | 8912.51 | 0.00 | 0.00 | 0.00 | - 0.45 | 0.45 | 0.30 |
| 9500 | 9440.61 | 0.00 | 0.00 | 0.00 | - 0.44 | 0.44 | 0.30 |
| 10000 | 10000.00 | 0.00 | 0.00 | 0.00 | - 0.45 | 0.45 | 0.30 |
| 10600 | 10592.54 | 0.00 | 0.00 | 0.00 | - 0.57 | 0.57 | 0.30 |
| 11200 | 11220.18 | 0.00 | 0.00 | 0.00 | - 0.86 | 0.86 | 0.30 |
| 11800 | 11885.02 | 0.00 | 0.00 | 0.00 | - 1.28 | 1.28 | 0.30 |
| 12500 | 12589.25 | 0.00 | 0.00 | 0.00 | - 1.85 | 1.85 | 0.30 |
| 13200 | 13335.21 | 0.00 | 0.00 | 0.00 | - 2.44 | 2.44 | 0.30 |
| 14000 | 14125.38 | 0.00 | 0.00 | 0.00 | - 3.09 | 3.09 | 0.30 |
| 15000 | 14962.36 | 0.00 | 0.00 | 0.00 | - 3.74 | 3.74 | 0.30 |
| 16000 | 15848.93 | 0.00 | 0.00 | 0.00 | - 4.31 | 4.31 | 0.30 |

| Nominal Frequency | Actual Frequency | 0° Free-field Frequency Response | 0° Free-field Correction | Housing Reflection and Microphone Diffraction Correction | Impact of WP40 Vertical sound incidence (Aircraft noise) | Free field correction with WP40 Vertical sound incidence (Aircraft noise) | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| 17000 | 16788.04 | 0.00 | 0.00 | 0.00 | - 4.79 | 4.79 | 0.30 |
| 18000 | 17782.79 | 0.00 | 0.00 | 0.00 | - 5.20 | 5.20 | 0.30 |
| 19000 | 18836.49 | 0.00 | 0.00 | 0.00 | - 5.53 | 5.53 | 0.30 |
| 20000 | 19952.62 | 0.00 | 0.00 | 0.00 | - 5.79 | 5.79 | 0.30 |

## 12.9 Frequency weighting filter

| Rated frequency [Hz] | Frequency weighting [dB] | | |
|---|---|---|---|
| | A | C | Z |
| **10** | –70.4 | –14.3 | 0.0 |
| **12.5** | –63.4 | –11.2 | 0.0 |
| **16** | –56.7 | –8.5 | 0.0 |
| **20** | –50.5 | –6.2 | 0.0 |
| **25** | –44.7 | –4.4 | 0.0 |
| **31.5** | –39.4 | –3.0 | 0.0 |
| **40** | –34.6 | –2.0 | 0.0 |
| **50** | –30.2 | –1.3 | 0.0 |
| **63** | –26.2 | –0.8 | 0.0 |
| **80** | –22.5 | –0.5 | 0.0 |
| **100** | –19.1 | –0.3 | 0.0 |
| **125** | –16.1 | –0.2 | 0.0 |
| **160** | –13.4 | –0.1 | 0.0 |
| **200** | –10.9 | 0.0 | 0.0 |
| **250** | –8.6 | 0.0 | 0.0 |
| **315** | –6.6 | 0.0 | 0.0 |
| **400** | –4.8 | 0.0 | 0.0 |
| **500** | –3.2 | 0.0 | 0.0 |
| **630** | –1.9 | 0.0 | 0.0 |
| **800** | –0.8 | 0.0 | 0.0 |
| **1000** | 0.0 | 0.0 | 0.0 |
| **1250** | 0.6 | 0.0 | 0.0 |

| Rated frequency [Hz] | Frequency weighting [dB] | | |
|---|---|---|---|
| | A | C | Z |
| **1600** | 1.0 | –0.1 | 0.0 |
| **2000** | 1.2 | –0.2 | 0.0 |
| **2500** | 1.3 | –0.3 | 0.0 |
| **3150** | 1.2 | –0.5 | 0.0 |
| **4000** | 1.0 | –0.8 | 0.0 |
| **5000** | 0.5 | –1.3 | 0.0 |
| **6300** | –0.1 | –2.0 | 0.0 |
| **8000** | –1.1 | –3.0 | 0.0 |
| **10000** | –2.5 | –4.4 | 0.0 |
| **12500** | –4.3 | –6.2 | 0.0 |
| **16000** | –6.6 | –8.5 | 0.0 |
| **20000** | –9.3 | –11.2 | 0.0 |

## 12.10 Level linearity of broadband levels

The initial values ("beginning at") for the level linearity test according to IEC61672 can be seen in the following tables. Sref = 42 mV/Pa* applies to all specifications.

### 12.10.1 Level range with M2340

| Frequency | dB | | | | | |
|---|---|---|---|---|---|---|
| | LAT* | LCT* | LZT* | LAeqT* | LAE* ($t_{int}$= 10 s) | LCpeak* |
| **31.5 Hz** | from 25 to 98<br>beginning at 94 | from 28 to 135<br>beginning at 114 | from 31 to 138<br>beginning at 114 | from 25 to 98<br>beginning at 94 | from 35 to 108<br>beginning at 94 | ---- |
| **1 kHz** | from 25 to 138<br>beginning at 114 | from 28 to 138<br>beginning at 114 | from 31 to 138<br>beginning at 114 | from 25 to 138<br>beginning at 114 | from 35 to 148<br>beginning at 124 | from 41 to 141 |
| **4 kHz** | from 25 to 139<br>beginning at 114 | from 28 to 137<br>beginning at 114 | from 31 to 138<br>beginning at 114 | from 25 to 139<br>beginning at 114 | from 35 to 149<br>beginning at 124 | ---- |
| **8 kHz** | from 25 to 136<br>beginning at 114 | from 28 to 135<br>beginning at 114 | from 31 to 138<br>beginning at 114 | from 25 to 136<br>beginning at 114 | from 35 to 146<br>beginning at 124 | ---- |

| Frequency | dB | | | | | |
|---|---|---|---|---|---|---|
| | LAT* | LCT* | LZT* | LAeqT* | LAE* ($t_{int}$= 10 s) | LCpeak* |
| 12.5 kHz | from 25 to 133 beginning at 114 | from 28 to 131 beginning at 114 | from 31 to 138 beginning at 114 | from 25 to 133 beginning at 114 | from 35 to 143 beginning at 124 | ---- |

* If the sensitivity Sx deviates from the given data, a correction value of 20*log(Sref/Sx) has to be added.

Example: Sx = 45 mV/Pa –> correction value = 20*log(42/45) = –0.6 dB

### 12.10.2 Level range with M2230

| Frequency | dB | | | | | |
|---|---|---|---|---|---|---|
| | LAT* | LCT* | LZT* | LAeqT* | LAE* ($t_{int}$ = 10 s) | LCpeak* |
| 31.5 Hz | from 24 to 98 beginning at 94 | from 27 to 134 beginning at 114 | from 30 to 137 beginning at 114 | from 24 to 98 beginning at 94 | from 34 to 108 beginning at 94 | ---- |
| 1 kHz | from 24 to 137 beginning at 114 | from 27 to 137 beginning at 114 | from 30 to 137 beginning at 114 | from 24 to 137 beginning at 114 | from 34 to 147 beginning at 124 | from 41 to 140 |
| 4 kHz | from 24 to 138 beginning at 114 | from 27 to 136 beginning at 114 | from 30 to 137 beginning at 114 | from 24 to 138 beginning at 114 | from 34 to 148 beginning at 124 | ---- |
| 8 kHz | from 24 to 136 beginning at 114 | from 27 to 134 beginning at 114 | from 30 to 137 beginning at 114 | from 24 to 136 beginning at 114 | from 34 to 146 beginning at 124 | ---- |
| 12.5 kHz | from 24 to 133 beginning at 114 | from 27 to 131 beginning at 114 | from 30 to 137 beginning at 114 | from 24 to 133 beginning at 114 | from 34 to 143 beginning at 124 | ---- |

Sound levels that continuously exceed the specified ranges and overdrive the microphone amplifier can, in extreme cases, result in the display of measured values below the real sound level.

### 12.10.3 Intrinsic noise with microphone M2340

| Frequency weighting | Intrinsic noise @ S = 42 mV/Pa | |
|---|---|---|
| | terminated with microphone preamplifier | with complete microphone M2340 |
| A | 12 | 18 |
| C | 15 | 21 |
| Z | 22 | 24 |

### 12.10.4 Intrinsic noise with microphone M2230

| Frequency weighting | Intrinsic noise @ S = 42 mV/Pa | |
|---|---|---|
| | terminated with microphone preamplifier | with complete microphone M2230 |
| A | 11 | 17 |
| C | 14 | 20 |
| Z | 22 | 23 |

### 12.10.5 Level linearity for Octave band level

For IEC 61260; for all specifications Sref = 42 mV/Pa*.

| Rated frequency [Hz] | Measuring range M2340 [dBSPL] | | Measuring range M2230 [dBSPL] | |
|---|---|---|---|---|
| | from | to | from | to |
| 8 | 24 | 137 | 24 | 137 |
| 16 | 21 | 137 | 21 | 137 |
| 31.5 | 17 | 137 | 17 | 137 |
| 63 | 15 | 137 | 15 | 137 |
| 125 | 14 | 137 | 14 | 137 |
| 250 | 13 | 137 | 13 | 137 |
| 500 | 13 | 137 | 13 | 137 |
| 1000 | 15 | 137 | 15 | 137 |
| 2000 | 17 | 137 | 17 | 137 |
| 4000 | 19 | 137 | 19 | 137 |
| 8000 | 19 | 137 | 19 | 137 |
| 16000 | 18 | 137 | 18 | 137 |

The basic sampling rate of the filters is 96 kHz

* If the sensitivity Sx differs, a correction value of 20*log(Sref/Sx) must be added to the specified values. Example: Sx = 45 mV/Pa –> correction value = 20*log(42/45) = –0.6 dB

### 12.10.6 Level linearity for 1/3$^{rd}$ Octave band level

for IEC 61260; for all specifications Sref = 42 mV/Pa*.

| Rated frequency [Hz] | Measuring range M2340 [dBSPL] | | Measuring range M2230 [dBSPL] | |
|---|---|---|---|---|
| | from | to | from | to |
| **6.3** | 20 | 137 | 20 | 137 |
| **8** | 19 | 137 | 19 | 137 |
| **10** | 18 | 137 | 18 | 137 |
| **12.5** | 17 | 137 | 17 | 137 |
| **16** | 16 | 137 | 16 | 137 |
| **20** | 15 | 137 | 15 | 137 |
| **25** | 13 | 137 | 13 | 137 |
| **31.5** | 12 | 137 | 12 | 137 |
| **40** | 11 | 137 | 11 | 137 |
| **50** | 11 | 137 | 11 | 137 |
| **63** | 10 | 137 | 10 | 137 |
| **80** | 9 | 137 | 9 | 137 |
| **100** | 9 | 137 | 9 | 137 |
| **125** | 8 | 137 | 8 | 137 |
| **160** | 8 | 137 | 8 | 137 |
| **200** | 8 | 137 | 8 | 137 |
| **250** | 8 | 137 | 8 | 137 |
| **315** | 8 | 137 | 8 | 137 |
| **400** | 8 | 137 | 8 | 137 |
| **500** | 8 | 137 | 8 | 137 |
| **630** | 9 | 137 | 9 | 137 |
| **800** | 9 | 137 | 9 | 137 |
| **1000** | 10 | 137 | 10 | 137 |
| **1250** | 11 | 137 | 11 | 137 |
| **1600** | 11 | 137 | 11 | 137 |
| **2000** | 13 | 137 | 13 | 137 |
| **2500** | 13 | 137 | 13 | 137 |
| **3150** | 14 | 137 | 14 | 137 |
| **4000** | 14 | 137 | 14 | 137 |
| **5000** | 15 | 137 | 15 | 137 |
| **6300** | 15 | 137 | 15 | 137 |
| **8000** | 15 | 137 | 15 | 137 |
| **10000** | 15 | 137 | 15 | 137 |

| Rated frequency [Hz] | Measuring range M2340 [dBSPL] | | Measuring range M2230 [dBSPL] | |
|---|---|---|---|---|
| | from | to | from | to |
| **12500** | 14 | 137 | 14 | 137 |
| **16000** | 13 | 137 | 13 | 137 |
| **20000** | 13 | 137 | 13 | 137 |

# 13 Safety instructions

In the following, you will find important information on the safe operation of the device. Read and follow these safety notes and instructions. Keep the instructions for future reference. Ensure that it is available to all persons using the device.

**DANGER! Threats for children**

Make sure that plastic covers, packaging, etc. are disposed of properly and are not within the reach of babies and small children. Danger of suffocation! Ensure that children do not detach any small parts from the device (e.g. control knobs or similar). They could swallow the parts and choke on them! Do not allow children to use electrical equipment unsupervised.

**DANGER! Fire, explosion or burn hazard**

Do not short-circuit, damage, heat above 60°C, burn or disassemble the battery. Follow the manufacturer's instructions.

**NOTE! Operating conditions**

The device is designed for indoor use. To avoid damage, never expose the device to liquids or high humidity. Avoid prolonged direct sunlight, heavy dirt and strong vibrations.

# 14 CE / FCC Declaration of Conformity

We, the manufacturers NTi Audio AG, Im alten Riet 102, 9494 Schaan, Liechtenstein, declare that the products XL3 Acoustic Analyzer, Measurement Microphones M2230, M2340, M2211, M2215 and M4261, as well as the Preamplifier MA220, MA230 and accessories* comply with the following standards or other normative documents:

**Directive:**

- **Directive 2014/30/EU** of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility.
- **Directive 2014/53/EU** of the European Parliament and of the Council of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC Text with EEA relevance.
- **Directive 2011/65/EC** on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

**Standards:**

- **EN61010-1:2010** Safety Requirements for electrical equipment for measurement, control and laboratory use - Part1.

**EMC:**

- **EN61672-1:2013** Electroacoustics - Sound level meters - Part 1: specifications.
- **EN61326-1:2013** Electrical equipment for measurement, control, and laboratory use. EMC requirements General requirements.
- **ETSI EN 301 489-1 V2.2.3 (2019-11)** ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility.
- **ETSI EN 301 489-17 V3.2.4 (2020-09)** Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for 2,4 GHz wideband transmission systems, 5 GHz high-performance RLAN equipment and 5,8 GHz Broadband Data Transmitting Systems.
- **ETSI EN 300 328 V2.2.2** (2.4 GHz Band): Spurious Emissions GHz.
- **FCC 47 CFR Part 15.247 & RSS-247** Digital Device - Subpart B - Unintentional Radiators und ICES-003 Issue 6.

**RoHS**

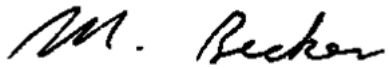
- **EN63000:2018** Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

***Accessories**:

| | |
|---|---|
| DC Power Supply | TDX0902000 9V2A |
| Microphones | M2230, M2340, M2211, M2215, M2914, M4261 |
| Microphones Preamplifier | MA220, MA230 |
| Battery Pack | BAP3 |

This declaration becomes null and void in the event of modifications to the devices without the written consent of NTi Audio.

Date: June 5, 2024



Position: CEO

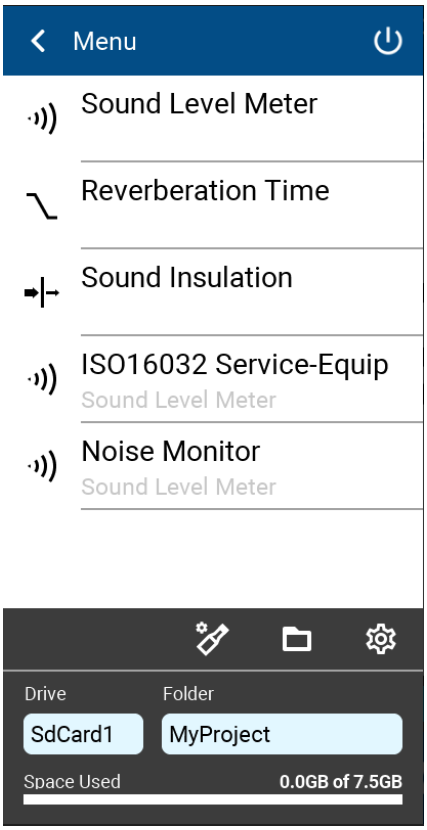
# APPENDIX: Measurement Functions and Configurations

The XL3 provides four basic measurement functions:

- Sound Level Meter;
- Reverberation Time;
- Sound Insulation;
- STIPA.

All setting changes are saved automatically. Settings are persistent when switching between functions and across power cycles.

Measurement functions do not display a subtitle in the main menu. Configurations, by contrast, always show the related measurement function as a subtitle.




## a. Configurations

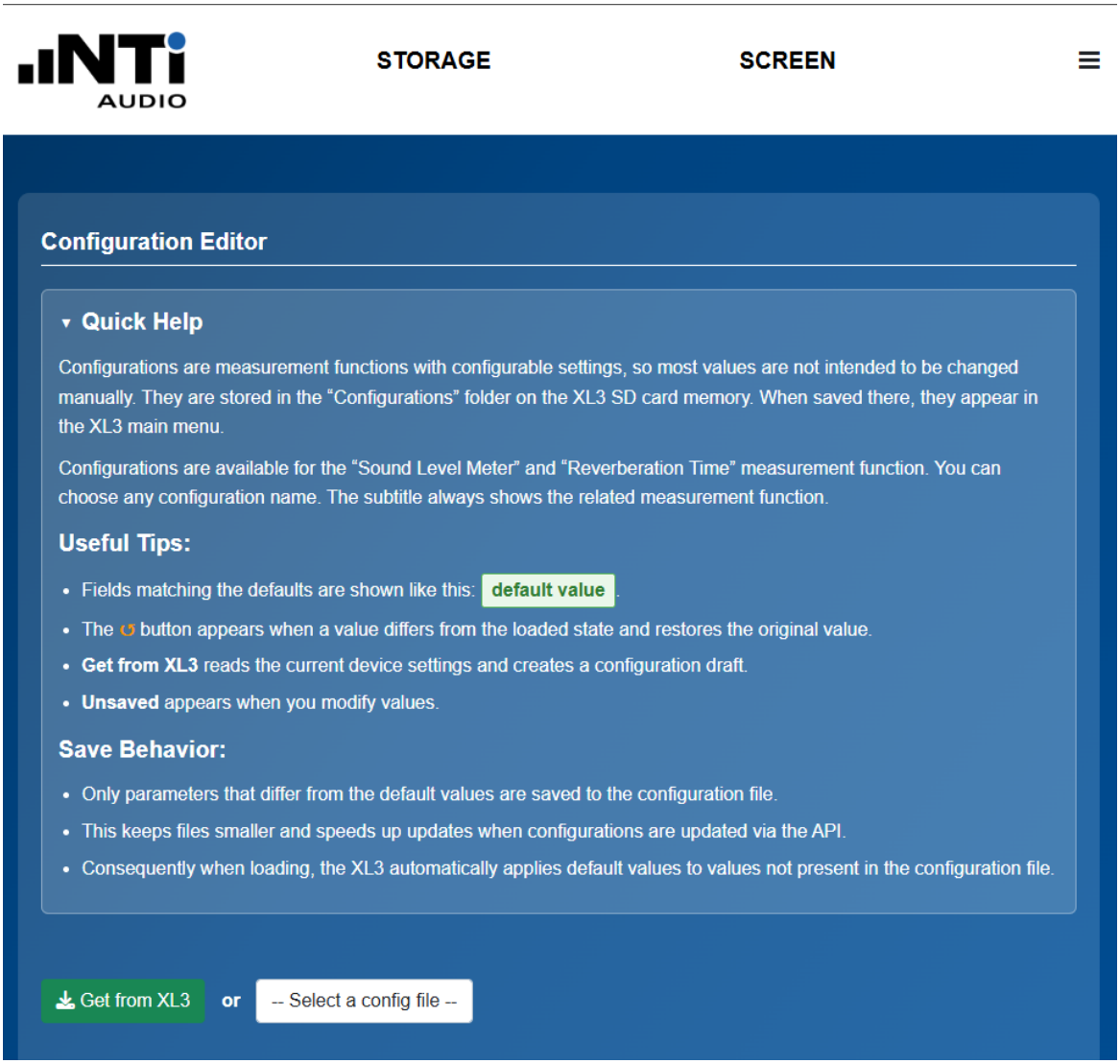
Configurations are measurement functions with fixed settings. Most settings within a configuration cannot be changed by the user. Configurations can be named freely, and the XL3 main menu displays the base measurement function as a subtitle.

### a.1 Configuration Builder

A web-based Configuration Editor is available via the NTi Audio Connect Service at connect.nti-audio.com. This tool is also listed in the website menu.

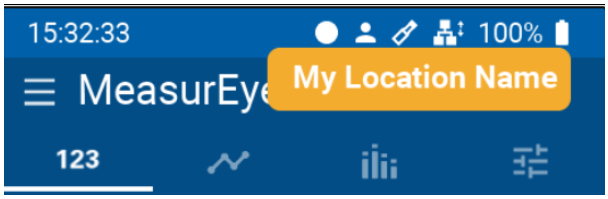
Key features of the Editor:

- **Get from XL3:** Reads the current device settings to create a configuration draft.
- **Default Values:** Parameters matching the defaults are highlighted in green.
- **Save Behavior:** Only parameters that differ from default values are saved. This keeps file sizes small and increases update speeds via the API.
- **Restore:** Use the reset icon to revert a parameter to its originally loaded value.
- **Unsaved indicator:** The label 'Unsaved' appears whenever values have been modified but not yet saved.




## a.2 Descriptions and Popups

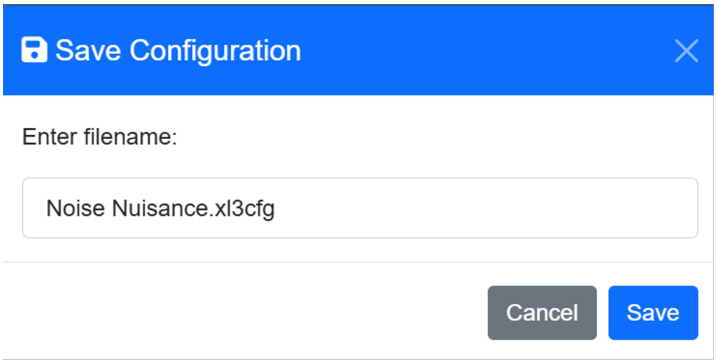
A description can be added to any configuration using the editor. When the configuration is selected or loaded on the XL3, this description is displayed as a popup on the screen to guide the operator.

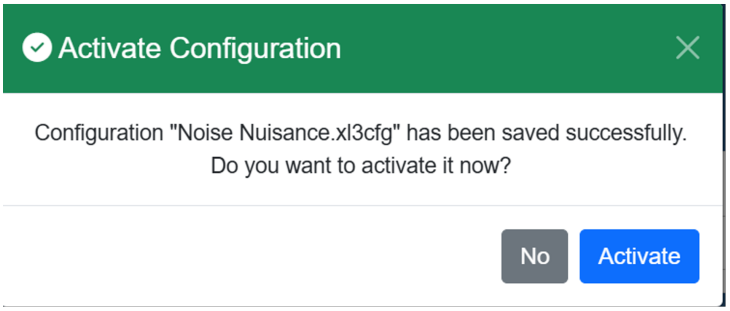


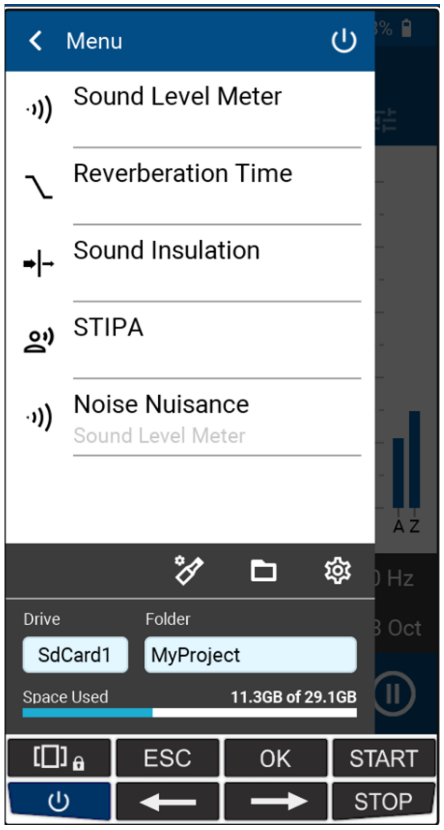

## b. File Management

The recommended approach is to create and save configurations directly from the web-based Configuration Editor. After editing, use the Save function to name and store the file. The Configuration Editor will prompt whether to activate the configuration on the XL3 immediately.

- **Prepare:** Adjust all desired settings within the relevant measurement function (e.g., Sound Level Meter).
- **Trigger backup:** Switch to any existing configuration. The XL3 automatically saves the previous settings to a file named *.gen_backup.xl3cfg*.
- **Rename:** Using USB or SFTP, rename *.gen_backup.xl3cfg* to the desired configuration name. The new configuration appears in the main menu immediately after renaming.
- **Verify:** Switch to the new configuration. If the file contains any errors, the XL3 will display a popup notification.




### b.1 Adding, Deleting, and Renaming Configurations

Navigate to the Configurations folder on the device and perform the required file operation:

- Add – Copy an existing .xl3cfg file into the folder.
- Delete – Remove the corresponding .xl3cfg file.
- Rename – Rename the .xl3cfg file directly.

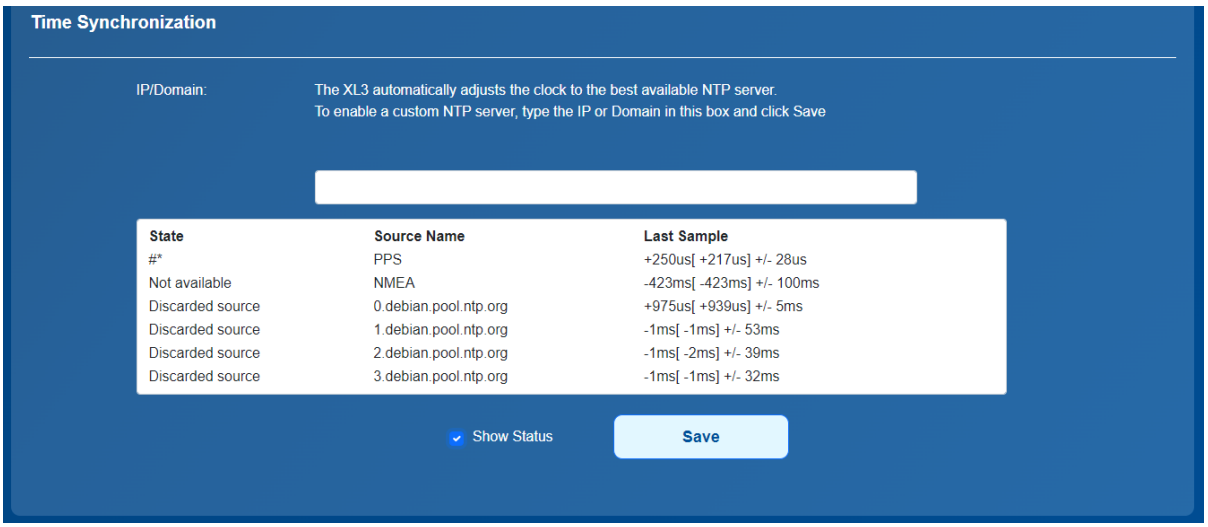
### b.2 Configuration Naming

Configuration names support two-line display in the main menu. The second line is defined by enclosing it in curly brackets within the filename.

- Syntax: <Line 1>{<Line 2>}.xl3cfg
- Example: ISO16032{Service-Equip}.xl3cfg

# APPENDIX: XL3 Time Synchronization with Chrony

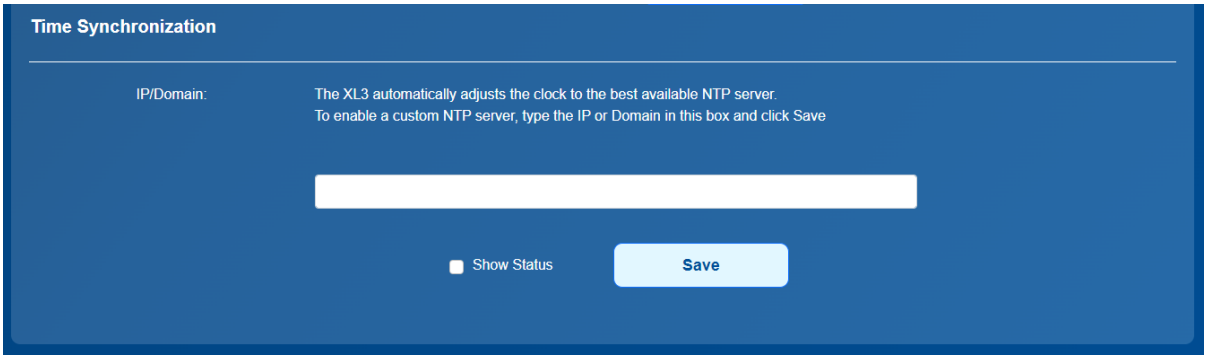
The XL3 seamlessly integrates the Linux tool Chrony for precise timekeeping. Chrony intelligently selects the right time source, be it NTP servers or GPS receivers, ensuring accurate time under diverse conditions such as intermittent networks and temperature variations.
Status of Time Synchronization:




## a. NTP Integration

The XL3 synchronizes seamlessly with NTP servers. NTP ensures not only precise timekeeping but also harmonizes the XL3's clock with global time standards. By regularly aligning with NTP servers, the XL3 maintains accurate time. Configurable NTP is part of the /Settings website of the XL3.

Use NTP server pool for better stability and availability of the NTP service.




## b. GPS Mouse

The GPS Mouse (NTi Audio: #600 000 358) serves as a highly accurate clock input for the XL3, enabling accuracies below 1 ms. Even after the removal of the GPS device, Chrony's Pulse Per Second (PPS) signal remains active, thanks to its "holdover" mode. This ensures continuous accurate timekeeping.

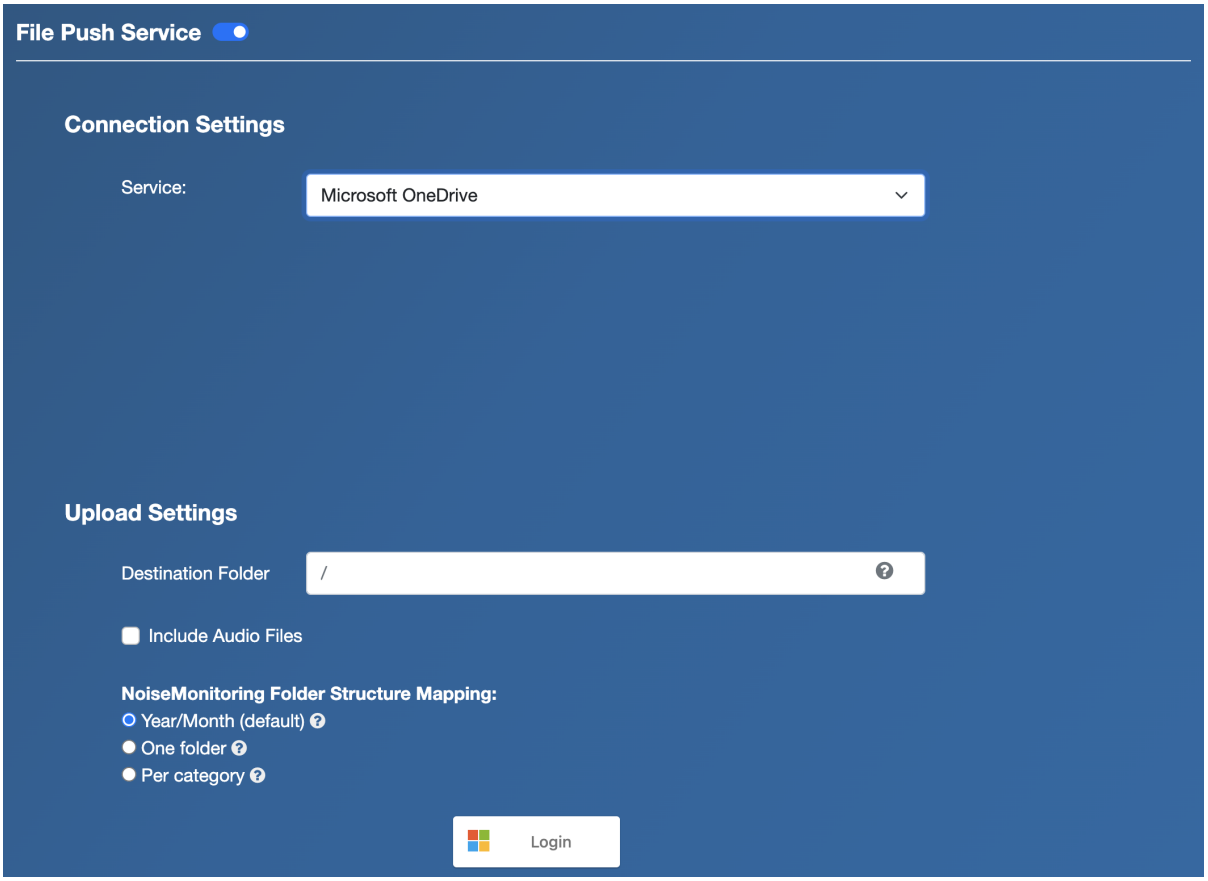
### c. SOH Clock Source

Monitoring the XL3 State of Health (SOH) data reveals the current clock source used by Chrony. Notably, due to Chrony's "holdover" ability, the SOH clock source may indicate PPS for several hours after the GPS Mouse has been removed.

# APPENDIX: FilePush

## a. OneDrive Business

OneDrive Business users can use OneDrive authentication method when navigating to your XL3 on the Connect Server (https://connect.nti-audio.com):




**How Authentication Works:** FilePush uses OAuth 2.0 to securely access your data without storing your password. This involves a "Refresh Token" that allows the app to stay logged in. However, Microsoft enforces specific limitations:

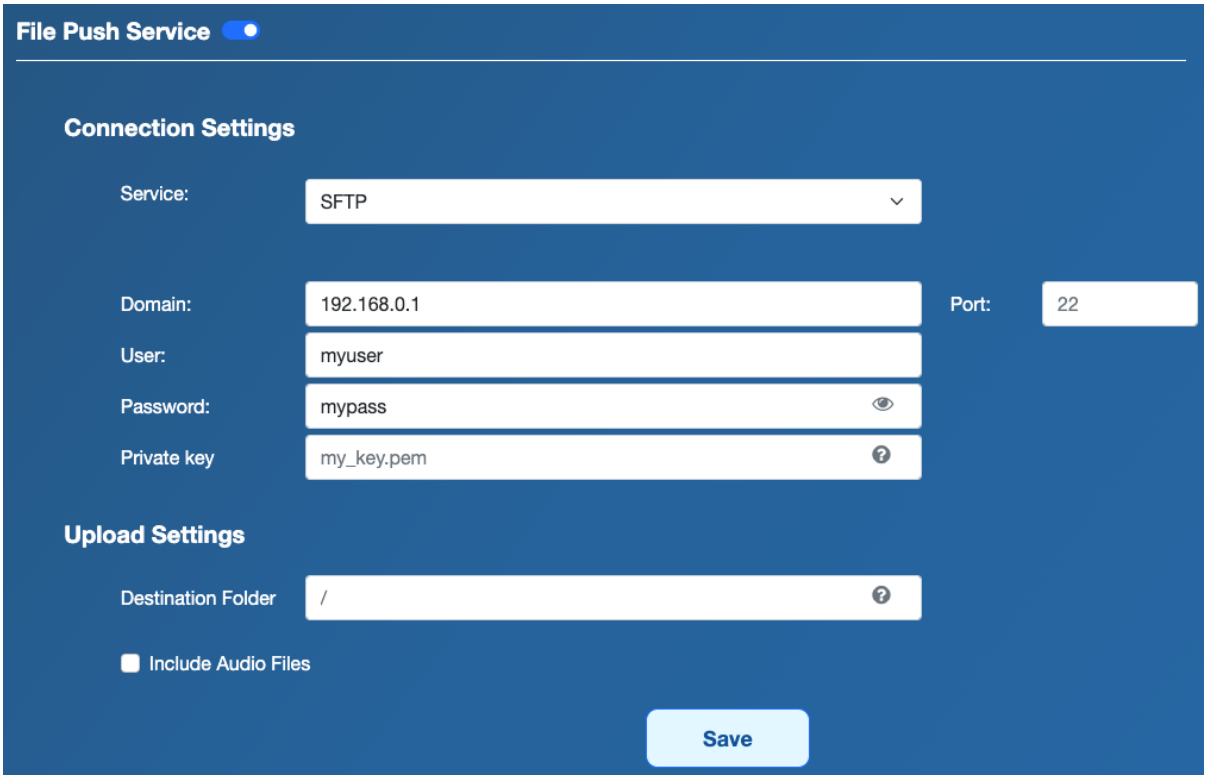
- The 90-Day Inactivity Limit: If the app does not perform a sync or access the cloud for 90 days, Microsoft revokes the token.
- Corporate Policies: If you are using a work or school account, your IT Administrator may have "Sign-in Frequency" policies that force a logout every 30, 90, or 120 days regardless of activity.
- Security Revocation: Changing your Microsoft account password or enabling/disabling Multi-Factor Authentication (MFA) will immediately invalidate existing connections for your protection.

If your sync fails after a long period of disuse, use the XL3 web page to logout and login again.

## b. Sharepoint

> Microsoft has deprecated legacy authentication methods (like username/password) for SharePoint Online. As of August 2025, SharePoint Online now requires App Access or Certificate-Based Authentication for automated or third-party tools like WebDAV clients (e.g., rclone, Cyberduck, WinSCP)[1].
>
> This change is documented in Microsoft's Message Center under MC1097272, and it affects any integration relying on older authentication methods.

## c. SFTP




If your server needs a private key as authentication factor, upload your piravate key to the /media/Configurations/ folder and write the name of the private key in this box.

> Filepush uses the root dir of the SFTP server to upload files. If the configured user does not have access to it, it will fail silently. Change it to a folder where the user has permission to access i.e. /home/myuser/xl3

```
[file_push] enabled = true

[file_push.preferences]
audio_files = false
destination_folder = "/Users/myuser/xl3/"
folder_structure = "default"
remote = "sftp"

[file_push.servers.sftp]
type = "sftp"
host = "192.168.68.113"
port = ""
user = "myuser"
pass = "tF-6XP9yZgLFPbJKrZySAdxCnqYY1Q"
key_file = ""
path_override = "/volume1/homes/myuser/xl3"
```

Synology server:

Use the configuration path_override.

This allows checksum calculation when SFTP and SSH paths are different. This issue affects among others Synology NAS boxes.

For instance if your home directory is found in a shared folder named "home": path_override = "/volume1/homes/myuser/xl3"

## d. File Push Configuration

The XL3 provides a flexible file push mechanism to upload measurement data to a remote destination. This subsection explains how file uploads are managed, including the selection of files for upload, timestamp configuration, and resetting uploads.

### d.1 File Selection for Upload

The XL3 determines which files to upload based on a timestamp reference (*upload_since*) specified in the configuration file. This timestamp defines the earliest creation date for files eligible for upload. Files created after this timestamp are considered for upload.

```
[file_push.preferences]
upload_since = "2025-09-23T10:30:00"
```

The timestamp must follow the ISO format (e.g., "YYYY-MM-DDTHH:mm:ss").

Once the XL3 reads the *upload_since* setting, it automatically deletes this entry from the configuration file after processing. Files already uploaded to the target destination are not duplicated.

The file push configuration is stored in the XL3's settings file and can be updated via the website or directly on the device.

### d.2 File Push History

The XL3 does not maintain a record of files that have been pushed. Instead, the upload process relies solely on the timestamp defined in the configuration file. However:

- Each file contains metadata, including a timestamp, which can be used to verify when it was uploaded.

### d.3 Interaction with the Target Directory

The behavior of the XL3 depends on the state of the target directory on the remote server or cloud storage:

- If the target directory exists:
  - Files are checked against the timestamp reference and the presence of files in the target directory. Duplicate uploads are avoided.
- If the target directory does not exist:
  - Files created after the specified timestamp are uploaded without verification of existing files.

### d.4 Re-uploading Files

If files are moved out of the target directory on the remote server, the XL3 does not detect their presence in the original location. As a result, these files would be pushed again during subsequent uploads.

### d.5 Resetting File Push

To force theXL3 to re-upload all measurement data, simply configure the upload_since timestamp to an earlier date. For example, setting the timestamp to "2020-01-01T00:00:00" will cause the XL3 to push all files created after this date.